AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Central District of California, Eastern Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	2/20/2018	Central District of California, Eastern Division

PLAINTIFF	DEFENDANT
Sleep Number Corporation	Sizewise Rentals, L.L.C.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 5,904,172	5/18/1999	Sleep Number Corporation
2 9,737,154	8/22/2017	Sleep Number Corporation
3 8,769,747	7/8/2014	Sleep Number Corporation
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
	2/20/2018	Central District of California, Eastern Division

PLAINTIFF	DEFENDANT
Sleep Number Corporation	American National Manufacturing, Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 5,904,172	5/18/1999	Sleep Number Corporation
2 9,737,154	8/22/2017	Sleep Number Corporation
3 8,769,747	7/8/2014	Sleep Number Corporation
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

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DECISION/JUDGEMENT

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Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Texas, Dallas Division on the following ☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:17-cv-3517-B	12/29/2017	Northern District of Texas, Dallas Division

PLAINTIFF	DEFENDANT
Sleep Number Corporation	American National Manufacturing Inc

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 5,904,172	5/18/1999	Sleep Number Corporation
2 9,737,154	8/22/2017	Sleep Number Corporation
3 8,769,747	7/8/2014	Sleep Number Corporation
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
Plaintiff's Notice of Voluntary Dismissal filed (copy attached).

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/K. Cheng	2/20/2018

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF TEXAS
DALLAS DIVISION

SLEEP NUMBER CORPORATION, *Plaintiff*, v. AMERICAN NATIONAL MANUFACTURING, INC., *Defendant*.	Civil Action No. 3:17-cv-03517-N JURY TRIAL DEMANDED

PLAINTIFF'S NOTICE OF VOLUNTARY DISMISSAL

Pursuant to Fed. R. Civ. P. 41(a)(1)(A)(i), Plaintiff Sleep Number Corporation hereby gives notice that the above-captioned action is voluntarily dismissed, without prejudice, against Defendant American National Manufacturing, Inc. This notice is being filed with the Court before Defendant has served an Answer or Motion for Summary Judgment in this action and thus does not require a court order.

Dated: February 20, 2018

/s/ Amy E. LaValle
Amy E. LaValle
State Bar No. 24040529
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anath@foxrothschild.com
epatton@foxrothschild.com

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on February 20, 2018, a true and correct copy of the foregoing was served electronically via this Court's CM/ECF system on all parties receiving electronic notice.

/s/ Amy E. LaValle
Amy E. LaValle

AO 120 (Rev. 08/10)

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☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:17-cv-3518-M	12/29/2017	Northern District of Texas, Dallas Division

PLAINTIFF	DEFENDANT
Sleep Number Corporation	Sizewise Rentals LLC

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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
Notice of Dismissal

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/Y. Pace	2/20/2018

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
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PLAINTIFF	DEFENDANT
Sleep Number Corporation	American National Manufacturing Inc

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DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Karen Mitchell	s/A. Lowe	12/29/2017

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TO: **Mail Stop 8** **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

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Karen Mitchell	s/A. Lowe	12/29/2017

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UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

FISH & RICHARDSON PC (TC)
PO BOX 1022
MINNEAPOLIS MN 55440-1022

MAILED
DEC 12 2017
OFFICE OF PETITIONS

In re Patent No. 9,737,154 :
Mahoney, et al. : ON REDERMINATION
Issue Date: 08/22/2017 : OF
Application No. 14/283,675 : PATENT TERM ADJUSTMENT
Filing or 371(c) Date: May 21, 2014 :
Docket No.: 39870-0048002 :

This is a redetermination of the patent term adjustment in response to the application for patent term adjustment, filed October 23, 2017, requesting that the patent term adjustment for the above identified patent be corrected from 16 days to 134 days.

This redetermination of patent term adjustment is not the Director's decision on the applicant's request for reconsideration for purposes of seeking judicial review under 35 U.S.C. §154(b)(4).

On July 19, 2016, the above-identified application matured into U.S. Patent No. 9,737,154. The patent issued with a PTA of 16 days. The PTA of 16 days was calculated based on 456 days of "A" delay plus 93 days of "B" delay, reduced by 533 days of Applicant delay.

The present petition

Patentees argue that the Office improperly calculated the Applicant delay during the period of abandonment, pursuant to 37 CFR 1.704(c)(3). The Office mailed a Notice to File Missing Parts on June 5, 2014. This Notice set an extendable period for reply of two months. No extensions of time were obtained. As such, the application became abandoned on August 6, 2014. On February 17, 2015, Applicants filed a petition to revive under 37 CFR 1.137(a). The petition to revive was granted in a decision mailed on September 21, 2015. Applicants were assessed 315 days of Applicant delay under 37 CFR 1.704(c)(3) for the abandonment of the application. Patentees assert that they should have instead been assessed 285 days. Patentees' argument has been considered, but is not persuasive.

37 CFR 1.704(c)(3) states that PTA shall be reduced by the number of days beginning on the date of abandonment of the application, and ending on the earlier of:

> i) The date of mailing of the decision reviving the application or accepting late payment of the issue fee; or
> (ii) The date that is four months after the date the grantable petition to revive the application or accept late payment of the issue fee was filed.

Here, the date that is four months after the date the grantable petition to revive was filed is June 17, 2015. Accordingly, Applicant delay under 37 CFR 1.704(c)(3) begins on the date of the abandonment of the application, or August 6, 2014, and ends on June 17, 2015, which equals 315 days.

In addition, Patentees argues that the 27 day period of Applicant delay they were assessed on February 17, 2015 overlaps with the 315 days they were assessed for the abandonment of the application. Patentees' argument has been considered, and is persuasive. As such, the assessment of 27 days of Applicant delay in this instance is not warranted.

Lastly, Patentees argue that they were improperly assessed 64 days under 37 CFR 1.704(c)(10), for filing a request for a corrected filing receipt on June 20, 2017. Here, a review of the file shows that the Office mailed the corrected filing receipt on June 22, 2017. As such, pursuant to 37 CFR 1.704(c)(10), 3 days of Applicant delay should have been assessed, not 64.

Overall PTA Calculation

Formula:

"A" delay + "B" delay + "C" delay - Overlap - applicant delay = X

USPTO's Calculation:

456 + 93 + 0 – 0 – 445 = 104 days

Conclusion

Patentees are entitled to PTA of one hundred four (104). Using the formula "A" delay + "B" delay + "C" delay - overlap - applicant delay = X, the amount of PTA is calculated as following: 456 + 93 + 0 – 0 – 445 = 104 days.

Patentees are given TWO (2) MONTHS from the mail date of this decision to respond to this redetermination. Extensions of time under 37 CFR 1.136(a) are permitted. This is not final agency action within the meaning of 5 U.S.C. § 704.

The application is being forwarded to the Certificate of Corrections Branch for issuance of a certificate of correction. The Office will issue a certificate of correction indicating that the term of the above-identified patent is extended or adjusted by **one hundred four (104) days.**

Telephone inquiries specific to this matter should be directed to the undersigned at (571) 272-3207.

/Cliff Congo/

Cliff Congo
Attorney Advisor
Office of Petitions

Enc: draft Certificate of Correction

DRAFT COPY

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT : 9,737,154

DATED : August 22, 2017

INVENTOR(S) : Mahoney et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the cover page,

[*] Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 USC 154(b) by 16 days.

Delete the phrase “by 16 days” and insert – by 104 days--

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Matthew Glen Hilden	Art Unit	:	3673
Patent No.	:	9,737,154	Examiner	:	Robert G. Santos
Issue Date	:	August 22, 2017	Conf. No.	:	5177
Serial No.	:	14/283,675			
Filed	:	May 21, 2014			
Title	:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT			

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPLICATION FOR PATENT TERM ADJUSTMENT UNDER 37 C.F.R. § 1.705(b)

Patentees hereby request reconsideration of the Patent Term Adjustment (PTA) accorded the above-referenced patent. Reconsideration of the final PTA calculation to increase total PTA from 16 days to 134 days is respectfully requested.

REMARKS

"A Delays" are defined as delays by the U.S. Patent and Trademark Office (PTO) under 35 U.S.C. § 154(b)(1)(A), which guarantees prompt PTO response. "B Delays" are defined as delays by the PTO under 35 U.S.C. § 154(b)(1)(B), which guarantees no more than three year application pendency.

REVIEW OF PATENT TERM ADJUSTMENT CALCULATION

"A Delay"

A first PTO action was due on or before July 21, 2015 (the date that is fourteen months after May 21, 2014, the date on which the application was filed). The PTO mailed the first non-final Office Action on October 7, 2016, thereby according a PTO Delay of 444 days. Patentees do not dispute the PTO's calculation for this "A Delay" from July 22, 2015 (the day after the date that is fourteen months after the date on which the application was filed), to October 7, 2016. See 37 C.F.R. §§ 1.702(a)(1) and 1.703(a)(1).

A PTO action was due on or before April 8, 2017 (the date that is four months after December 8, 2016, the date on which a response to Office Action was filed). The PTO mailed a Notice of Allowance on April 20, 2017, thereby according a PTO Delay of 12 days. Patentees do not dispute the PTO's calculation for this "A Delay" from April 9, 2017 (the day after the date that is four months after the date on which a response to Office Action was filed), to April 20, 2017. See 37 C.F.R. §§ 1.702(a)(2) and 1.703(a)(2).

In view of the periods of "A Delay" detailed above, the total "A Delay" for this patent should be calculated as 456 days (i.e., the sum of 444 days and 12 days).

"B Delay"

The period beginning on May 22, 2017, (the day after the date that is three years after the date on which the application was filed), and ending August 22, 2017, (the date the patent was issued), is 93 days in length.

"B Delay" may not include the number of days in the period during which the application is under continued examination. In the present application, there was no period of continued examination. See 37 C.F.R. §§ 1.702(b)(1) and 1.703(b)(1).

In addition, "B Delay" may not include the number of days in the period during which the application is under appellate review. In the present application, there was no period of appellate review. See 37 C.F.R. §§ 1.702(b)(4) and 1.703(b)(4).

In view of the periods of "B Delay" detailed above, the total "B Delay" for this patent should be calculated as 93 days. The PTO calculated 93 days of delay for issuance of a patent more than three years after filing. Patentees do not dispute the PTO's calculation for this "B Delay" as 93 days. See 37 C.F.R. §§ 1.702(b) and 1.703(b).

Overlap of "A Delay" and "B Delay"

As detailed above, 456 days of "A Delay" accumulated during the following periods:

July 22, 2015, to October 7, 2016; and

April 9, 2017, to April 20, 2017.

As detailed above, 93 days of "B Delay" accumulated during the following period:

May 22, 2017, to August 22, 2017.

As such, the periods of "A Delay" and "B Delay" do not overlap (i.e., occur on the same calendar day).

Applicant Delay

A Notice Abandonment was mailed by the PTO on February 4, 2015. Patentees filed a Petition to Revive Application Under 37 C.F.R. § 1.137(b) on February 17, 2015. A decision granting the Petition to Revive Application Under 37 C.F.R. § 1.137(b) was mailed by the PTO on September 21, 2015. Patentees were accorded 315 days delay for a period of abandonment. Patentees respectfully submit that the period of abandonment should have been accorded a total Applicant Delay of 285 days, for delay from September 6, 2014, to June 17, 2015. See 37 C.F.R. § 1.704(c)(3).

Patentees were accorded 27 days delay for failure to provide an application in condition for examination within eight months from the date on which the application was filed. Patentees respectfully submit that the period of delay should have been accorded a total Applicant Delay of 0 days, as this delay from January 22, 2015, to February 17, 2015, overlaps with the period of abandonment. See 37 C.F.R. § 1.704(c) and 37 C.F.R. § 1.704(c)(13).

Patentees filed a Terminal Disclaimer on April 14, 2017, subsequent to a reply filed on December 8, 2016. Patentees were accorded a delay of 127 days for a supplemental response. Patentees do not dispute the PTO's calculation for this Applicant Delay from December 9, 2016, to April 14, 2017. See 37 C.F.R. § 1.704(c)(8).

Patentees filed a Request for Corrected Official Filing Receipt on June 20, 2017, subsequent to the mailing of the Notice of Allowance. The PTO mailed a response to the Request for Corrected Official Filing Receipt on June 22, 2017. Patentees were accorded a delay of 64 days for this post-allowance filing. Patentees respectfully submit that a period of 3 days is appropriate for delay for the post-allowance filing under 37 C.F.R. § 1.704(c)(10), from June 20, 2017, to June 22, 2017, and ask that the Office recalculate this period of Applicant Delay as 3 days. See 37 C.F.R. § 1.704(c)(10).

In view of the periods of Applicant Delay detailed above, the total Applicant Delay for this patent should be calculated as 415 days (i.e., the sum of 285 days, 127 days, and 3 days).

<u>Terminal Disclaimer</u>

This patent is subject to a terminal disclaimer. In it, Patentees waive and disclaim the terminal portion of the term of the entire patent to be granted upon the present patent subsequent to the expiration date of U.S. Patent No. 8,769,747, provided that any patent granted on the present application shall be enforceable only for and during such period that it is commonly owned with U.S. Patent No. 8,769,747.

<u>Conclusion</u>

In consideration of the events described above, Patentees believe the PTA calculation of 16 days is incorrect. As such, Patentees respectfully request reconsideration of the PTA in the following manner:

1) Total PTO Delay should be calculated as 549 days (i.e., the sum of 456 days of "A Delay" and 93 days of "B Delay");

2) Total Applicant Delay should be calculated as 415 days; and

3) <u>Total PTA should be calculated as 134 days</u>.

The fee of $200 required under 37 C.F.R. § 1.18(e) is being submitted herewith. Please apply any required charges or credits to Deposit Account No. 06-1050, referencing Attorney Docket Number 39870-0048002.

Respectfully submitted,

Date: 10-23.2017

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number 26191
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

61580150.doc

Electronic Patent Application Fee Transmittal

Application Number:	14283675
Filing Date:	21-May-2014
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Filer:	Stuart A. Nelson/Mari Bohnhoff
Attorney Docket Number:	39870-0048002

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Application for patent term adjustment	1455	1	200	200
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**200**

Electronic Acknowledgement Receipt

EFS ID:	30726418
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Mari Bohnhoff
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	23-OCT-2017
Filing Date:	21-MAY-2014
Time Stamp:	12:05:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$200
RAM confirmation Number	102317INTEFSW00010916061050
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Patent Term Adjustment Petition	39870-0048002_PTAPetition.pdf	84433 5c83a4d7f0cbfe05e30fbf6a7e63ebc14eb2a8e1	no	4
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30652 b0f308b5f717ec7c571a6015b0587a9abbb1d1eb	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	115085	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	08/22/2017	9737154	39870-0048002	5177

26191 7590 08/02/2017

FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 16 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Paul James Mahoney, Stillwater, MN;
Select Comfort Corporation, Minneapolis, MN;
Matthew Glen Hilden, Robbinsdale, MN;
Matthew Wayne Tilstra, Rogers, MN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents							
Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1.	14/675,355		Palashewski et al.			03/31/2015
	2.	14/687,633		Brosnan et al.			04/15/2015
	3.	2015/0007393	01/08/2015	Palashewski			
	4.	2015/0026896	01/29/2015	Fleury et al.			
	5.	2015/0157137	06/11/2015	Nunn et al.			
	6.	2015/0157519	06/11/2015	Stusynski et al.			
	7.	2015/0182033	07/02/2015	Brosnan et al.			
	8.	2015/0182397	07/02/2015	Palashewski et al.			
	9.	2015/0182399	07/02/2015	Palashewski et al.			
	10.	2015/0182418	07/02/2015	Zaiss			
	11.	4,766,628	08/30/1988	~~Greer et al.~~ Walker			
	12.	4,788,729	12/06/1988	~~Greer et al.~~ Walker			
	13.	4,829,616	~~05/16/1982~~ 5/1989	Walker			
	14.	4,890,344	01/02/1990	Walker			
	15.	4,897,890	02/06/1990	Walker			
	16.	4,908,895	03/20/1990	Walker			
	17.	4,991,244	02/12/1991	Walker			
	18.	5,144,706	09/08/1992	Walker et al.			
	19.	8,931,329	01/13/2015	Mahoney et al.			
	20.	8,966,689	03/03/2015	McGuire et al.			
	21.	8,973,183	03/10/2015	Palashewski et al.			
	22.	8,984,687	03/24/2015	Stusynski et al.			

Change(s) applied to document, /R.K.C./ 4/28/2017

Foreign Patent Documents or Published Foreign Patent Applications								
Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation Yes	Translation No

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Substitute Disclosure Form

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office **Information Disclosure Statement by Applicant** (Use several sheets if necessary) (37 CFR §1.98(b))	Attorney Docket No. 39870-0048002	Application No. 14/283,675
	First Named Inventor Paul James Mahoney	
	Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	28	5,652,484	7/29/1997	Shafer et al.			
	29	5,765,246	6/16/1998	Shoenhair			
	30	5,903,941	5/18/1999	Shafer et al.			
	31	5,904,172	05/18/1999	Gifft et al.			
	32	6,014,784	01/18/2000	Taylor et al.			
	33	6,037,723	3/14/2000	Shafer et al.			
	34	6,088,643	07/11/2000	Long et al.			
	35	6,108,844	8/29/2000	Kraft et al.			
	36	6,161,231	12/19/2000	Kraft et al.			
	37	6,202,239	3/20/2001	Ward et al.			
	38	6,397,419	6/4/2002	Mechache			
	39	6,483,264	11/19/2002	Shafer et al.			
	40	6,686,711	2/3/2004	Rose et al.			
	41	6,708,357	3/23/2004	Gaboury et al.			
	42	6,763,541	7/20/2004	Mahoney et al.			
	43	6,789,284	09/14/2004	Kamp			
	44	6,804,848	10/19/2004	Rose			
	45	6,832,397	12/21/2004	Gaboury et al.			
Change(s) applied	46	6,883,191	~~5/26/2005~~ 4/2005	Gaboury et al.			
to document,	47	7,022,113	04/04/2006	Lockwood et al.			
/R.K.C./	48	7,389,554	6/24/2008	Rose			
4/28/2017	49	7,865,988	1/11/2011	Koughan et al.			
	50	8,336,369	12/25/2012	Mahoney			
	51	8,444,558	5/21/2013	Young et al.			
	52	8,672,853	3/18/2014	Young			
	53	8,769,747	7/8/2014	Mahoney et al.			

Foreign Patent Documents or Published Foreign Patent Applications

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 24

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	First Named Inventor Paul James Mahoney	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1	13/933,285		Palashewski			7/2/2013
	2	14/146,281		Palashewski et al.			1/2/2014
	3	14/146,327		Palashewski et al.			1/2/2014
	4	2002/0184711	12/2002	Mahoney et al.			
	5	2007/0227594	10/04/2007	Chaffe			
	6	2010/0174198	7/8/2010	Young et al.			
	7	2010/0206051	08/2010	Mahoney			
	8	2011/0306844	12/15/2011	Young			
	9	2014/0007656	1/9/2014	Mahoney			
	10	2014/0137332	5/22/2014	McGuire, et al.			
	11	2014/0182061	7/3/2014	Zaiss			
	12	2014/0250597	9/11/2014	Chen et al.			
	13	2014/0257571	9/11/2014	Chen et al.			
	14	2014/0259417	9/18/2014	Nunn et al.			
	15	2014/0259418	9/18/2014	Nunn et al.			
	16	2014/0259419	9/18/2014	Stusynski			
	17	2014/0259431	9/18/2014	Fleury			
	18	2014/0259433	9/18/2014	Nunn et al.			
	19	2014/0259434	9/18/2014	Nunn et al.			
	20	2014/0277611	9/18/2014	Nunn et al.			
	21	2014/0277778	9/18/2014	Nunn et al.			
	22	2014/0277822	9/18/2014	Nunn et al.			
	23	5,170,522	12/15/1992	Walker			
	24	5,170,522	12/15/1992	Walker			
	25	5,509,154	4/23/1996	Shafer et al.			
	26	5,564,140	10/15/1996	Shoenhair et al.			
	27	5,642,546	~~6/1/1997~~ 7/1997	Shoenhair			

Change(s) applied to document, /R.K.C./ 4/28/2017

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 25

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	~~Unknown~~ 14/283,675
	Filing Date	~~Herewith~~ May 21, 2014
	First Named Inventor	Paul James Mahoney
	Group Art Unit	~~Unknown~~ 3673
	Examiner Name	~~Unknown~~ Robert Santos
Sheet 1 of 2	Attorney Docket No: 3500.019US2	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20020184711A1	12/12/2002	Mahoney, Paul J
	US-20070227594A1	10/4/2007	Chaffee, Robert B
	US-20100206051A1	8/19/2010	Mahoney, Paul James
	US-20110138539A1	6/16/2011	Mahoney, Paul James, et al.
	US-5,904,172	5/18/1999	Gifft, James Edwin, et al.
	US-6,014,784	1/18/2000	Taylor, Rex E, et al.
	US-6,088,643	7/11/2000	Long, Bruce T, et al.
	US-6,789,284	9/14/2004	Kemp, Daniel
	US-7,022,113	4/2006 ~~1/16/2003~~	Lockwood, Jeffrey S

Change(s) applied to document, /R.K.C./ 4/28/2017

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1
	AU-2008353972	11/8/2012	Hilden, Matthew Glen, et al.	
	CA-2720467C	12/10/2013	Mahoney, Paul James, et al.	
	WO-0003628A2	1/27/2000		

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 12/936,084, Advisory Action mailed 10-18-13", 3 pgs	
	"Application Serial No. 12/936,084, Examiner Interview Summary mailed 08-06-13", 3 pgs	
	"Application Serial No. 12/936,084, Final Office Action mailed 01-10-13", 16 pgs	
	"Application Serial No. 12/936,084, Final Office Action mailed 07-29-13", 15 pgs	
	"Application Serial No. 12/936,084, Non Final Office Action mailed 08-02-12", 13 pgs	
	"Application Serial No. 12/936,084, Notice of Allowance mailed 03-12-14", 8 pgs	
	"Application Serial No. 12/936,084, Response filed 01-29-14 to Advisory Action mailed 10-18-13", 16 pgs	
	"Application Serial No. 12/936,084, Response filed 05-10-13 to Non Final Office Action mailed 01-10-13", 13 pgs.	
	"Application Serial No. 12/936,084, Response filed 09-27-13 to Non Final Office Action mailed 07-29-13", 14 pgs	
	"Application Serial No. 12/936,084, Response filed 11-08-12 to Non Final Office Action mailed 08-02-13", 13 pgs	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Matthew Glen Hilden	Art Unit	:	3673
			Examiner	:	Robert G. Santos
Serial No.	:	14/283,675	Confirmation No.	:	5177
Filed	:	May 21, 2014	Notice of Allowance Date: April 20, 2017		

Title : SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

MAIL STOP ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY TO NOTICE OF ALLOWANCE

In response to the Notice of Allowance dated April 20, 2017, enclosed is a completed Part B - Fee(s) Transmittal.

The issue fee is being paid with this reply on the Electronic Filing System. Apply those fees and any other necessary charges or credits to Deposit Account 06-1050, referencing the above attorney docket number.

COMMENTS ON EXAMINER'S REASONS FOR ALLOWANCE

It is recognized that in accordance with M.P.E.P. § 1302.14, the Examiner's reasons for allowance need not set forth all of the details as to why the claims are allowed. In the above-referenced application, it is not conceded that the Examiner's stated reasons for allowance are the only reasons for which the claims are allowable. The Examiner's reasons for allowance indicate that particular claim elements are not disclosed or suggested by the prior art of record, yet the claims may be patentable for other reasons as well, including the inventive combination of all of the recited claim elements. It is not conceded that the specific limitations identified by the Examiner are necessary to distinguish the art of record or to satisfy the requirements of 35 U.S.C. § 112. Moreover, the Examiner does not assert, and it would not be conceded, that the Examiner's reasons have any bearing on the patentability of claims in any other applications directed to the disclosed subject matter.

In addition, each dependent claim stands on its own and may be allowable on its own merits. In particular, each dependent claim may be allowable on the basis of a combination of some of the features recited in the dependent claim and its base claim(s), which combination of features may not include all of the limitations identified in the Examiner's reasons for allowance.

Respectfully submitted,

Date: 7/20/2017

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number 26191
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

61530701.doc

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 28

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26191 7590 04/20/2017

FISH & RICHARDSON P.C.
P.O. BOX 1022
MINNEAPOLIS, MN 55440-1022

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

TITLE OF INVENTION: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	LARGE	$960	$0		$960	07/20/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
SANTOS, ROBERT G.	3673	005-713000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

[ ] Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

[ ] "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Fish & Richardson P.C.
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
Select Comfort Corporation

(B) RESIDENCE: (CITY and STATE OR COUNTRY)
United, States

Please check the appropriate assignee category or categories (will not be printed on the patent): [ ] Individual [X] Corporation or other private group entity [ ] Government

4a. The following fee(s) are submitted:
[X] Issue Fee
[ ] Publication Fee (No small entity discount permitted)
[ ] Advance Order - # of Copies ______

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
[ ] A check in the amount of the fee(s) is enclosed.
[ ] Payment by credit card. Form PTO-2038 is attached.
[X] The Director is hereby authorized to charge the required fee(s), or credit any overpayment, to Deposit Account Number 06-1050

5. **Change in Entity Status** (from status indicated above)

[ ] Applicant certifying micro entity status. See 37 CFR 1.29 — **NOTE**: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

[ ] Applicant asserting small entity status. See 37 CFR 1.27. — **NOTE**: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

[ ] Applicant changing to regular undiscounted fee status. — **NOTE**: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Stuart A. Nelson/ Date 7/20/2017

Typed or printed name Stuart A. Nelson Registration No. 63,947

61530708.doc

Electronic Patent Application Fee Transmittal

Application Number:	14283675
Filing Date:	21-May-2014
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Filer:	Stuart A. Nelson/Abby Remer
Attorney Docket Number:	39870-0048002

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt

EFS ID:	29843278
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Alysha Claflin
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	20-JUL-2017
Filing Date:	21-MAY-2014
Time Stamp:	15:06:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$960
RAM confirmation Number	072117INTEFSW00001460061050
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFee.pdf	133117 d47856**4bcd6f569d75b8003445dfae**79ee9f**574e**	no	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	30491 b6bfb**6251a7fc834ad9cc3814f2ad8**aa963f**98f2**	no	2

Warnings:

Information:

Total Files Size (in bytes):	163608

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/283,675	05/21/2014	3673	2320	39870-0048002	20	4

CONFIRMATION NO. 5177

CORRECTED FILING RECEIPT

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

OC000000092264449

Date Mailed: 06/22/2017

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, Robbinsdale, MN;
Matthew Wayne Tilstra, Rogers, MN;

Applicant(s)

Select Comfort Corporation, Minneapolis, MN;

Assignment For Published Patent Application

Select Comfort Corporation, Minneapolis, MN

Power of Attorney: The patent practitioners associated with Customer Number 26191

Domestic Priority data as claimed by applicant

This application is a CON of 12/936,084 10/01/2010 PAT 8769747
which is a 371 of PCT/US08/59409 04/04/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/02/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/283,675**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
Title

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Preliminary Class

005

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/283,675	05/21/2014	3744	2160	39870-0048002	20	4

CONFIRMATION NO. 5177

UPDATED FILING RECEIPT

OC000000077548170

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

Date Mailed: 09/22/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, ~~Bobbisndale~~, MN; Robbinsdale
Matthew Wayne Tilstra, Rogers, MN;

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This application is a CON of 12/936,084 10/01/2010 PAT 8769747
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Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 06/02/2014
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/283,675**

Projected Publication Date: 12/31/2015

Non-Publication Request: No

Early Publication Request: No
Title

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Preliminary Class

062

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~3500.019US2~~ 39870-0048002
	Application Number	14/283,675
Title of Invention	System and Method for Improved Pressure Adjustment	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.

Inventor Information:

Inventor 1.

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Paul	James	Mahoney	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Stillwater	**State/Province**	MN	**Country of Residence**	US

Mailing Address of Inventor:

Address 1	1331 Dallager Ct		
Address 2			
City	Stillwater	**State/Province**	MN
Postal Code	55082	**Country**	US

Inventor 2.

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Matthew	Glen	Hilden	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	~~Robbisndale~~ Robbinsdale	**State/Province**	MN	**Country of Residence**	US

Mailing Address of Inventor:

Address 1	4310 Toledo Ave. N
Address 2	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~3500-019US2~~ 39870-0048002
	Application Number	14/283,675
Title of Invention	System and Method for Improved Pressure Adjustment	

City	~~Robbisndale~~ Robbinsdale	**State/Province**	MN
Postal Code	55422	**Country**	US

Inventor 3.				
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Matthew	Wayne	Tilstra	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Rogers	**State/Province**	MN	**Country of Residence**	US

Mailing Address of Inventor:

Address 1	13915 Hill Place Dr		
Address 2			
City	Rogers	**State/Province**	MN
Postal Code	55374	**Country**	US

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Stuart A. Nelson/			Date (MM/DD/YYYY)	6/20/2017
First Name	Stuart	Last Name	Nelson	Registration Number	63,947

61499262.doc

Electronic Acknowledgement Receipt

EFS ID:	29546920
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Abby Remer
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	20-JUN-2017
Filing Date:	21-MAY-2014
Time Stamp:	11:19:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	Request.pdf	42169 b5d6ddc632aad54567749ead54354a5ef5547c8c	no	1

Warnings:

Information:					
2	Request for Corrected Filing Receipt	FilingReceipt.pdf	183028 78df0bdd04521d7e9bd3b6bac41eadb1d7fa3424	no	3
Warnings:					
Information:					
3	Application Data Sheet	SuppADS.pdf	73345 65fc29cff3609f2e1aa865f6055c0109f798284f	no	2
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
			Total Files Size (in bytes):	298542	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Matthew Glen Hilden	Art Unit	:	3673
Serial No.	:	14/283,675	Examiner	:	Robert G. Santos
Filed	:	May 21, 2014	Conf. No.	:	5177
Title	:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT			

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CORRECTED OFFICIAL FILING RECEIPT

Please correct the Filing Receipt for the above-referenced application to reflect the following:

Matthew Glen Hilden, Robbinsdale, MN

Please supply a corrected Filing Receipt to the undersigned with respect to this application. A copy of the original Filing Receipt showing the desired changes is attached for your convenience.

No fee is believed to be due. If, however, there are any necessary charges or credits, please apply them to Deposit Account No. 06-1050, referencing the above attorney docket number.

Respectfully submitted,

Date: 6/20/2017

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number 26191
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

61499273.doc

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26191 7590 04/20/2017

FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	
SANTOS, ROBERT G	
ART UNIT	PAPER NUMBER
3673	

DATE MAILED: 04/20/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

TITLE OF INVENTION: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/20/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (**Note:** Use Block **1 for any change of address**)

26191 7590 04/20/2017

FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

TITLE OF INVENTION: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/20/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
SANTOS, ROBERT G	3673	005-713000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________
   2 ____________
   3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ____________ Date ____________

Typed or printed name ____________ Registration No. ____________

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

26191 7590 04/20/2017

FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	
SANTOS, ROBERT G	
ART UNIT	**PAPER NUMBER**
3673	

DATE MAILED: 04/20/2017

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 14/283,675	Applicant(s) MAHONEY ET AL.	
	Examiner ROBERT G. SANTOS	Art Unit 3673	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *See Continuation Sheet*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-18 and 21-24, now renumbered as claims 1-22*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/ROBERT G. SANTOS/
Primary Examiner, Art Unit 3673

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Continuation of Item 1. This communication is responsive to: The papers filed 08 December 2016 and 14 April 2017, and the telephonic interview held on 14 April 2017.

EXAMINER'S AMENDMENT

1. The present application is being examined under the pre-AIA first to invent provisions.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicants, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Stuart A. Nelson on April 14, 2017.

The application has been amended as follows: In claim 16, line 5: The phrase --for the pump housing-- has been inserted after the term "target".

3. The following is an examiner's statement of reasons for allowance: The examiner respectfully agrees with Applicants' arguments on pages 8-10 of their amendment with respect to the cited Chaffee '594, Lockwood et al. '113 and Kemp '284 references; accordingly, the claim rejections under pre-AIA 35 U.S.C. 103(a) contained in the previous Office action dated October 7, 2016 have been respectfully withdrawn. Since the Terminal Disclaimer filed April 14, 2017 obviates fully the double patenting rejections also indicated in the previous Office action, and an updated search of the prior art did not yield any other references pertinent to all of the limitations

presently recited in Applicants' claims, it is considered that the application is currently in full and proper condition for allowance.

Any comments considered necessary by Applicants must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT G. SANTOS whose telephone number is (571)272-7048. The examiner can normally be reached on Monday through Friday, 11:00 a.m. to 7:30 p.m.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, Applicants are encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter M. Cuomo can be reached on (571) 272-6856. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ROBERT G. SANTOS/
Primary Examiner, Art Unit 3673

Examiner-Initiated Interview Summary	**Application No.** 14/283,675	**Applicant(s)** MAHONEY ET AL.	
	Examiner ROBERT G. SANTOS	**Art Unit** 3673	

All participants (applicant, applicant's representative, PTO personnel):

(1) *ROBERT G. SANTOS*.

(2) *STUART A. NELSON*.

(3)_____.

(4)_____.

Date of Interview: *14 April 2017*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *16*.

Identification of prior art discussed: *N/A*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicants' representative and the examiner agreed to the change to claim 16 as described in the examiner's amendment in order to place the application in full and proper condition for allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/ROBERT G. SANTOS/
Primary Examiner, Art Unit 3673

Search Notes	Application/Control No. 14283675	Applicant(s)/Patent Under Reexamination MAHONEY ET AL.
	Examiner ROBERT G SANTOS	Art Unit 3673

CPC- SEARCHED

Symbol	Date	Examiner
A47C 27/08, 27/081, 27/082, 27/083, 27/10	10/01/2016	R.S.
A61G 7/05769, 7/05776	10/01/2016	R.S.
Y10T 137/3584, 137/36	10/01/2016	R.S.
G05B 15/02	10/01/2016	R.S.
UPDATED	4/11/2017	R.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
5	706, 710, 713, 714, 644, 654, 655.3	10/01/2016	R.S.
137	224, 223	10/01/2016	R.S.
700	17	10/01/2016	R.S.
Above	UPDATED	4/11/2017	R.S.

SEARCH NOTES

Search Notes	Date	Examiner
Search obtained from parent case (Serial No. 12/936,084, now U.S. Pat. No. 8,769,747)	10/01/2016	R.S.
EAST Image, Text and CPC Searches	10/01/2016	R.S.
EAST Image, Text and CPC Searches	4/11/2017 & 4/14/2017	R.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
5	644, 654, 655.3, 706, 710, 713, 714	4/14/2017	R.S.

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INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
137	223, 224	4/14/2017	R.S.
700	17	4/14/2017	R.S.
A47C	27/08, 27/081, 27/082, 27/083, 27/10	4/14/2017	R.S.
A61G	7/05769, 7/05776	4/14/2017	R.S.
G05B	15/02	4/14/2017	R.S.
Y10T	137/3584, 137/36	4/14/2017	R.S.

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Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 5177

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/283,675	05/21/2014 **RULE**	005	3673	39870-0048002

APPLICANTS
Select Comfort Corporation, Minneapolis, MN;

INVENTORS
Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, Bobbisndale, MN;
Matthew Wayne Tilstra, Rogers, MN;

** **CONTINUING DATA** *************************
This application is a CON of 12/936,084 10/01/2010 PAT 8769747
which is a 371 of PCT/US08/59409 04/04/2008

** **FOREIGN APPLICATIONS** *************************

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
06/02/2014

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ROBERT G SANTOS/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		MN	8	20	4

ADDRESS
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022
UNITED STATES

TITLE
SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
2320	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14283675	MAHONEY ET AL.
	Examiner	**Art Unit**
	ROBERT G SANTOS	3673

CPC					
Symbol				**Type**	**Version**
A47C		27	/ 083	F	2013-01-01
A47C		27	/ 10	A	2013-01-01
A47C		17	/ 80	I	2013-01-01
A47C		27	/ 082	I	2013-01-01
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CPC Combination Sets							
Symbol				**Type**	**Set**	**Ranking**	**Version**
			/				
			/				

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 22	
/ROBERT G SANTOS/ Primary Examiner.Art Unit 3673 04/14/2017 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1; 6

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14283675	MAHONEY ET AL.
	Examiner	**Art Unit**
	ROBERT G SANTOS	3673

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

INTERNATIONAL CLASSIFICATION

CLAIMED					NON-CLAIMED				
A	4	7	C	27 / 08 (2006.01.01)					
A	4	7	C	27 / 10 (2006.01.01)					

NONE (Assistant Examiner) (Date)	Total Claims Allowed: 22	
/ROBERT G SANTOS/ Primary Examiner.Art Unit 3673 04/14/2017 (Primary Examiner) (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1; 6

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14283675	MAHONEY ET AL.
	Examiner	**Art Unit**
	ROBERT G SANTOS	3673

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☒ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	20	17												
2	2	21	18												
3	3		19												
4	4		20												
5	5	22	21												
6	6	10	22												
7	7	11	23												
8	8	19	24												
9	9														
12	10														
13	11														
14	12														
15	13														
16	14														
17	15														
18	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 22	
/ROBERT G SANTOS/ Primary Examiner.Art Unit 3673 (Primary Examiner)	04/14/2017 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1; 6

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Index of Claims	Application/Control No. 14283675	Applicant(s)/Patent Under Reexamination MAHONEY ET AL.
	Examiner ROBERT G SANTOS	**Art Unit** 3673

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☒ **T.D.** ☐ **R.1.47**

CLAIM		DATE								
Final	Original	10/02/2016	04/14/2017							
1	1	✓	=							
2	2	✓	=							
3	3	✓	=							
4	4	✓	=							
5	5	✓	=							
6	6	✓	=							
7	7	✓	=							
8	8	✓	=							
9	9	✓	=							
12	10	✓	=							
13	11	✓	=							
14	12	✓	=							
15	13	✓	=							
16	14	✓	=							
17	15	✓	=							
18	16	✓	=							
20	17	✓	=							
21	18	✓	=							
	19	✓	-							
	20	✓	-							
22	21		=							
10	22		=							
11	23		=							
19	24		=							

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	111	@pd>"20161001" and (5/706 or 5/710 or 5/713 or 5/714 or 5/644 or 5/654 or 5/655.3 or 137/224 or 137/223 or 700/17).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:29
L2	3945	5/706,710,713,714,644,654,655.3.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L3	60	@pd>"20161001" and L2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L4	2178	L2 AND ((A47C27/081 OR A47C27/10 OR A47C27/083 OR A47C27/082 OR A47C27/08 OR A61G7/05769 OR A61G7/05776).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L5	50	@pd>"20161001" and L4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L6	2178	L2 AND ((A47C27/081 OR A47C27/10 OR A47C27/083 OR A47C27/082 OR A47C27/08 OR A61G7/05769 OR A61G7/05776).CPC. AND (5/706 OR 5/710 OR 5/655.3 OR 5/644 OR 5/713 OR 5/654 OR 5/714).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L7	50	@pd>"20161001" and L6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:30
L8	1968	L2 AND ((A47C27/081 OR A47C27/10 OR	US-PGPUB;	OR	OFF	2017/04/11

		A47C27/083 OR A47C27/082 OR A47C27/08 OR A61G7/05769 OR A61G7/05776).CPC. AND (5/706 OR 5/710 OR 5/655.3 OR 5/644 OR 5/713 OR 5/654 OR 5/714).CCLS. AND (A47C27/08 OR A47C27/10 OR A61G7/057).IPCR.)	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			15:31
L9	50	@pd>"20161001" and L8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:31
L10	619	137/224.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:31
L11	6	@pd>"20161001" and L10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:31
L12	561	L10 AND ((Y10T137/36 OR Y10T137/3584).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:32
L13	4	@pd>"20161001" and L12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:32
L14	561	L10 AND ((Y10T137/36 OR Y10T137/3584).CPC. AND (137/224 OR 137/223).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:32
L15	4	@pd>"20161001" and L14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:32
L16	2061	700/17.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2017/04/11 15:33

			IBM_TDB			
L17	34	@pd>"20161001" and L16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:33
L18	237	L16 AND ((G05B15/02).CPC.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:33
L19	9	@pd>"20161001" and L18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:33
L20	237	L16 AND ((G05B15/02).CPC. AND (700/17).CCLS.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:34
L21	9	@pd>"20161001" and L20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:34
L22	206	L16 AND ((G05B15/02).CPC. AND (700/17).CCLS. AND (G05B15/02 OR G05B11/01 OR G05B15/00).IPCR.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:34
L23	9	@pd>"20161001" and L22	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/04/11 15:34

4/11/2017 3:34:55 PM
C:\Users\rsantos\Documents\EAST\Workspaces\14283675.wsp

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	14283675
Filing Date	21-May-2014
First Named Inventor	Paul Mahoney
Attorney Docket Number	39870-0048002
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Select Comfort Corporation	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

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as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 63947 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request

Signature	/Stuart A. Nelson/
Name	Stuart A. Nelson

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	14283675
Filing Date:	21-May-2014
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Filer:	Stuart A. Nelson/Amanda Petersen
Attorney Docket Number:	39870-0048002

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 14283675

Filing Date: 21-May-2014

Applicant/Patent under Reexamination: Mahoney

Electronic Terminal Disclaimer filed on April 14, 2017

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	28929452
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Amanda Petersen
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	14-APR-2017
Filing Date:	21-MAY-2014
Time Stamp:	12:30:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	041417INTEFSW00009121061050
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	33419 a0bd0033cbe24a86898f4610bf1f96bd8be7a9d4	no	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	30343 f53712de4305d66e2b9d46cfd367d5eb12aacd46	no	2

Warnings:

Information:

Total Files Size (in bytes): 63762

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	: Matthew Glen Hilden	Art Unit	: 3673
Serial No.	: 14/283,675	Examiner	: Robert G. Santos
Filed	: May 21, 2014	Conf. No.	: 5177
Title	: System and Method for Improved Pressure Adjustment		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY TO ACTION OF OCTOBER 07, 2016

Please consider the following reply.

Electronic Patent Application Fee Transmittal

Application Number:	14283675
Filing Date:	21-May-2014
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Filer:	Stuart A. Nelson/Abby Remer
Attorney Docket Number:	39870-0048002

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	2	80	160
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**160**

Electronic Acknowledgement Receipt

EFS ID:	27736785
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Abby Remer
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	08-DEC-2016
Filing Date:	21-MAY-2014
Time Stamp:	15:05:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	120916INTEFSW00001578061050
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response.pdf	136328 da368b00b721513f36b7050ed20e1774b9c4a97f	yes	11

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Applicant Arguments/Remarks Made in an Amendment	8	11
Claims	2	7
Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	30525 4279e4bc47e26c45942b0e4cff1cde8130f235ac	no	2

Warnings:

Information:

Total Files Size (in bytes):	166853

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Claims 1-18 and 21-24 are pending, with claims 1, 10, 16, and 17 being independent. Claims 1, 2, 4, 6, 7, 9, 10, and 12-17 have been amended, claims 19-20 have been cancelled without prejudice or disclaimer, and claims 21-24 have been added. Support for the amendments and new claims can be found throughout the specification. No new matter has been introduced.

Examiner Interview

An examiner interview was conducted on November 21, 2016 between Examiner Robert G. Santos for the USPTO and Stuart A. Nelson for the Applicant. The applicant thanks Examiner Santos for the courtesies extended in the interview. During the interview, the parties discussed claim 1 and the differences between the claim and the cited references. ***It was agreed*** that the elements of claim 1 are not taught by the cited references at least if claim 1 is amended to clarify that the "pressure target" is "a pressure target for the pump housing." The Applicant agreed to make that amendment to claim 1, and has done so herein.

Statutory Double Patenting

Claims 1-15 and 17-20 were rejected under 35 U.S.C. § 101 as claiming the same invention as that of claims 1-19 of U.S. Patent No. 8,769,747.

The double patenting rejections will be addressed upon notice of allowable subject matter with a terminal disclaimer if appropriate at that time.

Section 103

Claim Rejections – 35 USC § 103

Claims 1, 2, 4-10, 12-17, 19 and 20 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Pub. No. 2007/0227594 (Chaffee) in view of U.S. Pat. No. 7,022,113 (Lockwood). Claims 3, 11 and 18 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Pub. No. 2007/0227594 (Chaffee) in view of U.S. Pat. No. 7,022,113 (Lockwood) and further in view of U.S. Pat. No. 6,789,284 (Kemp).

Without conceding the merits of the rejections and to move the prosecution forward (and as agreed to in the examiner interview), the Applicant has amended the claims with amendments that overcome the pending rejection. For example, claim 1 as amended requires "calculating a pressure target <u>for the pump housing</u>, wherein the pressure target <u>for the pump housing</u> is calculated based upon the desired pressure setpoint <u>for the air chamber</u> and a pressure adjustment factor," which was agreed during the November 21, 2016 interview was not disclosed by the cited prior art alone or in combination. Accordingly, claim 1 and all claims depending therefrom are patentable for at least this reason.

Independent claim 10 as amended requires "calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint <u>for the air chamber</u> and a pressure adjustment factor<u>, wherein the manifold pressure target is calculated to approximate the desired pressure setpoint for the air chamber as modified by the pressure adjustment factor to account for differences between sensing pressure in the manifold and sensing pressure in the air chamber</u>," which is also not disclosed by the cited references. None of the cited references, alone or in combination, teach calculating a *manifold* pressure target based upon a desired pressure setpoint for an air chamber and a pressure adjustment factor, let alone that the manifold pressure target is calculated to approximate the desired pressure setpoint for the air chamber as modified by the pressure adjustment factor to account for differences between sensing pressure in the manifold and sensing pressure in the air chamber. Accordingly, claim 10 and all claims depending therefrom are patentable for at least this reason.

Independent claim 16 as amended requires "calculating a pressure target <u>that is different than the desired pressure setpoint for the air chamber</u>, wherein the pressure target is calculated based upon the desired pressure setpoint <u>for the air chamber</u> and a pressure adjustment factor." None of the cited references discloses calculating a pressure target that is *different* than the *desired* pressure setpoint for the air chamber, let alone one that is calculated based upon the desired pressure setpoint for the air chamber and a pressure adjustment factor. The system disclosed by Lockwood, for example, uses a PID algorithm to control pressure in a manner different than claimed, and without teaching the claimed steps. Accordingly, claim 16 is patentable for at least this reason.

Independent claim 17 as amended requires "control logic that is programmed to determine a manifold pressure target that corresponds to and is different than the desired pressure setpoint." None of the cited references, alone or in combination, teach control logic programmed to determine a manifold pressure target that corresponds to and is also *different* than a desired pressure setpoint. Claim 17 also requires that the control logic is programmed to perform a number of additional steps, and "calculating a modified manifold pressure target that corresponds to and is different than the desired pressure setpoint as a function of the adjustment factor error," which is also not disclosed by and of the cited references, alone or in combination. Accordingly, claim 17 and all claims depending therefrom are patentable for at least this reason.

Conclusion

The other claims in the application are each dependent on the independent claims, and are allowable for at least the above reasons. Because each claim is deemed to define additional aspects of the disclosure, however, the individual consideration of each claim on its own merits is respectfully requested.

By responding in the foregoing remarks only to particular positions taken in the action, applicant does not acquiesce with other positions that have not been explicitly addressed. In addition, applicant's selecting some particular arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.[1] Finally, applicant's decision to amend or cancel any claim should not be understood as implying that applicant agrees with any positions taken in the action with reference to that claim or other claims, or that applicant adopts or agrees with any position except as specifically stated in this paper. In particular, by amending a claim, applicant does not necessarily concede that the claim prior to amendment was unpatentable.

The fee of $160 for excess claims is being filed with this replay on the Electronic Filing System. Please charge any fees that need to be paid and apply any credits to deposit account 06-1050.

Respectfully submitted,

Date: 12/8/2016

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

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Facsimile: (877) 769-7945

1227949o.docx

[1] For example, the Applicant does not concede that a POSITA would have been motivated to combine references as indicated or that the cited references teach all claim elements of dependent claims. Such arguments are omitted herein for sake of brevity in favor of focusing on reasons for patentability discussed during the Examiner Interview.

List of Claims (replacing prior versions).

1. (Currently Amended) A method for adjusting pressure within an air bed including an air chamber and a pump having a pump housing comprising:

~~providing an air bed, the air bed including an air chamber and a pump having a pump housing;~~

receiving a selection for ~~selecting~~ a desired pressure setpoint for the air chamber;

calculating a pressure target for the pump housing, wherein the pressure target for the pump housing is calculated based upon the desired pressure setpoint for the air chamber and a pressure adjustment factor;

adjusting pressure within the air chamber until a pressure sensed within the pump housing is substantially equal to the pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and

modifying the pressure adjustment factor based upon the adjustment factor error.

2. (Currently Amended) The method of claim 1, wherein the pressure sensed within the pump housing is sensed simultaneously while ~~the step of~~ adjusting pressure within the air chamber ~~further comprises simultaneously sensing pressure within the pump housing~~.

3. (Original) The method of claim 1, wherein pressure is sensed with a pressure transducer.

4. (Currently Amended) The method of claim 1, wherein the pressure target for the pump housing is a deflate pressure target for the pump housing.

5. (Original) The method of claim 4, wherein the pressure adjustment factor is a multiplicative pressure adjustment factor.

6. (Currently Amended) The method of claim 5, wherein the deflate pressure target for the pump housing is calculated by dividing the desired pressure setpoint for the air chamber by the

multiplicative pressure adjustment factor.

7. (Currently Amended) The method of claim 1, wherein the pressure target for the pump housing is an inflate pressure target.

8. (Original) The method of claim 7, wherein the pressure adjustment factor is an additive pressure adjustment factor.

9. (Currently Amended) The method of claim 7, wherein the inflate pressure target for the pump housing is calculated by determining the sum of the desired pressure setpoint for the air chamber and the additive pressure adjustment factor.

10. (Currently Amended) A method for adjusting pressure within an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the air chamber and the pump manifold comprising:

~~providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump;~~

selecting a desired pressure setpoint for the air chamber;

calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint for the air chamber and a pressure adjustment factor, wherein the manifold pressure target is calculated to approximate the desired pressure setpoint for the air chamber as modified by the pressure adjustment factor to account for differences between sensing pressure in the manifold and sensing pressure in the air chamber;

sensing pressure within the pump manifold;

adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint for the air chamber to determine an adjustment factor error;

modifying the pressure adjustment factor based upon the adjustment factor error to create a modified pressure adjustment factor configured to more accurately account for differences between sensing pressure in the manifold and sensing pressure in the air chamber; and

storing the modified pressure adjustment factor in memory;

calculating a modified manifold pressure target, wherein the modified manifold pressure target is calculated based upon the desired pressure setpoint for the air chamber and the modified pressure adjustment factor; and

adjusting pressure within the air chamber until pressure sensed within the pump manifold is substantially equal to the modified manifold pressure target.

11. (Original) The method of claim 10, wherein pressure is sensed with a pressure transducer.

12. (Currently Amended) The method of claim 10, wherein the manifold pressure target is a manifold deflate pressure target that is different than a manifold inflate pressure target.

13. (Currently Amended) The method of claim 12, wherein the manifold deflate pressure target is calculated by dividing the desired pressure setpoint for the air chamber by a manifold deflate pressure adjustment factor.

14. (Currently Amended) The method of claim 10, wherein the manifold pressure target is [[an]] a manifold inflate pressure target that is different than a manifold deflate pressure target.

15. (Currently Amended) The method of claim 14, wherein the manifold inflate pressure target is calculated by determining the sum of the desired pressure setpoint for the air chamber and [[an]] a manifold inflate pressure adjustment factor.

16. (Currently Amended) A method for adjusting pressure within an air bed comprising:

(a) providing an air bed, the air bed including an air chamber and a pump having a pump housing;

(b) receiving a selection for ~~selecting~~ a desired pressure setpoint for the air chamber;

(c) calculating a pressure target that is different than the desired pressure setpoint for the air chamber, wherein the pressure target is calculated based upon the desired pressure setpoint for the air chamber and a pressure adjustment factor;

(d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

(e) determining an actual chamber pressure within the air chamber;

(f) comparing the actual chamber pressure within the air chamber to the desired pressure setpoint for the air chamber to determine an adjustment factor error;

(g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and

(h) repeating steps (b)-(g) [[with]] using the updated pressure adjustment factor in place of the pressure adjustment factor.

17. (Currently Amended) A pressure adjustment system for an air bed comprising:

an air chamber;

a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve;

an input device adapted to receive a desired pressure setpoint selected by a user;

a pressure sensing means adapted to monitor pressure within the pump manifold; and

a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is programmed to determine a manifold pressure target that corresponds to and is different than the desired pressure setpoint, adjust pressure in the air chamber until a sensed pump manifold pressure is substantially equal to the manifold pressure target, determining an actual chamber pressure within the air chamber after adjusting pressure, determining an adjustment factor error as a function of a difference between the desired pressure setpoint and the actual chamber pressure within the air chamber after adjusting pressure, calculating a modified manifold pressure target that corresponds to and is different than the desired pressure setpoint as a function of the adjustment factor error, and subsequently adjusting pressure in the air chamber until the sensed pump manifold pressure is substantially equal to modified manifold pressure target in response to the input device receiving a selection of the desired pressure setpoint at a subsequent time ~~capable of calculating a manifold~~

~~pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error~~.

18. (Original) The pressure adjustment system of claim 17, wherein the pressure sensing means is a pressure transducer.

19.-20. (Canceled)

21. (New) The pressure adjustment system of claim 17, wherein the sensed pump manifold pressure is sensed by the pressure sensing means while adjusting pressure in the air chamber and the actual chamber pressure is determined via the pressure sensing means sensing pressure in the pump manifold while pressure is not being adjusted.

22. (New) The method of claim 1, wherein modifying the pressure adjustment factor based on the adjustment factor error creates a modified pressure adjustment factor, wherein the method further comprises:

calculating a modified pressure target that is different than the desired pressure setpoint, wherein the modified pressure target is calculated based upon the desired pressure setpoint and the modified pressure adjustment factor; and

adjusting pressure within the air chamber until the pressure sensed within the pump housing is substantially equal to the modified pressure target.

23. (New) The method of claim 1, wherein the pressure sensed within the pump housing is sensed in a manifold in the pump housing.

24. (New) The method of claim 16, wherein the pressure within the pump housing is a pressure

within a manifold in the pump housing.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/283,675	Filing Date 05/21/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	12/08/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 22	Minus	** 20	= 2	x $80 =	160
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**160**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
TAMARA DARKO

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

26191 7590 11/30/2016
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	
SANTOS, ROBERT G	

ART UNIT	PAPER NUMBER
3673	

NOTIFICATION DATE	DELIVERY MODE
11/30/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/283,675	MAHONEY ET AL.	
	Examiner	Art Unit	
	ROBERT G. SANTOS	3673	

All participants (applicant, applicant's representative, PTO personnel):

(1) ROBERT G. SANTOS. (3)_____.

(2) STUART A. NELSON. (4)_____.

Date of Interview: 21 November 2016.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1,10,16 and 17.

Identification of prior art discussed: Lockwood et al. '113.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicants' representative and the examiner discussed various proposed amendments (e.g., calculating a pressure target for the pump housing or the pump manifold) which are considered to distinguish fully over the cited Lockwood et al. '113, reference, which primarily discloses an adjustment factor error with respect to an inflatable air chamber as opposed to a pressure target for an associated pump housing or pump manifold. An updated search of the prior art will be conducted after receipt of a formal amendment.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/ROBERT G. SANTOS/
Primary Examiner, Art Unit 3673

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 90

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

USPTO Automated Interview Request (AIR)

Nov 15 2016

This paper requesting to schedule and/or conduct an interview is appropriate because:

This submission is requested to be accepted as an authorization for this interview to communicate via the internet. Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned concerning scheduling of the interview via video conference, instant messaging, or electronic mail, and to conduct the interview in accordance with office practice including video conferencing.

Name(s):
Stuart A. Nelson

S-signature:
/Stuart A Nelson/

Registration Number:
63947

U.S. Application Number:
14283675

Confirmation Number:
5177

E-mail Address:
snelson@fr.com

Phone Number:
6123372538

Proposed Time of Interview:
11-23-2016 11:30 AM ET

Prefered Interview Type:
Telephonic

I am the applicant or applicant's representative for this application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

26191 7590 10/07/2016
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	
SANTOS, ROBERT G	

ART UNIT	PAPER NUMBER
3673	

NOTIFICATION DATE	DELIVERY MODE
10/07/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

Office Action Summary	Application No. 14/283,675	Applicant(s) MAHONEY ET AL.	
	Examiner ROBERT G. SANTOS	Art Unit 3673	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *See Continuation Sheet*.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-20* is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6)☐ Claim(s) _____ is/are allowed.
7)☒ Claim(s) *1-20* is/are rejected.
8)☐ Claim(s) _____ is/are objected to.
9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.
11)☒ The drawing(s) filed on *21 May 2014* is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a)☐ All b)☐ Some** c)☐ None of the:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.
3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
4) ☐ Other: _____.

Continuation of Status 1).Responsive to communication(s) filed on: 21 May 2014, 18 July 2014, 31 October 2014, 18 December 2014, 01 October 2015 and on 07 December 2015.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

3. Claims 1-15 and 17-20 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-19 of U.S. Patent No. 8,769,747. Although the claims at issue are not identical, they are not patentably distinct from each other because claims 1-15 and 17-20 are generic to all that is recited in claims 1-19 of U.S. Patent No. 8,769,747. In other words, claims 1-19 of U.S. Patent No. 8,769,747 fully encompass the subject matter of claims 1-15 and 17-20 and therefore anticipate claims 1-15 and 17-20. Since claims 1-15 and 17-20 are anticipated by claims 1-19 of the patent, they are not patentably distinct from claims 1-19. Thus the invention of claims 1-19 of the patent is in effect a "species" of the "generic" invention of claims 1-15 and 17-20. It has been held that the generic invention is anticipated by the species, see *In re Goodman*, 29 USPQ2d 2010 (Fed. Cir. 1993). Since claims 1-15 and 17-20 are

anticipated (fully encompassed) by claims 1-19 of the patent, claims 1-15 and 17-20 are not patentably distinct from claims 1-19, regardless of any additional subject matter present in claims 1-19.

4. Claim 16 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 8,769,747 in view of U.S. Patent No. 7,022,113 to Lockwood et al. Claim 1 of U.S. Patent No. 8,769,747 does not specifically recite the method steps of (g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and (h) repeating steps (b)-(g) with the updated pressure adjustment factor. Lockwood et al. provide the basic teaching of a method including calculating an updated factor error (Lockwood et al. utilize sensors to determine the error between the desired pressure and the sensed pressure as described in column 13, line 15) and calculating the adjustment factor based upon the adjustment factor error (as described in column 13, line 21). The skilled artisan would have found it obvious at the time the invention was made to modify the method as recited in claim 1 of U.S. Patent No. 8,769,747 to include the adjustment error as disclosed by Lockwood et al. and to repeat all the steps since such would further improve the ability of the method to achieve the desired pressure.

Claim Rejections - 35 USC § 103

5. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the

statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

6. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 2, 4-10, 12-17, 19 and 20 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. App. Pub. No. 2007/0227594 to Chaffee in view of Lockwood et al. '113. As concerns claims 1, 4 and 7, Chaffee '594 shows the claimed limitations of a method for adjusting pressure within an air bed comprising: providing an air bed, the air bed including an air chamber (bladder) and a pump having a pump housing (as described on page 3, in paragraph 0059); selecting a desired pressure setpoint for the air chamber (as described on page 4, in paragraph 0060); calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint (as described on page 4, in paragraph 0062); adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (as described on page 4, in paragraph 0062); determining an actual chamber pressure within the air chamber (as described on page 4, in paragraph 0062); and wherein the pressure target is a deflate pressure target and wherein the pressure target is an inflate pressure target (also as described on page 4, in paragraph 0062).

However, Chaffee '594 does not specifically disclose the method steps of comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error, and modifying the pressure adjustment factor based upon the adjustment factor error. Lockwood et al. provide the basic teaching of a method including determining an adjustment factor error (Lockwood et al. utilize sensors to determine the error between the desired pressure end the sensed pressure as described in column 13, line 15) and modifying the adjustment factor based upon the adjustment factor error (as described in column 13, line 21). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee '594 to include the adjustment error as disclosed by Lockwood et al. since such would further improve the ability of the method to achieve the desired pressure.

With respect to claim 2, Chaffee '594 further discloses wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the conduit (see page 5, paragraph 0072). However, Chaffee '594 does not specifically disclose sensing the pressure in the pump housing. The skilled artisan would have found it obvious at the time the invention was made to locate the sensor in the conduit within the housing since the pressure immediately outside the housing in the conduit would be the same as in the housing thus the exact location is arbitrary. Also, it has been held that rearranging parts of an invention involves only routine skill in the art.

With respect to claims 5 and 6, Chaffee '594 further discloses adjusting the pressure (as described on page 4, paragraph 0062), but does not specifically disclose conditions wherein the pressure adjustment factor is a multiplicative pressure adjustment factor and wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor. Lockwood et al. provide the basic teaching of a method wherein the adjustment factor is a multiplicative adjustment factor (see column 12, lines 45-48). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee ‘594 to include the adjustment error as disclosed by Lockwood et al. and in doing so using division to calculate the deflate pressure target since such would further improve the ability of the method to achieve the desired pressure.

With respect to claims 8 and 9, Lockwood et al. further teach wherein the pressure adjustment factor is an additive pressure adjustment factor (see column 3, line 21). The skilled artisan would have also found it obvious at the time the invention was made to modify the method as disclosed by Chaffee ‘594 to include the adjustment error as disclosed by Lockwood et al. and in doing so using addition to calculate the inflate pressure target since such would further improve the ability of the method to achieve the desired pressure.

With respect to claims 10, 12 and 13, Chaffee ‘594 shows the claimed limitations of a method for adjusting pressure within an air bed comprising: providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump (as described on page 3, in paragraph 0059); selecting a desired pressure setpoint for the air chamber (as described on page 4, in paragraph 0060); calculating a manifold pressure target wherein the manifold pressure target is calculated based upon the desired pressure setpoint (as described on page 4, in paragraph 0062); sensing pressure within the conduit (as described on page 5, in paragraph 0072); determining an actual chamber pressure within the air chamber (as described on page 4, in paragraph 0062); storing the pressure in memory (as described on page 7, in paragraph 0098 and on page 8, in paragraph 0098); and wherein the pressure target is a deflate pressure target and wherein the pressure target is an inflate pressure target (also as described on page 4, in paragraph 0062).

However, Chaffee '594 does not specifically disclose the method steps of sensing pressure within the pump manifold; adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target; comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; modifying the pressure adjustment factor based upon the adjustment factor error; and storing the modified pressure adjustment factor in memory. Lockwood et al. provide the basic teaching of a method including determining an adjustment factor error (Lockwood et al. utilize sensors to determine the error between the desired pressure and the sensed pressure as described in column 13, line 15) and modifying the adjustment factor based upon the adjustment factor error (as described in column 13, line 21). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee '594 to include the adjustment error as disclosed by Lockwood et al. since such would further improve the ability of the method to achieve the desired pressure. Furthermore, the skilled artisan would have found it obvious at the time the invention was made to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as in the housing thus the exact location is arbitrary. Also, it has been held that rearranging parts of an invention involves only routine skill in the art.

With respect to claim 13, Chaffee '594 further discloses adjusting the pressure (as described on page 4, paragraph 0062), but does not specifically disclose a condition wherein the pressure adjustment factor is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor. Lockwood et al. provide the basic teaching of a method wherein the adjustment factor is a deflate adjustment factor (see column 12, lines 45-48). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee '594 to include the adjustment error as disclosed by Lockwood et al. and in doing so using division to calculate the deflate pressure target since such would further improve the ability of the method to achieve the desired pressure.

With respect to claim 15, Chaffee '594 further discloses adjusting the pressure (as described on page 4, paragraph 0062), but does not specifically disclose a condition wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor. Lockwood et al. further teach wherein the pressure adjustment factor is an inflate pressure adjustment factor (see column 3, line 21). The skilled artisan would have also found it obvious at the time the invention was made to modify the method as disclosed by Chaffee '594 to include the adjustment error as disclosed by Lockwood et al. and in doing so using addition to calculate the inflate pressure target since such would further improve the ability of the method to achieve the desired pressure.

With respect to claim 16, Chaffee '594 discloses a method for adjusting pressure within an air bed comprising: (a) providing an air bed, the air bed including an air chamber and a pump having a pump housing (as described on page 2, in paragraph 0059); (b) selecting a desired pressure setpoint for the air chamber (as described on page 2, in paragraph 0060); (c) calculating a pressure target wherein the pressure target is calculated based upon the desired pressure setpoint (as described on page 4, in paragraph 0062); (d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (as described on page 4, in paragraph 0062); and (e) determining an actual chamber pressure within the air chamber (also as described on page 4, in paragraph 0062).

However, Chaffee ‘594 does not specifically disclose the method steps of (f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; (g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and (h) repeating steps (b)-(g) with the updated pressure adjustment factor. Lockwood et al. provide the basic teaching of a method including calculating an updated factor error (Lockwood et al. utilize sensors to determine the error between the desired pressure and the sensed pressure as described in column 13, line 15) and calculating the adjustment factor based upon the adjustment factor error (as described in column 13, line 21). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee ‘594 to include the adjustment error as disclosed by Lockwood et al. and to repeat all the steps since such would further improve the ability of the method to achieve the desired pressure.

With respect to claims 17, 19 and 20, Chaffee ‘594 shows the claimed limitations of a pressure adjustment system for an air bed comprising: an air chamber (as described on page 3, in paragraph 0059); a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve (also as described on page 3, in paragraph 0059); an input device adapted to receive a desired pressure setpoint selected by a user (as described on page 4, in paragraph 0064); a pressure sensing means adapted to monitor pressure within the pump conduit (as described on page 5, in paragraph 0072); and a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target, and comparing an actual chamber pressure to the desired pressure setpoint (as described on page 4, in paragraph 0062); and wherein the input device is a remote control having pressure selecting means and wherein the remote control is a wireless remote control (as described on page 4, in paragraph 0064).

However, Chaffee ‘594 does not specifically disclose a pressure sensing means adapted to monitor pressure within the pump manifold; monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error. Lockwood et al. provide the basic teaching of a method including determining an adjustment factor error (Lockwood et al. utilize sensors to determine the error between the desired pressure and the sensed pressure as described in column 13, line 15) and modifying the adjustment factor based upon the adjustment factor error (as described in column 13, line 21). The skilled artisan would have found it obvious at the time the invention was made to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood et al. since such would further improve the ability of the method to achieve the desired pressure. Furthermore, the skilled artisan would have found it obvious at the time the invention was made to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as In the housing thus the exact location is arbitrary. Also, it has been held that rearranging parts of an invention involves only routine skill in the art.

8. Claims 3, 11 and 18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Chaffee '594 in view of Lockwood et al. '113 as applied to claims 1, 10 and 17 above, and further in view of U.S. Pat. No. 6,789,284 to Kemp. Chaffee '594 further discloses wherein the pressure is sensed (see page 4, paragraph 0060); however, Chaffee '594 as modified by Lockwood et al. does not specifically disclose a condition wherein the pressure is sensed with a pressure transducer. Kemp provides the basic teaching of a method wherein pressure is sensed with a pressure transducer (see column 3, lines 57-58). The skilled artisan would have found it obvious at the time the invention was made to modify the method of Chaffee as modified by Lockwood et al. to include the pressure transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to Applicants' disclosure: Nunn et al. '879, Nunn et al. '457, Mahoney et al. '137 and Fleury et al. '339.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT G. SANTOS whose telephone number is (571)272-7048. The examiner can normally be reached on Monday through Friday, 11:00 a.m. to 7:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Peter M. Cuomo can be reached on (571) 272-6856. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ROBERT G. SANTOS/
Primary Examiner, Art Unit 3673

Notice of References Cited	Application/Control No. 14/283,675	Applicant(s)/Patent Under Reexamination MAHONEY ET AL.	
	Examiner ROBERT G. SANTOS	Art Unit 3673	Page 1 of 1

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	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	V	
	W	
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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BIB DATA SHEET

CONFIRMATION NO. 5177

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/283,675	05/21/2014 **RULE**	005	3673	39870-0048002

APPLICANTS
Select Comfort Corporation, Minneapolis, MN;

INVENTORS
Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, Bobbisndale, MN;
Matthew Wayne Tilstra, Rogers, MN;

** **CONTINUING DATA** *************************
This application is a CON of 12/936,084 10/01/2010 PAT 8769747
which is a 371 of PCT/US08/59409 04/04/2008

** **FOREIGN APPLICATIONS** *************************

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
06/02/2014

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ROBERT G SANTOS/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		MN	8	20	4

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UNITED STATES

TITLE

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

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2160	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ________________ ☐ Credit

BIB (Rev. 05/07).

Substitute Disclosure Form / U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

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Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
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Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation	
							Yes	No

Other Documents (include Author, Title, Date, and Place of Publication)

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Examiner Signature	Date Considered
/Robert Santos/	10/01/2016
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	mahoney-paul.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40
L2	28	mahoney-paul-$.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40
L3	8	hilden-matthew.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40
L4	4	hilden-matthew-$.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40
L5	9	tilstra-matthew.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40
L6	13	tilstra-matthew-$.in.	US-PGPUB; USPAT	OR	OFF	2016/10/01 12:40

10/1/2016 12:41:17 PM

Substitute for form 1449A/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	**Application Number**	~~Unknown~~14/283,675
(Use as many sheets as necessary)	**Filing Date**	~~Herewith~~ May 21, 2014
	First Named Inventor	Paul James Mahoney
	Group Art Unit	~~Unknown~~ 3673
	Examiner Name	~~Unknown~~ Robert Santos
Sheet 1 of 2	Attorney Docket No: 3500.019US2	

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Examiner Initial *	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
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EXAMINER **DATE CONSIDERED**

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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	Unknown
	Filing Date	Herewith
	First Named Inventor	Paul James Mahoney
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 2 of 2	Attorney Docket No: 3500.019US2	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS		
Examiner Initial *	**Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.**	**T 1**
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S/N Unknown **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Paul James Mahoney et al.	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket: 3500.019US2
Customer No.:	21186	Confirmation No.: Unknown
Title:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

	Serial No./ Patent No.	Filing Date	Attorney Docket	Title
/R.S./	12/936,084	October 1, 2010	3500.019US1	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Respectfully submitted,

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Date May 21, 2014 By /Adam Kiedrowski/
Adam P. Kiedrowski
Reg. No. 60,296

/Robert Santos/ 10/01/2016

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	First Named Inventor Paul James Mahoney	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

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Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
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Examiner Signature	Date Considered
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		First Named Inventor Paul James Mahoney	
		Filing Date May 21, 2014	Group Art Unit

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Foreign Patent Documents or Published Foreign Patent Applications

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Information Disclosure Statement by Applicant (Use several sheets if necessary)		First Named Inventor Paul James Mahoney	
(37 CFR §1.98(b))		Filing Date May 21, 2014	Group Art Unit

Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation	
							Yes	No
	54	WO 00/03628A2	01/27/2000	WO				
	55	CA 2720467C	12/10/2013	CA				

Other Documents (include Author, Title, Date, and Place of Publication)		
Examiner Initial	Desig. ID	Document
	56	Australian Application Serial No. 2008353972, First Examiner Report dated 04/18/2011, 2 pages
	57	European Application Serial No. 08745110.0, Supplementary European Search Report mailed 01/25/2012, 5 pages
	58	International Application Serial No. PCT/US08/59409, International Search Report mailed 08/15/2008, 2 pages
	59	International Application Serial No. PCT/US08/59409, Written Report mailed 08/15/2008, 5 pages
	60	Canadian Application Serial No. 2,720,467, Response filed 11/29/2012 to Office Action mailed 05/31/2012, 10 pages

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Search Notes	Application/Control No. 14283675	Applicant(s)/Patent Under Reexamination MAHONEY ET AL.
	Examiner ROBERT G SANTOS	Art Unit 3673

CPC- SEARCHED

Symbol	Date	Examiner
A47C 27/08, 27/081, 27/082, 27/083, 27/10	10/01/2016	R.S.
A61G 7/05769, 7/05776	10/01/2016	R.S.
Y10T 137/3584, 137/36	10/01/2016	R.S.
G05B 15/02	10/01/2016	R.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner
5	706, 710, 713, 714, 644, 654, 655.3	10/01/2016	R.S.
137	224, 223	10/01/2016	R.S.
700	17	10/01/2016	R.S.

SEARCH NOTES

Search Notes	Date	Examiner
Search obtained from parent case (Serial No. 12/936,084, now U.S. Pat. No. 8,769,747)	10/01/2016	R.S.
EAST Image, Text and CPC Searches	10/01/2016	R.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No. 14283675	Applicant(s)/Patent Under Reexamination MAHONEY ET AL.
	Examiner ROBERT G SANTOS	Art Unit 3673

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/02/2016								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								

Substitute Disclosure Form — U.S. Department of Commerce, Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant: Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date: May 21, 2014	Group Art Unit

U.S. Patent Documents							
Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1.	14/675,355		Palashewski et al.			03/31/2015
	2.	14/687,633		Brosnan et al.			04/15/2015
	3.	2015/0007393	01/08/2015	Palashewski			
	4.	2015/0026896	01/29/2015	Fleury et al.			
	5.	2015/0157137	06/11/2015	Nunn et al.			
	6.	2015/0157519	06/11/2015	Stusynski et al.			
	7.	2015/0182033	07/02/2015	Brosnan et al.			
	8.	2015/0182397	07/02/2015	Palashewski et al.			
	9.	2015/0182399	07/02/2015	Palashewski et al.			
	10.	2015/0182418	07/02/2015	Zaiss			
	11.	4,766,628	08/30/1988	Greer et al.			
	12.	4,788,729	12/06/1988	Greer et al.			
	13.	4,829,616	05/16/1982	Walker			
	14.	4,890,344	01/02/1990	Walker			
	15.	4,897,890	02/06/1990	Walker			
	16.	4,908,895	03/20/1990	Walker			
	17.	4,991,244	02/12/1991	Walker			
	18.	5,144,706	09/08/1992	Walker et al.			
	19.	8,931,329	01/13/2015	Mahoney et al.			
	20.	8,966,689	03/03/2015	McGuire et al.			
	21.	8,973,183	03/10/2015	Palashewski et al.			
	22.	8,984,687	03/24/2015	Stusynski et al.			

Foreign Patent Documents or Published Foreign Patent Applications								
Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation Yes	Translation No

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

Other Documents (include Author, Title, Date, and Place of Publication)		
Examiner Initial	Desig. ID	Document

Examiner Signature /Robert Santos/	Date Considered 10/01/2016
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Substitute Disclosure Form

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.S./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002

CONFIRMATION NO. 5177

PUBLICATION NOTICE

OC000000079647048

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

Title:SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Publication No.US-2015-0374137-A1
Publication Date:12/31/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Paul James Mahoney	Art Unit	:	3644
Serial No.	:	14/283,675	Examiner	:	Richard G. Davis
Filed	:	May 21, 2014	Conf. No.	:	5177

Title : SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

MAIL STOP MISSING PARTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF MISSING PARTS OF APPLICATION

In order to complete this application, applicant as a large entity submits herewith the following:

☒ Declaration in compliance with 37 CFR §1.63.

Apply any necessary charges or credits to Deposit Account 06 1050, referencing the above attorney docket number.

Respectfully submitted,

Date: 12/7/2015

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number 26191
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

61249692.doc

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

As the below named inventor, I hereby declare that:

This declaration is directed to:

[ ] The attached application, or

[X] United States application or PCT international application number 14/283,675

filed on May 21, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Matthew Wayne Tilstra Date (Optional): 11-24-2015

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Attorney Docket No.: 39870-0048002 / Client Ref: 201400140

PTO/AIA/01 (06-12)
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LEGAL NAME OF INVENTOR

Inventor: Matthew Glen Hilden Date (Optional) : ____________

Signature: ____________

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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LEGAL NAME OF INVENTOR

Inventor: Paul James Mahoney Date (Optional) :

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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Electronic Acknowledgement Receipt

EFS ID:	24281863
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Lisa Becker
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	07-DEC-2015
Filing Date:	21-MAY-2014
Time Stamp:	15:23:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	39870048002submission.pdf	68389 70d84b0fd1509ed4741014c8a3af7b6666ff9f7d	no	1

Warnings:

Information:

2	Oath or Declaration filed	39870048002Dec.pdf	284171 bba9b38e15824fd5b30d54bf7ba3a918d7915fe3	no	3
Warnings:					
Information:					
			Total Files Size (in bytes):	352560	

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1.	14/675,355		Palashewski et al.			03/31/2015
	2.	14/687,633		Brosnan et al.			04/15/2015
	3.	2015/0007393	01/08/2015	Palashewski			
	4.	2015/0026896	01/29/2015	Fleury et al.			
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	9.	2015/0182399	07/02/2015	Palashewski et al.			
	10.	2015/0182418	07/02/2015	Zaiss			
	11.	4,766,628	08/30/1988	Greer et al.			
	12.	4,788,729	12/06/1988	Greer et al.			
	13.	4,829,616	05/16/1982	Walker			
	14.	4,890,344	01/02/1990	Walker			
	15.	4,897,890	02/06/1990	Walker			
	16.	4,908,895	03/20/1990	Walker			
	17.	4,991,244	02/12/1991	Walker			
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	22.	8,984,687	03/24/2015	Stusynski et al.			

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Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

Other Documents (include Author, Title, Date, and Place of Publication)		
Examiner Initial	Desig. ID	Document

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Electronic Acknowledgement Receipt

EFS ID:	23665986
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Anastasia Renard
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	01-OCT-2015
Filing Date:	21-MAY-2014
Time Stamp:	15:22:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS_Transmittal.pdf	62233 c1d7cc650189f7191544434bcebf9714a8081672	no	1

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Information:					
This is not an USPTO supplied IDS fillable form					
			Total Files Size (in bytes):	170880	

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Paul James Mahoney	Art Unit	:	Unknown
Serial No.	:	14/283,675	Examiner	:	Unknown
Filed	:	May 21, 2014	Conf. No.	:	5177
Title	:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT			

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Please consider the references listed on the enclosed PTO-1449 Form. Cited U.S. patents and patent application publications will be provided on request.

While these documents may be material pursuant to 37 C.F.R. § 1.56, their disclosure is not intended to constitute an admission that the documents are prior art in regard to this invention. The filing of this Statement should not be construed to mean that a search has been conducted or that no other material documents or information exists.

This statement is being filed before the receipt of a first action on the merits.

Apply any necessary charges or credits to deposit account 06-1050, referencing the above attorney docket number.

Please contact the undersigned if there are any questions regarding this Statement.

Respectfully submitted,

Date: 10/1/2015

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002

CONFIRMATION NO. 5177

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

INFORMAL NOTICE

OC000000077548171

Date Mailed: 09/22/2015

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Paul James Mahoney
  Matthew Glen Hilden
  Matthew Wayne Tilstra

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/283,675	05/21/2014	3744	2160	39870-0048002	20	4

CONFIRMATION NO. 5177

UPDATED FILING RECEIPT

OC000000077548170

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

Date Mailed: 09/22/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, Bobbisndale, MN;
Matthew Wayne Tilstra, Rogers, MN;

Applicant(s)

Select Comfort Corporation, Minneapolis, MN;

Assignment For Published Patent Application

Select Comfort Corporation, Minneapolis, MN

Power of Attorney: The patent practitioners associated with Customer Number 26191

Domestic Priority data as claimed by applicant

This application is a CON of 12/936,084 10/01/2010 PAT 8769747
which is a 371 of PCT/US08/59409 04/04/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 06/02/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/283,675**

Projected Publication Date: 12/31/2015

Non-Publication Request: No

Early Publication Request: No
Title

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Preliminary Class

062

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/283,675		Paul James Mahoney	39870-0048002

CONFIRMATION NO. 5177

26191
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

WITHDRAWAL NOTICE

OC000000077548156

Date Mailed: 09/22/2015

Letter Regarding a New Notice and/or the Status of the Application

If a new notice or Filing Receipt is enclosed, applicant may disregard the previous notice mailed on 02/04/2015. The time period for reply runs from the mail date of the new notice. Within the time period for reply, applicant is required to file a reply in compliance with the requirements set forth in the new notice to avoid abandonment of the application.

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web. https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If the reply is not filed electronically via EFS-Web, the reply must be accompanied by a copy of the new notice.

If the Office previously granted a petition to withdraw the holding of abandonment or a petition to revive under 37 CFR 1.137, the status of the application has been returned to pending status.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/ggasgedom/

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
14/283,675

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 420 =	420
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	2020

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

Office of Petitions: Routing Sheet

4700

Application No. 14/283,675

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application, as indicated below. For details of this decision, please see the document PET.OP.DEC filed on the same date as this document.

- [x] **GRANTED**
- [ ] **DISMISSED**
- [ ] **DENIED**

Office of Petitions: Decision Count Sheet

Mailing Month

Application No. 14283675

14283675

For US serial numbers: enter number only, no slashes or commas. Ex: 10123456
For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official: JOHNSON, NANCY

Count (1) - Palm Credit 14/283,675

Decision: GRANT

FINANCE WORK NEEDED
☐ Select Check Box for YES

GRANT

Decision Type: 502 - 37 CFR 1.137(b) - REVIVAL BASED ON UNINTEN

502

Notes:

Count (2)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Count (3)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach 2nd count sheet & mark this box

Printed on: 9/16/2015

Office of Petitions Internal Document - Ver. 5.0

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002	5177

26191 7590 09/21/2015
FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	

ART UNIT	PAPER NUMBER
3744	

NOTIFICATION DATE	DELIVERY MODE
09/21/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Application of :
Mahoney et al. : DECISION ON PETITION
Application No. 14/283,675 :
Filed: May 21, 2014 :
Atty Docket No. 39870-0048002 :

This is in response to the PETITION TO REVIVE APPLICATION UNDER 37 CFR §1.137(b) filed February 17, 2015, which is properly treated under the provisions of revised 37 CFR 1.137(a).

The petition is **GRANTED**.

The above-identified application became abandoned effective August 6, 2014 for failure to file a reply to the Notice to File Missing Parts of Nonprovisional Application Papers mailed June 5, 2014. The Notice required payment of outstanding fees and payment of the late surcharge[1]. A courtesy Notice of Abandonment was mailed on January 28, 2015.

Petitioner has satisfied the requirements of 37 CFR 1.137 for revival of this application. This petition includes the required reply in the form of payment of the fees, including payment of the late surcharge per the Notice[2]; payment of the petition fee; and the required statement of unintentional delay. No terminal disclaimer is required for revival of this application.

The application is being forwarded to the Office of Patent Application Processing for completion of pre-examination processing.

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[1] The Notice also required the submission of an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability."

[2] As authorized, the claim fee of $420 and the late surcharge of $140 were charged to the Deposit Account. These fees were not submitted with the other fees on filing of the petition.

Telephone inquiries specific to this decision should be directed to the undersigned at (571) 272-3219.

/Nancy Johnson/

Nancy Johnson
Attorney Advisor
Office of Petitions

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Paul James Mahoney	Art Unit	:	Unknown
Serial No.	:	14/283,675	Examiner	:	Unknown
Filed	:	May 21, 2014			
Title	:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT			

MAIL STOP PETITIONS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION TO REVIVE APPLICATION UNDER 37 CFR §1.137(b)

Applicant hereby petitions under 37 CFR §1.137(b) to revive the above application, which was abandoned on February 4, 2015 for failure to respond to Notice to File Missing Parts mailed June 5, 2014.

Enclosed are 1) the missing filing fees listed in the Notice to File Missing Parts to continue prosecution of the application and 2) the fees in the amount of $1700 in payment of the petition fee by a large entity as set forth in 37 CFR §1.17(m) are being paid concurrently herewith. In addition, please apply any other necessary charges or credits to Deposit Account 06-1050, referencing the above attorney docket number.

Applicant submits that the entire period of delay was unintentional.

Respectfully submitted,

Date: 2/17/2015

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

61038827.doc

Electronic Patent Application Fee Transmittal

Application Number:	14283675
Filing Date:	21-May-2014
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Filer:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Pet. Revive Abandon App, Delay Pymt-Resp	1453	1	1700	1700

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**3300**

Electronic Acknowledgement Receipt

EFS ID:	21517870
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	26191
Filer:	Stuart A. Nelson/Renee Neuman
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	39870-0048002
Receipt Date:	17-FEB-2015
Filing Date:	21-MAY-2014
Time Stamp:	16:13:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$3300
RAM confirmation Number	1531
Deposit Account	061050
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions.	PetRevive.pdf	61102 382d55c2a60d9c7689606e7511cf9236d57 18b39	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37046 bc0b05bb572b6dc78052f2da3ac3bfe9c14 3d3bc	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	98148	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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14/283,675	05/21/2014	Paul James Mahoney	39870-0048002

CONFIRMATION NO. 5177

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FISH & RICHARDSON P.C. (TC)
PO BOX 1022
MINNEAPOLIS, MN 55440-1022

POA ACCEPTANCE LETTER

OC000000073197626

Date Mailed: 02/04/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/18/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/zretta/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/283,675	05/21/2014	Paul James Mahoney	39870-0048002

CONFIRMATION NO. 5177

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PO BOX 1022
MINNEAPOLIS, MN 55440-1022

ABANDONMENT/TERMINATION LETTER

OC000000073197698

Date Mailed: 02/04/2015

NOTICE OF ABANDONMENT UNDER 37 CFR 1.53 (f) OR (g)

The above-identified application is abandoned for failure to timely or properly reply to the Notice to File Missing Parts (Notice) mailed on 06/05/2014.

- No reply was received.

If a complete reply to the notice was previously filed by applicant within the time period set forth in the notice, applicant may request for reconsideration of the holding of abandonment within 2 months from the mailing of this notice of abandonment by filing a petition to withdraw the holding of abandonment under 37 CFR 1.181(a). No petition fee is required. The petition must be accompanied by a true copy of the originally filed reply and the item(s) identified in one of the following:

1. A properly itemized date-stamped postcard receipt (see MPEP § 503);

2. If the originally filed reply included a certificate of mailing or transmission in compliance with 37 CFR 1.8(a), a copy of the certificate of mailing or transmission and a statement in compliance with 37 CFR 1.8(b) (see MPEP § 512); or

3. If the reply was filed via "Express Mail", (now "Priority Mail Express"), a submission satisfying the requirements of 37 CFR 1.10(e) including, for example, a copy of the mailing label showing the "date-in" (or "date accepted") (see MPEP § 513).

If applicant did not previously file complete reply within the the time period set forth in the notice, applicant may file a petition to revive the application under 37 CFR 1.137.

Under 37 CFR 1.137, a petition requesting that the application be revived on the grounds of UNINTENTIONAL DELAY must be filed promptly after applicant becomes aware of the abandonment and such petition must be accompanied by: (1) the reply required to the outstanding Office action or notice, unless previously filed; (2) the petition fee set forth in 37 CFR 1.17(m); (3) a terminal disclaimer (and fee set forth in 37 CFR 1.20(d)) if required by 37 CFR 1.137(d); and (4) a statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition was unintentional. See MPEP 711.03(c) and Form PTO/SB/64.

Any questions concerning petitions to revive should be directed to the Office of Petitions at (571) 272-3282. Petitions should be mailed to Mail Stop Petitions, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

A copy of this notice MUST be returned with the reply.

/zretta/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	:	Paul James Mahoney	Art Unit	:	Unknown
Serial No.	:	14/283,675	Examiner	:	Unknown
Filed	:	May 21, 2014	Conf. No.	:	5177
Title	:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT			

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Please consider the references listed on the enclosed PTO-1449 Form. Cited U.S. patents and patent application publications will be provided on request.

Under 35 USC §120, this application relies on the earlier filing date of application serial number 12/936,084, filed on October 1, 2010.

This statement is being filed before the receipt of a first action on the merits.

Apply any necessary charges or credits to deposit account 06-1050, referencing the above attorney docket number.

Respectfully submitted,

Date: 12/18/2014

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

60997123.doc

Substitute Disclosure Form U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)	Applicant Select Comfort Corporation	
(37 CFR §1.98(b))	Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1	2003/0182728	10/02/2003	Chapman et al.			
	2	2008/0307582	12/18/2008	Flocard et al.			
	3	2009/0314354	12/24/2009	Chaffee			
	4	2012/0311790	12/13/2012	Nomura et al.			

Foreign Patent Documents or Published Foreign Patent Applications

Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation Yes	Translation No

Other Documents (include Author, Title, Date, and Place of Publication)

Examiner Initial	Desig. ID	Document

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Electronic Acknowledgement Receipt

EFS ID:	21002693
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	21186
Filer:	Stuart A. Nelson/Anastasia Bergquist
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	3500.019US2
Receipt Date:	18-DEC-2014
Filing Date:	21-MAY-2014
Time Stamp:	13:31:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS_Transmittal.pdf	61164 37e7d6be7b8337bc2dbe184e1daddaa35f5cd90e	no	1

Warnings:

Information:

This is not an USPTO supplied IDS fillable form					
2	Information Disclosure Statement (IDS) Form (SB08)	PTO1449.pdf	79134 18f0cda814c32d6920ff51b03d729d1af4fc088e	no	1

Warnings:

Information:

This is not an USPTO supplied IDS fillable form

Total Files Size (in bytes):	140298

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Select Comfort Corporation	Art Unit	: Unknown
Serial No.	: 14/283,675	Examiner	: Unknown
Filed	: May 21, 2014	Conf. No.	: 5177
Title	: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT		

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Please consider the references listed on the enclosed PTO-1449 Form. Cited U.S. patents and patent application publications will be provided on request.

Under 35 USC §120, this application relies on the earlier filing date of application serial number 12/936,084, filed on October 1, 2010 and US2008/059409, filed on April 4, 2008. The following references were submitted to and/or cited by the Office in the prior application and, therefore, are not provided in this application:

Desig. IDs:

4, 5, 7, 31, 32, 34, 43, 47, and 54-60.

This statement is being filed before the receipt of a first action on the merits.

Apply any necessary charges or credits to deposit account 06-1050, referencing the above attorney docket number.

Respectfully submitted,

Date: 10/28/2014

/Stuart A. Nelson/
Stuart A. Nelson
Reg. No. 63,947

Customer Number
Fish & Richardson P.C.
Telephone: (612) 337-2538
Facsimile: (877) 769-7945

60980921.doc

Substitute Disclosure Form	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)		First Named Inventor Paul James Mahoney	
(37 CFR §1.98(b))		Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1	13/933,285		Palashewski			7/2/2013
	2	14/146,281		Palashewski et al.			1/2/2014
	3	14/146,327		Palashewski et al.			1/2/2014
	4	2002/0184711	12/2002	Mahoney et al.			
	5	2007/0227594	10/04/2007	Chaffe			
	6	2010/0174198	7/8/2010	Young et al.			
	7	2010/0206051	08/2010	Mahoney			
	8	2011/0306844	12/15/2011	Young			
	9	2014/0007656	1/9/2014	Mahoney			
	10	2014/0137332	5/22/2014	McGuire, et al.			
	11	2014/0182061	7/3/2014	Zaiss			
	12	2014/0250597	9/11/2014	Chen et al.			
	13	2014/0257571	9/11/2014	Chen et al.			
	14	2014/0259417	9/18/2014	Nunn et al.			
	15	2014/0259418	9/18/2014	Nunn et al.			
	16	2014/0259419	9/18/2014	Stusynski			
	17	2014/0259431	9/18/2014	Fleury			
	18	2014/0259433	9/18/2014	Nunn et al.			
	19	2014/0259434	9/18/2014	Nunn et al.			
	20	2014/0277611	9/18/2014	Nunn et al.			
	21	2014/0277778	9/18/2014	Nunn et al.			
	22	2014/0277822	9/18/2014	Nunn et al.			
	23	5,170,522	12/15/1992	Walker			
	24	5,170,522	12/15/1992	Walker			
	25	5,509,154	4/23/1996	Shafer et al.			
	26	5,564,140	10/15/1996	Shoenhair et al.			
	27	5,642,546	6/1/1997	Shoenhair			

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 158

Substitute Disclosure Form	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
Information Disclosure Statement by Applicant (Use several sheets if necessary)		First Named Inventor Paul James Mahoney	
(37 CFR §1.98(b))		Filing Date May 21, 2014	Group Art Unit

U.S. Patent Documents

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	28	5,652,484	7/29/1997	Shafer et al.			
	29	5,765,246	6/16/1998	Shoenhair			
	30	5,903,941	5/18/1999	Shafer et al.			
	31	5,904,172	05/18/1999	Gifft et al.			
	32	6,014,784	01/18/2000	Taylor et al.			
	33	6,037,723	3/14/2000	Shafer et al.			
	34	6,088,643	07/11/2000	Long et al.			
	35	6,108,844	8/29/2000	Kraft et al.			
	36	6,161,231	12/19/2000	Kraft et al.			
	37	6,202,239	3/20/2001	Ward et al.			
	38	6,397,419	6/4/2002	Mechache			
	39	6,483,264	11/19/2002	Shafer et al.			
	40	6,686,711	2/3/2004	Rose et al.			
	41	6,708,357	3/23/2004	Gaboury et al.			
	42	6,763,541	7/20/2004	Mahoney et al.			
	43	6,789,284	09/14/2004	Kamp			
	44	6,804,848	10/19/2004	Rose			
	45	6,832,397	12/21/2004	Gaboury et al.			
	46	6,883,191	5/26/2005	Gaboury et al.			
	47	7,022,113	04/04/2006	Lockwood et al.			
	48	7,389,554	6/24/2008	Rose			
	49	7,865,988	1/11/2011	Koughan et al.			
	50	8,336,369	12/25/2012	Mahoney			
	51	8,444,558	5/21/2013	Young et al.			
	52	8,672,853	3/18/2014	Young			
	53	8,769,747	7/8/2014	Mahoney et al.			

Foreign Patent Documents or Published Foreign Patent Applications

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 159

Substitute Disclosure Form **Information Disclosure Statement by Applicant** (Use several sheets if necessary) (37 CFR §1.98(b))	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 39870-0048002	Application No. 14/283,675
		First Named Inventor Paul James Mahoney	
		Filing Date May 21, 2014	Group Art Unit

Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation Yes	Translation No
	54	WO 00/03628A2	01/27/2000	WO				
	55	CA 2720467C	12/10/2013	CA				

Other Documents (include Author, Title, Date, and Place of Publication)		
Examiner Initial	Desig. ID	Document
	56	Australian Application Serial No. 2008353972, First Examiner Report dated 04/18/2011, 2 pages
	57	European Application Serial No. 08745110.0, Supplementary European Search Report mailed 01/25/2012, 5 pages
	58	International Application Serial No. PCT/US08/59409, International Search Report mailed 08/15/2008, 2 pages
	59	International Application Serial No. PCT/US08/59409, Written Report mailed 08/15/2008, 5 pages
	60	Canadian Application Serial No. 2,720,467, Response filed 11/29/2012 to Office Action mailed 05/31/2012, 10 pages

Examiner Signature	Date Considered
EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

Electronic Acknowledgement Receipt

EFS ID:	20571370
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	21186
Filer:	Stuart A. Nelson/Anastasia Bergquist
Filer Authorized By:	Stuart A. Nelson
Attorney Docket Number:	3500.019US2
Receipt Date:	31-OCT-2014
Filing Date:	21-MAY-2014
Time Stamp:	11:04:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS_Transmittal.pdf	61267 b4d43faae775d38ce4fa6b50d4c0f0ccdf7c7fef	no	1

Warnings:

Information:

This is not an USPTO supplied IDS fillable form					
2	Information Disclosure Statement (IDS) Form (SB08)	PTO1449.pdf	101609 e616d9881baae5bd0c3e4041125173be22f69cc4	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
		Total Files Size (in bytes):	162876		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	14/283,675
Filing Date	May 21, 2014
First Named Inventor	Paul James Mahoney
Title	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
Art Unit	
Examiner Name	
Attorney Docket Number	39870-0048002

SIGNATURE of Applicant or Patent Practitioner

Signature	/Patrick J. Bisenius/	Date (Optional)	July 18, 2014
Name	Patrick J. Bisenius	Registration Number	63,893
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ___________ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
60952393.doc

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/82B(07-13)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

26191

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☐ The address associated with the above-mentioned Customer Number

OR

☒ The address associated with Customer Number: **26191**

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Select Comfort Corporation

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	Mark A. Kimball	Date (Optional)	
Name	Mark A. Kimball		
Title	SVP - Chief Legal and Risk Officer		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ________ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	19625012
Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney
Customer Number:	21186
Filer:	Patrick J. Bisenius/Beth Bauer
Filer Authorized By:	Patrick J. Bisenius
Attorney Docket Number:	3500.019US2
Receipt Date:	18-JUL-2014
Filing Date:	21-MAY-2014
Time Stamp:	18:12:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	0048002poa.pdf	165084 a53c7b49bdc80ce3e3ab12300cfea92b1562d35e	no	2

Warnings:

Information:

Total Files Size (in bytes):	165084

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/283,675	05/21/2014	Paul James Mahoney	3500.019US2

CONFIRMATION NO. 5177

21186
SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

FORMALITIES LETTER

OC000000068779437

Date Mailed: 06/05/2014

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Additional claim fees of $ **420** as an undiscounted entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.
  The surcharge is due for any one of:
  - late submission of the basic filing fee, search fee, or examination fee,
  - late submission of inventor's oath or declaration,
  - filing an application that does not contain at least one claim on filing, or
  - submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. No entity status discount is in effect. If applicant is qualified for small entity status, a written assertion of small entity status must be submitted to establish small entity status. (See 37 CFR 1.27). If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- $ **280** basic filing fee.
- $ **140** surcharge.
- $ **600** search fee.
- $ **720** examination fee.
- $ **420** for **1** independent claims over 3.

- <u>$(**0**) previous unapplied payment amount.</u>
- $ **2160** TOTAL FEE BALANCE DUE.

<u>Items Required To Avoid Processing Delays:</u>

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Paul James Mahoney
  Matthew Glen Hilden
  Matthew Wayne Tilstra

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/wtsige/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
14/283,675

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 420 =	420
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	2020

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/283,675	05/21/2014	3744	0.00	3500.019US2	20	4

CONFIRMATION NO. 5177

FILING RECEIPT

OC000000068779436

21186
SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

Date Mailed: 06/05/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Paul James Mahoney, Stillwater, MN;
Matthew Glen Hilden, Bobbisndale, MN;
Matthew Wayne Tilstra, Rogers, MN;

Applicant(s)

Select Comfort Corporation, Minneapolis, MN

Assignment For Published Patent Application

Select Comfort Corporation, Minneapolis, MN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/936,084 10/01/2010
which is a 371 of PCT/US08/59409 04/04/2008

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 06/02/2014
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/283,675**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No
Title

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Preliminary Class

062

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Paul James Mahoney et al.
Title: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
Attorney Docket No.: 3500.019US2
Customer No.: 21186

PATENT APPLICATION TRANSMITTAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the following attached items and information (as indicated with an "X"):

X **CONTINUATION under 37 CFR 1.53(b) of prior Patent Application No. 12/936,084 comprising:**
- X Specification (27 pgs, including claims numbered 1 through 20 and a 1 page Abstract).
- X Formal Drawing(s) (8 sheets).
- X Application Data Sheet (5 pgs).

X Prior application is assigned of record to Select Comfort Corporation.
X Information Disclosure Statement (2 pgs), Form 1449 (2 pgs), and copies of cited references (24).
X Preliminary Amendment (3 pgs).
X Communication Concerning Prior and Copending Applications (1 pg).

The filing fee (NOT ENCLOSED) will be calculated as follows:

	No. Filed	No. Extra	Rate	Fee
TOTAL CLAIMS	20- 20	0	x $80.00 =	**$0.00**
INDEPENDENT CLAIMS	4 - 3	1	x $420.00 =	**$420.00**
[]MULTIPLE DEPENDENT CLAIMS PRESENTED				**$0.00**
BASIC FEE				**$280.00**
SEARCH FEE				**$600.00**
EXAMINATION FEE				**$720.00**
	No. of pages (75% for e-filing)	**Extra sets of 50 pages**	**Rate**	
APPLICATION SIZE FEE	(26 - 100) / 50	0	$400.00	**$0.00**
TOTAL				**$2,020.00**

THE FILING FEE WILL BE PAID UPON RECEIPT OF THE NOTICE TO FILE MISSING PARTS.

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
Customer Number: 21186

By: /Adam Kiedrowski/
Adam P. Kiedrowski
Reg. No. 60,296

Date of Deposit: May 21, 2014
This paper or fee is being filed on the date indicated above using the USPTO's electronic filing system EFS-Web, and is addressed to The Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3500.019US2
	Application Number	Unknown
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ **Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)**

Inventor Information:

Inventor 1: Paul James Mahoney

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Paul	James	Mahoney	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Stillwater	State/Province	MN	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	1331 Dallager Ct.		
Address 2			
City	Stillwater	State/Province	MN
Postal Code	55082	Country	United States of America

Inventor 2: Matthew Glen Hilden

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Matthew	Glen	Hilden	

Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service

City	Robbisndale	State/Province	MN	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	4310 Toledo Ave. N.		
Address 2			
City	Robbisndale	State/Province	MN
Postal Code	55422	Country	United States of America

Application Data Sheet 37 CFR 1.76	**Attorney Docket Number**	3500.019US2
	Application Number	Unknown
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

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This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Inventor 3: Matthew Wayne Tilstra

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Matthew	Wayne	Tilstra	

Residence Information (Select One)
☒ **US Residency** ☐ **Non US Residency** ☐ **Active US Military Service**

City	Rogers	**State/Province**	MN	**Country of Residence**	United States of America

Mailing Address of Inventor:

Address 1	13915 Hill Place Dr		
Address 2			
City	Rogers	**State/Province**	MN
Postal Code	55374	**Country**	United States of America

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	21186
Email Address	request@slwip.com

Application Information:

Title of the Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT		
Attorney Docket Number	3500.019US2	**Small Entity Status Claimed**	☐
Application Type	Non-Provisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	8	**Suggested Figure for Publication (if any)**	
Filing By Reference:			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3500.019US2
	Application Number	Unknown
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country Publication

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Entereither Customer Number or complete theRepresentative Name section below. If bothsections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	21186		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
This Application	Continuation of	12/936,084	2010-10-01
Prior Application Status	Patented		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
12/936,084	a 371 of international	PCT/US2008/059409	2008-04-04

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3500.019US2
	Application Number	Unknown
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)i the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the POX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Authorization to Permit Access:

☒ **Authorization to Permit Access to the Instant Application by the Participating Offices**

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant: Select Comfort Corporation

<u>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed</u>. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Sleep Number Corp.
EXHIBIT 2003
IPR2019-00500
Page 177

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3500.019US2
	Application Number	Unknown
Title of Invention	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

☒ **Assignee**	☐ **Legal Representative under 35 U.S.C. 117**	☐ **Joint Inventor**
☐ **Person to whom the inventor is obligated to assign**	☐ **Person who shows sufficient proprietary interest**	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

☐ **Deceased** ☐ **Legally incapacitated**

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☒

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1	9800 59th Avenue North		
Address 2			
City	Minneapolis	**State/Province**	MN
Country	United States of America	**Postal Code**	55442
Phone Number			
Email Address			

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

Signature	/Adam Kiedrowski/			**Date (YYYY-MM-DD)**	2014-05-21
First Name	Adam P.	**Last Name**	Kiedrowski	**Registration Number**	60,296

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-14**

S/N Unknown **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Paul James Mahoney et al.	Examiner: Unknown
Serial No.: Unknown	Group Art Unit: Unknown
Filed: Herewith	Docket: 3500.019US2
Customer No.: 21186	Confirmation No.: Unknown

Title: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq*., the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.97(b), it is believed that no fee or statement is required with the Information Disclosure Statement. However, if an Office Action on the merits has been mailed after filing of the application or after the filing of the most recent RCE, the Commissioner is hereby authorized to charge the required fees to Deposit Account No. 19-0743 in order to have this Information Disclosure Statement considered.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 349-9585

Date May 21, 2014 By /Adam Kiedrowski/

Adam P. Kiedrowski
Reg. No. 60,296

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	Unknown
	Filing Date	Herewith
	First Named Inventor	Paul James Mahoney
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 2	Attorney Docket No: 3500.019US2	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-20020184711A1	12/12/2002	Mahoney, Paul J
	US-20070227594A1	10/4/2007	Chaffee, Robert B
	US-20100206051A1	8/19/2010	Mahoney, Paul James
	US-20110138539A1	6/16/2011	Mahoney, Paul James, et al.
	US-5,904,172	5/18/1999	Gifft, James Edwin, et al.
	US-6,014,784	1/18/2000	Taylor, Rex E, et al.
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Examiner Initial *	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Application Serial No. 12/936,084, Advisory Action mailed 10-18-13", 3 pgs	
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* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	Unknown
	Filing Date	Herewith
	First Named Inventor	Paul James Mahoney
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 2 of 2	Attorney Docket No: 3500.019US2	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"Australian Application Serial No. 2008353972, First Examiner Report dated 07-18-11", 2 pgs.	
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EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

S/N Unknown **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Paul James Mahoney et al.	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket: 3500.019US2
Customer No.:	21186	Confirmation No.: Unknown
Title:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

COMMUNICATION CONCERNING PRIOR OR COPENDING APPLICATION(S)

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Pursuant to the guidance of MPEP §§ 2001.06(b) and 2004(9), Applicant would like to bring the following additional application(s) to the Examiner's attention. The identification of these applications is not intended to suggest that the subject matter claimed in any listed application is, or has been, substantially similar to any claim or claims in the present application.

Serial No./ Patent No.	Filing Date	Attorney Docket	Title
12/936,084	October 1, 2010	3500.019US1	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

Respectfully submitted,

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Date May 21, 2014 By /Adam Kiedrowski/
Adam P. Kiedrowski
Reg. No. 60,296

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Paul James Mahoney et al.	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket No.: 3500.019US2
Customer No.:	21186	Confirmation No.: Unknown
Title:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT	

PRELIMINARY AMENDMENT

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Prior to taking up this application for examination, please enter the following amendments:

IN THE SPECIFICATION

Please amend the specification as follows:

Please add the following paragraph on page 1 of the specification below the title:

CLAIM OF PRIORITY

This application is a continuation of and claims priority under 35 U.S.C. § 120 to U.S. Patent Application Serial No. 12/936,084, filed on October 1, 2010, which is a U.S. National Stage Application under 35 U.S.C. § 371 of PCT/US2008/059409, filed on April 4, 2008, and published on October 8, 2009 as WO 2009/123641, the disclosure of which are incorporated herein by these references.

CONCLUSION

Applicant respectfully submit that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's representative at (612) 349-9585 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully Submitted,

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SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a system and method for adjusting the pressure in an inflatable object. More particularly, the present invention relates to a system and method for adjusting the pressure in an air bed in less time and with greater accuracy.

[0002] Advances made in the quality of air beds having air chambers as support bases have resulted in vastly increased popularity and sales of such air beds. These air beds are advantageous in that they have an electronic control panel which allows a user to select a desired inflation setting for optimal comfort and to change the inflation setting at any time, thereby providing changes in the firmness of the bed.

[0003] Air bed systems, such as the one described in U.S. Patent No. 5,904,172 which is incorporated herein by reference in its entirety, generally allow a user to select a desired pressure for each air chamber within the mattress. Upon selecting the desired pressure, a signal is sent to a pump and valve assembly in order to inflate or deflate the air bladders as necessary in order to achieve approximately the desired pressure within the air bladders.

[0004] In one embodiment of an air bed system, there are two separate air hoses coupled to each of the air bladders. A first air hose extends between the interior of the air bladder and the valve assembly associated with the pump. This first air hose fluidly couples the pump to the air bladder, and is structured to allow air to be added or removed from the air bladder. A second hose extends from the air bladder to a pressure transducer, which continuously monitors the pressure within the air bladder. Thus, as air is being added or removed from the air bladder, the pressure transducer coupled to the second hose is able to continuously check the actual air bladder pressure, which may then be compared to the

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desired air pressure in order to determine when the desired air pressure within the bladder has been reached.

[0005] In another embodiment of an air bed system, there is only a single hose coupled to each of the air bladders. In particular, the hose extends between the interior of the air bladder and the valve assembly associated with the pump, and is structured to allow air to be added or removed from the air bladder. Instead of having a second hose with a pressure transducer coupled thereto for continuously reading the pressure within the air bladder, a pressure transducer is positioned within a chamber of the valve assembly. Once the user selects the desired air pressure within the air bladder, the pressure transducer first senses a pressure in the chamber, which it equates to an actual pressure in the air bladder. Then, air is added or removed from the bladder as necessary based upon feedback from the sensed pressure. After a first iteration of sensing the pressure and adding or removing air, the pump turns off and the pressure within the chamber is once again sensed by the pressure transducer and compared to the desired air pressure. The process of adding or removing air, turning off the pump, and sensing pressure within the chamber is repeated for several more iterations until the pressure sensed within the chamber is within an acceptable range close to the desired pressure. As one skilled in the art will appreciate, numerous iterations of inflating and deflating the air bladder may be required until the sensed chamber pressure falls within the acceptable range of the desired pressure.

[0006] Thus, while this second embodiment of an air bed system may be desired because it minimizes the necessary number of hoses, it is rather inefficient in that numerous iterations may be required before the sensed pressure reaches the desired pressure. Furthermore, the pump must be turned off each time the pressure transducer takes a pressure measurement, which increases the amount of time that the user must wait until the air bladder reaches the desired pressure.

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[0007] Therefore, there is a need for an improved pressure adjustment system and method for an air bed that is able to minimize the amount of time and the number of adjustment iterations necessary to achieve a desired pressure in an air bladder, while also increasing the accuracy of the actual bladder pressure.

BRIEF SUMMARY OF THE INVENTION

[0008] The present invention solves the foregoing problems by providing a method for adjusting pressure within an air bed comprising providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Furthermore, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

[0009] The present invention also provides a pressure adjustment system for an air bed comprising an air chamber, a pump in fluid communication with the air chamber and including a pump manifold and at least one valve, an input device adapted to receive a desired pressure setpoint selected by a user, a pressure sensing means adapted to monitor pressure within the pump manifold, and a control device operably connected to the input device and to the pressure sensing means. The control device includes control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the

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desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a diagrammatic representation of one embodiment of an air bed system.

[0011] FIG. 2 is a block diagram of the various components of the air bed system illustrated in FIG. 1.

[0012] FIG. 3 is a circuit diagram model of the air bed system illustrated in FIGS. 1 and 2.

[0013] FIG. 4 is an exemplary graph illustrating the pressure relationships derived from the circuit diagram model of FIG. 3.

[0014] FIG. 5 is a flowchart illustrating one embodiment of a pressure setpoint monitoring method in accordance with the present invention.

[0015] FIG. 6 is a flowchart illustrating one embodiment of an improved pressure adjustment method in accordance with the present invention.

[0016] FIG. 7 is a flowchart illustrating a second embodiment of an improved pressure adjustment method in accordance with the present invention.

[0017] FIG. 8 is a block diagram illustrating an air bed system according to the present invention incorporated into a network system for remote access.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring now to the figures, and first to FIG. 1, there is shown a diagrammatic representation of air bed system 10 of the present invention. The system 10 includes bed 12, which generally comprises at

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least one air chamber 14 surrounded by a resilient, preferably foam, border 16 and encapsulated by bed ticking 18.

[0019] As illustrated in FIG. 1, bed 12 is a two chamber design having a first air chamber 14A and a second air chamber 14B. Chambers 14A and 14B are in fluid communication with pump 20. Pump 20 is in electrical communication with a manual, hand-held remote control 22 via control box 24. Remote control 22 may be either "wired" or "wireless." Control box 24 operates pump 20 to cause increases and decreases in the fluid pressure of chambers 14A and 14B based upon commands input by a user through remote control 22. Remote control 22 includes display 26, output selecting means 28, pressure increase button 29, and pressure decrease button 30. Output selecting means 28 allows the user to switch the pump output between first and second chambers 14A and 14B, thus enabling control of multiple chambers with a single remote control unit. Alternatively, separate remote control units may be provided for each chamber. Pressure increase and decrease buttons 29 and 30 allow a user to increase or decrease the pressure, respectively, in the chamber selected with output selecting means 28. As those skilled in the art will appreciate, adjusting the pressure within the selected chamber causes a corresponding adjustment to the firmness of the chamber.

[0020] FIG. 2 shows a block diagram detailing the data communication between the various components of system 10. Beginning with control box 24, it can be seen that control box 24 comprises power supply 34, at least one microprocessor 36, memory 37, at least one switching means 38, and at least one analog to digital (A/D) converter 40. Switching means 38 may be, for example, a relay or a solid state switch.

[0021] Pump 20 is preferably in two-way communication with control box 24. Also in two-way communication with control box 24 is hand-held remote control 22. Pump 20 includes motor 42, pump manifold 43, relief valve 44, first control valve 45A, second control valve 45B, and pressure transducer 46, and is fluidly connected with left chamber 14A and right chamber 14B via first tube 48A and second tube 48B, respectively. First

and second control valves 45A and 45B are controllable by switching means 38, and are structured to regulate the flow of fluid between pump 20 and first and second chambers 14A and 14B, respectively.

[0022] In operation, power supply 34 receives power, preferably 110 VAC power, from an external source and converts it to the various forms required by the different components. Microprocessor 36 is used to control various logic sequences of the present invention. Examples of such sequences are illustrated in FIGS. 5-7, which will be discussed in detail below.

[0023] The embodiment of system 10 shown in FIG. 2 contemplates two chambers 14A and 14B and a single pump 20. Alternatively, in the case of a bed with two chambers, it is envisioned that a second pump may be incorporated into the system such that a separate pump is associated with each chamber. Separate pumps would allow each chamber to be inflated or deflated independently and simultaneously. Additionally, a second pressure transducer may also be incorporated into the system such that a separate pressure transducer is associated with each chamber.

[0024] In the event that microprocessor 36 sends a decrease pressure command to one of the chambers, switching means 38 is used to convert the low voltage command signals sent by microprocessor 36 to higher operating voltages sufficient to operate relief valve 44 of pump 20. Alternatively, switching means 38 could be located within pump 20. Opening relief valve 44 allows air to escape from first and second chambers 14A and 14B through air tubes 48A and 48B. During deflation, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. A/D converter 40 receives analog information from pressure transducer 46 and converts that information to digital information useable by microprocessor 36.

[0025] In the event that microprocessor 36 sends an increase pressure command, pump motor 42 may be energized, sending air to the designated chamber through air tube 48A or 48B via the corresponding

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valve 45A or 45B. While air is being delivered to the designated chamber in order to increase the firmness of the chamber, pressure transducer 46 senses pressure within pump manifold 43. Again, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. Microprocessor 36 uses the information received from A/D converter 40 to determine the difference between the actual pressure in the chamber 14 and the desired pressure. Microprocessor 36 sends the digital signal to remote control 22 to update display 26 on the remote control in order to convey the pressure information to the user.

[0026] Generally speaking, during an inflation or deflation process, the pressure sensed within pump manifold 43 provides an approximation of the pressure within the chamber. However, when it is necessary to obtain an accurate approximation of the chamber pressure, other methods must be used.

[0027] One method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is to turn off the pump, allow the pressure within the chamber and the pump manifold to equalize, and then sense the pressure within the pump manifold with a pressure transducer. Thus, providing a sufficient amount of time to allow the pressures within the pump manifold 43 and the chamber to equalize may result in pressure readings that are accurate approximations of the actual pressure within the chamber. One obvious drawback to this type of method is the need to turn off the pump prior to obtaining the pump manifold pressure reading.

[0028] A second method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is through use of the pressure adjustment method in accordance with the present invention. The pressure adjustment method is described in detail in FIGS. 5-7. However, in general, the method functions by approximating the chamber pressure based upon a mathematical relationship between the chamber pressure and the pressure measured within the pump manifold (during both an inflation cycle and a deflation

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cycle), thereby eliminating the need to turn off the pump in order to obtain a substantially accurate approximation of the chamber pressure. As a result, a desired pressure setpoint within a chamber may be achieved faster, with greater accuracy, and without the need for turning the pump off to allow the pressures to equalize.

[0029] FIG. 3 is a circuit diagram model 50 of the air bed system 10 illustrated in FIG. 2. As shown in FIG. 3, first and second chambers 14A and 14B may be modeled by capacitors 51A and 51B, motor 42 of pump 20 may be modeled by current source 52 and resistor 53, relief valve 44 may be modeled by resistor 54, pressure transducer 46 may be modeled by resistor 56 and a voltage sensing lead 57, first and second tubes 48A and 48B may be modeled by resistors 58A and 58B, and first and second valves 49A and 49B may be modeled by resistors 59A and 59B. Additionally, pump manifold 43 may be modeled by another capacitor 60 because it also acts as a chamber, albeit much smaller than first and second chambers 14A and 14B.

[0030] As those skilled in the art will appreciate, by assuming current source 52 is a constant current source, pressure readings may be analogized with voltage readings. Thus, in reference to the circuit diagram 50 in FIG. 3, the voltages associated with capacitors 51A and 51B may be used to analyze pressure within first and second chambers 14A and 14B, respectively. Because the voltage readings are not dependent upon the capacitance value of capacitors 51A and 51B, the capacitance value may be discarded for purposes of the present analysis. Translated to pressure terms, this means that the size of first and second chambers 14A and 14B is irrelevant when measuring the pressure within the chambers.

[0031] Furthermore, weight positioned on a chamber (such as that caused by the user lying on bed 12) is directly related to the volume of the chamber and does not affect the ability of the system to measure the pressure within the chamber. In addition, because the system measures pressure in real time, weight changes do not affect the ability of the control system to accurately measure chamber pressure.

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[0032] The relationship between the voltage on first or second capacitors 51A or 51B and the voltage sensed at voltage sensing lead 57 is dependent upon whether current is flowing toward the capacitor (i.e., the chamber is going through an inflation cycle) or away from the capacitor (i.e., the chamber is going through a deflation cycle). In particular, and as will be discussed in detail with reference to FIG. 4, modeling air bed system 10 as circuit diagram 50 results in an additive manifold pressure offset factor during an inflation cycle and a multiplicative manifold pressure factor during a deflation cycle.

[0033] The relationship between voltage associated with a chamber capacitor (i.e., the "chamber voltage") and the sensed "manifold" voltage during an inflation cycle may be stated as follows:

[0034] *Chamber Voltage = (Manifold Voltage) – (Inflate Factor)* (Eq. 1)

[0035] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during an inflation cycle may be stated as follows:

[0036] *Chamber Pressure = (Manifold Pressure) – (Inflate Factor)* (Eq. 2)

[0037] In one exemplary embodiment, the inflate offset factor may generally fall in a range between about 0.0201 and about 0.1601. Because pressure readings may be analogous to voltage readings as discussed previously, the value of the inflate offset factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0038] The relationship between voltage associated with a chamber capacitor and the sensed manifold voltage during a deflation cycle may be stated as follows:

[0039] *Chamber Voltage = (Manifold Voltage) x (Deflate Factor)* (Eq. 3)

[0040] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during a deflation cycle may be stated as follows:

[0041] *Chamber Pressure = (Manifold Pressure) x (Deflate Factor)* (Eq. 4)

[0042] In one exemplary embodiment, the deflate factor may generally fall in a range between about 1.6 and about 6.5. Once again, because pressure readings may be analogous to voltage readings as discussed previously, the value of the deflate factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0043] FIG. 4 is an exemplary graph 70 illustrating the pressure relationships derived from circuit diagram 50 of FIG. 3 and discussed in detail above. In particular, the vertical axis on the graph represents pressure in pounds per square inch (psi), while the horizontal axis on the graph represents time in milliseconds (ms). Thus, the graph illustrates a measure of chamber pressure over time.

[0044] In particular, a first portion 71 of the graph 70 between about 0 ms and about 65000 ms represents the inflation of a chamber from about 0 psi to about 0.6 psi. A second portion 72 of the graph 70 between about 65000 ms and about 135000 ms represents the pressure in the chamber being maintained at about 0.6 psi. Finally, a third portion 73 of the graph 70 between about 135000 ms and about 200000 ms represents deflation of the chamber from about 0.6 psi to about 0 psi.

[0045] With further reference to the graph in FIG. 4, the solid line 76 represents the actual pressure within the chamber throughout the inflation and deflation cycles, while broken line 78 represents the sensed pump manifold pressure throughout the inflation and deflation cycles. As illustrated in FIG. 4, in the first portion 71 of the graph 70 representing inflation of the chamber, lines 76 and 78 are generally linear and offset from one another by a substantially constant additive offset factor 80. In

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this exemplary graph, the additive inflate offset factor is about 0.0505. Thus, the pressure within the chamber may be approximated during an inflation cycle by subtracting from the sensed manifold pressure an inflate offset factor of about 0.0505. Lines 76 and 78 generally converge in the second portion 72 of the graph 70 when the chamber is being neither inflated nor deflated. Finally, in the third portion 73 of the graph 74 representing deflation of the chamber, lines 76 and 78 are both non-linear and offset from one another by a substantially constant multiplicative factor 82. In this exemplary graph, the multiplicative deflate factor is about 2.25. Thus, the pressure within the chamber may be approximated during a deflation cycle by multiplying the sensed manifold pressure by a deflate factor of about 2.25.

[0046] Now that a brief description of an air bed system and the relationship between chamber and pump manifold pressures have been provided, one embodiment of an improved pressure adjustment method according to the present invention will be described in detail. For purposes of discussion only, the pressure adjustment method in accordance with the present invention will be described in reference to first chamber 14A. However, those skilled in the art will appreciate that the pressure adjustment method applies in a similar manner to other chambers, such as second chamber 14B of bed 12.

[0047] In particular, FIG. 5 illustrates a flowchart of a sample control logic sequence of a pressure setpoint monitoring method 100 according to the present invention. The sequence begins at step 102 upon the occurrence of a "power-on" event. A power-on event may be, for example, coupling power supply 34 of control box 24 to an external power source. The sequence continues at step 104 where microprocessor 36 obtains one or more default adjustment constants stored in, for example, memory 37. In one exemplary embodiment, these default adjustments correspond with the additive inflate factor and the multiplicative deflate factor previously described. Thus, for instance, the default additive inflate factor may be about 0.0505, while the default multiplicative deflate factor may be about 2.25. Workers skilled in the art will appreciate that these default values

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are approximate and were determined for the particular air bed system modeled in FIGS. 1-3 above with an average sized user, and that these values may change as modifications are made to the air bed system. These default adjustment constants will be used by the improved pressure adjustment method of the present invention until they are later updated after a first pressure adjustment iteration as will be discussed in further detail to follow.

[0048] The sequence continues at step 106 where microprocessor 36 detects whether a new pressure setpoint has been selected by the user to either increase or decrease the pressure in first chamber 14A. The new pressure setpoint may be a pressure that is either higher or lower than the current pressure in first chamber 14A, as desired by the user. As will be appreciated by those skilled in the art, the range of possible chamber pressures is not important to the operation of the present invention. Thus, numerous pressure ranges are contemplated. The new pressure setpoint may be selected by, for example, manipulating pressure increase button 29 or pressure decrease button 30 on manual remote control 22. Alternatively, the pressure increase and decrease buttons may be provided on another component of system 10, such as pump 20.

[0049] If microprocessor 36 does not detect that a new pressure setpoint has been selected, the sequence then continues at step 108 where microprocessor 36 determines whether or not there has been an interfering event, such as a loss in power. If microprocessor 36 determines that a loss in power has occurred, the adjustment factors are then discarded in step 110 and the sequence loops back to step 102 to monitor for the occurrence of another power-on event. However, if microprocessor 36 determines that a loss in power has not occurred, the sequence enters monitoring loop 112 where microprocessor 36 continually monitors whether a new pressure setpoint is selected in step 106 or whether a loss in power has occurred in step 108.

[0050] Alternatively, if microprocessor 36 detects that a new pressure setpoint has been selected in step 106, then the sequence continues to

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pressure adjustment method 150 as will be described in detail in reference to FIG. 6. Thus, the selection of a new pressure setpoint by the user triggers a pressure adjustment.

[0051] As will be appreciated by those skilled in the art, air bed system 10 may include a back-up power source such that if the power to power supply 34 is interrupted, the pressure adjustment factors remain stored within memory 37. As a result, it may be possible to avoid the discarding step previously described.

[0052] FIG. 6 illustrates a flowchart of a sample control logic sequence of an exemplary pressure adjustment method 150 according to the present invention. The sequence begins at step 152 when pressure transducer 46 samples the pressure within pump manifold 43. Because motor 42 of pump 20 is not running at this point, air is neither flowing into or out of first chamber 14A. Therefore, the manifold pressure sampled in step 152 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled in step 152, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure previously selected by the user (in step 106) to determine if an adjustment is required. In one embodiment, microprocessor 36 calculates the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user, and compares the difference to a predetermined, acceptable "error." The acceptable error may be any value greater than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete. However, if the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is not within the acceptable error range, then an adjustment is required, and the pressure adjustment method continues at step 158.

[0053] In step 158, microprocessor 36 determines if inflation or deflation of first chamber 14A is required. If it is determined in step 158 that deflation of first chamber 14A is required, the method continues at step 160 where microprocessor 36 calculates a deflate pressure target, which corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during a deflation cycle. In particular, the deflate pressure target may be calculated through use of Equation 4 above. Based upon the relationship between chamber pressure and manifold pressure during a deflation cycle recited in Equation 4, the deflate pressure target may calculate as follows:

[0054] *Deflate Manifold Pressure Target = (Desired Pressure Setpoint) / (Deflate Factor)*

[0055] The first time the user selects a new pressure setpoint that requires deflation of first chamber 14A, the deflate factor will be set to the default value of 2.25 discussed above in step 104. However, as will be discussed in further detail to follow, this deflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0056] Once the deflate pressure target is calculated in step 160, microprocessor 36 instructs pump 20 to begin the deflate operation in step 162.

[0057] Alternatively, if it is determined in step 158 that inflation of first chamber 14A is required, the method continues at step 164 where microprocessor 36 calculates an inflate pressure target. The inflate pressure target corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during an inflation cycle. In particular, the inflate pressure target may be calculated through use of Equation 2 above. Based upon the relationship between chamber pressure and manifold pressure during an inflation cycle recited in Equation 2, the inflate pressure target may calculate as follows:

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[0058] *Inflate Manifold Pressure Target = (Desired Pressure Setpoint) + (Inflate Offset Factor)*

[0059] The first time the user selects a new pressure setpoint that requires inflation of first chamber 14A, the inflate factor will be set to the default value of 0.0505 discussed above in step 104. However, as will be discussed in further detail to follow, this inflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0060] Once the inflate pressure target is calculated in step 164, microprocessor 36 instructs pump 20 to begin the inflate operation in step 166.

[0061] After performing the pressure deflate operation in step 162 or the pressure inflate operation in step 166 as required, the manifold pressure within pump manifold 43 is once again sampled in step 168. Because either motor 42 of pump 20 has been running in order to inflate first chamber 14A, or relief valve 44 has been open in order to deflate first chamber 14A, the manifold pressure sampled in step 168 is now instable and by itself does not provide an accurate representation of the actual pressure within first chamber 14A. However, because of the known relationship between manifold pressure and chamber pressure discussed previously, the present invention is able to accurately approximate the actual chamber pressure based upon a sensed manifold pressure. Therefore, after the manifold pressure has once again been sampled, the method continues at step 170 where microprocessor 36 compares the sampled manifold pressure to the manifold pressure target calculated in either step 160 or step 164 to determine if the manifold pressure target has been achieved.

[0062] Similar to the process utilized in step 154, microprocessor 36 calculates the difference between the sampled manifold pressure and the manifold pressure target and compares the difference to a predetermined, pressure target error. The pressure target error may be any value greater

than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the manifold pressure target is greater than the acceptable pressure target error, then further inflation or deflation is required. As a result, pressure adjustment method 150 returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. On the other hand, if the difference between the sampled manifold pressure and the manifold pressure target is within the pressure target error limit, then no further inflation or deflation is necessary, and the pressure adjustment method continues at step 174 where the inflate or deflate operation is ended.

[0063] Next, pressure transducer 46 once again samples the pressure within pump manifold 43 at step 176. Because all inflate or deflate operations have ceased, air is neither flowing into nor out of first chamber 14A, and the manifold pressure sampled in step 176 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled again in step 176, the sequence continues at step 178 where microprocessor 36 compares the "actual" manifold pressure sampled in step 176 with the "expected" user setpoint pressure previously selected by the user (in step 106) to determine if the desired setpoint pressure has been achieved. If the actual manifold pressure sampled in step 176 is not substantially equal to the expected setpoint pressure selected by the user, then an adjustment must be made to the pressure adjustment factor. An updated adjustment factor is therefore determined based upon a comparison between the sensed pressure and the desired setpoint pressure, and the pressure adjustment factor is thereafter modified in step 180.

[0064] With regard to the deflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0065] *Updated Deflate Adjustment Factor = (Pressure Setpoint from Step 106) / (Manifold Pressure from Step 168)*

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[0066] With regard to the inflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0067] *Updated Inflate Adjustment Factor = (Manifold Pressure from Step 168) – (Pressure Setpoint from Step 106)*

[0068] Next, the method loops back to step 152 where pressure transducer 46 samples the pressure within pump manifold 43. Once the manifold pressure has again been sampled in step 152 after a first "iteration" of adjustments, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure selected by the user (in step 106) to determine if a further adjustment is required. For instance, if the pressure adjustment factor had to be modified in step 180 of the previous pressure adjustment iteration, then a further adjustment will most likely be required because the fact that the pressure adjustment factor had to be modified indicates that the actual pressure in chamber 14A is not equal to the desired pressure setpoint selected by the user. In this case, at least one more pressure adjustment iteration will be required before the actual chamber pressure is substantially equal to the desired pressure setpoint. However, if it is determined in step 154 that the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete.

[0069] After completing the pressure adjustment method 150, microprocessor 36 return back to pressure setpoint monitoring method 100 illustrated in FIG. 5 and replaces the default deflate or inflate pressure adjustment factor in step 114 with a "customized" pressure adjustment factor specifically tailored to that user. The customized pressure adjustment factor may then be stored in memory 37 for future use in pressure adjustments.

[0070] As those skilled in the art will appreciate, the default pressure adjustment factors corresponding to both the deflate and inflate operations

must be replaced after the detection of a power-on event because these default factors are only temporary and based upon the size of an average user. Therefore, when microprocessor 36 detects an increase in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized inflate pressure adjustment constant being determined that replaces the temporary default constant. Similarly, when microprocessor 36 detects a decrease in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized default pressure adjustment constant being determined that replaces the temporary default constant. Furthermore, when microprocessor 36 detects subsequent increases or decreases in the desired pressure setpoint after the default constants have been replaced, the customized default constants may continue to be updated and replaced in step 114 to maintain the highest degree of accuracy when performing pressure adjustments and to take into account changes in the user such as, for example, an increase or decrease in the weight of the user. Thus, while it is not necessary to "update" the customized adjustment constants after initially replacing the temporary default adjustment constants after a power-on event, performing such updates may increase the accuracy of future pressure adjustments.

[0071] FIG. 7 illustrates a flowchart of a sample control logic sequence of a second pressure adjustment method 150A according of the present invention. Pressure adjustment method 150A is similar to pressure adjustment method 150 previously described, but includes several additional steps to further optimize operation of the pressure adjustment method.

[0072] In addition to the steps previously described above in reference to FIG. 6, pressure adjustment method 150A further includes steps 151, 182, and 173. In particular, steps 151 and 182 involve maintaining a count of the number of pressure adjustment attempts remaining during a pressure adjustment operation, while step 173 involves tracking elapsed time during an inflation or deflation cycle.

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[0073] With regard to steps 151 and 182, the number of pressure adjustment "attempts" may be tracked to limit the number of pressure adjustment iterations that pressure adjustment method 150A may perform after a new pressure setpoint has been selected. In particular, prior to sensing manifold pressure in step 152, microprocessor 36 determines if the number of remaining attempts is greater than zero. If the number of attempts remaining is greater than zero, then the method continues at step 154 where microprocessor 36 determines if a pressure adjustment is required. However, if the number of attempts remaining is not greater than zero, then the method instead continues at step 156 where the pressure adjustment is presumed to be complete. Thus, pressure adjustment method 150A may allow for a predetermined number of iterations before the pressure adjustment method "times out." In one exemplary embodiment, the default number of attempts may be set to four. However, any number of attempts are possible and within the intended scope of the present invention.

[0074] If the pressure adjustment factor (either inflate or deflate) is modified in step 180, then the number of remaining attempts is decremented by one attempt in step 182. Therefore, if the desired pressure setpoint is not reached within four attempts, no further pressure adjustment is attempted and the pressure adjustment factor corresponding to the final iteration will be used to update the temporary default adjustment constant as previously discussed.

[0075] With regard to step 173, the amount of time elapsed during a pressure adjustment operation may also be also be tracked. As discussed above, if it is determined in step 170 that the pressure target has not been achieved, pressure adjustment method 150A returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. However, prior to reaching either deflate operation step 162 or inflate operation step 166, the method first enters step 173 where microprocessor 36 monitors the time that has elapsed since the initial determination was made in step 170 regarding

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whether or not the manifold pressure target has been achieved. Thus, if the amount of elapsed time is less than a maximum, predetermined time period, the sequence continues within loop 172 to inflate or deflate first chamber 14A as necessary in an attempt to achieve the manifold pressure target. However, if the desired pressure target has not been reached when microprocessor 36 determines that the maximum time period has expired, then the method exits loop 172 and advances directly to step 156, where no further adjustment will be attempted.

[0076] The maximum, predetermined time period may be any value greater than zero. However, in one exemplary embodiment of pressure adjustment method 150A, the maximum time period may be about 30 minutes. Generally speaking, the maximum time period may be selected such that the manifold pressure target is not achieved prior to the expiration of the maximum time period only if air bed system 10 is not functioning properly. For example, if first tube 48A becomes disconnected from first chamber 14A, it will most likely not be possible to attain the manifold pressure target in step 170. Under these circumstances, and without the addition of the time tracking step 173, pump 20 may continue to run until the user disconnects power from the pump or notices that first tube 48A has been disconnected from first chamber 14A.

[0077] Workers skilled in the art will appreciate that although the features added in steps 151, 173, and 182 are not necessary components of the present invention, their presence helps to optimize the operation of the pressure adjustment method by preventing the method from being trapped in a "continuous loop" of attempting to reach the desired pressure setpoint. Furthermore, it will be obvious to those skilled in the art that the order and number of steps described in reference to FIGS. 5-7 may be modified without departing from the intended scope of the present invention.

[0078] Referring now to FIG. 8, in yet another alternate embodiment in accordance with the present invention, microprocessor 36 may be integrated within network 200 for remote accessing and use of a pressure

adjustment method according to the present invention for improving the accuracy and minimizing the time of pressure adjustments. This allows for centralized data storage and archival of air bed system information (such as customized pressure adjustment factors) by, for example, the customer service department of the air bed system manufacturer. Additionally, networking may provide for information input and retrieval, as well as remote access of control box 24 to operate the air bed system.

[0079] Network 200 may be integrated either locally or accessible via a public network protocol such as the Internet 202 and optionally through an Internet service provider 204. Connection to network 200 may be wired or wireless, and may incorporate control from a detached device (e.g., handheld, laptop, tablet, or other mobile device). In addition, microprocessor 36 may be accessible remotely by a third party user 206 via Internet 202 and/or Internet service provider 204.

[0080] Network 200 may be configured to enable remote pressure adjustment of an air bed system by a third party user 206, such as by a customer service representative at a remote location. In particular, the customer service representative may be able to remotely connect to Internet 202 and assist the user in performing a pressure adjustment set-up, such as pressure adjustment method 150 previously described, in order to optimize the accuracy and operation of the pressure adjustment method. Network 200 may also be configured to allow the customer service representative to access and store the customized pressure adjustment factors in, for example, a central storage system in case of a power loss or similar event. Numerous other advantages of network 200 will be appreciated by those having ordinary skill in the art.

[0081] Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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We Claim:

1. A method for adjusting pressure within an air bed comprising:

providing an air bed, the air bed including an air chamber and a pump having a pump housing;

selecting a desired pressure setpoint for the air chamber;

calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and

modifying the pressure adjustment factor based upon the adjustment factor error.

2. The method of claim 1, wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the pump housing.

3. The method of claim 1, wherein pressure is sensed with a pressure transducer.

4. The method of claim 1, wherein the pressure target is a deflate pressure target.

5. The method of claim 4, wherein the pressure adjustment factor is a multiplicative pressure adjustment factor.

6. The method of claim 5, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor.

7. The method of claim 1, wherein the pressure target is an inflate pressure target.

8. The method of claim 7, wherein the pressure adjustment factor is an additive pressure adjustment factor.

9. The method of claim 7, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and the additive pressure adjustment factor.

10. A method for adjusting pressure within an air bed comprising:

providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump;

selecting a desired pressure setpoint for the air chamber;

calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

sensing pressure within the pump manifold;

adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

modifying the pressure adjustment factor based upon the adjustment factor error; and

storing the modified pressure adjustment factor in memory.

11. The method of claim 10, wherein pressure is sensed with a pressure transducer.

12. The method of claim 10, wherein the pressure target is a deflate pressure target.

13. The method of claim 12, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor.

14. The method of claim 10, wherein the pressure target is an inflate pressure target.

15. The method of claim 14, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor.

16. A method for adjusting pressure within an air bed comprising:

(a) providing an air bed, the air bed including an air chamber and a pump having a pump housing;

(b) selecting a desired pressure setpoint for the air chamber;

(c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

(d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

(e) determining an actual chamber pressure within the air chamber;

(f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

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(g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and

(h) repeating steps (b)-(g) with the updated pressure adjustment factor.

17. A pressure adjustment system for an air bed comprising:

an air chamber;

a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve;

an input device adapted to receive a desired pressure setpoint selected by a user;

a pressure sensing means adapted to monitor pressure within the pump manifold; and

a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

18. The pressure adjustment system of claim 17, wherein the pressure sensing means is a pressure transducer.

19. The pressure adjustment system of claim 17, wherein the input device is a remote control having pressure selecting means.

20. The pressure adjustment system of claim 19, wherein the remote control is a wireless remote control.

ABSTRACT:

A method for adjusting pressure within an air bed comprises providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Furthermore, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

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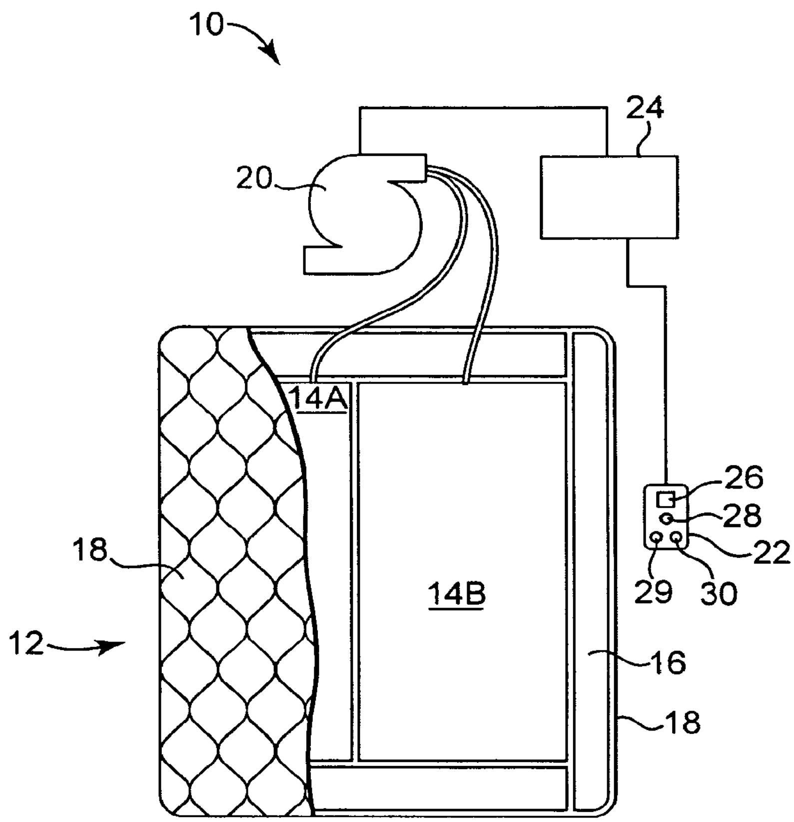
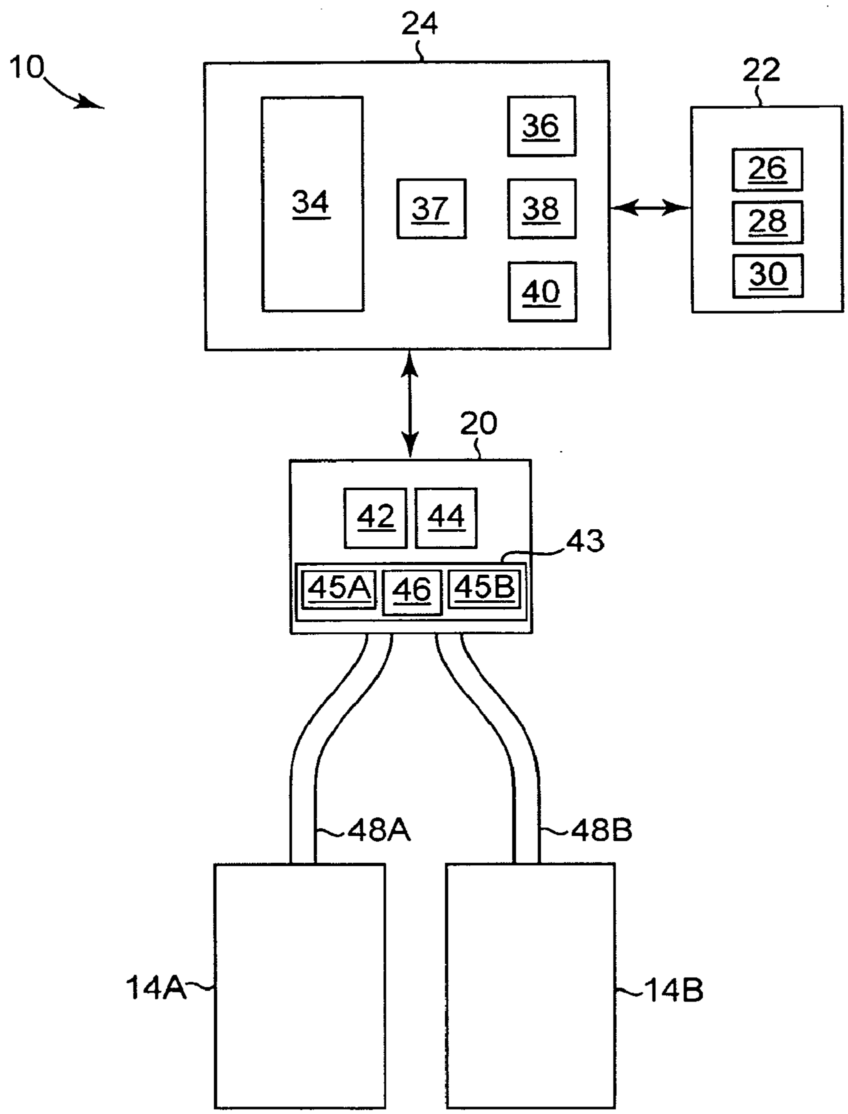


Fig. 1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48B
14A
14B

Fig. 2

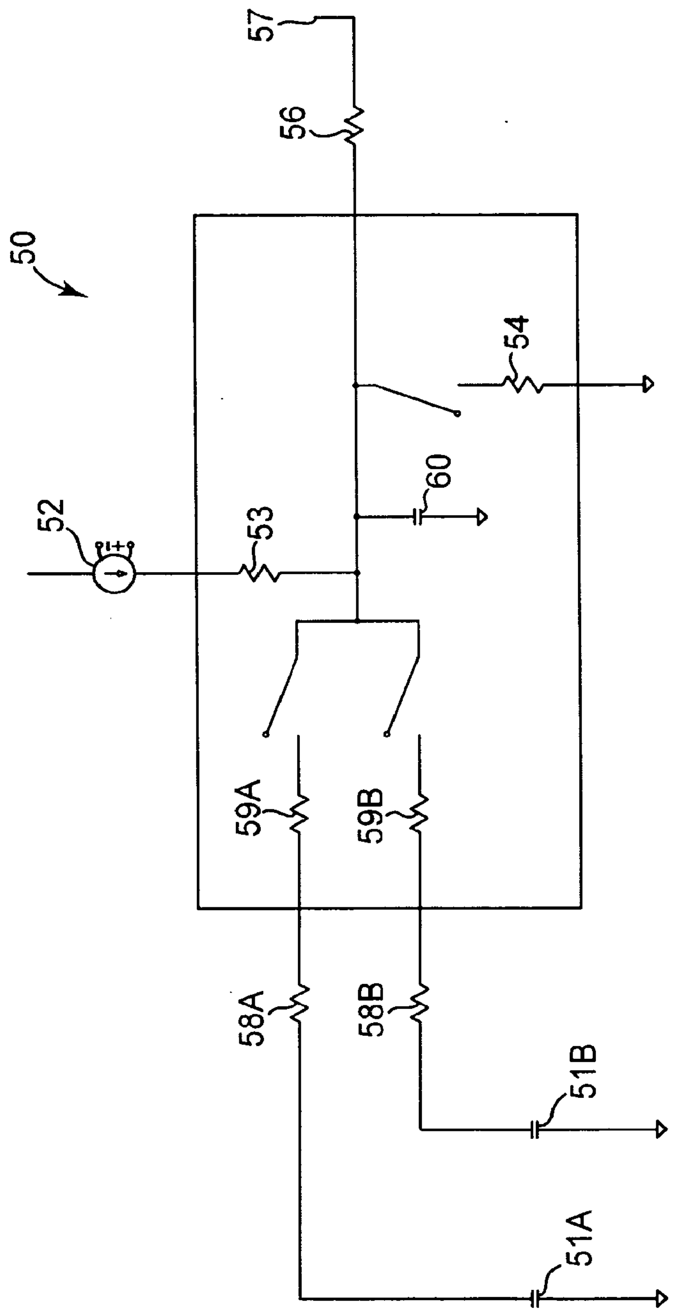
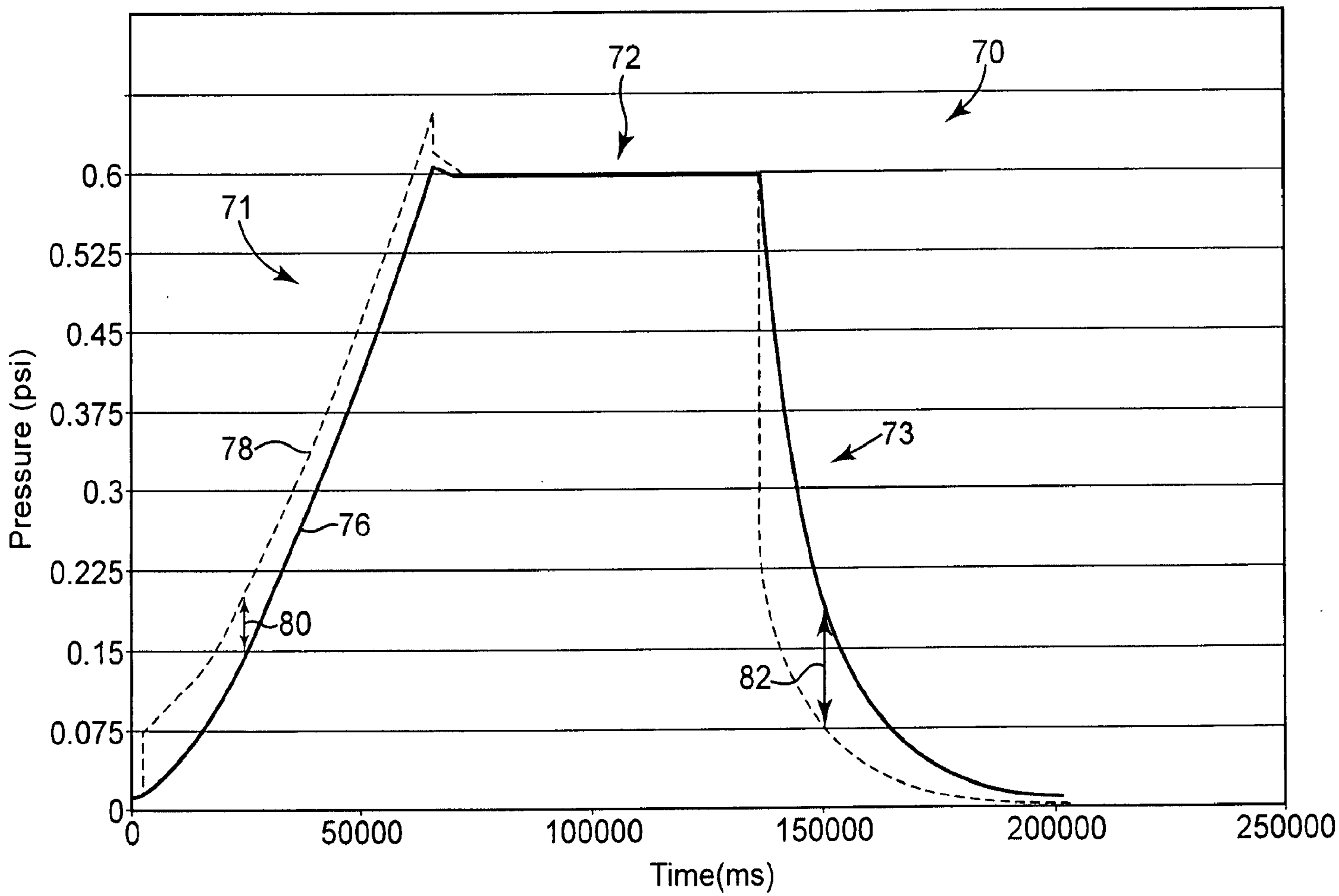


Fig. 3



72
70
0.6
0.525
0.45
0.375
0.3
0.225
0.15
0.075
0
Pressure (psi)
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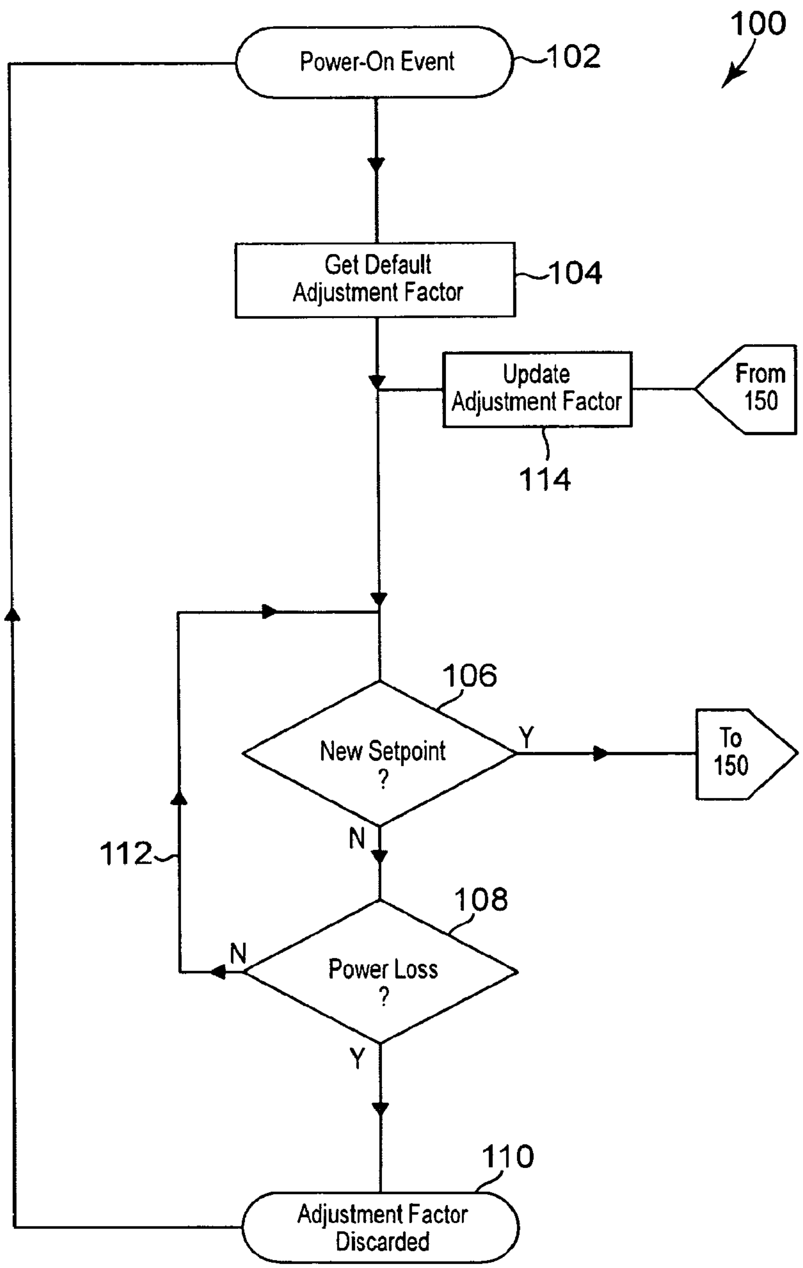
78
76
80
73
82
0
50000
100000
150000
200000
250000
Time(ms)

Fig. 4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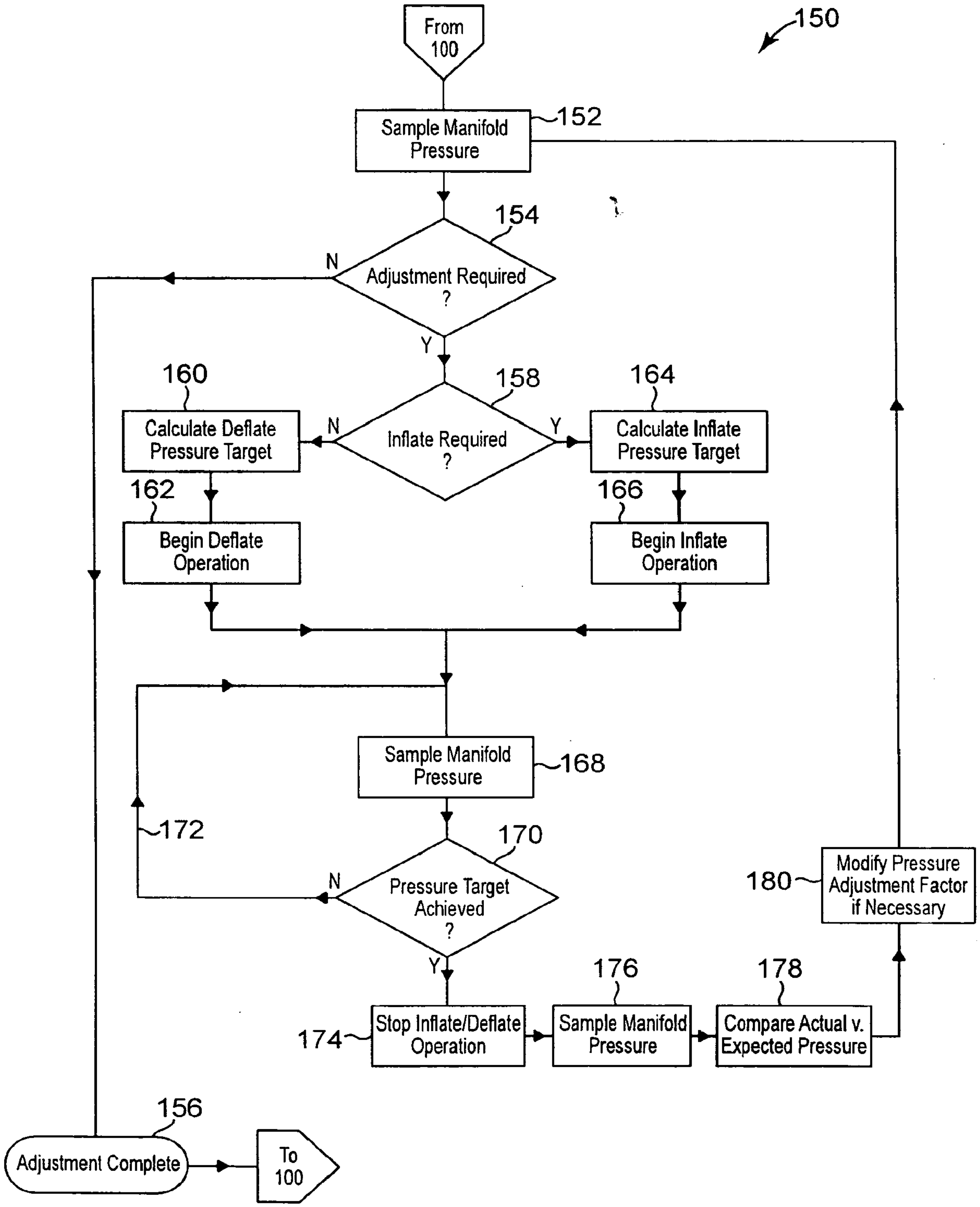
Power-On Event
102
Get Default Adjustment Factor
104
Update Adjustment Factor
114
From 150
New Setpoint ?
106
Y
To 150
N
112
Power Loss ?
108
N
Y
Adjustment Factor Discarded
110

Fig. 5



150
From 100
Sample Manifold Pressure
152
154
Adjustment Required ?
N
Y
158
Inflate Required ?
N
Y
160
Calculate Deflate Pressure Target
164
Calculate Inflate Pressure Target
162
Begin Deflate Operation
166
Begin Inflate Operation
Sample Manifold Pressure
168
172
170
Pressure Target Achieved ?
N
Y
180
Modify Pressure Adjustment Factor if Necessary
174
Stop Inflate/Deflate Operation
176
Sample Manifold Pressure
178
Compare Actual v. Expected Pressure
156
Adjustment Complete
To 100

Fig. 6

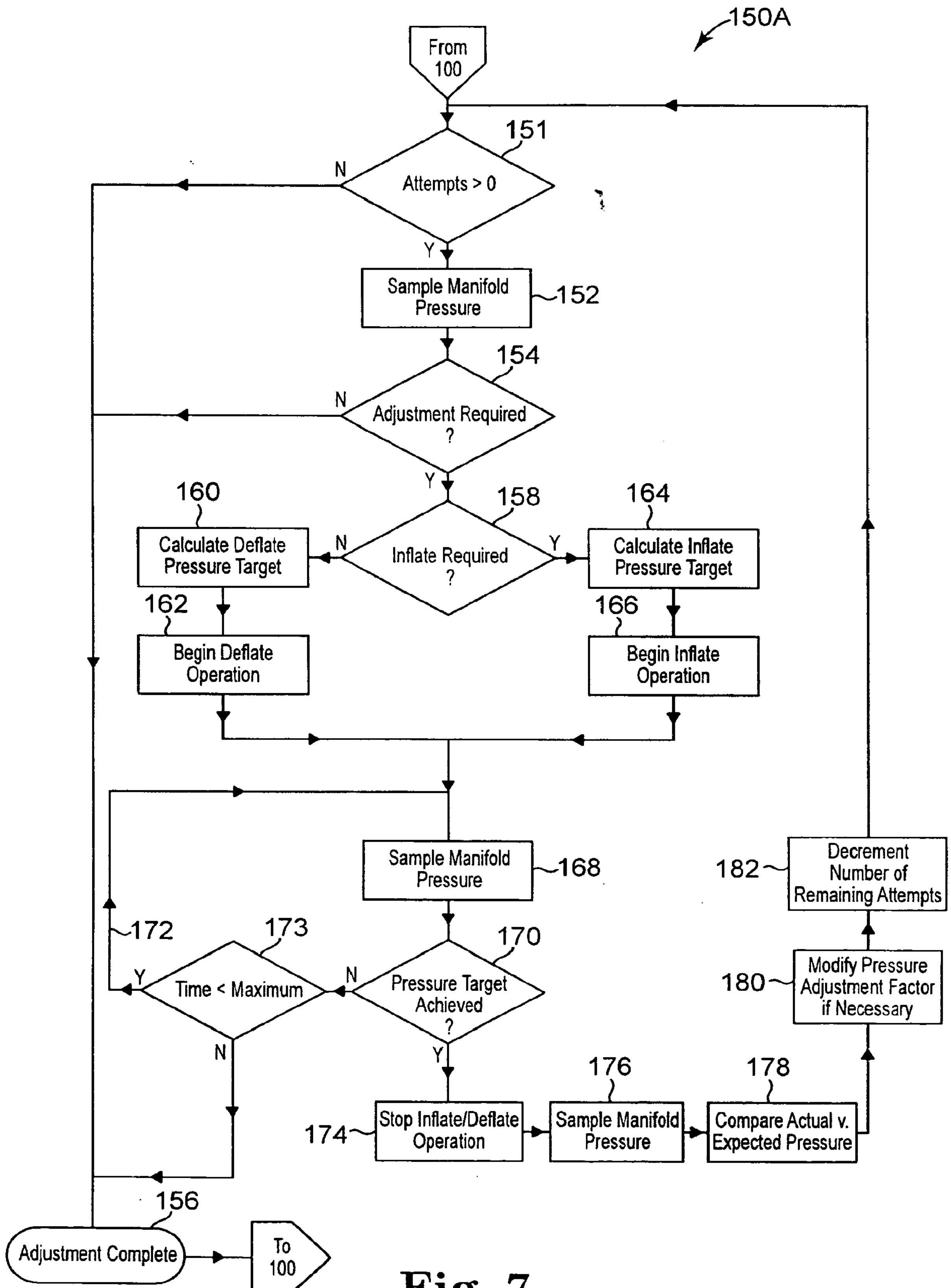

150A
From 100
151
Attempts > 0
N
Y
Sample Manifold Pressure
152
154
Adjustment Required ?
N
Y
158
Inflate Required ?
N
Y
160
Calculate Deflate Pressure Target
162
Begin Deflate Operation
164
Calculate Inflate Pressure Target
166
Begin Inflate Operation
Sample Manifold Pressure
168
172
173
Time < Maximum
Y
N
170
Pressure Target Achieved ?
N
Y
174
Stop Inflate/Deflate Operation
176
Sample Manifold Pressure
178
Compare Actual v. Expected Pressure
180
Modify Pressure Adjustment Factor if Necessary
182
Decrement Number of Remaining Attempts
156
Adjustment Complete
To 100

Fig. 7

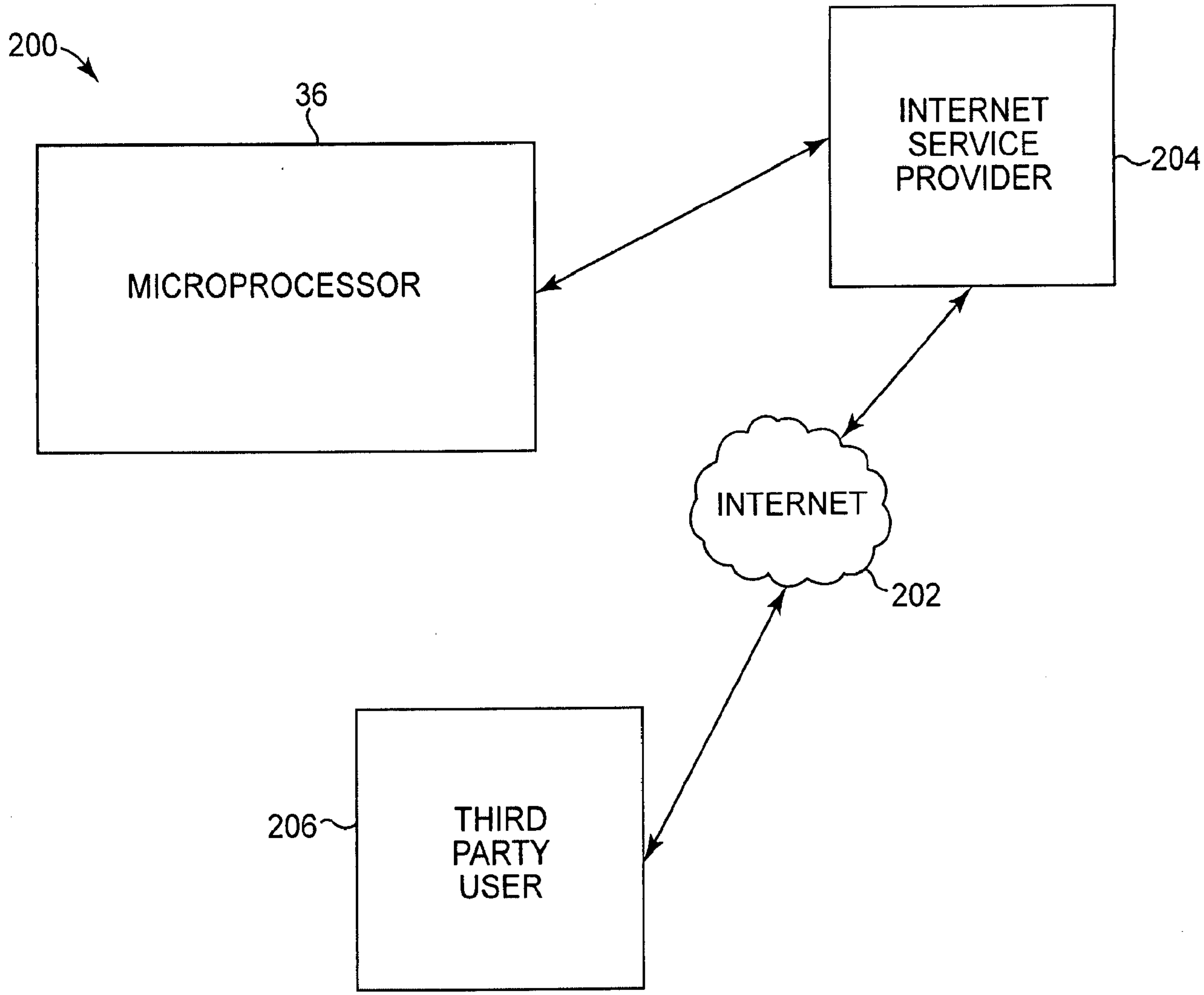

200
36
MICROPROCESSOR
INTERNET SERVICE PROVIDER
204
INTERNET
202
206
THIRD PARTY USER

Fig. 8

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60/092,856	15 July 1998 (15.07.98)	US
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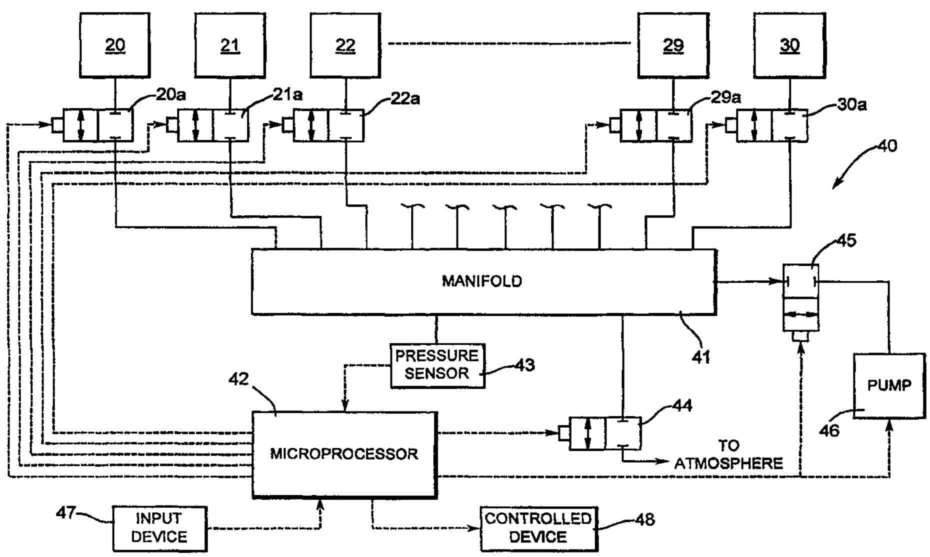
(54) Title: ELECTRONIC CONTROL SYSTEM FOR A VARIABLE SUPPORT MECHANISM

(57) Abstract



A variable support mechanism includes a plurality of pneumatic bladders and an electronic control system for controlling the inflation and deflation thereof. Each of the bladders communicates through a valve with a common manifold. The operations of the valves are individually controlled by a microprocessor. A pressure sensor communicates with the manifold and generates electrical signals that are representative of the magnitude of the fluid pressure in the manifold to the microprocessor. The microprocessor is also connected to a vent valve that provides selective fluid communication between the manifold and the atmosphere. The microprocessor is further connected to a pressure valve that provides selective fluid communication between the manifold and a pump. Initially, the magnitude of the pressure in each of the bladders is sampled, measured, and stored by the electronic control system. Then, it is determined whether a person is using the variable support mechanism. If so, the measured pressure readings from the bladders are compared with respective target values and, in response to that comparison, are designated as being either (1) Too Low, (2) Too High, or (3) Within Limits. The bladders that have been identified as being Too Low are inflated until they have achieved their respective target values, and the bladders that have been identified as being Too High are deflated until they have achieved their respective target values. The electronic control system identifies the user of the vehicular seat assembly and, in response thereto, customizes the operation of one or more controlled devices in the vehicle. Lastly, the electronic control system is placed in an inactive mode, wherein no action occurs for a predetermined length of time. When the predetermined length of time expires, the algorithm branches back to the first routine discussed above, wherein this cycle is repeated.

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TITLE

ELECTRONIC CONTROL SYSTEM FOR A VARIABLE SUPPORT MECHANISM

BACKGROUND OF THE INVENTION

This invention relates in general to support mechanisms, such as seats or beds, upon which some or all of a human body can be comfortably supported. More specifically, this invention relates to an improved structure for a variable support mechanism including a plurality of pneumatic bladders and an electronic control system for controlling the inflation and deflation of such bladders so as to comfortably support the body of a person on a support surface.

Generally speaking, a support mechanism is a device that includes a support surface adapted to engage and provide support for some or all of a human body. In a fixed support mechanism, the support surface is generally fixed in size and shape, deforming only as a result of forces being applied thereto. A wide variety of fixed support mechanisms are known in the art, including conventional seats and beds. However, a number of other fixed support mechanisms having support surfaces are known in the art, such as bandages, braces, and the like. It is known that when a portion of a human body contacts a support surface for an extended period of time, several undesirable effects can occur. These undesirable effects can range from minor muscle aches and fatigue to more severe discomforts. In the past, the solution to this problem involved human intervention to vary the position of the body of the person relative to the support surface.

More recently, a variety of support mechanisms have been developed having support surfaces that can be varied in shape or size provide an increased level of comfort to the person supported thereon. Such variable support mechanisms are commonly found, for example, in vehicular seat assemblies. In such vehicular seat assemblies, it is known to provide a plurality of pneumatic bladders at predetermined locations so as to individually support the thigh, ischial, and lumbar regions of the

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user. The variable support mechanism in such a vehicular seat assembly further includes a pump and one or more valves for selectively increasing or decreasing the amount of air contained within each or all of the bladders. By selectively inflating and deflating these bladders, the shape and size of the support surface can be quickly and easily customized in accordance with the body shape of the user. Such a device has been found to significantly increase the overall comfort to the user.

In the past, inflation and deflation of the bladders were performed manually by the user. Typically, this was accomplished by providing one or more electrical switches that controlled the operations of the pump and the valves. By properly manipulating the switches, the user could cause the bladders to be inflated and deflated as desired. Although these systems were effective, they were reliant upon manual manipulation and control by the user to effect adjustments. More recently, electronic control systems have been incorporated into these variable support mechanisms to permit the inflation and deflation of the bladders to occur automatically in response to predetermined sensed conditions. However, the cost and complexity of known variable support mechanisms and their associated electronic control systems have been found to be relatively high. Thus, it would be desirable to provide an improved structure for a variable support mechanism including a plurality of pneumatic bladders and an electronic control system for controlling the inflation and deflation of such bladders so as to comfortably support the body of a person on a support surface.

SUMMARY OF THE INVENTION

This invention relates to an improved structure for a variable support mechanism including a plurality of pneumatic bladders and an electronic control system for controlling the inflation and deflation of such bladders so as to comfortably support the body of a person on a support surface. Each of the bladders communicates through a solenoid operated valve with a common manifold. The operations of the solenoid operated valves are individually controlled by a microprocessor. A pressure sensor communicates with the manifold and generates electrical signals that is representative of the magnitude of the fluid pressure in the manifold to the

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microprocessor. The microprocessor is also connected to a solenoid operated vent valve that provides selective fluid communication between the manifold and the atmosphere. The microprocessor is further connected to a solenoid operated pressure valve that provides selective fluid communication between the manifold and a pump. An algorithm for controlling the operation of the electronic control system begins with an initial routine wherein the magnitude of the pressure in each of the bladders is sampled, measured, and stored by the electronic control system. Then, it is determined whether a person is using the variable support mechanism. If so, the algorithm enters a second routine wherein the measured pressure readings from the bladders are compared with respective target values and, in response to that comparison, are designated as being either (1) Too Low, (2) Too High, or (3) Within Limits. In a third routine of the algorithm, the bladders that have been identified as being Too Low are inflated until they have achieved their respective target values. Similarly, in a fourth routine of the algorithm, the bladders that have been identified as being Too High are deflated until they have achieved their respective target values. In a fifth routine of the algorithm, the electronic control system identifies the user of the vehicular seat assembly and, in response thereto, customizes the operation of one or more controlled devices in the vehicle. In a final routine of the algorithm, the electronic control system is placed an inactive mode, wherein no action occurs for a predetermined length of time. When the predetermined length of time expires, the algorithm branches back to the first routine discussed above, wherein this cycle is repeated.

Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a vehicular seat assembly including a variable support mechanism and electronic control system in accordance with this invention.

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Fig. 2 is a schematic block diagram of an electronic control system for controlling the inflation and deflation of the variable support mechanism illustrated in Fig. 1.

Fig. 3 is a simplified flow chart of a first embodiment of an algorithm for controlling the operation of the electronic control system illustrated in Fig. 2.

Fig. 4 is a detailed flow chart of the steps involved in a first routine of the algorithm illustrated in Fig. 3.

Fig. 5 is a detailed flow chart of the steps involved in a second routine of the algorithm illustrated in Fig. 3.

Fig. 6 is a detailed flow chart of the steps involved in a third routine of the algorithm illustrated in Fig. 3.

Fig. 7 is a detailed flow chart of the steps involved in a fourth routine of the algorithm illustrated in Fig. 3.

Fig. 8 is a detailed flow chart of the steps involved in a fifth routine of the algorithm illustrated in Fig. 3.

Fig. 9 is a simplified flow chart of a first embodiment of an algorithm for controlling the operation of the electronic control system illustrated in Fig. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is illustrated in Fig. 1 a perspective view of a vehicular seat assembly, indicated generally at 10, including a variable support mechanism and electronic control system in accordance with this invention. Although this invention will be described in the context of the illustrated vehicular seat assembly 10, it will be appreciated that this invention may be used in conjunction with any known variable support mechanism. The seat assembly 10 includes a seat portion 11 and a back portion 12. A plurality of pneumatic bladders 20 through 30 are provided within the seat portion 11 and the back portion 12 of the seat assembly 10. In the illustrated embodiment, the bladder 20 is provide to support the upper back region of a user, the bladders 21, 22, and 23 are provided to support the central lumbar region of the user, the bladders 24 and 25 are provided to support the lateral lumbar regions of

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the user, the bladder 26 is provided to support the ischial region of the user, the bladders 27 and 28 are provided to support the central thigh regions of the user, and the bladders 29 and 30 are provided to support the lateral thigh regions of the user. This invention contemplates that a greater or lesser number of such bladders 20 through 30 may be provided in the support mechanism, and that the locations of such bladders 20 through 30 within the seat assembly 10 may be varied as desired. Although this invention will be described and illustrated in the context of pneumatic bladders 20 through 30, it will be appreciated that this invention may be practiced using other well known fluid operated actuators or similar structures.

Fig. 2 is a schematic block diagram of an electronic control system, indicated generally at 40, for automatically controlling the inflation and deflation of the bladders 20 through 30 so as to comfortably support the body of a person on the variable support mechanism provided in the seat assembly 10. For the sake of simplicity, not all of the bladder 20 through 30 are illustrated in Fig. 2. Nonetheless, it will be appreciated that the non-illustrated bladders can be structured and operated in the same manner as the illustrated bladders. Each of the bladders 20 through 30 communicates through a solenoid operated valve 20a through 30a, respectively, with a common manifold 41. Each of the solenoid operated valves 20a through 30a shown in Fig. 2 is illustrated in a closed position, wherein fluid communication is prevented between each of the bladders 20 through 30 and the manifold 41. However, each of the solenoid operated valves 20a through 30a can be moved to an opened position, wherein fluid communication is permitted between each of the bladders 20 through 30 and the manifold 41. If desired, the solenoid operated valves 20a through 30a can be connected mounted together in side-by-side fashion to function in the aggregate as the manifold 41.

The operations of the solenoid operated valves 20a through 30a are individually controlled by an electronic controller, such as a microprocessor 42. The microprocessor 42 is, of itself, conventional in the art and may be embodied as any general purpose control device that is responsive to one or more input signals for generating one or more output signals to control the operation of the electronic control

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system 40 in a desired manner. The manner of operation of the microprocessor 42 will be explained in detail below. A pressure sensor 43 communicates with the manifold 41 and is connected with the microprocessor 42. The pressure sensor 43 is conventional in the art and is adapted to generate an electrical signal that is representative of the magnitude of the fluid pressure in the manifold 41 to the microprocessor 41.

The microprocessor 42 is also connected to a solenoid operated vent valve 44. The vent valve 44 provides selective fluid communication between the manifold 41 and the atmosphere. The vent valve 44 shown in Fig. 2 is illustrated in a closed position, wherein fluid communication is prevented between the manifold 41 and the atmosphere. However, the vent valve 44 can be moved to an opened position, wherein fluid communication is permitted between the manifold 41 and the atmosphere.

The microprocessor 42 is further connected to a solenoid operated pressure valve 45. The pressure valve 45 provides selective fluid communication between the manifold 41 and a pump 46. The pressure valve 45 shown in Fig. 2 is illustrated in a closed position, wherein fluid communication is prevented between the manifold 41 and the pump 46. However, the pressure valve 45 can be moved to an opened position, wherein fluid communication is permitted between the manifold 41 and the pump 46. The operation of the pump 46 is also controlled by the microprocessor 42.

One or more input devices 47 may be connected to the microprocessor 42. The input device 47 is conventional in the art and may be embodied as any well known manually operable device, such as one or more switches, a keyboard, and the like. Generally speaking, the input device 47 is provided to allow a user to generate electrical signals to the microprocessor 47 to control the operation of the electronic control system 40 in a desired manner. Also, one or more conventional output devices (not shown) may be connected to the microprocessor 42 if desired. The output device may be provided to facilitate the use of the electronic control system 40 by the user.

Lastly, one or more controlled devices 48 may be connected to the microprocessor 42. The controlled device 48 may include any device that is capable of being adjusted in size, position, or mode of operation to a particular user of the

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vehicular seat assembly 10. For example, the controlled device 48 may be an air bag assembly that is adapted to be deployed in the event of a collision. As will be explained in greater detail below, the microprocessor 42 determines the identity of the user of the vehicular seat assembly 10 based upon measured pressure readings of the bladders 20 through 30. In response thereto, the microprocessor 42 generates signals to the controlled device 48 to customize the operation thereof in accordance with the identified user. For example, the rate of deployment of the air bag assembly may be varied in accordance with the size and weight of the user of the vehicular seat assembly 10. Other examples of controlled devices 48 include a seat track positioning mechanism (that adjusts the vehicular seat assembly 10 forwardly and rearwardly), a tilt mechanism for adjusting the position of the back portion 12 of the vehicular seat assembly 10 relative to the seat portion 11, radio station selections, climate controls and mirror positioning mechanisms. Communications between the microprocessor 42 and any or all of these controlled devices 48 can be accomplished in any conventional manner, such as by standard electronic bus lines provided in most modern vehicles.

Fig. 3 is a simplified flow chart of a first embodiment of an algorithm, indicated generally at 100, for controlling the operation of the electronic control system 40 illustrated in Fig. 2. As shown therein, the algorithm 100 begins with an initial routine 110 wherein the magnitude of the pressure in each of the bladders 20 through 30 is sampled, measured, and stored by the electronic control system 40. Then, the algorithm 100 enters a second routine 120 wherein the measured pressure readings from the bladders 20 through 30 are compared with respective target values and, in response to that comparison, are designated as being either (1) Too Low, (2) Too High, or (3) Within Limits. In a third routine 130 of the algorithm 100, the bladders 20 through 30 that have been identified as being Too Low are inflated until they have achieved their respective target values. Similarly, in a fourth routine 140 of the algorithm 100, the bladders 20 through 30 that have been identified as being Too High are deflated until they have achieved their respective target values. The third and fourth routines 130 and 140 may be performed in reverse order or otherwise combined together if desired. In a fifth routine 150 of the algorithm 100, the electronic control

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system 40 identifies the user of the vehicular seat assembly 10 and, in response thereto, customizes the operation of one or more controlled devices in the vehicle. In a final routine 160 of the algorithm 100, the electronic control system 40 is placed an inactive mode, wherein no action occurs for a predetermined length of time. This predetermined length of time may be set as desired, such as for approximately two minutes. When the predetermined length of time expires, the algorithm 100 branches back to the first routine 110 discussed above, wherein this cycle is repeated.

Fig. 4 is a detailed flow chart of the steps involved in the first routine 110 of the algorithm 100 illustrated in Fig. 3, wherein the magnitude of the pressure in each of the bladders 20 through 30 is sampled, measured, and stored by the electronic control system 20. In a first step 111 of the first routine 110, the microprocessor 42 causes the vent valve 44, the pressure valve 45, and each of the individual solenoid operated valves 20a through 30a to be closed or to remain closed. Next, the first routine 110 enters a step 112, wherein a first one of the solenoid operated valves 20a through 30a is opened such that the associated bladder 20 through 30 is placed in fluid communication with the manifold 40. When this occurs, the pressure of the fluid contained within the manifold 41 becomes equal with the pressure of the fluid contained within the associated bladder 20. The first routine 110 then enters a step 113, wherein the pressure in the manifold 41 and the associated bladder 20 (as measured by the pressure sensor 43) is sampled by and stored in the microprocessor 42. Thereafter, the first routine 110 enters a step 114 wherein it is determined whether the pressure levels of all of the bladders 20 through 30 have been sampled and stored. If not, the first routine 110 enters a step 115 wherein the microprocessor 42 causes the opened first one of the individual solenoid operated valves 20a through 30a to be closed, and further causes the next one of the individual solenoid operated valves 20a through 30a to be opened. The first routine 110 then branches back to the step 113 wherein the pressure in the manifold 41 and the associated bladder 20 (as measured by the pressure sensor 43) is sampled by and stored in the microprocessor 42. This process is repeated until the pressure levels of all of the bladders 20a through 30a have

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been sampled and stored. When this occurs, the first routine 110 returns from the step 114 to the algorithm 110 and enters the second routine 120.

Fig. 5 is a detailed flow chart of the steps involved in the second routine 120 of the algorithm 100 illustrated in Fig. 3, wherein the measured pressure readings from the bladders 20 through 30 are compared with respective target values and, in response to that comparison, are designated as being either (1) Too Low, (2) Too High, or (3) Within Limits. In a first step 121 of the second routine 120, the microprocessor 42 selects the first pressure level (for example, the pressure level corresponding to the magnitude of the pressure in the first bladder 20) stored in memory. At the same time, the microprocessor 42 selects the target value associated with that particular bladder 20. The target value can be a single discrete value or, more preferably, a range of values defined by upper and lower limits about a predetermined center value. The magnitude of the target values associated with each of the bladders 20 through 30 can be stored in the microprocessor 42 at the time of manufacture. Whether or not this is done, it is desirable that the magnitude of the target values be capable of adjustment by the user as desired, such as by using the input device 47.

Next, the second routine 120 enters a step 122 wherein the value of the stored pressure level is compared with the target value associated with that particular bladder 20. Specifically, it is determined if the value of the stored pressure level is less than the target value associated therewith. If the value of the stored pressure level is less than the associated target value, then the second routine 120 branches to a step 123 wherein the bladder 20 is designated as being Too Low. Then, the second routine 120 enters a step 124. If, alternatively, it is determined at the step 122 that the value of the stored pressure level is not less than the associated target value, then the second routine 120 branches directly to the step 124. In either event, it is determined at the step 124 whether the pressure levels of all of the bladders 20 through 30 have been sampled and stored. If not all of the pressure levels of all of the bladders 20 through 30 have been sampled and stored, then the second routine 120 branches from the step 124 to a step 125 wherein the microprocessor 42 selects the next pressure level stored in memory and the target value associated therewith. Then, the second routine 120

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moves from the step 125 back to the step 122 wherein the value of the next stored pressure level is compared with the target value associated therewith. This process is repeated until the values of all of the stored pressure levels have been compared with the target values associated therewith. At this point of the second routine 120, none, some, or all of the bladders 20 through 30 may be designated as being Too Low, depending upon the results of the comparisons.

When the values of all of the stored pressure levels have been compared with the target values associated therewith, the second routine 120 branches from the step 124 to a step 126 wherein the microprocessor 42 again selects the first pressure level stored in memory. At the same time, the microprocessor 42 selects the target value associated with that particular bladder 20. Next, the second routine 120 enters a step 127 wherein the value of the stored pressure level is compared with the target value associated with that particular bladder 20. Specifically, it is determined if the value of the stored pressure level is greater than the target value associated therewith. If the value of the stored pressure level is greater than the associated target value, then the second routine 120 branches to a step 128 wherein the bladder 20 is designated as being Too High. Then, the second routine 120 enters a step 129. If, alternatively, it is determined at the step 127 that the value of the stored pressure level is not greater than the associated target value, then the second routine 120 branches directly to the step 129. In either event, it is determined at the step 129 whether the pressure levels of all of the bladders 20 through 30 have been sampled and stored. If not all of the pressure levels of all of the bladders 20 through 30 have been sampled and stored, then the second routine 120 branches from the step 129 to a step 129a wherein the microprocessor 42 selects the next pressure level stored in memory and the target value associated therewith. Then, the second routine 120 moves from the step 129a back to the step 127 wherein the value of the next stored pressure level is compared with the target value associated therewith. This process is repeated until the values of all of the stored pressure levels have been compared with the target values associated therewith. At this point of the second routine 120, none, some, or all of the bladders

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20 through 30 may be designated as being either Too Low of Too High, depending upon the results of the comparisons.

When the values of all of the stored pressure levels have been compared with the target values associated therewith, the second routine 120 branches from the step 129 to a step 129b wherein any of the bladders 20 through 30 that have not already been designated as being either Too Low or Too High are now designated as being Within Limits. Thus, at the conclusion of the second routine 120, each of the bladders 20 through 30 that is currently at a pressure level that is less than the target value associated therewith is designated as being Too Low, each of the bladders 20 through 30 that is currently at a pressure level that is greater than the target value associated therewith is designated as being Too High, and the remaining bladders are designated as being Within Limits. When this occurs, the second routine 120 returns from the step 129b to the algorithm 110 and enters the third routine 130.

Fig. 6 is a detailed flow chart of the steps involved in the third routine 130 of the algorithm 100 illustrated in Fig. 3, wherein the bladders 20 through 30 that have been identified as being Too Low are inflated until they have achieved their respective target values. In a first step 131 of the third routine 130, the microprocessor 42 initially causes each of the individual solenoid operated valves 20a through 30a associated with the bladders 20 through 30 that were designated in the manner described above to be Too Low to be opened. As a result, each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a is placed in fluid communication with the manifold 41. Next, the third routine 130 enters a step 132 wherein the pressure valve 45 is moved from the closed position to the opened position, and wherein the pump 46 is energized for operation. As a result, pressurized fluid is introduced within the manifold 41 and, therefore, each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a. Consequently, the pressure levels are increased in the manifold 41 and in each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a.

As this increase in pressure level occurs, the third routine 130 enters a step 133 wherein the pressure in the manifold 41 (as measured by the pressure sensor 43) is

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sampled by and stored in the microprocessor 42. Thereafter, the third routine 130 enters a step 134 wherein it is determined whether any of the target values for bladders 20 through 30 designated as being Too Low has been achieved, as determined by the pressure in the manifold 41. If none of the target values for bladders 20 through 30 designated as being Too Low have been achieved, then the third routine 130 branches back to the step 133 wherein the pressure in the manifold 41 is again sampled by and stored in the microprocessor 42. However, if any of the target values for bladders 20 through 30 designated as being Too Low have been achieved, then the third routine 130 branches to a step 135 wherein the microprocessor 42 causes individual solenoid operated valves 20a through 30a associated with such bladders 20 through 30 to be closed. As a result, no further increase in the pressure levels therein can occur.

The third routine 130 then enters a step 136 wherein it is determined whether all of the individual solenoid operated valves 20a through 30a that were opened have been closed. If not, the third routine 130 branches back to the step 133 wherein the pressure in the manifold 41 is again sampled by and stored in the microprocessor 42. Thus, the sampling of the pressure levels in the bladders 20 through 30 is repeated until all of the individual solenoid operated valves 20a through 30a that were opened have been closed. When this occurs, the third routine 130 enters a step 137 wherein the pressure valve 45 is moved from the opened position to the closed position, and wherein the pump 46 is de-energized to prevent further operation. Lastly, the third routine 130 returns from the step 137 to the algorithm 110 and enters the fourth routine 140.

Fig. 7 is a detailed flow chart of the steps involved in the fourth routine 140 of the algorithm 100 illustrated in Fig. 3, wherein the bladders 20 through 30 that have been identified as being Too High are deflated until they have achieved their respective target values. In a first step 141 of the fourth routine 140, the microprocessor 42 initially causes each of the individual solenoid operated valves 20a through 30a associated with the bladders 20 through 30 that were designated in the manner described above to be Too High to be opened. As a result, each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a is

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placed in fluid communication with the manifold 41. Next, the fourth routine 140 enters a step 142 wherein the vent valve 44 is moved from the closed position to the opened position. As a result, pressurized fluid is vented from the manifold 41 and, therefore, each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a. Consequently, the pressure levels are decreased in the manifold 41 and in each of the bladders 20 through 30 that are associated with the opened valves 20a through 30a.

As this decrease in pressure level occurs, the fourth routine 140 enters a step 143 wherein the pressure in the manifold 41 (as measured by the pressure sensor 43) is sampled by and stored in the microprocessor 42. Thereafter, the fourth routine 140 enters a step 144 wherein it is determined whether any of the target values for bladders 20 through 30 designated as being Too High has been achieved, as determined by the pressure in the manifold 41. If none of the target values for bladders 20 through 30 designated as being Too High have been achieved, then the fourth routine 140 branches back to the step 143 wherein the pressure in the manifold 41 is again sampled by and stored in the microprocessor 42. However, if any of the target values for bladders 20 through 30 designated as being Too High have been achieved, then the fourth routine 140 branches to a step 145 wherein the microprocessor 42 causes individual solenoid operated valves 20a through 30a associated with such bladders 20 through 30 to be closed. As a result, no further decrease in the pressure levels therein can occur.

The fourth routine 140 then enters a step 146 wherein it is determined whether all of the individual solenoid operated valves 20a through 30a that were opened have been closed. If not, the fourth routine 140 branches back to the step 143 wherein the pressure in the manifold 41 is again sampled by and stored in the microprocessor 42. Thus, the sampling of the pressure levels in the bladders 20 through 30 is repeated until all of the individual solenoid operated valves 20a through 30a that were opened have been closed. When this occurs, the fourth routine 140 enters a step 147 wherein the vent valve 44 is moved from the opened position to the closed position. Lastly, the

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fourth routine 140 returns from the step 147 to the algorithm 110 and enters the fifth routine 150.

Fig. 8 is a detailed flow chart of the steps involved in the fifth routine 150 of the algorithm 100 illustrated in Fig. 3, wherein the electronic control system 40 identifies the user of the vehicular seat assembly 10 and, in response thereto, customizes the operation of one or more controlled devices in the vehicle. In a first step 151 of the fifth routine 150, the previously measured pressure readings from some or all of the bladders 20 through 30 are compared with a table of values stored in memory. The table of values can consist of a list of a plurality of persons, each of which has one or more pressure readings associated therewith. By comparing the previously measured pressure readings with the pressure readings stored in the table, a correlation can be made as to the identity of the user of the vehicular seat assembly 10, as shown in step 152. This comparison and correlation can be made using any conventional algorithm.

The table of values stored in memory also includes settings for one or more of the controlled devices 48 that are customized to the particular user of the vehicular seat assembly 10. Thus, having identified the user in step 152, the fifth routine 150 next enters a step 153 wherein electrical signals are generated from the microprocessor 42 to each of the controlled devices 48. In response to such signals, the controlled devices 48 are customized to the particular user of the vehicular seat assembly 10. Then, the fifth routine 150 returns to the algorithm 100 and enters the sixth routine 160. As discussed above, the sixth routine 160 causes the electronic control system 40 to enter an inactive mode wherein no action occurs for a predetermined length of time. This predetermined length of time may be set as desired, such as for approximately two minutes. When the predetermined length of time expires, the algorithm 100 branches back to the first routine 110 discussed above, wherein the entire cycle is repeated.

Fig. 9 is a simplified flow chart of a second embodiment of an algorithm, indicated generally at 100', for controlling the operation of the electronic control system 40 illustrated in Fig. 2. The second algorithm 100' is, in large measure, similar

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to the first algorithm 100 discussed above, and like reference numbers are used to indicate similar routines. The second algorithm 100' begins with an initial routine 110' wherein the magnitude of the pressure in each of the bladders 20 through 30 is sampled, measured, and stored by the electronic control system 40. Then, the algorithm 100' enters an occupant detection routine 200 wherein it is determined whether a person is sitting in the vehicular seat assembly 10. The specific process by which this is accomplished is discussed below. If it is determined that a person is sitting in the vehicular seat assembly 10, then the algorithm 100' branches to a second routine 120' wherein the measured pressure readings from the bladders 20 through 30 are compared with respective target values and, in response to that comparison, are designated as being either (1) Too Low, (2) Too High, or (3) Within Limits. In a third routine 130' of the algorithm 100', the bladders 20 through 30 that have been identified as being Too Low are inflated until they have achieved their respective target values. Similarly, in a fourth routine 140' of the algorithm 100', the bladders 20 through 30 that have been identified as being Too High are deflated until they have achieved their respective target values. The third and fourth routines 130' and 140' may be performed in reverse order or otherwise combined together if desired. In a fifth routine 150' of the algorithm 100', the electronic control system 40 identifies the user of the vehicular seat assembly 10 and, in response thereto, customizes the operation of one or more controlled devices in the vehicle. In a final routine 160' of the algorithm 100', the electronic control system 40 is placed an inactive mode, wherein no action occurs for a predetermined length of time. This predetermined length of time may be set as desired, such as for approximately two minutes. When the predetermined length of time expires, the algorithm 100' branches back to the first routine 110' discussed above, wherein this cycle is repeated.

If, on the other hand, it is determined in the occupant detection routine 200 that a person is not sitting in the vehicular seat assembly 10, then the algorithm 100' branches directly to the final routine 160', omitting the intermediate routines 120', 130', 140', and 150'. Thus, it can be seen that the algorithm 100' performs the desired pressure comparisons and adjustments only when a person is sitting in the vehicular

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seat assembly 10. If no person is sitting in the vehicular seat assembly 10, then the algorithm 100' merely enters the inactive mode. This prevents the algorithm 100' from undesirably increasing the pressures in the bladders 20 through 30 when a person is not occupying the vehicular seat assembly 10. For example, let it be assumed that a person who has been sitting in the vehicular seat assembly 10 stops the vehicle and gets out for a short period of time. The first algorithm 100 discussed above would eventually react to this situation by increasing the pressures in each of the bladders 20 through 30 to a maximum value. Then, when the person subsequently returns to the vehicle and sits in the vehicular seat assembly 10, he or she will have to sit on the uncomfortably fully inflated bladders 20 through 30 for whatever period of time is remaining in the inactive mode of the final routine 160. However, by virtue of the occupant detection routine 200 of the second algorithm 100', the pressures in the bladders 20 through 30 will not be varied while the person is not sitting on the vehicular seat assembly 10. Thus, when returning to the vehicle, the person will not experience any discomfort.

The occupant detection routine 200 can be performed by comparing the current pressure level in one or more of the bladders 20 through 30 with a predetermined threshold value. For example, if the pressure in the bladder 26 provided to support the ischial region of the user decreases below a predetermined threshold, then it can be assumed that no person is sitting on the vehicular seat assembly 10. Alternatively, the occupant detection routine 200 can be performed by comparing the current pressure level in one or more of the bladders 20 through 30 with a previous measured pressure. For example, if the pressure in the bladder 26 provided to support the ischial region of the user changes by more than a predetermined amount from the previous pressure reading, then it can be assumed that no person is sitting on the vehicular seat assembly 10. Any known method can be used to perform these comparisons.

In accordance with the provisions of the patent statutes, the principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced

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otherwise than as specifically explained and illustrated without departing from its spirit or scope.

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What is claimed is:

1. A method of operating variable support mechanism in a vehicle having a controlled device, the variable support mechanism including a support mechanism including a plurality of bladders having respective valves connected to a manifold and an electronic control system for selectively inflating and deflating the bladders, said method comprising the steps of:

(a) measuring the magnitude of the pressure in each of the bladders;

(b) comparing the measured pressures from the bladders with respective target values;

(c) adjusting the pressures in the bladders such that the measured values achieve the target values;

(d) identifying the user of the variable support mechanism based upon the measured pressures; and

(e) controlling the operation of the controlled device in response to the identity of the user of the variable support mechanism.

2. The method defined in Claim 1 wherein said step (d) is performed by comparing the measured pressures from the bladders with a table of predetermined values that are correlated with the identity of the user.

3. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of an air bag assembly.

4. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of a seat track positioning mechanism.

5. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of a tilt mechanism for adjusting the position of a back portion of the vehicular seat assembly relative to the seat portion.

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6. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of a radio.

7. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of a climate control.

8. The method defined in Claim 1 wherein said step (e) is performed by controlling the operation of a mirror positioning mechanism.

9. A method of operating variable support mechanism in a vehicle having a controlled device, the variable support mechanism including a support mechanism including a plurality of bladders having respective valves connected to a manifold and an electronic control system for selectively inflating and deflating the bladders, said method comprising the steps of:

(a) measuring the magnitude of the pressure in each of the bladders;

(b) determining from the measured pressures whether a user is using the variable support mechanism; and

(c) only if user is using the variable support mechanism, then comparing the measured pressures from the bladders with respective target values and adjusting the pressures in the bladders such that the measured values achieve the target values.

10. The method defined in Claim 9 wherein said step (b) is performed by comparing the measured pressure from at least one of the bladders with a predetermined threshold value.

11. The method defined in Claim 9 wherein said step (b) is performed by comparing the measured pressure from at least one of the bladders with a previous measured pressure.

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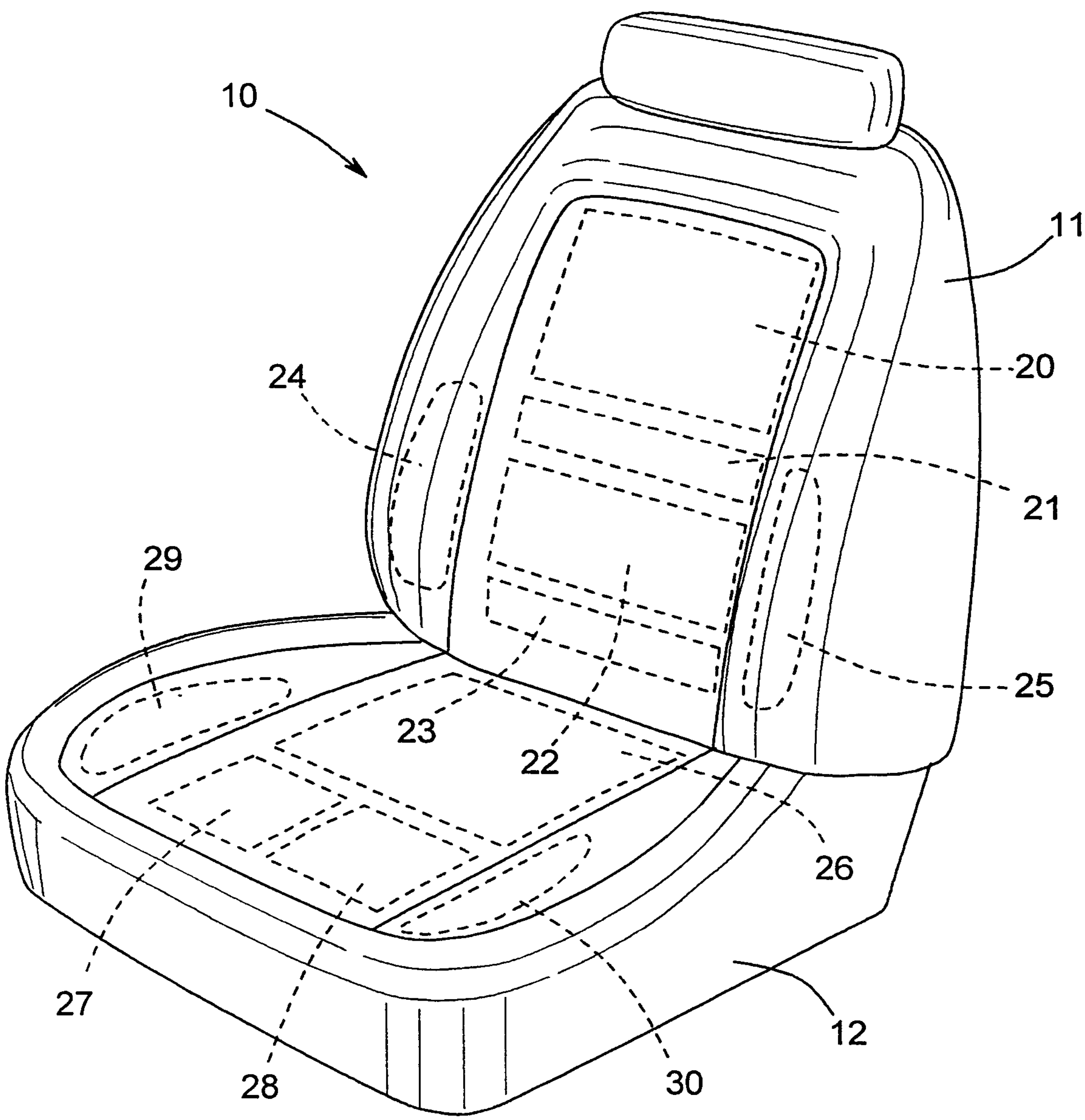

FIG. 1

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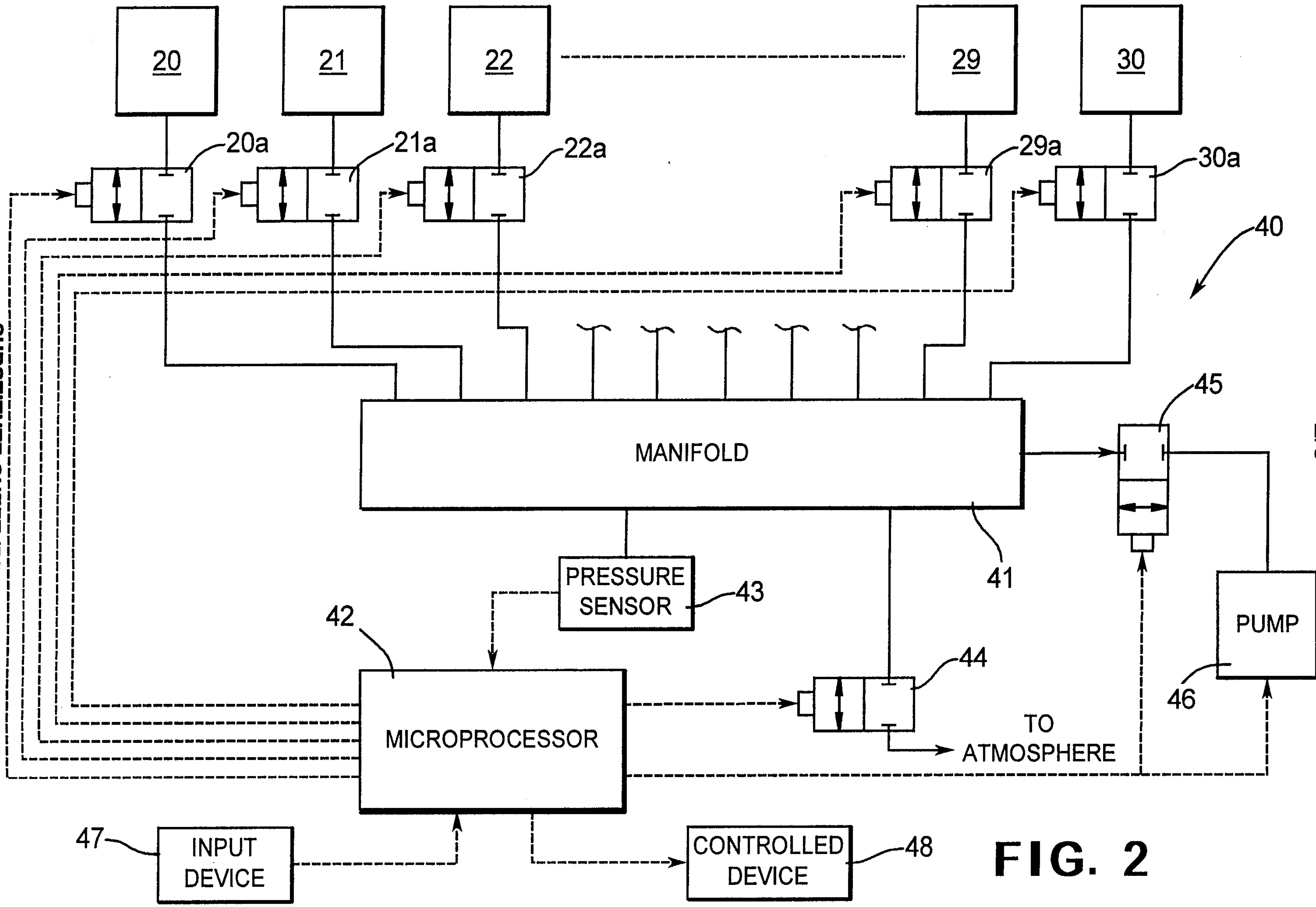

FIG. 2

SUBSTITUTE SHEET (RULE 26)

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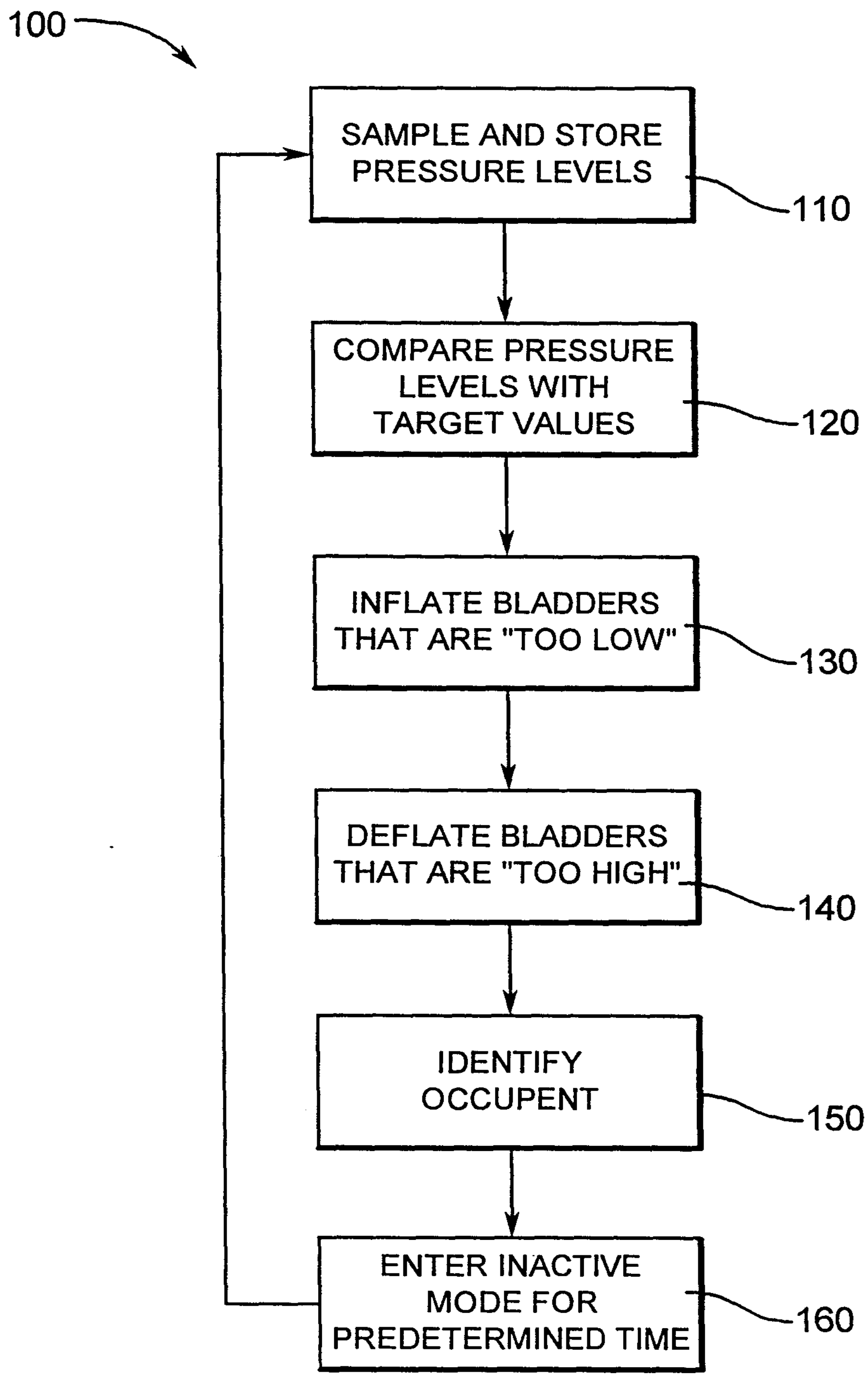

FIG. 3

Sleep Number Corp.
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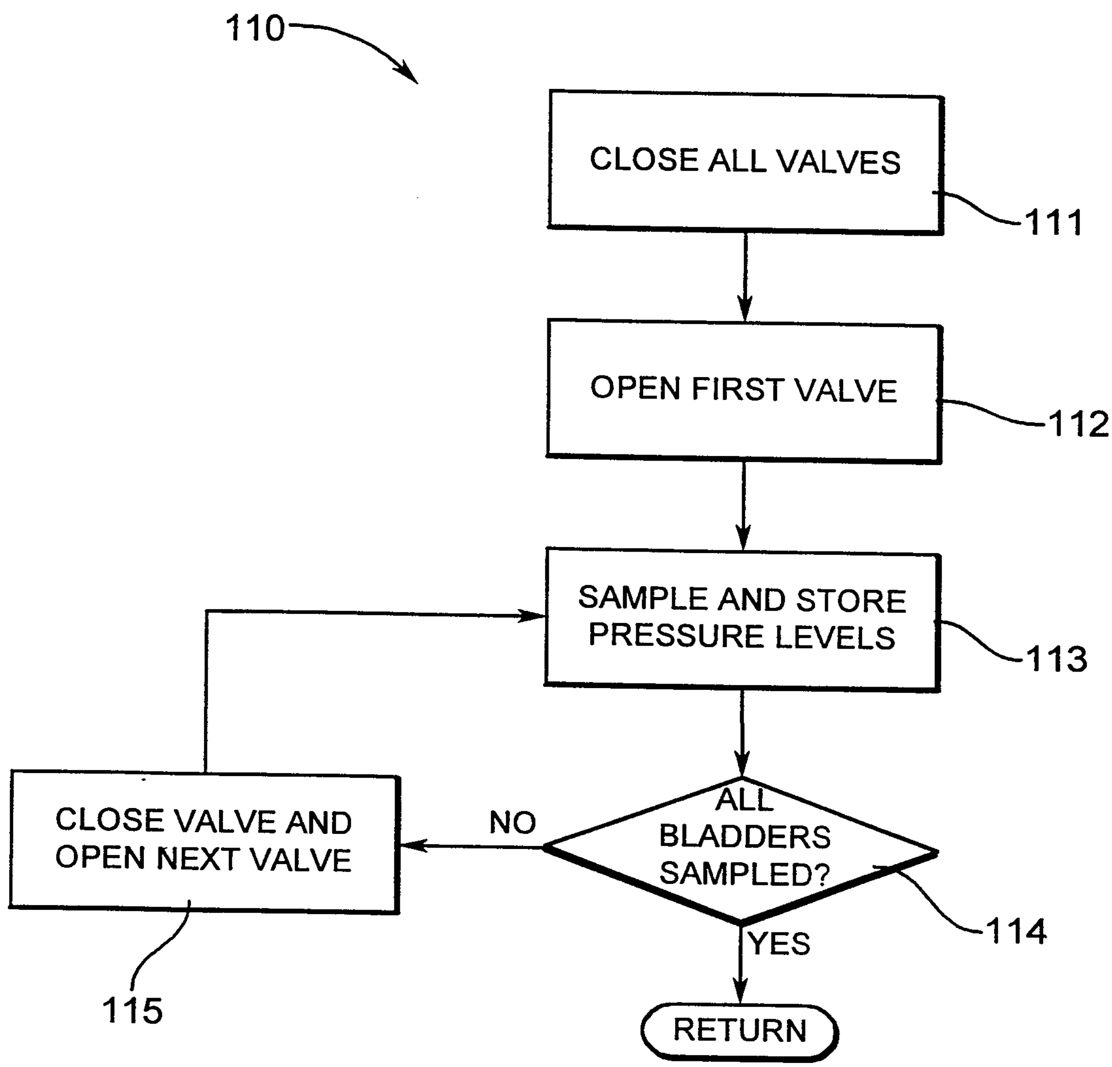

FIG. 4

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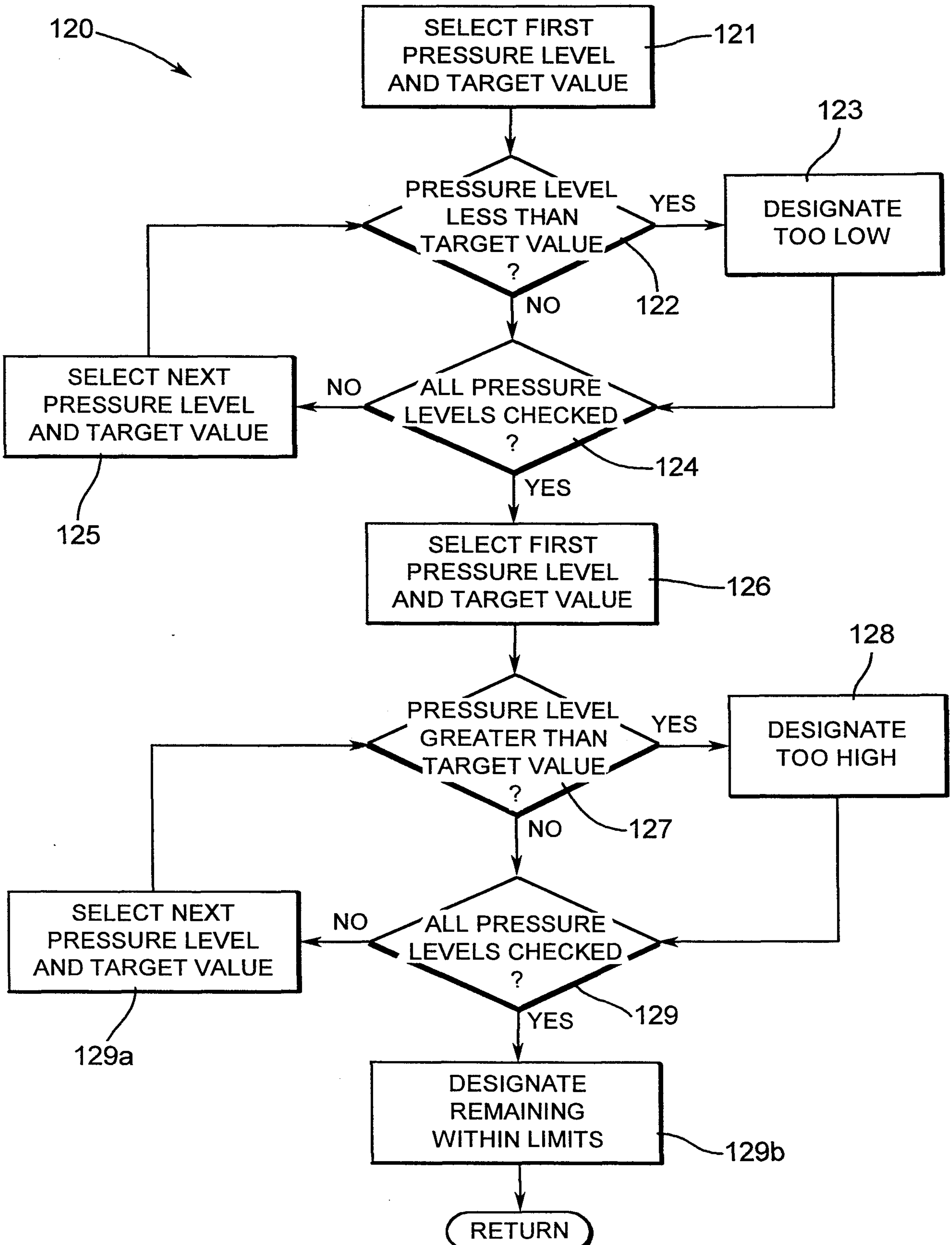

FIG. 5

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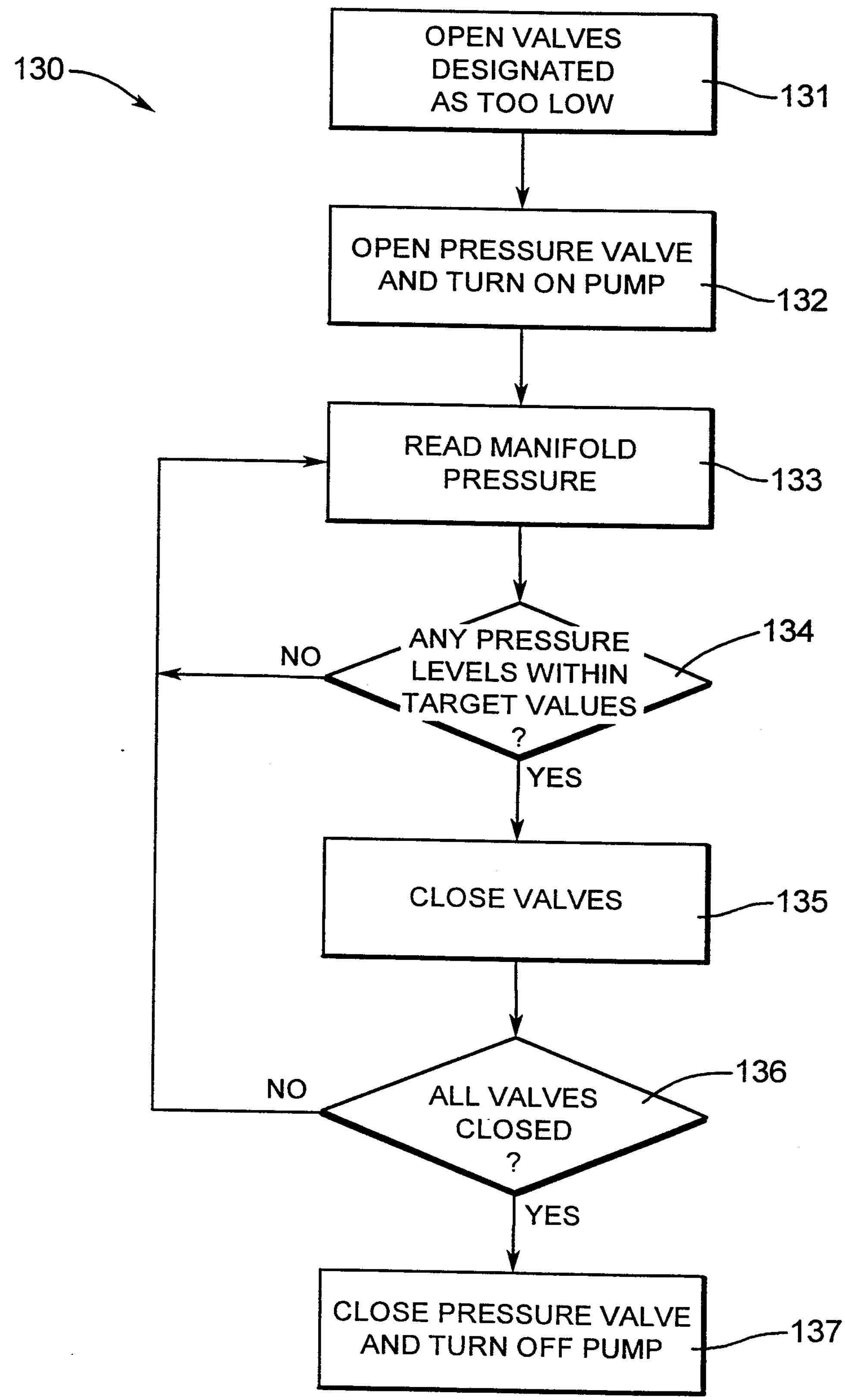

FIG. 6

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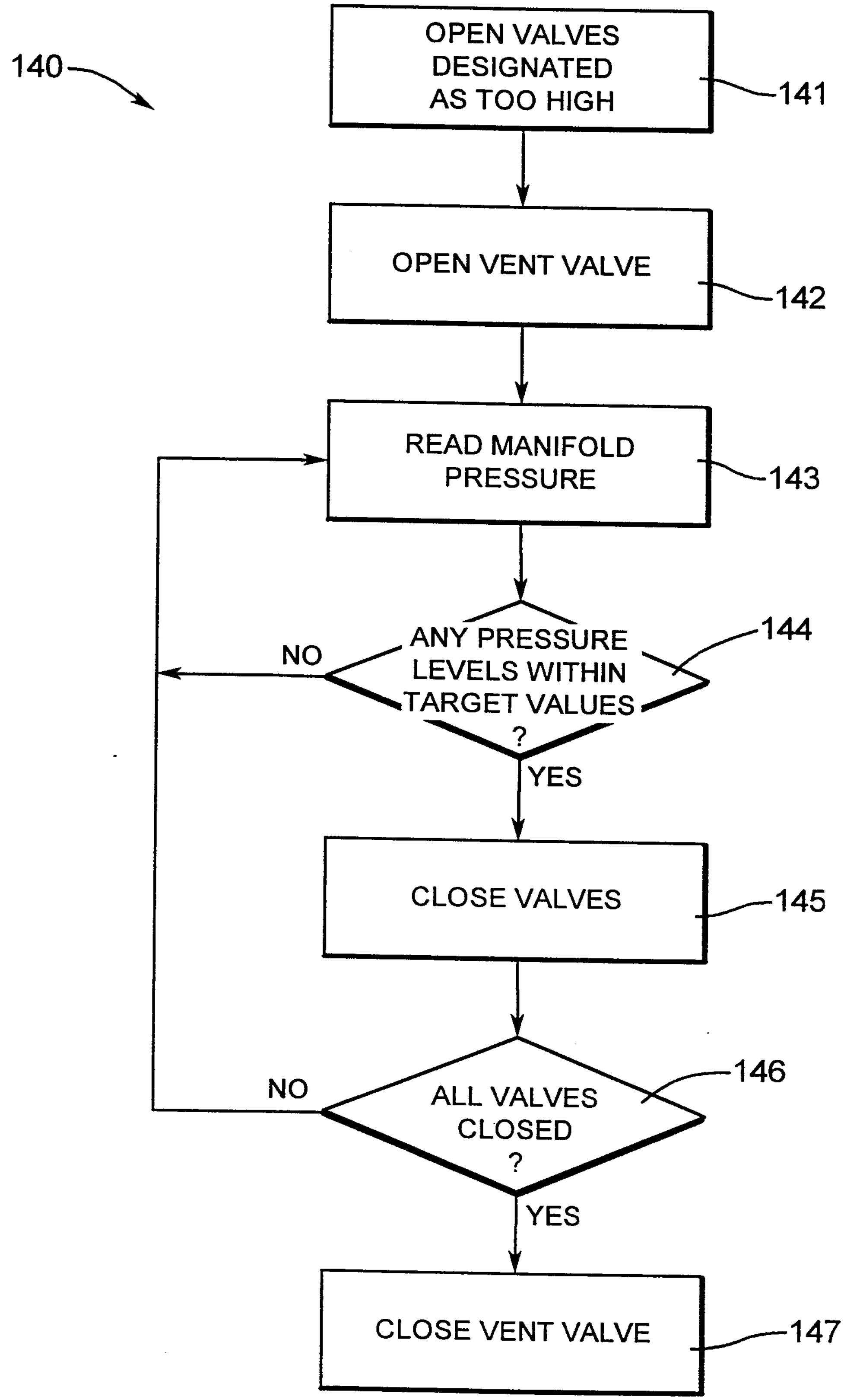

FIG. 7

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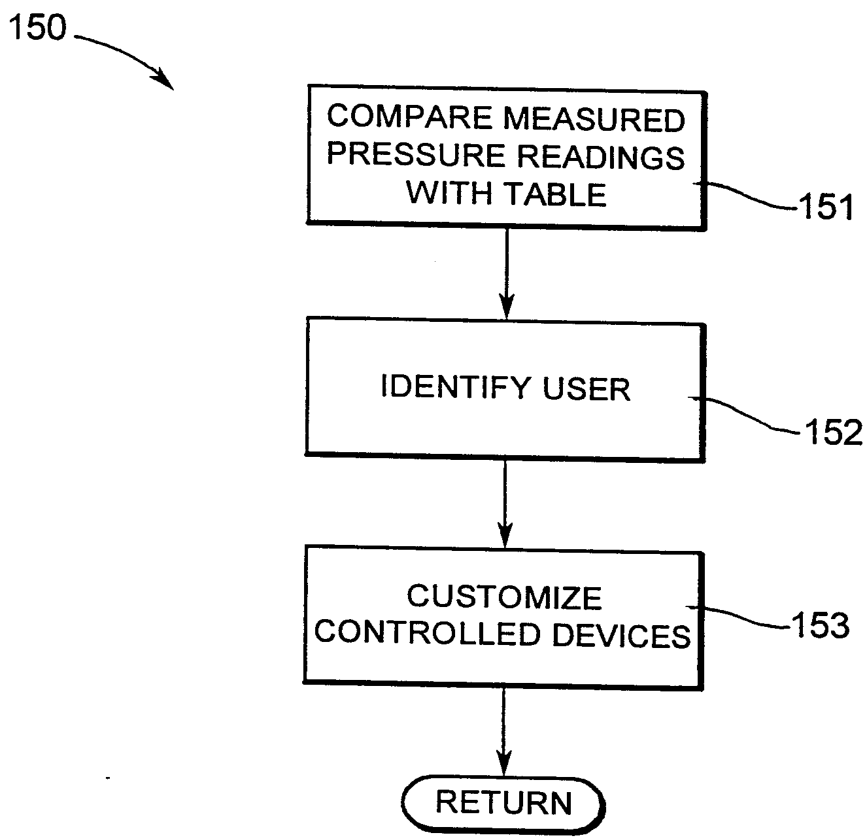

FIG. 8

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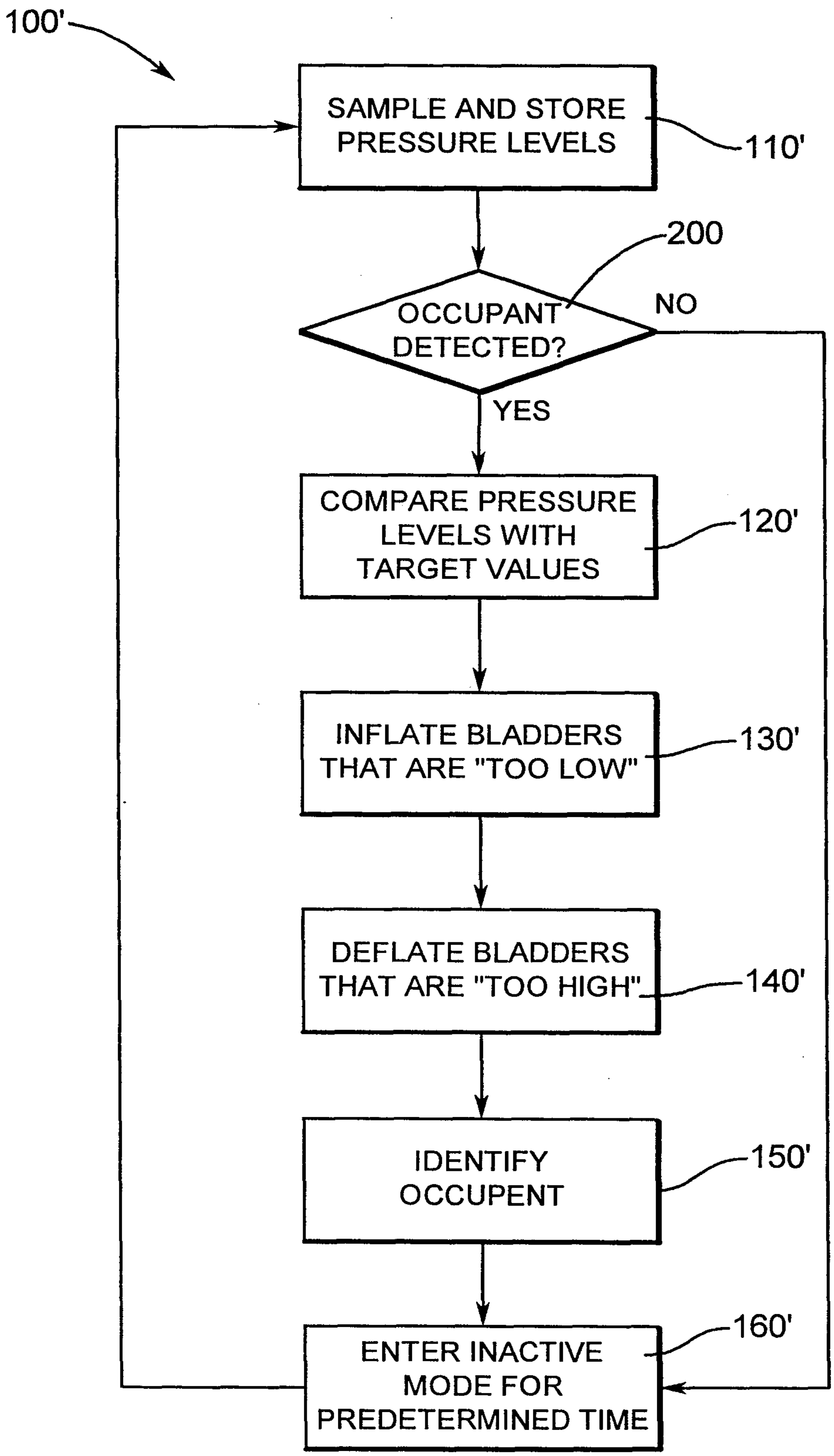

FIG. 9

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 8929-3300	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 08/59409	International filing date *(day/month/year)* 04 April 2008 (04.04.2008)	(Earliest) Priority Date *(day/month/year)*
Applicant SELECT COMFORT CORPORATION		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the language, the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed.
      ☐ a translation of the international application into ________________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1
      ☒ as suggested by the applicant.
      ☐ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/59409

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A47C 27/08 (2008.04)
USPC - 5/713
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A47C 27/08 (2008.04)
USPC - 5/713

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 5/690, 706, 710; 137/224 (text search - see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); Google Scholar; Google Patents
Search Terms: air, inflatable, bed, mattress, pump, compressor, pressure, adjustable, transducer, determining, calculating, sensing, chamber, setpoint, factor, error

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0227594 A1 (Chaffee) 04 October 2007 (04.10.2007), see para [0059]-[0060], [0062], [0064], [0072] and [0098]	1-20
Y	US 7,022,113 B2 (Lockwood et al.) 04 April 2006 (04.04.2006), col 12, ln 45-52, col 13, ln 15 and ln 21	1-20
Y	US 6,789,284 B2 (Kemp) 14 September 2004 (14.09.2004), col 3, ln 57-58	3, 11 and 18

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 August 2008 (04.08.2008)	15 AUG 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
ADAM KIEDROWSKI
OPPENHEIMER WOLFF & DONNELLY LLP
Plaza VIII, Suite 3300
45 SOUTH SEVENTH STREET
MINNEAPOLIS, MN 55402-1609

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	15 AUG 2008
Applicant's or agent's file reference: 8929-3300	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 08/59409	04 April 2008 (04.04.2008)	

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - A47C 27/08 (2008.04)
USPC - 5/713

Applicant SELECT COMFORT CORPORATION

1. This opinion contains indications relating to the following items.
   - [x] Box No. I Basis of the opinion
   - [ ] Box No. II Priority
   - [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - [ ] Box No. IV Lack of unity of invention
   - [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - [ ] Box No. VI Certain documents cited
   - [ ] Box No. VII Certain defects in the international application
   - [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

   If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

   If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

   For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	04 August 2008 (04.08.2008)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 08/59409

Box No. I   Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:
   - [X] the international application in the language in which it was filed.
   - [ ] a translation of the international application into ______________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of:

   a. type of material
      - [ ] a sequence listing
      - [ ] table(s) related to the sequence listing

   b. format of material
      - [ ] on paper
      - [ ] in electronic form

   c. time of filing/furnishing
      - [ ] contained in the international application as filed
      - [ ] filed together with the international application in electronic form
      - [ ] furnished subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US 08/59409

Box No. V *Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement*

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-3, 4-10, 12-17 and 19-20 lack an inventive step under PCT Article 33(3) as being obvious over US 2007/0227594 A1 (Chaffee) in view of US 7,022,113 B2 to Lockwood et al. (hereinafter 'Lockwood').

As per claim 1, Chaffee discloses a method for adjusting pressure within an air bed comprising: providing an air bed, the air bed including an air chamber (bladder) and a pump having a pump housing (see para [0059]); selecting a desired pressure setpoint for the air chamber (see para [0060]); calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint (see para [0062]); adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (see para [0062]); determining an actual chamber pressure within the air chamber (see para [0062]). Chaffee does not specifically disclose comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and modifying the pressure adjustment factor based upon the adjustment factor error. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure; col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure.

As per claim 3, Chaffee further discloses wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the conduit (see para [0073]). Chaffee does not specifically sensing the pressure in the pump housing. However, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the housing since the pressure immediately outside the housing in the conduit would be the same as in the housing thus the exact location is arbitrary.

As per claim 4, Chaffee further discloses wherein the pressure target is a deflate pressure target (see para [0062])

As per claim 5, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the pressure adjustment factor is a multiplicative pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a multiplicative adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure

As per claim 6, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a multiplicative adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using division to calculate the deflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 7, Chaffee further discloses wherein the pressure target is an inflate pressure target (see para [0062])

As per claim 8, Lockwood further discloses wherein the pressure adjustment factor is an additive pressure adjustment factor (col 13, ln 21).

As per claim 9, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and the additive pressure adjustment factor. Lockwood further discloses wherein the pressure adjustment factor is an additive pressure adjustment factor (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using addition to calculate the inflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

— Please See Continuation Sheet —

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 08/59409

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V. 2. Citations and explanations:

As per claim 10, Chaffee discloses a method for adjusting pressure within an air bed comprising: providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump (see para [0059]); selecting a desired pressure setpoint for the air chamber (see para [0060]); calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint (see para [0062]); sensing pressure within the conduit (see para [0072]); determining an actual chamber pressure within the air chamber (see para [0062]) and storing the pressure in memory (see para [0068]). Chaffee does not specifically disclose sensing pressure within the pump manifold; adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target; comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; modifying the pressure adjustment factor based upon the adjustment factor error, and storing the modified pressure adjustment factor in memory. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure;col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure. Furthermore, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as in the housing thus the exact location is arbitrary.

As per claim 12, Chaffee further discloses wherein the pressure target is a deflate pressure target (see para [0062]).

As per claim 13, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a deflate adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using division to calculate the deflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 14, Chaffee further disclose wherein the pressure target is an inflate pressure target (see para [0062]).

As per claim 15, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor. Lockwood further discloses wherein the pressure adjustment factor is an inflate pressure adjustment factor (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using addition to calculate the inflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 16, Chaffee discloses a method for adjusting pressure within an air bed comprising: (a) providing an air bed, the air bed including an air chamber and a pump having a pump housing (see para [0059]); (b) selecting a desired pressure setpoint for the air chamber (see para [0060]); (c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint (see para [0062]); (d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (see para [0062]); (e) determining an actual chamber pressure within the air chamber (see para [0062]). Chaffee does not specifically disclose (f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; (g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and (h) repeating steps (b)-(g) with the updated pressure adjustment factor. Lockwood discloses a method including calculating an updated factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure;col 13, ln 15); and calculating the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and to repeat all the steps, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 17, Chaffee discloses a pressure adjustment system for an air bed comprising: an air chamber (see para [0059]); a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve (see para [0059]); an input device adapted to receive a desired pressure setpoint selected by a user (see para [0064]); a pressure sensing means adapted to monitor pressure within the pump conduit (see para [0072]); and a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target, comparing an actual chamber pressure to the desired pressure setpoint (see para [0062]). Chaffee does not specifically disclose a pressure sensing means adapted to monitor pressure within the pump manifold; monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure; col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure. Furthermore, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as in the housing thus the exact location is arbitrary.

As per claim 19, Chaffee further discloses wherein the input device is a remote control having pressure selecting means (see para [0064]).

As per claim 20, Chaffee further disclose wherein the remote control is a wireless remote control (see para [0064]).

--- Please See Continuation Sheet ---

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 08/59409

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Supplemental Box 1:

Claims 3, 11 and 18 lack an inventive step under PCT Article 33(3) as being obvious over Chaffee in view of Lockwood, further in view of US 6,789,284 B2 (Kemp).

As per claim 3, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a method wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

As per claim 11, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a method wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

As per claim 18, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a system wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the system as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

Claims 1-20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (April 2007)

Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2720467 C 2013/12/10

(11)(21) **2 720 467**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(86) Date de dépôt PCT/PCT Filing Date: 2008/04/04
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(45) Date de délivrance/Issue Date: 2013/12/10
(85) Entrée phase nationale/National Entry: 2010/10/04
(86) N° demande PCT/PCT Application No.: US 2008/059409
(87) N° publication PCT/PCT Publication No.: 2009/123641

(51) Cl.Int./Int.Cl. *A47C 31/00* (2006.01), *A47C 27/08* (2006.01)
(72) Inventeurs/Inventors:
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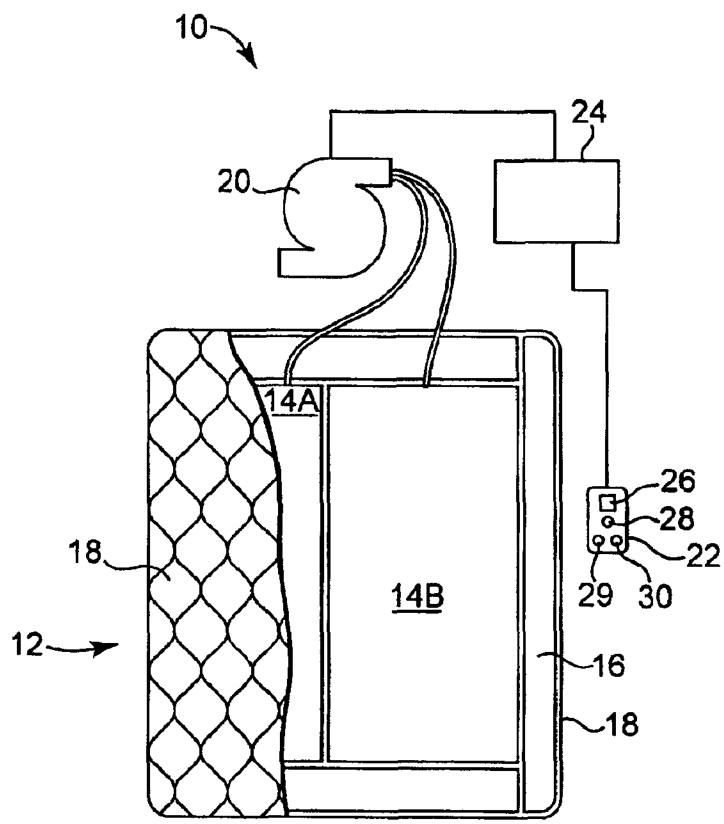
TILSTRA, MATTHEW WAYNE, US

(73) Propriétaire/Owner:
SELECT COMFORT CORPORATION, US

(74) Agent: SIM & MCBURNEY

(54) Titre : SYSTEME ET PROCEDE POUR REGLAGE DE PRESSION AMELIORE
(54) Title: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT



(57) Abrégé/Abstract:
A method for adjusting pressure within an air bed comprises providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within

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(57) **Abrégé(suite)/Abstract(continued):**
the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Further-more, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

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SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a system and method for adjusting the pressure in an inflatable object. More particularly, the present invention relates to a system and method for adjusting the pressure in an air bed in less time and with greater accuracy.

[0002] Advances made in the quality of air beds having air chambers as support bases have resulted in vastly increased popularity and sales of such air beds. These air beds are advantageous in that they have an electronic control panel which allows a user to select a desired inflation setting for optimal comfort and to change the inflation setting at any time, thereby providing changes in the firmness of the bed.

[0003] Air bed systems, such as the one described in U.S. Patent No. 5,904, 172, generally allow a user to select a desired pressure for each air chamber within the mattress. Upon selecting the desired pressure, a signal is sent to a pump and valve assembly in order to inflate or deflate the air bladders as necessary in order to achieve approximately the desired pressure within the air bladders.

[0004] In one embodiment of an air bed system, there are two separate air hoses coupled to each of the air bladders. A first air hose extends between the interior of the air bladder and the valve assembly associated with the pump. This first air hose fluidly couples the pump to the air bladder, and is structured to allow air to be added or removed from the air bladder. A second hose extends from the air bladder to a pressure transducer, which continuously monitors the pressure within the air bladder. Thus, as air is being added or removed from the air bladder, the pressure transducer coupled to the second hose is able to continuously check the actual air bladder pressure, which may then be compared to the

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desired air pressure in order to determine when the desired air pressure within the bladder has been reached.

[0005] In another embodiment of an air bed system, there is only a single hose coupled to each of the air bladders. In particular, the hose extends between the interior of the air bladder and the valve assembly associated with the pump, and is structured to allow air to be added or removed from the air bladder. Instead of having a second hose with a pressure transducer coupled thereto for continuously reading the pressure within the air bladder, a pressure transducer is positioned within a chamber of the valve assembly. Once the user selects the desired air pressure within the air bladder, the pressure transducer first senses a pressure in the chamber, which it equates to an actual pressure in the air bladder. Then, air is added or removed from the bladder as necessary based upon feedback from the sensed pressure. After a first iteration of sensing the pressure and adding or removing air, the pump turns off and the pressure within the chamber is once again sensed by the pressure transducer and compared to the desired air pressure. The process of adding or removing air, turning off the pump, and sensing pressure within the chamber is repeated for several more iterations until the pressure sensed within the chamber is within an acceptable range close to the desired pressure. As one skilled in the art will appreciate, numerous iterations of inflating and deflating the air bladder may be required until the sensed chamber pressure falls within the acceptable range of the desired pressure.

[0006] Thus, while this second embodiment of an air bed system may be desired because it minimizes the necessary number of hoses, it is rather inefficient in that numerous iterations may be required before the sensed pressure reaches the desired pressure. Furthermore, the pump must be turned off each time the pressure transducer takes a pressure measurement, which increases the amount of time that the user must wait until the air bladder reaches the desired pressure.

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[0007] Therefore, there is a need for an improved pressure adjustment system and method for an air bed that is able to minimize the amount of time and the number of adjustment iterations necessary to achieve a desired pressure in an air bladder, while also increasing the accuracy of the actual bladder pressure.

BRIEF SUMMARY OF THE INVENTION

[0008] The present invention solves the foregoing problems by providing a method for adjusting pressure within an air bed comprising providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Furthermore, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

[0009] The present invention also provides a pressure adjustment system for an air bed comprising an air chamber, a pump in fluid communication with the air chamber and including a pump manifold and at least one valve, an input device adapted to receive a desired pressure setpoint selected by a user, a pressure sensing means adapted to monitor pressure within the pump manifold, and a control device operably connected to the input device and to the pressure sensing means. The control device includes control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the

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desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

According to another aspect, there is provided a method for adjusting pressure within an air bed comprising:

providing an air bed, the air bed including an air chamber and a pump having a pump housing;

selecting a desired pressure setpoint for the air chamber;

calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and

modifying the pressure adjustment factor based upon the adjustment factor error.

According to a further aspect, there is provided a method for adjusting pressure within an air bed comprising:

providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump;

selecting a desired pressure setpoint for the air chamber;

calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

sensing pressure within the pump manifold;

adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired

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pressure setpoint to determine an adjustment factor error;

modifying the pressure adjustment factor based upon the adjustment factor error; and

storing the modified pressure adjustment factor in memory.

According to another aspect, there is provided a method for adjusting pressure within an air bed comprising:

(a) providing an air bed, the air bed including an air chamber and a pump having a pump housing;

(b) selecting a desired pressure setpoint for the air chamber;

(c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

(d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

(e) determining an actual chamber pressure within the air chamber;

(f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

(g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and

(h) repeating steps (b)-(g) with the updated pressure adjustment factor.

According to a further aspect, there is provided a pressure adjustment system for an air bed comprising:

an air chamber;

a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve;

an input device adapted to receive a desired pressure setpoint selected by a user;

a pressure sensing means adapted to monitor pressure within the pump manifold; and

a control device operably connected to the input device and to the

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pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a diagrammatic representation of one embodiment of an air bed system.

[0011] FIG. 2 is a block diagram of the various components of the air bed system illustrated in FIG. 1.

[0012] FIG. 3 is a circuit diagram model of the air bed system illustrated in FIGS. 1 and 2.

[0013] FIG. 4 is an exemplary graph illustrating the pressure relationships derived from the circuit diagram model of FIG. 3.

[0014] FIG. 5 is a flowchart illustrating one embodiment of a pressure setpoint monitoring method in accordance with the present invention.

[0015] FIG. 6 is a flowchart illustrating one embodiment of an improved pressure adjustment method in accordance with the present invention.

[0016] FIG. 7 is a flowchart illustrating a second embodiment of an improved pressure adjustment method in accordance with the present invention.

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[0017] FIG. 8 is a block diagram illustrating an air bed system according to the present invention incorporated into a network system for remote access.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring now to the figures, and first to FIG. 1, there is shown a diagrammatic representation of air bed system 10 of the present invention. The system 10 includes bed 12, which generally comprises at

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least one air chamber 14 surrounded by a resilient, preferably foam, border 16 and encapsulated by bed ticking 18.

[0019] As illustrated in FIG. 1, bed 12 is a two chamber design having a first air chamber 14A and a second air chamber 14B. Chambers 14A and 14B are in fluid communication with pump 20. Pump 20 is in electrical communication with a manual, hand-held remote control 22 via control box 24. Remote control 22 may be either "wired" or "wireless." Control box 24 operates pump 20 to cause increases and decreases in the fluid pressure of chambers 14A and 14B based upon commands input by a user through remote control 22. Remote control 22 includes display 26, output selecting means 28, pressure increase button 29, and pressure decrease button 30. Output selecting means 28 allows the user to switch the pump output between first and second chambers 14A and 14B, thus enabling control of multiple chambers with a single remote control unit. Alternatively, separate remote control units may be provided for each chamber. Pressure increase and decrease buttons 29 and 30 allow a user to increase or decrease the pressure, respectively, in the chamber selected with output selecting means 28. As those skilled in the art will appreciate, adjusting the pressure within the selected chamber causes a corresponding adjustment to the firmness of the chamber.

[0020] FIG. 2 shows a block diagram detailing the data communication between the various components of system 10. Beginning with control box 24, it can be seen that control box 24 comprises power supply 34, at least one microprocessor 36, memory 37, at least one switching means 38, and at least one analog to digital (A/D) converter 40. Switching means 38 may be, for example, a relay or a solid state switch.

[0021] Pump 20 is preferably in two-way communication with control box 24. Also in two-way communication with control box 24 is hand-held remote control 22. Pump 20 includes motor 42, pump manifold 43, relief valve 44, first control valve 45A, second control valve 45B, and pressure transducer 46, and is fluidly connected with left chamber 14A and right chamber 14B via first tube 48A and second tube 48B, respectively. First

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and second control valves 45A and 45B are controllable by switching means 38, and are structured to regulate the flow of fluid between pump 20 and first and second chambers 14A and 14B, respectively.

[0022] In operation, power supply 34 receives power, preferably 110 VAC power, from an external source and converts it to the various forms required by the different components. Microprocessor 36 is used to control various logic sequences of the present invention. Examples of such sequences are illustrated in FIGS. 5-7, which will be discussed in detail below.

[0023] The embodiment of system 10 shown in FIG. 2 contemplates two chambers 14A and 14B and a single pump 20. Alternatively, in the case of a bed with two chambers, it is envisioned that a second pump may be incorporated into the system such that a separate pump is associated with each chamber. Separate pumps would allow each chamber to be inflated or deflated independently and simultaneously. Additionally, a second pressure transducer may also be incorporated into the system such that a separate pressure transducer is associated with each chamber.

[0024] In the event that microprocessor 36 sends a decrease pressure command to one of the chambers, switching means 38 is used to convert the low voltage command signals sent by microprocessor 36 to higher operating voltages sufficient to operate relief valve 44 of pump 20. Alternatively, switching means 38 could be located within pump 20. Opening relief valve 44 allows air to escape from first and second chambers 14A and 14B through air tubes 48A and 48B. During deflation, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. A/D converter 40 receives analog information from pressure transducer 46 and converts that information to digital information useable by microprocessor 36.

[0025] In the event that microprocessor 36 sends an increase pressure command, pump motor 42 may be energized, sending air to the designated chamber through air tube 48A or 48B via the corresponding

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valve 45A or 45B. While air is being delivered to the designated chamber in order to increase the firmness of the chamber, pressure transducer 46 senses pressure within pump manifold 43. Again, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. Microprocessor 36 uses the information received from A/D converter 40 to determine the difference between the actual pressure in the chamber 14 and the desired pressure. Microprocessor 36 sends the digital signal to remote control 22 to update display 26 on the remote control in order to convey the pressure information to the user.

[0026] Generally speaking, during an inflation or deflation process, the pressure sensed within pump manifold 43 provides an approximation of the pressure within the chamber. However, when it is necessary to obtain an accurate approximation of the chamber pressure, other methods must be used.

[0027] One method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is to turn off the pump, allow the pressure within the chamber and the pump manifold to equalize, and then sense the pressure within the pump manifold with a pressure transducer. Thus, providing a sufficient amount of time to allow the pressures within the pump manifold 43 and the chamber to equalize may result in pressure readings that are accurate approximations of the actual pressure within the chamber. One obvious drawback to this type of method is the need to turn off the pump prior to obtaining the pump manifold pressure reading.

[0028] A second method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is through use of the pressure adjustment method in accordance with the present invention. The pressure adjustment method is described in detail in FIGS. 5-7. However, in general, the method functions by approximating the chamber pressure based upon a mathematical relationship between the chamber pressure and the pressure measured within the pump manifold (during both an inflation cycle and a deflation

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cycle), thereby eliminating the need to turn off the pump in order to obtain a substantially accurate approximation of the chamber pressure. As a result, a desired pressure setpoint within a chamber may be achieved faster, with greater accuracy, and without the need for turning the pump off to allow the pressures to equalize.

[0029] FIG. 3 is a circuit diagram model 50 of the air bed system 10 illustrated in FIG. 2. As shown in FIG. 3, first and second chambers 14A and 14B may be modeled by capacitors 51A and 51B, motor 42 of pump 20 may be modeled by current source 52 and resistor 53, relief valve 44 may be modeled by resistor 54, pressure transducer 46 may be modeled by resistor 56 and a voltage sensing lead 57, first and second tubes 48A and 48B may be modeled by resistors 58A and 58B, and first and second valves 49A and 49B may be modeled by resistors 59A and 59B. Additionally, pump manifold 43 may be modeled by another capacitor 60 because it also acts as a chamber, albeit much smaller than first and second chambers 14A and 14B.

[0030] As those skilled in the art will appreciate, by assuming current source 52 is a constant current source, pressure readings may be analogized with voltage readings. Thus, in reference to the circuit diagram 50 in FIG. 3, the voltages associated with capacitors 51A and 51B may be used to analyze pressure within first and second chambers 14A and 14B, respectively. Because the voltage readings are not dependent upon the capacitance value of capacitors 51A and 51B, the capacitance value may be discarded for purposes of the present analysis. Translated to pressure terms, this means that the size of first and second chambers 14A and 14B is irrelevant when measuring the pressure within the chambers.

[0031] Furthermore, weight positioned on a chamber (such as that caused by the user lying on bed 12) is directly related to the volume of the chamber and does not affect the ability of the system to measure the pressure within the chamber. In addition, because the system measures pressure in real time, weight changes do not affect the ability of the control system to accurately measure chamber pressure.

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[0032] The relationship between the voltage on first or second capacitors 51A or 51B and the voltage sensed at voltage sensing lead 57 is dependent upon whether current is flowing toward the capacitor (i.e., the chamber is going through an inflation cycle) or away from the capacitor (i.e., the chamber is going through a deflation cycle). In particular, and as will be discussed in detail with reference to FIG. 4, modeling air bed system 10 as circuit diagram 50 results in an additive manifold pressure offset factor during an inflation cycle and a multiplicative manifold pressure factor during a deflation cycle.

[0033] The relationship between voltage associated with a chamber capacitor (i.e., the "chamber voltage") and the sensed "manifold" voltage during an inflation cycle may be stated as follows:

[0034] *Chamber Voltage = (Manifold Voltage) – (Inflate Factor)* (Eq. 1)

[0035] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during an inflation cycle may be stated as follows:

[0036] *Chamber Pressure = (Manifold Pressure) – (Inflate Factor)* (Eq. 2)

[0037] In one exemplary embodiment, the inflate offset factor may generally fall in a range between about 0.0201 and about 0.1601. Because pressure readings may be analogous to voltage readings as discussed previously, the value of the inflate offset factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0038] The relationship between voltage associated with a chamber capacitor and the sensed manifold voltage during a deflation cycle may be stated as follows:

[0039] *Chamber Voltage = (Manifold Voltage) x (Deflate Factor)* (Eq. 3)

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[0040] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during a deflation cycle may be stated as follows:

[0041] *Chamber Pressure = (Manifold Pressure) x (Deflate Factor)* (Eq. 4)

[0042] In one exemplary embodiment, the deflate factor may generally fall in a range between about 1.6 and about 6.5. Once again, because pressure readings may be analogous to voltage readings as discussed previously, the value of the deflate factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0043] FIG. 4 is an exemplary graph 70 illustrating the pressure relationships derived from circuit diagram 50 of FIG. 3 and discussed in detail above. In particular, the vertical axis on the graph represents pressure in pounds per square inch (psi), while the horizontal axis on the graph represents time in milliseconds (ms). Thus, the graph illustrates a measure of chamber pressure over time.

[0044] In particular, a first portion 71 of the graph 70 between about 0 ms and about 65000 ms represents the inflation of a chamber from about 0 psi to about 0.6 psi. A second portion 72 of the graph 70 between about 65000 ms and about 135000 ms represents the pressure in the chamber being maintained at about 0.6 psi. Finally, a third portion 73 of the graph 70 between about 135000 ms and about 200000 ms represents deflation of the chamber from about 0.6 psi to about 0 psi.

[0045] With further reference to the graph in FIG. 4, the solid line 76 represents the actual pressure within the chamber throughout the inflation and deflation cycles, while broken line 78 represents the sensed pump manifold pressure throughout the inflation and deflation cycles. As illustrated in FIG. 4, in the first portion 71 of the graph 70 representing inflation of the chamber, lines 76 and 78 are generally linear and offset from one another by a substantially constant additive offset factor 80. In

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this exemplary graph, the additive inflate offset factor is about 0.0505. Thus, the pressure within the chamber may be approximated during an inflation cycle by subtracting from the sensed manifold pressure an inflate offset factor of about 0.0505. Lines 76 and 78 generally converge in the second portion 72 of the graph 70 when the chamber is being neither inflated nor deflated. Finally, in the third portion 73 of the graph 74 representing deflation of the chamber, lines 76 and 78 are both non-linear and offset from one another by a substantially constant multiplicative factor 82. In this exemplary graph, the multiplicative deflate factor is about 2.25. Thus, the pressure within the chamber may be approximated during a deflation cycle by multiplying the sensed manifold pressure by a deflate factor of about 2.25.

[0046] Now that a brief description of an air bed system and the relationship between chamber and pump manifold pressures have been provided, one embodiment of an improved pressure adjustment method according to the present invention will be described in detail. For purposes of discussion only, the pressure adjustment method in accordance with the present invention will be described in reference to first chamber 14A. However, those skilled in the art will appreciate that the pressure adjustment method applies in a similar manner to other chambers, such as second chamber 14B of bed 12.

[0047] In particular, FIG. 5 illustrates a flowchart of a sample control logic sequence of a pressure setpoint monitoring method 100 according to the present invention. The sequence begins at step 102 upon the occurrence of a "power-on" event. A power-on event may be, for example, coupling power supply 34 of control box 24 to an external power source. The sequence continues at step 104 where microprocessor 36 obtains one or more default adjustment constants stored in, for example, memory 37. In one exemplary embodiment, these default adjustments correspond with the additive inflate factor and the multiplicative deflate factor previously described. Thus, for instance, the default additive inflate factor may be about 0.0505, while the default multiplicative deflate factor may be about 2.25. Workers skilled in the art will appreciate that these default values

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are approximate and were determined for the particular air bed system modeled in FIGS. 1-3 above with an average sized user, and that these values may change as modifications are made to the air bed system. These default adjustment constants will be used by the improved pressure adjustment method of the present invention until they are later updated after a first pressure adjustment iteration as will be discussed in further detail to follow.

[0048] The sequence continues at step 106 where microprocessor 36 detects whether a new pressure setpoint has been selected by the user to either increase or decrease the pressure in first chamber 14A. The new pressure setpoint may be a pressure that is either higher or lower than the current pressure in first chamber 14A, as desired by the user. As will be appreciated by those skilled in the art, the range of possible chamber pressures is not important to the operation of the present invention. Thus, numerous pressure ranges are contemplated. The new pressure setpoint may be selected by, for example, manipulating pressure increase button 29 or pressure decrease button 30 on manual remote control 22. Alternatively, the pressure increase and decrease buttons may be provided on another component of system 10, such as pump 20.

[0049] If microprocessor 36 does not detect that a new pressure setpoint has been selected, the sequence then continues at step 108 where microprocessor 36 determines whether or not there has been an interfering event, such as a loss in power. If microprocessor 36 determines that a loss in power has occurred, the adjustment factors are then discarded in step 110 and the sequence loops back to step 102 to monitor for the occurrence of another power-on event. However, if microprocessor 36 determines that a loss in power has not occurred, the sequence enters monitoring loop 112 where microprocessor 36 continually monitors whether a new pressure setpoint is selected in step 106 or whether a loss in power has occurred in step 108.

[0050] Alternatively, if microprocessor 36 detects that a new pressure setpoint has been selected in step 106, then the sequence continues to

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pressure adjustment method 150 as will be described in detail in reference to FIG. 6. Thus, the selection of a new pressure setpoint by the user triggers a pressure adjustment.

[0051] As will be appreciated by those skilled in the art, air bed system 10 may include a back-up power source such that if the power to power supply 34 is interrupted, the pressure adjustment factors remain stored within memory 37. As a result, it may be possible to avoid the discarding step previously described.

[0052] FIG. 6 illustrates a flowchart of a sample control logic sequence of an exemplary pressure adjustment method 150 according to the present invention. The sequence begins at step 152 when pressure transducer 46 samples the pressure within pump manifold 43. Because motor 42 of pump 20 is not running at this point, air is neither flowing into or out of first chamber 14A. Therefore, the manifold pressure sampled in step 152 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled in step 152, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure previously selected by the user (in step 106) to determine if an adjustment is required. In one embodiment, microprocessor 36 calculates the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user, and compares the difference to a predetermined, acceptable "error." The acceptable error may be any value greater than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete. However, if the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is not within the acceptable error range, then an adjustment is required, and the pressure adjustment method continues at step 158.

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[0053] In step 158, microprocessor 36 determines if inflation or deflation of first chamber 14A is required. If it is determined in step 158 that deflation of first chamber 14A is required, the method continues at step 160 where microprocessor 36 calculates a deflate pressure target, which corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during a deflation cycle. In particular, the deflate pressure target may be calculated through use of Equation 4 above. Based upon the relationship between chamber pressure and manifold pressure during a deflation cycle recited in Equation 4, the deflate pressure target may calculate as follows:

[0054] *Deflate Manifold Pressure Target = (Desired Pressure Setpoint) / (Deflate Factor)*

[0055] The first time the user selects a new pressure setpoint that requires deflation of first chamber 14A, the deflate factor will be set to the default value of 2.25 discussed above in step 104. However, as will be discussed in further detail to follow, this deflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0056] Once the deflate pressure target is calculated in step 160, microprocessor 36 instructs pump 20 to begin the deflate operation in step 162.

[0057] Alternatively, if it is determined in step 158 that inflation of first chamber 14A is required, the method continues at step 164 where microprocessor 36 calculates an inflate pressure target. The inflate pressure target corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during an inflation cycle. In particular, the inflate pressure target may be calculated through use of Equation 2 above. Based upon the relationship between chamber pressure and manifold pressure during an inflation cycle recited in Equation 2, the inflate pressure target may calculate as follows:

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[0058] *Inflate Manifold Pressure Target = (Desired Pressure Setpoint) + (Inflate Offset Factor)*

[0059] The first time the user selects a new pressure setpoint that requires inflation of first chamber 14A, the inflate factor will be set to the default value of 0.0505 discussed above in step 104. However, as will be discussed in further detail to follow, this inflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0060] Once the inflate pressure target is calculated in step 164, microprocessor 36 instructs pump 20 to begin the inflate operation in step 166.

[0061] After performing the pressure deflate operation in step 162 or the pressure inflate operation in step 166 as required, the manifold pressure within pump manifold 43 is once again sampled in step 168. Because either motor 42 of pump 20 has been running in order to inflate first chamber 14A, or relief valve 44 has been open in order to deflate first chamber 14A, the manifold pressure sampled in step 168 is now instable and by itself does not provide an accurate representation of the actual pressure within first chamber 14A. However, because of the known relationship between manifold pressure and chamber pressure discussed previously, the present invention is able to accurately approximate the actual chamber pressure based upon a sensed manifold pressure. Therefore, after the manifold pressure has once again been sampled, the method continues at step 170 where microprocessor 36 compares the sampled manifold pressure to the manifold pressure target calculated in either step 160 or step 164 to determine if the manifold pressure target has been achieved.

[0062] Similar to the process utilized in step 154, microprocessor 36 calculates the difference between the sampled manifold pressure and the manifold pressure target and compares the difference to a predetermined, pressure target error. The pressure target error may be any value greater

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than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the manifold pressure target is greater than the acceptable pressure target error, then further inflation or deflation is required. As a result, pressure adjustment method 150 returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. On the other hand, if the difference between the sampled manifold pressure and the manifold pressure target is within the pressure target error limit, then no further inflation or deflation is necessary, and the pressure adjustment method continues at step 174 where the inflate or deflate operation is ended.

[0063] Next, pressure transducer 46 once again samples the pressure within pump manifold 43 at step 176. Because all inflate or deflate operations have ceased, air is neither flowing into nor out of first chamber 14A, and the manifold pressure sampled in step 176 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled again in step 176, the sequence continues at step 178 where microprocessor 36 compares the "actual" manifold pressure sampled in step 176 with the "expected" user setpoint pressure previously selected by the user (in step 106) to determine if the desired setpoint pressure has been achieved. If the actual manifold pressure sampled in step 176 is not substantially equal to the expected setpoint pressure selected by the user, then an adjustment must be made to the pressure adjustment factor. An updated adjustment factor is therefore determined based upon a comparison between the sensed pressure and the desired setpoint pressure, and the pressure adjustment factor is thereafter modified in step 180.

[0064] With regard to the deflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0065] *Updated Deflate Adjustment Factor = (Pressure Setpoint from Step 106) / (Manifold Pressure from Step 168)*

[0066] With regard to the inflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0067] *Updated Inflate Adjustment Factor = (Manifold Pressure from Step 168) – (Pressure Setpoint from Step 106)*

[0068] Next, the method loops back to step 152 where pressure transducer 46 samples the pressure within pump manifold 43. Once the manifold pressure has again been sampled in step 152 after a first "iteration" of adjustments, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure selected by the user (in step 106) to determine if a further adjustment is required. For instance, if the pressure adjustment factor had to be modified in step 180 of the previous pressure adjustment iteration, then a further adjustment will most likely be required because the fact that the pressure adjustment factor had to be modified indicates that the actual pressure in chamber 14A is not equal to the desired pressure setpoint selected by the user. In this case, at least one more pressure adjustment iteration will be required before the actual chamber pressure is substantially equal to the desired pressure setpoint. However, if it is determined in step 154 that the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete.

[0069] After completing the pressure adjustment method 150, microprocessor 36 return back to pressure setpoint monitoring method 100 illustrated in FIG. 5 and replaces the default deflate or inflate pressure adjustment factor in step 114 with a "customized" pressure adjustment factor specifically tailored to that user. The customized pressure adjustment factor may then be stored in memory 37 for future use in pressure adjustments.

[0070] As those skilled in the art will appreciate, the default pressure adjustment factors corresponding to both the deflate and inflate operations

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must be replaced after the detection of a power-on event because these default factors are only temporary and based upon the size of an average user. Therefore, when microprocessor 36 detects an increase in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized inflate pressure adjustment constant being determined that replaces the temporary default constant. Similarly, when microprocessor 36 detects a decrease in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized default pressure adjustment constant being determined that replaces the temporary default constant. Furthermore, when microprocessor 36 detects subsequent increases or decreases in the desired pressure setpoint after the default constants have been replaced, the customized default constants may continue to be updated and replaced in step 114 to maintain the highest degree of accuracy when performing pressure adjustments and to take into account changes in the user such as, for example, an increase or decrease in the weight of the user. Thus, while it is not necessary to "update" the customized adjustment constants after initially replacing the temporary default adjustment constants after a power-on event, performing such updates may increase the accuracy of future pressure adjustments.

[0071] FIG. 7 illustrates a flowchart of a sample control logic sequence of a second pressure adjustment method 150A according of the present invention. Pressure adjustment method 150A is similar to pressure adjustment method 150 previously described, but includes several additional steps to further optimize operation of the pressure adjustment method.

[0072] In addition to the steps previously described above in reference to FIG. 6, pressure adjustment method 150A further includes steps 151, 182, and 173. In particular, steps 151 and 182 involve maintaining a count of the number of pressure adjustment attempts remaining during a pressure adjustment operation, while step 173 involves tracking elapsed time during an inflation or deflation cycle.

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[0073] With regard to steps 151 and 182, the number of pressure adjustment "attempts" may be tracked to limit the number of pressure adjustment iterations that pressure adjustment method 150A may perform after a new pressure setpoint has been selected. In particular, prior to sensing manifold pressure in step 152, microprocessor 36 determines if the number of remaining attempts is greater than zero. If the number of attempts remaining is greater than zero, then the method continues at step 154 where microprocessor 36 determines if a pressure adjustment is required. However, if the number of attempts remaining is not greater than zero, then the method instead continues at step 156 where the pressure adjustment is presumed to be complete. Thus, pressure adjustment method 150A may allow for a predetermined number of iterations before the pressure adjustment method "times out." In one exemplary embodiment, the default number of attempts may be set to four. However, any number of attempts are possible and within the intended scope of the present invention.

[0074] If the pressure adjustment factor (either inflate or deflate) is modified in step 180, then the number of remaining attempts is decremented by one attempt in step 182. Therefore, if the desired pressure setpoint is not reached within four attempts, no further pressure adjustment is attempted and the pressure adjustment factor corresponding to the final iteration will be used to update the temporary default adjustment constant as previously discussed.

[0075] With regard to step 173, the amount of time elapsed during a pressure adjustment operation may also be also be tracked. As discussed above, if it is determined in step 170 that the pressure target has not been achieved, pressure adjustment method 150A returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. However, prior to reaching either deflate operation step 162 or inflate operation step 166, the method first enters step 173 where microprocessor 36 monitors the time that has elapsed since the initial determination was made in step 170 regarding

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whether or not the manifold pressure target has been achieved. Thus, if the amount of elapsed time is less than a maximum, predetermined time period, the sequence continues within loop 172 to inflate or deflate first chamber 14A as necessary in an attempt to achieve the manifold pressure target. However, if the desired pressure target has not been reached when microprocessor 36 determines that the maximum time period has expired, then the method exits loop 172 and advances directly to step 156, where no further adjustment will be attempted.

[0076] The maximum, predetermined time period may be any value greater than zero. However, in one exemplary embodiment of pressure adjustment method 150A, the maximum time period may be about 30 minutes. Generally speaking, the maximum time period may be selected such that the manifold pressure target is not achieved prior to the expiration of the maximum time period only if air bed system 10 is not functioning properly. For example, if first tube 48A becomes disconnected from first chamber 14A, it will most likely not be possible to attain the manifold pressure target in step 170. Under these circumstances, and without the addition of the time tracking step 173, pump 20 may continue to run until the user disconnects power from the pump or notices that first tube 48A has been disconnected from first chamber 14A.

[0077] Workers skilled in the art will appreciate that although the features added in steps 151, 173, and 182 are not necessary components of the present invention, their presence helps to optimize the operation of the pressure adjustment method by preventing the method from being trapped in a "continuous loop" of attempting to reach the desired pressure setpoint. Furthermore, it will be obvious to those skilled in the art that the order and number of steps described in reference to FIGS. 5-7 may be modified without departing from the intended scope of the present invention.

[0078] Referring now to FIG. 8, in yet another alternate embodiment in accordance with the present invention, microprocessor 36 may be integrated within network 200 for remote accessing and use of a pressure

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adjustment method according to the present invention for improving the accuracy and minimizing the time of pressure adjustments. This allows for centralized data storage and archival of air bed system information (such as customized pressure adjustment factors) by, for example, the customer service department of the air bed system manufacturer. Additionally, networking may provide for information input and retrieval, as well as remote access of control box 24 to operate the air bed system.

[0079] Network 200 may be integrated either locally or accessible via a public network protocol such as the Internet 202 and optionally through an Internet service provider 204. Connection to network 200 may be wired or wireless, and may incorporate control from a detached device (e.g., handheld, laptop, tablet, or other mobile device). In addition, microprocessor 36 may be accessible remotely by a third party user 206 via Internet 202 and/or Internet service provider 204.

[0080] Network 200 may be configured to enable remote pressure adjustment of an air bed system by a third party user 206, such as by a customer service representative at a remote location. In particular, the customer service representative may be able to remotely connect to Internet 202 and assist the user in performing a pressure adjustment set-up, such as pressure adjustment method 150 previously described, in order to optimize the accuracy and operation of the pressure adjustment method. Network 200 may also be configured to allow the customer service representative to access and store the customized pressure adjustment factors in, for example, a central storage system in case of a power loss or similar event. Numerous other advantages of network 200 will be appreciated by those having ordinary skill in the art.

[0081] Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the scope of the invention.

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We Claim:

1. A method for adjusting pressure within an air bed comprising:

providing an air bed, the air bed including an air chamber and a pump having a pump housing;

selecting a desired pressure setpoint for the air chamber;

calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and

modifying the pressure adjustment factor based upon the adjustment factor error.

2. The method of claim 1, wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the pump housing.

3. The method of claim 1, wherein pressure is sensed with a pressure transducer.

4. The method of claim 1, wherein the pressure target is a deflate pressure target.

5. The method of claim 4, wherein the pressure adjustment factor is a multiplicative pressure adjustment factor.

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6. The method of claim 5, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor.

7. The method of claim 1, wherein the pressure target is an inflate pressure target.

8. The method of claim 7, wherein the pressure adjustment factor is an additive pressure adjustment factor.

9. The method of claim 7, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and the additive pressure adjustment factor.

10. A method for adjusting pressure within an air bed comprising:

providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump;

selecting a desired pressure setpoint for the air chamber;

calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

sensing pressure within the pump manifold;

adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

modifying the pressure adjustment factor based upon the adjustment factor error; and

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storing the modified pressure adjustment factor in memory.

11. The method of claim 10, wherein pressure is sensed with a pressure transducer.

12. The method of claim 10, wherein the pressure target is a deflate pressure target.

13. The method of claim 12, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor.

14. The method of claim 10, wherein the pressure target is an inflate pressure target.

15. The method of claim 14, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor.

16. A method for adjusting pressure within an air bed comprising:

(a) providing an air bed, the air bed including an air chamber and a pump having a pump housing;

(b) selecting a desired pressure setpoint for the air chamber;

(c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

(d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

(e) determining an actual chamber pressure within the air chamber;

(f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

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(g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and

(h) repeating steps (b)-(g) with the updated pressure adjustment factor.

17. A pressure adjustment system for an air bed comprising:

an air chamber;

a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve;

an input device adapted to receive a desired pressure setpoint selected by a user;

a pressure sensing means adapted to monitor pressure within the pump manifold; and

a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

18. The pressure adjustment system of claim 17, wherein the pressure sensing means is a pressure transducer.

19. The pressure adjustment system of claim 17, wherein the input device is a remote control having pressure selecting means.

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20. The pressure adjustment system of claim 19, wherein the remote control is a wireless remote control.

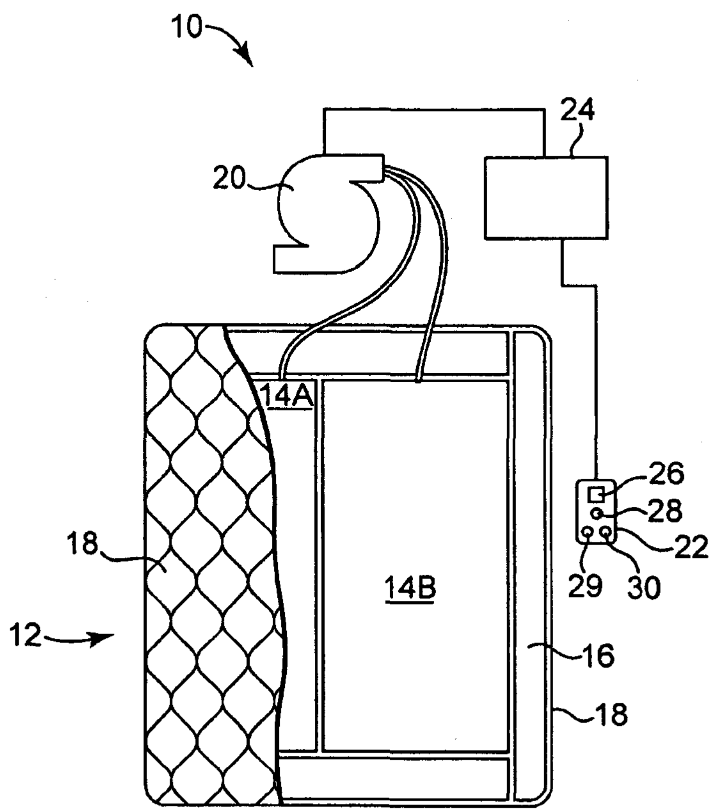

Fig. 1

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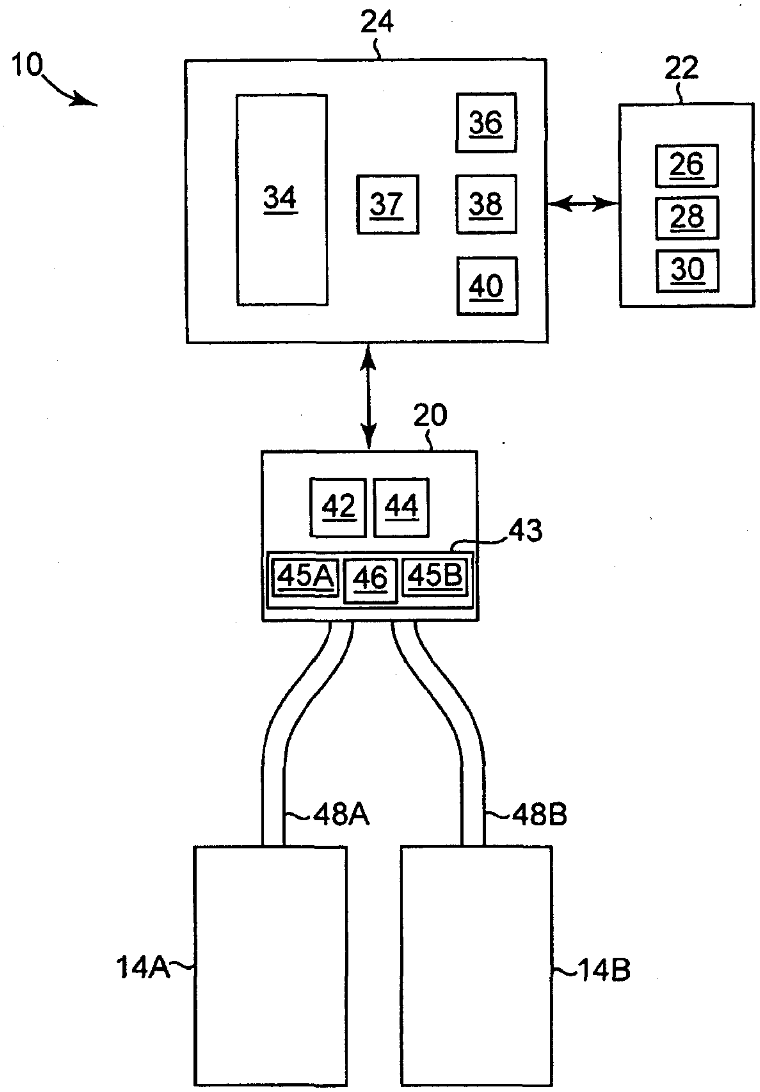

Fig. 2

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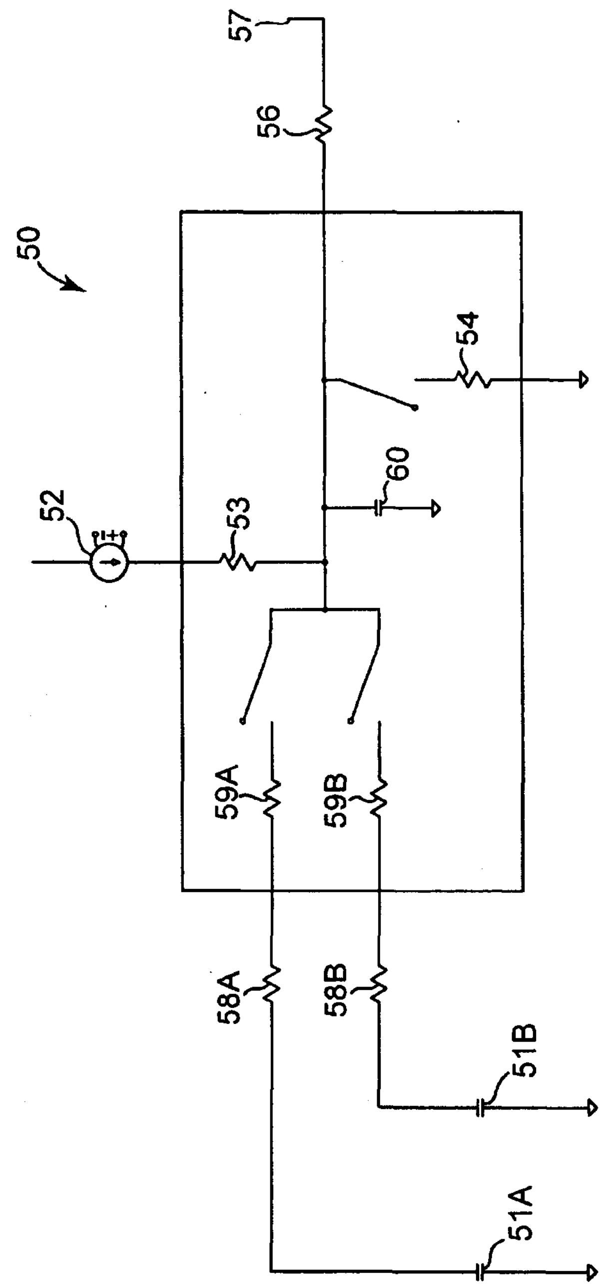

Fig. 3

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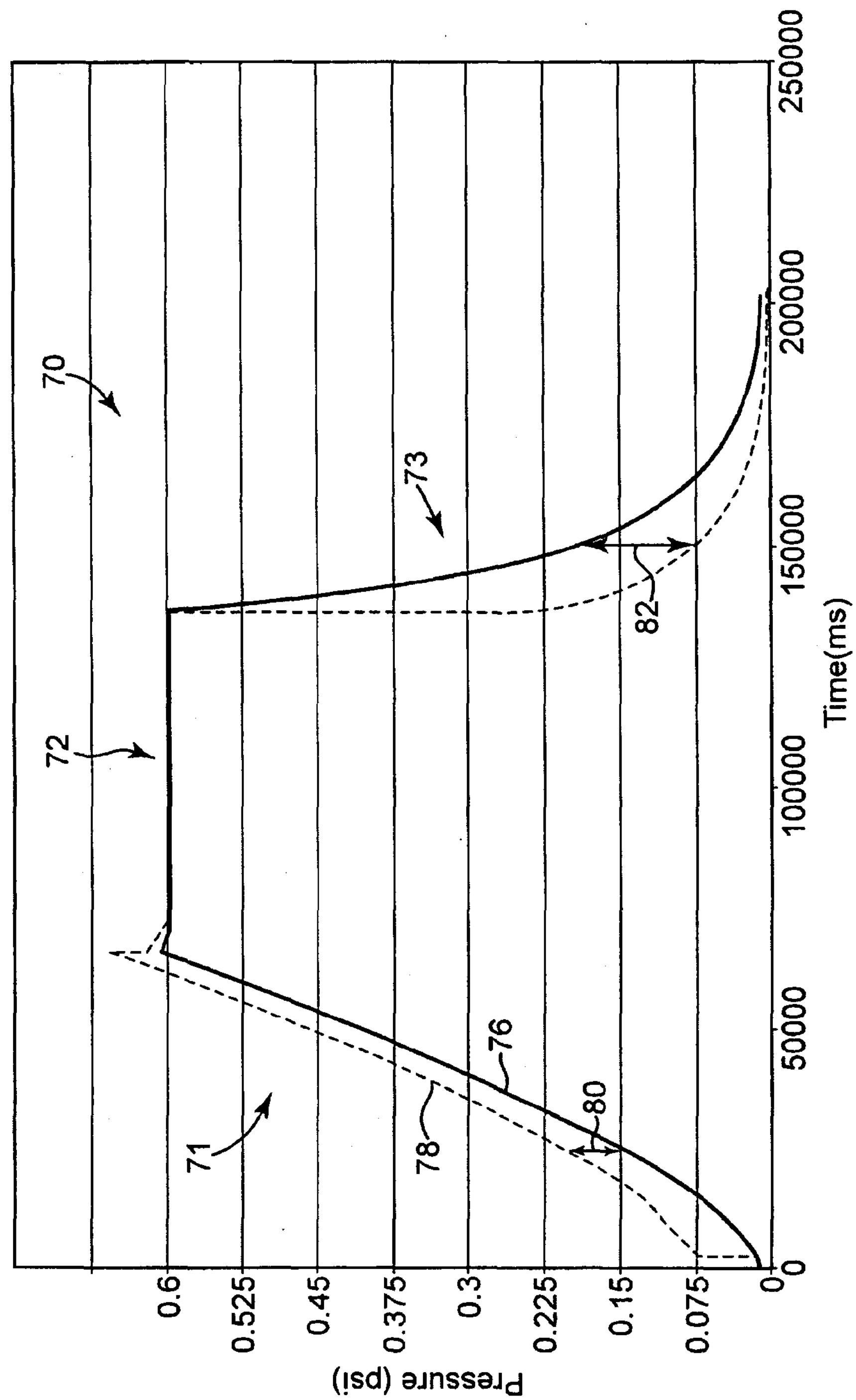

Fig. 4

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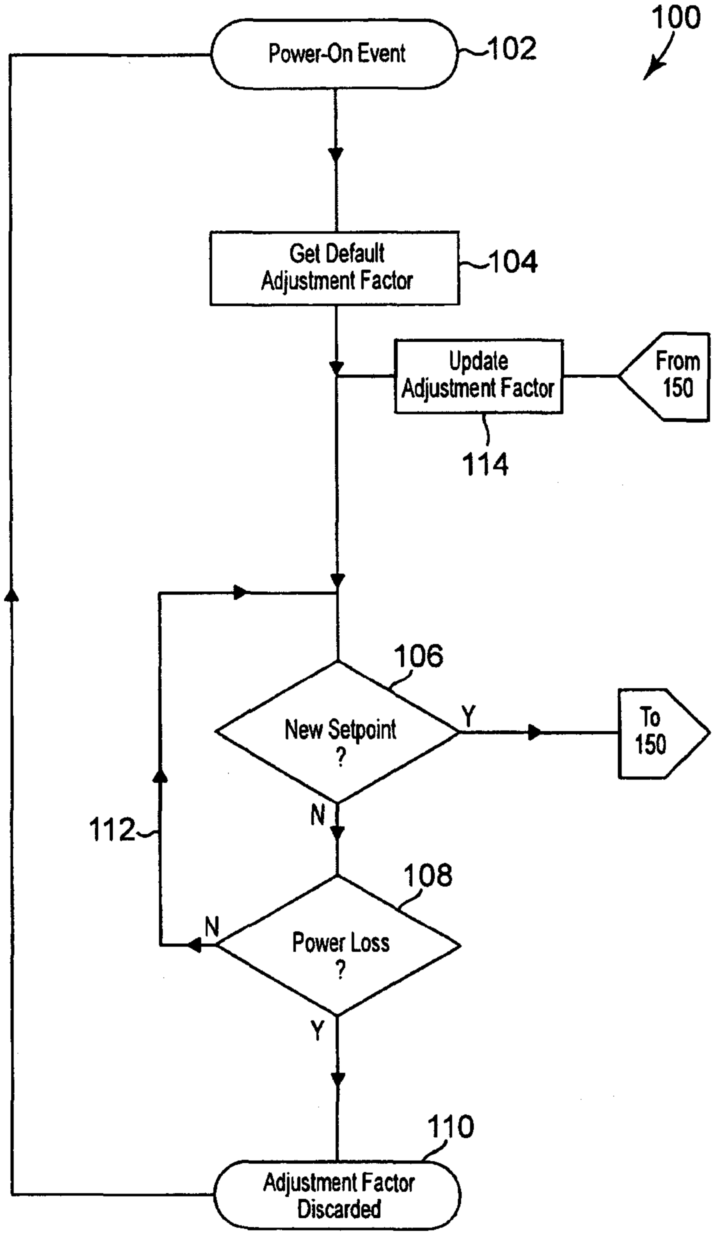

Fig. 5

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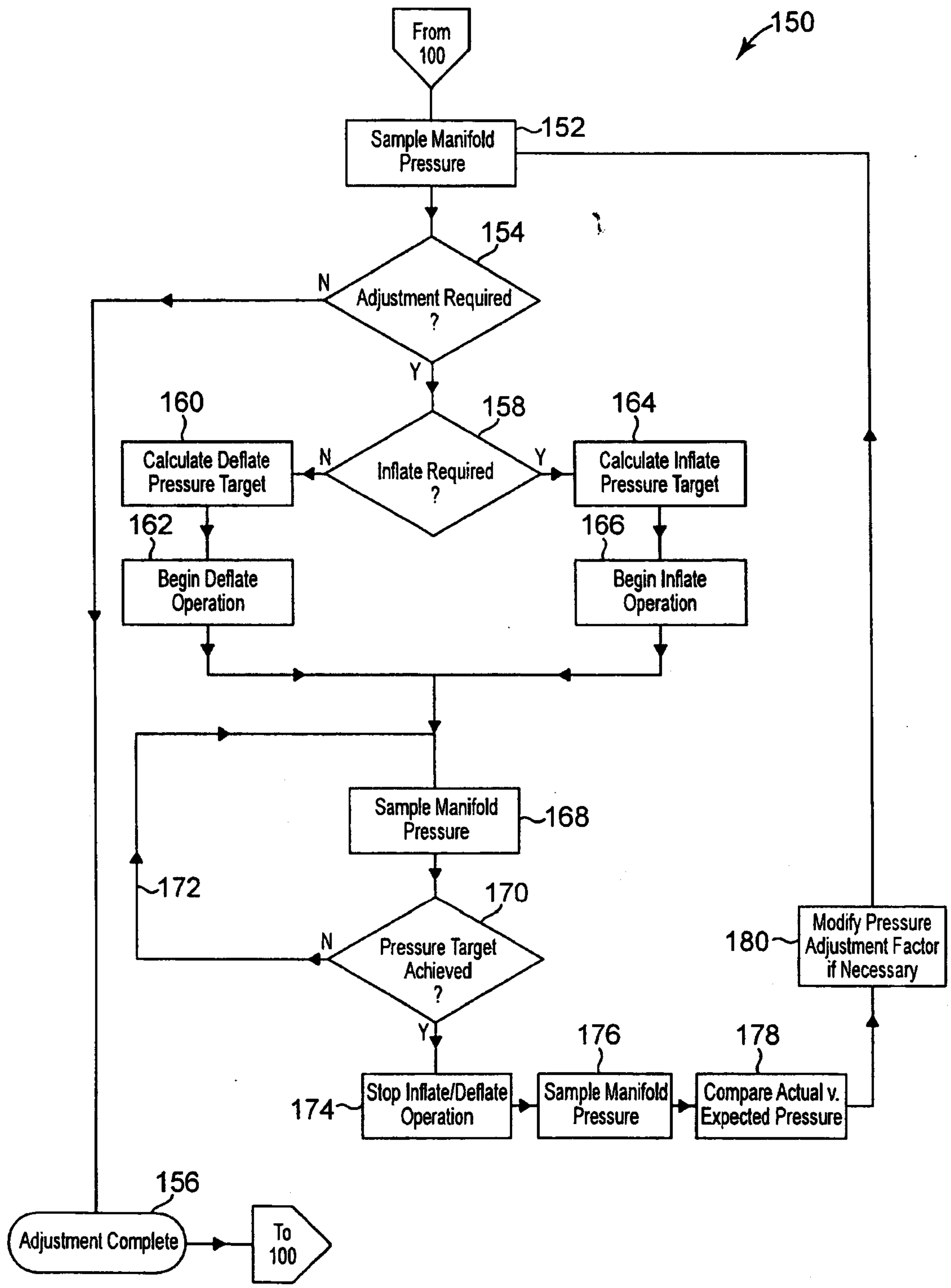

Fig. 6

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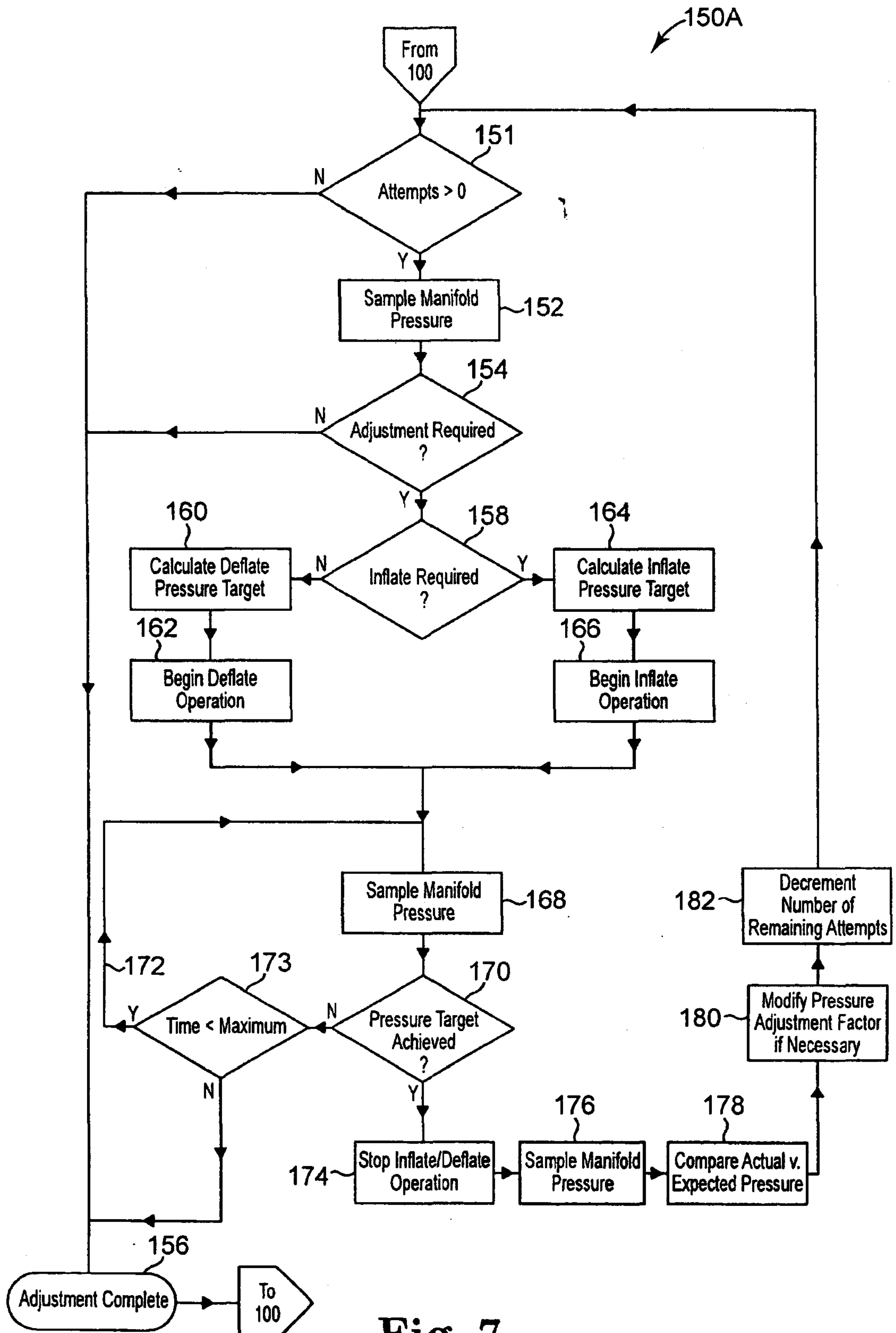

Fig. 7

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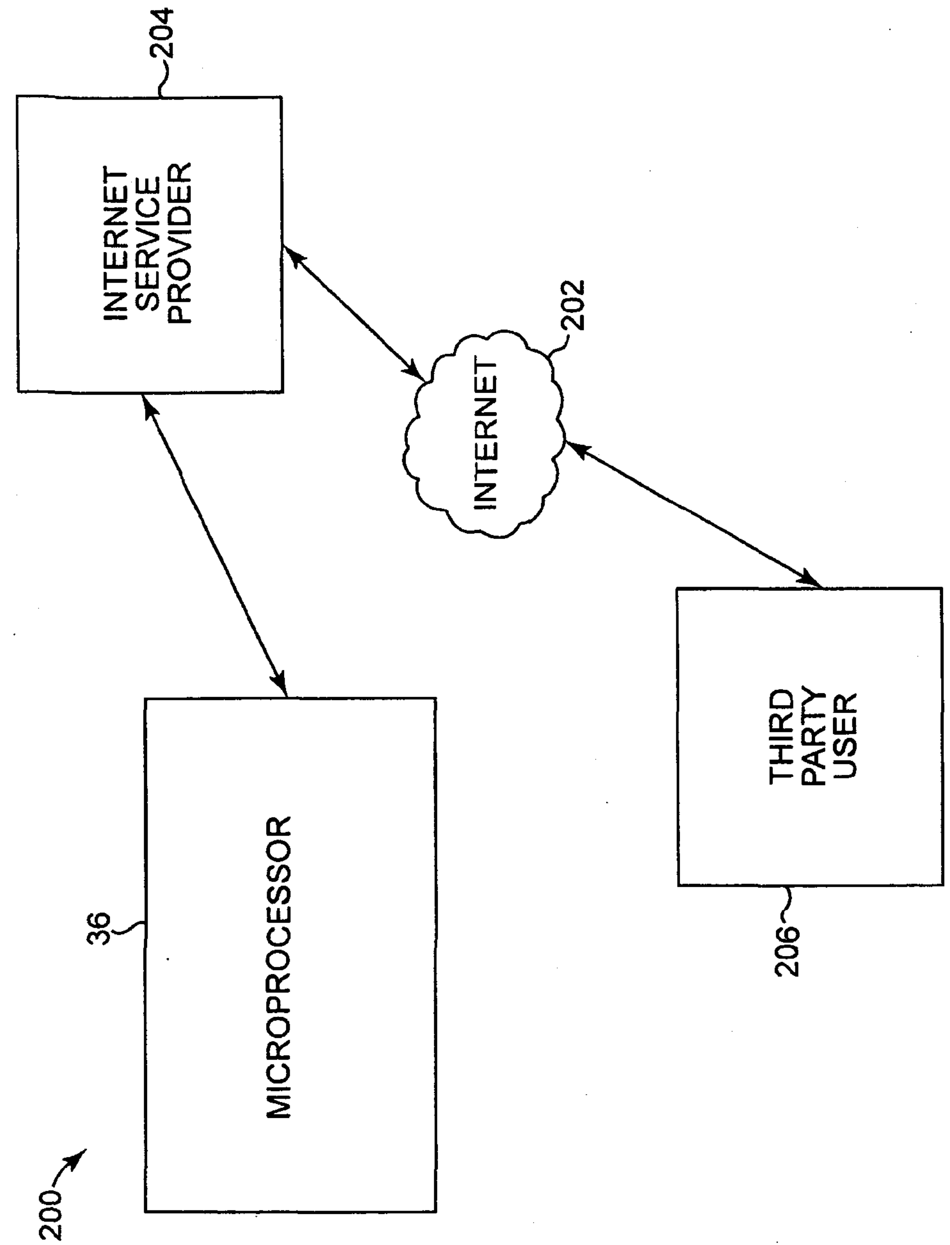

Fig. 8

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 8929-3300	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2008/059409	International filing date *(day/month/year)* 04 April 2008 (04.04.2008)	Priority date *(day/month/year)*
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant SELECT COMFORT CORPORATION		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 05 October 2010 (05.10.2010)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Gijsbertus Beijer e-mail: pt02.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
ADAM KIEDROWSKI
OPPENHEIMER WOLFF & DONNELLY LLP
Plaza VIII, Suite 3300
45 SOUTH SEVENTH STREET
MINNEAPOLIS, MN 55402-1609

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	15 AUG 2008	
Applicant's or agent's file reference 8929-3300	FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US 08/59409	International filing date *(day/month/year)* 04 April 2008 (04.04.2008)	Priority date *(day/month/year)*
International Patent Classification (IPC) or both national classification and IPC IPC(8) - A47C 27/08 (2008.04) USPC - 5/713		
Applicant SELECT COMFORT CORPORATION		

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	04 August 2008 (04.08.2008)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 08/59409

Box No. I **Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of:
   - [x] the international application in the language in which it was filed.
   - [ ] a translation of the international application into ______________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. [ ] This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of:
   a. type of material
   - [ ] a sequence listing
   - [ ] table(s) related to the sequence listing

   b. format of material
   - [ ] on paper
   - [ ] in electronic form

   c. time of filing/furnishing
   - [ ] contained in the international application as filed
   - [ ] filed together with the international application in electronic form
   - [ ] furnished subsequently to this Authority for the purposes of search

4. [ ] In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 08/59409

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-2, 4-10, 12-17 and 19-20 lack an inventive step under PCT Article 33(3) as being obvious over US 2007/0227594 A1 (Chaffee) in view of US 7,022,113 B2 to Lockwood et al. (hereinafter 'Lockwood').

As per claim 1, Chaffee discloses a method for adjusting pressure within an air bed comprising: providing an air bed, the air bed including an air chamber (bladder) and a pump having a pump housing (see para [0059]); selecting a desired pressure setpoint for the air chamber (see para [0060]); calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint (see para [0062]); adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (see para [0062]); determining an actual chamber pressure within the air chamber (see para [0062]). Chaffee does not specifically disclose comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and modifying the pressure adjustment factor based upon the adjustment factor error. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure; col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure.

As per claim 2, Chaffee further discloses wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the conduit (see para [0072]). Chaffee does not specifically sensing the pressure in the pump housing. However, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the housing since the pressure immediately outside the housing in the conduit would be the same as in the housing thus the exact location is arbitrary.

As per claim 4, Chaffee further discloses wherein the pressure target is a deflate pressure target (see para [0062]).

As per claim 5, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the pressure adjustment factor is a multiplicative pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a multiplicative adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure.

As per claim 6, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a multiplicative adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using division to calculate the deflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 7, Chaffee further discloses wherein the pressure target is an inflate pressure target (see para [0062]).

As per claim 8, Lockwood further discloses wherein the pressure adjustment factor is an additive pressure adjustment factor (col 13, ln 21).

As per claim 9, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and the additive pressure adjustment factor. Lockwood further discloses wherein the pressure adjustment factor is an additive pressure adjustment factor (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using addition to calculate the inflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

— Please See Continuation Sheet —

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 08/59409

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V. 2. Citations and explanations:

As per claim 10, Chaffee discloses a method for adjusting pressure within an air bed comprising: providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump (see para [0059]); selecting a desired pressure setpoint for the air chamber (see para [0060]); calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint (see para [0062]); sensing pressure within the conduit (see para [0072]); determining an actual chamber pressure within the air chamber (see para [0062]) and storing the pressure in memory (see para [0098]). Chaffee does not specifically disclose sensing pressure within the pump manifold; adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target; comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; modifying the pressure adjustment factor based upon the adjustment factor error; and storing the modified pressure adjustment factor in memory. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure;col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure. Furthermore, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as in the housing thus the exact location is arbitrary.

As per claim 12, Chaffee further discloses wherein the pressure target is a deflate pressure target (see para [0062]).

As per claim 13, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor. Lockwood discloses a method wherein the adjustment factor is a deflate adjustment factor (col 12, ln 45-48). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using division to calculate the deflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 14, Chaffee further discloses wherein the pressure target is an inflate pressure target (see para [0062]).

As per claim 15, Chaffee further discloses adjusting the pressure (see para [0062]). Chaffee does not specifically disclose wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor. Lockwood further discloses wherein the pressure adjustment factor is an inflate pressure adjustment factor (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and in doing so using addition to calculate the inflate pressure target, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 16, Chaffee discloses a method for adjusting pressure within an air bed comprising: (a) providing an air bed, the air bed including an air chamber and a pump having a pump housing (see para [0059]); (b) selecting a desired pressure setpoint for the air chamber (see para [0060]); (c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint (see para [0062]); (d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target (see para [0062]); (e) determining an actual chamber pressure within the air chamber (see para [0062]). Chaffee does not specifically disclose (f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; (g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and (h) repeating steps (b)-(g) with the updated pressure adjustment factor. Lockwood discloses a method including calculating an updated factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure;col 13, ln 15); and calculating the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood, and to repeat all the steps, since such would further improve the ability of the method to achieve the desired pressure.

As per claim 17, Chaffee discloses a pressure adjustment system for an air bed comprising: an air chamber (see para [0059]); a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve (see para [0059]); an input device adapted to receive a desired pressure setpoint selected by a user (see para [0064]); a pressure sensing means adapted to monitor pressure within the pump conduit (see para [0072]); and a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target, comparing an actual chamber pressure to the desired pressure setpoint (see para [0062]). Chaffee does not specifically disclose a pressure sensing means adapted to monitor pressure within the pump manifold; monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error. Lockwood discloses a method including determining an adjustment factor error (Lockwood utilizes sensors to determine the error between the desired pressure and the sensed pressure; col 13, ln 15); and modifying the adjustment factor based upon the adjustment factor error (col 13, ln 21). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee to include the adjustment error as disclosed by Lockwood since such would further improve the ability of the method to achieve the desired pressure. Furthermore, it would have been obvious to one of ordinary skill in the art to locate the sensor in the conduit within the manifold since the pressure immediately outside the housing in the manifold would be the same as in the housing thus the exact location is arbitrary.

As per claim 19, Chaffee further discloses wherein the input device is a remote control having pressure selecting means (see para [0064]).

As per claim 20, Chaffee further discloses wherein the remote control is a wireless remote control (see para [0064]).

— Please See Continuation Sheet —

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 08/59409

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Supplemental Box 1:

Claims 3, 11 and 18 lack an inventive step under PCT Article 33(3) as being obvious over Chaffee in view of Lockwood, further in view of US 6,789,284 B2 (Kemp).

As per claim 3, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a method wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

As per claim 11, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a method wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the method as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

As per claim 18, Chaffee further discloses wherein the pressure is sensed (see para [0060]). Chaffee does not specifically disclose wherein pressure is sensed with a pressure transducer. Kemp discloses a system wherein pressure is sensed with a pressure transducer (col 3, ln 57-58). It would have been obvious to one of ordinary skill in the art to modify the system as disclosed by Chaffee and Lockwood to include the transducer as disclosed by Kemp since such transducers are reliable and accurate means for sensing the pressure.

Claims 1-20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/59409

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A47C 27/08 (2008.04)
USPC - 5/713
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A47C 27/08 (2008.04)
USPC - 5/713

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 5/690, 706, 710; 137/224 (text search - see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); Google Scholar; Google Patents
Search Terms: air, inflatable, bed, mattress, pump, compressor, pressure, adjustable, transducer, determining, calculating, sensing, chamber, setpoint, factor, error

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0227594 A1 (Chaffee) 04 October 2007 (04.10.2007), see para [0059]-[0060], [0062], [0064], [0072] and [0098]	1-20
Y	US 7,022,113 B2 (Lockwood et al.) 04 April 2006 (04.04.2006), col 12, ln 45-52, col 13, ln 15 and ln 21	1-20
Y	US 6,789,284 B2 (Kemp) 14 September 2004 (14.09.2004), col 3, ln 57-58	3, 11 and 18

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 August 2008 (04.08.2008)	15 AUG 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

Australian Government

IP Australia

LETTERS PATENT

STANDARD PATENT

2008353972

I, Robyn Foster, the Commissioner of Patents, grant a Standard Patent with the following particulars:

Name and Address of Patentee(s):

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Name of Actual Inventor(s):

Hilden, Matthew Glen; Mahoney, Paul James and Tilstra, Matthew Wayne.

Title of Invention:

System and method for improved pressure adjustment

Term of Letters Patent:

Twenty years from 4 April 2008

COMMONWEALTH OF AUSTRALIA
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PATENT OFFICE

Dated this 8th day of November 2012

R E Foster

Robyn Foster
Commissioner of Patents

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

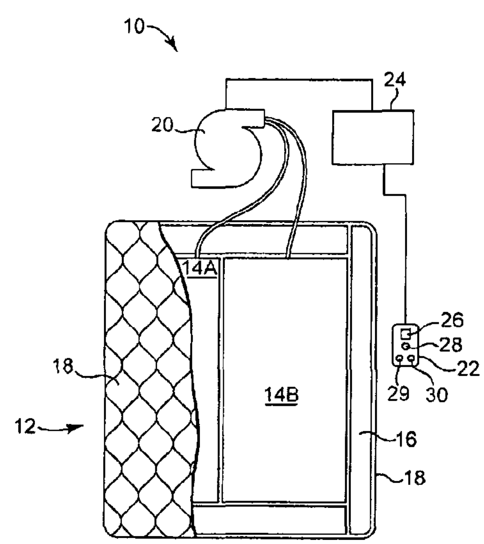

Fig. 1

(57) Abstract: A method for adjusting pressure within an air bed comprises providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Furthermore, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

WO 2009/123641 A1

TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a system and method for adjusting the pressure in an inflatable object. More particularly, the present invention relates to a system and method for adjusting the pressure in an air bed in less time and with greater accuracy.

[0002] Advances made in the quality of air beds having air chambers as support bases have resulted in vastly increased popularity and sales of such air beds. These air beds are advantageous in that they have an electronic control panel which allows a user to select a desired inflation setting for optimal comfort and to change the inflation setting at any time, thereby providing changes in the firmness of the bed.

[0003] Air bed systems, such as the one described in U.S. Patent No. 5,904,172 which is incorporated herein by reference in its entirety, generally allow a user to select a desired pressure for each air chamber within the mattress. Upon selecting the desired pressure, a signal is sent to a pump and valve assembly in order to inflate or deflate the air bladders as necessary in order to achieve approximately the desired pressure within the air bladders.

[0004] In one embodiment of an air bed system, there are two separate air hoses coupled to each of the air bladders. A first air hose extends between the interior of the air bladder and the valve assembly associated with the pump. This first air hose fluidly couples the pump to the air bladder, and is structured to allow air to be added or removed from the air bladder. A second hose extends from the air bladder to a pressure transducer, which continuously monitors the pressure within the air bladder. Thus, as air is being added or removed from the air bladder, the pressure transducer coupled to the second hose is able to continuously check the actual air bladder pressure, which may then be compared to the

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desired air pressure in order to determine when the desired air pressure within the bladder has been reached.

[0005] In another embodiment of an air bed system, there is only a single hose coupled to each of the air bladders. In particular, the hose extends between the interior of the air bladder and the valve assembly associated with the pump, and is structured to allow air to be added or removed from the air bladder. Instead of having a second hose with a pressure transducer coupled thereto for continuously reading the pressure within the air bladder, a pressure transducer is positioned within a chamber of the valve assembly. Once the user selects the desired air pressure within the air bladder, the pressure transducer first senses a pressure in the chamber, which it equates to an actual pressure in the air bladder. Then, air is added or removed from the bladder as necessary based upon feedback from the sensed pressure. After a first iteration of sensing the pressure and adding or removing air, the pump turns off and the pressure within the chamber is once again sensed by the pressure transducer and compared to the desired air pressure. The process of adding or removing air, turning off the pump, and sensing pressure within the chamber is repeated for several more iterations until the pressure sensed within the chamber is within an acceptable range close to the desired pressure. As one skilled in the art will appreciate, numerous iterations of inflating and deflating the air bladder may be required until the sensed chamber pressure falls within the acceptable range of the desired pressure.

[0006] Thus, while this second embodiment of an air bed system may be desired because it minimizes the necessary number of hoses, it is rather inefficient in that numerous iterations may be required before the sensed pressure reaches the desired pressure. Furthermore, the pump must be turned off each time the pressure transducer takes a pressure measurement, which increases the amount of time that the user must wait until the air bladder reaches the desired pressure.

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[0007] Therefore, there is a need for an improved pressure adjustment system and method for an air bed that is able to minimize the amount of time and the number of adjustment iterations necessary to achieve a desired pressure in an air bladder, while also increasing the accuracy of the actual bladder pressure.

[0007A] Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present disclosure as it existed before the priority date of each claim of this application.

BRIEF SUMMARY OF THE INVENTION

[0007B] Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

[0008] The present invention solves the foregoing problems by providing a method for adjusting pressure within an air bed comprising providing an air bed that includes an air chamber and a pump having a pump housing, selecting a desired pressure setpoint for the air chamber, calculating a pressure target, adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target, determining an actual chamber pressure within the air chamber, and comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error. The pressure target may be calculated based upon the desired pressure setpoint and a pressure adjustment factor. Furthermore, the pressure adjustment factor may be modified based upon the adjustment factor error determined by comparing the actual chamber pressure to the desired pressure setpoint.

[0009] The present invention also provides a pressure adjustment system for an air bed comprising an air chamber, a pump in fluid communication with the air chamber and including a pump manifold and at least one valve, an input device adapted to receive a desired pressure setpoint selected by a user, a pressure sensing means adapted to monitor pressure within the pump manifold, and a control device operably connected to the input device and to the pressure sensing means. The control device includes control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the

desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a diagrammatic representation of one embodiment of an air bed system.

[0011] FIG. 2 is a block diagram of the various components of the air bed system illustrated in FIG. 1.

[0012] FIG. 3 is a circuit diagram model of the air bed system illustrated in FIGS. 1 and 2.

[0013] FIG. 4 is an exemplary graph illustrating the pressure relationships derived from the circuit diagram model of FIG. 3.

[0014] FIG. 5 is a flowchart illustrating one embodiment of a pressure setpoint monitoring method in accordance with the present invention.

[0015] FIG. 6 is a flowchart illustrating one embodiment of an improved pressure adjustment method in accordance with the present invention.

[0016] FIG. 7 is a flowchart illustrating a second embodiment of an improved pressure adjustment method in accordance with the present invention.

[0017] FIG. 8 is a block diagram illustrating an air bed system according to the present invention incorporated into a network system for remote access.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring now to the figures, and first to FIG. 1, there is shown a diagrammatic representation of air bed system 10 of the present invention. The system 10 includes bed 12, which generally comprises at

least one air chamber 14 surrounded by a resilient, preferably foam, border 16 and encapsulated by bed ticking 18.

[0019] As illustrated in FIG. 1, bed 12 is a two chamber design having a first air chamber 14A and a second air chamber 14B. Chambers 14A and 14B are in fluid communication with pump 20. Pump 20 is in electrical communication with a manual, hand-held remote control 22 via control box 24. Remote control 22 may be either "wired" or "wireless." Control box 24 operates pump 20 to cause increases and decreases in the fluid pressure of chambers 14A and 14B based upon commands input by a user through remote control 22. Remote control 22 includes display 26, output selecting means 28, pressure increase button 29, and pressure decrease button 30. Output selecting means 28 allows the user to switch the pump output between first and second chambers 14A and 14B, thus enabling control of multiple chambers with a single remote control unit. Alternatively, separate remote control units may be provided for each chamber. Pressure increase and decrease buttons 29 and 30 allow a user to increase or decrease the pressure, respectively, in the chamber selected with output selecting means 28. As those skilled in the art will appreciate, adjusting the pressure within the selected chamber causes a corresponding adjustment to the firmness of the chamber.

[0020] FIG. 2 shows a block diagram detailing the data communication between the various components of system 10. Beginning with control box 24, it can be seen that control box 24 comprises power supply 34, at least one microprocessor 36, memory 37, at least one switching means 38, and at least one analog to digital (A/D) converter 40. Switching means 38 may be, for example, a relay or a solid state switch.

[0021] Pump 20 is preferably in two-way communication with control box 24. Also in two-way communication with control box 24 is hand-held remote control 22. Pump 20 includes motor 42, pump manifold 43, relief valve 44, first control valve 45A, second control valve 45B, and pressure transducer 46, and is fluidly connected with left chamber 14A and right chamber 14B via first tube 48A and second tube 48B, respectively. First

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and second control valves 45A and 45B are controllable by switching means 38, and are structured to regulate the flow of fluid between pump 20 and first and second chambers 14A and 14B, respectively.

[0022] In operation, power supply 34 receives power, preferably 110 VAC power, from an external source and converts it to the various forms required by the different components. Microprocessor 36 is used to control various logic sequences of the present invention. Examples of such sequences are illustrated in FIGS. 5-7, which will be discussed in detail below.

[0023] The embodiment of system 10 shown in FIG. 2 contemplates two chambers 14A and 14B and a single pump 20. Alternatively, in the case of a bed with two chambers, it is envisioned that a second pump may be incorporated into the system such that a separate pump is associated with each chamber. Separate pumps would allow each chamber to be inflated or deflated independently and simultaneously. Additionally, a second pressure transducer may also be incorporated into the system such that a separate pressure transducer is associated with each chamber.

[0024] In the event that microprocessor 36 sends a decrease pressure command to one of the chambers, switching means 38 is used to convert the low voltage command signals sent by microprocessor 36 to higher operating voltages sufficient to operate relief valve 44 of pump 20. Alternatively, switching means 38 could be located within pump 20. Opening relief valve 44 allows air to escape from first and second chambers 14A and 14B through air tubes 48A and 48B. During deflation, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. A/D converter 40 receives analog information from pressure transducer 46 and converts that information to digital information useable by microprocessor 36.

[0025] In the event that microprocessor 36 sends an increase pressure command, pump motor 42 may be energized, sending air to the designated chamber through air tube 48A or 48B via the corresponding

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valve 45A or 45B. While air is being delivered to the designated chamber in order to increase the firmness of the chamber, pressure transducer 46 senses pressure within pump manifold 43. Again, pressure transducer 46 sends pressure readings to microprocessor 36 via A/D converter 40. Microprocessor 36 uses the information received from A/D converter 40 to determine the difference between the actual pressure in the chamber 14 and the desired pressure. Microprocessor 36 sends the digital signal to remote control 22 to update display 26 on the remote control in order to convey the pressure information to the user.

[0026] Generally speaking, during an inflation or deflation process, the pressure sensed within pump manifold 43 provides an approximation of the pressure within the chamber. However, when it is necessary to obtain an accurate approximation of the chamber pressure, other methods must be used.

[0027] One method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is to turn off the pump, allow the pressure within the chamber and the pump manifold to equalize, and then sense the pressure within the pump manifold with a pressure transducer. Thus, providing a sufficient amount of time to allow the pressures within the pump manifold 43 and the chamber to equalize may result in pressure readings that are accurate approximations of the actual pressure within the chamber. One obvious drawback to this type of method is the need to turn off the pump prior to obtaining the pump manifold pressure reading.

[0028] A second method of obtaining a pump manifold pressure reading that is substantially equivalent to the actual pressure within a chamber is through use of the pressure adjustment method in accordance with the present invention. The pressure adjustment method is described in detail in FIGS. 5-7. However, in general, the method functions by approximating the chamber pressure based upon a mathematical relationship between the chamber pressure and the pressure measured within the pump manifold (during both an inflation cycle and a deflation

cycle), thereby eliminating the need to turn off the pump in order to obtain a substantially accurate approximation of the chamber pressure. As a result, a desired pressure setpoint within a chamber may be achieved faster, with greater accuracy, and without the need for turning the pump off to allow the pressures to equalize.

[0029] FIG. 3 is a circuit diagram model 50 of the air bed system 10 illustrated in FIG. 2. As shown in FIG. 3, first and second chambers 14A and 14B may be modeled by capacitors 51A and 51B, motor 42 of pump 20 may be modeled by current source 52 and resistor 53, relief valve 44 may be modeled by resistor 54, pressure transducer 46 may be modeled by resistor 56 and a voltage sensing lead 57, first and second tubes 48A and 48B may be modeled by resistors 58A and 58B, and first and second valves 49A and 49B may be modeled by resistors 59A and 59B. Additionally, pump manifold 43 may be modeled by another capacitor 60 because it also acts as a chamber, albeit much smaller than first and second chambers 14A and 14B.

[0030] As those skilled in the art will appreciate, by assuming current source 52 is a constant current source, pressure readings may be analogized with voltage readings. Thus, in reference to the circuit diagram 50 in FIG. 3, the voltages associated with capacitors 51A and 51B may be used to analyze pressure within first and second chambers 14A and 14B, respectively. Because the voltage readings are not dependent upon the capacitance value of capacitors 51A and 51B, the capacitance value may be discarded for purposes of the present analysis. Translated to pressure terms, this means that the size of first and second chambers 14A and 14B is irrelevant when measuring the pressure within the chambers.

[0031] Furthermore, weight positioned on a chamber (such as that caused by the user lying on bed 12) is directly related to the volume of the chamber and does not affect the ability of the system to measure the pressure within the chamber. In addition, because the system measures pressure in real time, weight changes do not affect the ability of the control system to accurately measure chamber pressure.

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[0032] The relationship between the voltage on first or second capacitors 51A or 51B and the voltage sensed at voltage sensing lead 57 is dependent upon whether current is flowing toward the capacitor (i.e., the chamber is going through an inflation cycle) or away from the capacitor (i.e., the chamber is going through a deflation cycle). In particular, and as will be discussed in detail with reference to FIG. 4, modeling air bed system 10 as circuit diagram 50 results in an additive manifold pressure offset factor during an inflation cycle and a multiplicative manifold pressure factor during a deflation cycle.

[0033] The relationship between voltage associated with a chamber capacitor (i.e., the "chamber voltage") and the sensed "manifold" voltage during an inflation cycle may be stated as follows:

[0034] *Chamber Voltage = (Manifold Voltage) – (Inflate Factor)* (Eq. 1)

[0035] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during an inflation cycle may be stated as follows:

[0036] *Chamber Pressure = (Manifold Pressure) – (Inflate Factor)* (Eq. 2)

[0037] In one exemplary embodiment, the inflate offset factor may generally fall in a range between about 0.0201 and about 0.1601. Because pressure readings may be analogous to voltage readings as discussed previously, the value of the inflate offset factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0038] The relationship between voltage associated with a chamber capacitor and the sensed manifold voltage during a deflation cycle may be stated as follows:

[0039] *Chamber Voltage = (Manifold Voltage) x (Deflate Factor)* (Eq. 3)

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[0040] Restated in terms of pressure, the relationship between the pressure within a chamber and a sensed manifold pressure during a deflation cycle may be stated as follows:

[0041] *Chamber Pressure = (Manifold Pressure) x (Deflate Factor)* (Eq. 4)

[0042] In one exemplary embodiment, the deflate factor may generally fall in a range between about 1.6 and about 6.5. Once again, because pressure readings may be analogous to voltage readings as discussed previously, the value of the deflate factor will be the same regardless of whether the relationship between the chamber and the pump manifold is being stated in terms of pressure or voltage.

[0043] FIG. 4 is an exemplary graph 70 illustrating the pressure relationships derived from circuit diagram 50 of FIG. 3 and discussed in detail above. In particular, the vertical axis on the graph represents pressure in pounds per square inch (psi), while the horizontal axis on the graph represents time in milliseconds (ms). Thus, the graph illustrates a measure of chamber pressure over time.

[0044] In particular, a first portion 71 of the graph 70 between about 0 ms and about 65000 ms represents the inflation of a chamber from about 0 psi to about 0.6 psi. A second portion 72 of the graph 70 between about 65000 ms and about 135000 ms represents the pressure in the chamber being maintained at about 0.6 psi. Finally, a third portion 73 of the graph 70 between about 135000 ms and about 200000 ms represents deflation of the chamber from about 0.6 psi to about 0 psi.

[0045] With further reference to the graph in FIG. 4, the solid line 76 represents the actual pressure within the chamber throughout the inflation and deflation cycles, while broken line 78 represents the sensed pump manifold pressure throughout the inflation and deflation cycles. As illustrated in FIG. 4, in the first portion 71 of the graph 70 representing inflation of the chamber, lines 76 and 78 are generally linear and offset from one another by a substantially constant additive offset factor 80. In

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this exemplary graph, the additive inflate offset factor is about 0.0505. Thus, the pressure within the chamber may be approximated during an inflation cycle by subtracting from the sensed manifold pressure an inflate offset factor of about 0.0505. Lines 76 and 78 generally converge in the second portion 72 of the graph 70 when the chamber is being neither inflated nor deflated. Finally, in the third portion 73 of the graph 74 representing deflation of the chamber, lines 76 and 78 are both non-linear and offset from one another by a substantially constant multiplicative factor 82. In this exemplary graph, the multiplicative deflate factor is about 2.25. Thus, the pressure within the chamber may be approximated during a deflation cycle by multiplying the sensed manifold pressure by a deflate factor of about 2.25.

[0046] Now that a brief description of an air bed system and the relationship between chamber and pump manifold pressures have been provided, one embodiment of an improved pressure adjustment method according to the present invention will be described in detail. For purposes of discussion only, the pressure adjustment method in accordance with the present invention will be described in reference to first chamber 14A. However, those skilled in the art will appreciate that the pressure adjustment method applies in a similar manner to other chambers, such as second chamber 14B of bed 12.

[0047] In particular, FIG. 5 illustrates a flowchart of a sample control logic sequence of a pressure setpoint monitoring method 100 according to the present invention. The sequence begins at step 102 upon the occurrence of a "power-on" event. A power-on event may be, for example, coupling power supply 34 of control box 24 to an external power source. The sequence continues at step 104 where microprocessor 36 obtains one or more default adjustment constants stored in, for example, memory 37. In one exemplary embodiment, these default adjustments correspond with the additive inflate factor and the multiplicative deflate factor previously described. Thus, for instance, the default additive inflate factor may be about 0.0505, while the default multiplicative deflate factor may be about 2.25. Workers skilled in the art will appreciate that these default values

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are approximate and were determined for the particular air bed system modeled in FIGS. 1-3 above with an average sized user, and that these values may change as modifications are made to the air bed system. These default adjustment constants will be used by the improved pressure adjustment method of the present invention until they are later updated after a first pressure adjustment iteration as will be discussed in further detail to follow.

[0048] The sequence continues at step 106 where microprocessor 36 detects whether a new pressure setpoint has been selected by the user to either increase or decrease the pressure in first chamber 14A. The new pressure setpoint may be a pressure that is either higher or lower than the current pressure in first chamber 14A, as desired by the user. As will be appreciated by those skilled in the art, the range of possible chamber pressures is not important to the operation of the present invention. Thus, numerous pressure ranges are contemplated. The new pressure setpoint may be selected by, for example, manipulating pressure increase button 29 or pressure decrease button 30 on manual remote control 22. Alternatively, the pressure increase and decrease buttons may be provided on another component of system 10, such as pump 20.

[0049] If microprocessor 36 does not detect that a new pressure setpoint has been selected, the sequence then continues at step 108 where microprocessor 36 determines whether or not there has been an interfering event, such as a loss in power. If microprocessor 36 determines that a loss in power has occurred, the adjustment factors are then discarded in step 110 and the sequence loops back to step 102 to monitor for the occurrence of another power-on event. However, if microprocessor 36 determines that a loss in power has not occurred, the sequence enters monitoring loop 112 where microprocessor 36 continually monitors whether a new pressure setpoint is selected in step 106 or whether a loss in power has occurred in step 108.

[0050] Alternatively, if microprocessor 36 detects that a new pressure setpoint has been selected in step 106, then the sequence continues to

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pressure adjustment method 150 as will be described in detail in reference to FIG. 6. Thus, the selection of a new pressure setpoint by the user triggers a pressure adjustment.

[0051] As will be appreciated by those skilled in the art, air bed system 10 may include a back-up power source such that if the power to power supply 34 is interrupted, the pressure adjustment factors remain stored within memory 37. As a result, it may be possible to avoid the discarding step previously described.

[0052] FIG. 6 illustrates a flowchart of a sample control logic sequence of an exemplary pressure adjustment method 150 according to the present invention. The sequence begins at step 152 when pressure transducer 46 samples the pressure within pump manifold 43. Because motor 42 of pump 20 is not running at this point, air is neither flowing into or out of first chamber 14A. Therefore, the manifold pressure sampled in step 152 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled in step 152, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure previously selected by the user (in step 106) to determine if an adjustment is required. In one embodiment, microprocessor 36 calculates the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user, and compares the difference to a predetermined, acceptable "error." The acceptable error may be any value greater than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete. However, if the difference between the sampled manifold pressure and the desired pressure setpoint selected by the user is not within the acceptable error range, then an adjustment is required, and the pressure adjustment method continues at step 158.

[0053] In step 158, microprocessor 36 determines if inflation or deflation of first chamber 14A is required. If it is determined in step 158 that deflation of first chamber 14A is required, the method continues at step 160 where microprocessor 36 calculates a deflate pressure target, which corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during a deflation cycle. In particular, the deflate pressure target may be calculated through use of Equation 4 above. Based upon the relationship between chamber pressure and manifold pressure during a deflation cycle recited in Equation 4, the deflate pressure target may calculate as follows:

[0054] *Deflate Manifold Pressure Target = (Desired Pressure Setpoint) / (Deflate Factor)*

[0055] The first time the user selects a new pressure setpoint that requires deflation of first chamber 14A, the deflate factor will be set to the default value of 2.25 discussed above in step 104. However, as will be discussed in further detail to follow, this deflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0056] Once the deflate pressure target is calculated in step 160, microprocessor 36 instructs pump 20 to begin the deflate operation in step 162.

[0057] Alternatively, if it is determined in step 158 that inflation of first chamber 14A is required, the method continues at step 164 where microprocessor 36 calculates an inflate pressure target. The inflate pressure target corresponds to the sensed manifold pressure that will yield the desired pressure setpoint during an inflation cycle. In particular, the inflate pressure target may be calculated through use of Equation 2 above. Based upon the relationship between chamber pressure and manifold pressure during an inflation cycle recited in Equation 2, the inflate pressure target may calculate as follows:

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[0058] *Inflate Manifold Pressure Target = (Desired Pressure Setpoint) + (Inflate Offset Factor)*

[0059] The first time the user selects a new pressure setpoint that requires inflation of first chamber 14A, the inflate factor will be set to the default value of 0.0505 discussed above in step 104. However, as will be discussed in further detail to follow, this inflate factor will be modified at a later step in order to more accurately reflect the mathematical relationship between the chamber pressure and the sensed manifold pressure for that particular user.

[0060] Once the inflate pressure target is calculated in step 164, microprocessor 36 instructs pump 20 to begin the inflate operation in step 166.

[0061] After performing the pressure deflate operation in step 162 or the pressure inflate operation in step 166 as required, the manifold pressure within pump manifold 43 is once again sampled in step 168. Because either motor 42 of pump 20 has been running in order to inflate first chamber 14A, or relief valve 44 has been open in order to deflate first chamber 14A, the manifold pressure sampled in step 168 is now instable and by itself does not provide an accurate representation of the actual pressure within first chamber 14A. However, because of the known relationship between manifold pressure and chamber pressure discussed previously, the present invention is able to accurately approximate the actual chamber pressure based upon a sensed manifold pressure. Therefore, after the manifold pressure has once again been sampled, the method continues at step 170 where microprocessor 36 compares the sampled manifold pressure to the manifold pressure target calculated in either step 160 or step 164 to determine if the manifold pressure target has been achieved.

[0062] Similar to the process utilized in step 154, microprocessor 36 calculates the difference between the sampled manifold pressure and the manifold pressure target and compares the difference to a predetermined, pressure target error. The pressure target error may be any value greater

than or equal to zero. If the absolute value of the difference between the sampled manifold pressure and the manifold pressure target is greater than the acceptable pressure target error, then further inflation or deflation is required. As a result, pressure adjustment method 150 returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. On the other hand, if the difference between the sampled manifold pressure and the manifold pressure target is within the pressure target error limit, then no further inflation or deflation is necessary, and the pressure adjustment method continues at step 174 where the inflate or deflate operation is ended.

[0063] Next, pressure transducer 46 once again samples the pressure within pump manifold 43 at step 176. Because all inflate or deflate operations have ceased, air is neither flowing into nor out of first chamber 14A, and the manifold pressure sampled in step 176 is substantially stable and a fairly accurate approximation of the actual pressure within first chamber 14A. After the manifold pressure has been sampled again in step 176, the sequence continues at step 178 where microprocessor 36 compares the "actual" manifold pressure sampled in step 176 with the "expected" user setpoint pressure previously selected by the user (in step 106) to determine if the desired setpoint pressure has been achieved. If the actual manifold pressure sampled in step 176 is not substantially equal to the expected setpoint pressure selected by the user, then an adjustment must be made to the pressure adjustment factor. An updated adjustment factor is therefore determined based upon a comparison between the sensed pressure and the desired setpoint pressure, and the pressure adjustment factor is thereafter modified in step 180.

[0064] With regard to the deflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0065] *Updated Deflate Adjustment Factor = (Pressure Setpoint from Step 106) / (Manifold Pressure from Step 168)*

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[0066] With regard to the inflate pressure adjustment factor, an updated factor may be calculated in the following manner:

[0067] *Updated Inflate Adjustment Factor = (Manifold Pressure from Step 168) – (Pressure Setpoint from Step 106)*

[0068] Next, the method loops back to step 152 where pressure transducer 46 samples the pressure within pump manifold 43. Once the manifold pressure has again been sampled in step 152 after a first "iteration" of adjustments, the method continues at step 154 where microprocessor 36 compares the sampled manifold pressure to the desired pressure selected by the user (in step 106) to determine if a further adjustment is required. For instance, if the pressure adjustment factor had to be modified in step 180 of the previous pressure adjustment iteration, then a further adjustment will most likely be required because the fact that the pressure adjustment factor had to be modified indicates that the actual pressure in chamber 14A is not equal to the desired pressure setpoint selected by the user. In this case, at least one more pressure adjustment iteration will be required before the actual chamber pressure is substantially equal to the desired pressure setpoint. However, if it is determined in step 154 that the absolute value of the difference between the sampled manifold pressure and the desired pressure setpoint is less than or equal to the acceptable error, then no adjustment is required, and the pressure adjustment method ends at step 156 where microprocessor 36 determines that the pressure adjustment process is complete.

[0069] After completing the pressure adjustment method 150, microprocessor 36 return back to pressure setpoint monitoring method 100 illustrated in FIG. 5 and replaces the default deflate or inflate pressure adjustment factor in step 114 with a "customized" pressure adjustment factor specifically tailored to that user. The customized pressure adjustment factor may then be stored in memory 37 for future use in pressure adjustments.

[0070] As those skilled in the art will appreciate, the default pressure adjustment factors corresponding to both the deflate and inflate operations

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must be replaced after the detection of a power-on event because these default factors are only temporary and based upon the size of an average user. Therefore, when microprocessor 36 detects an increase in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized inflate pressure adjustment constant being determined that replaces the temporary default constant. Similarly, when microprocessor 36 detects a decrease in the desired pressure setpoint for the first time at step 106, then execution of pressure adjustment method 150 will result in a customized default pressure adjustment constant being determined that replaces the temporary default constant. Furthermore, when microprocessor 36 detects subsequent increases or decreases in the desired pressure setpoint after the default constants have been replaced, the customized default constants may continue to be updated and replaced in step 114 to maintain the highest degree of accuracy when performing pressure adjustments and to take into account changes in the user such as, for example, an increase or decrease in the weight of the user. Thus, while it is not necessary to "update" the customized adjustment constants after initially replacing the temporary default adjustment constants after a power-on event, performing such updates may increase the accuracy of future pressure adjustments.

[0071] FIG. 7 illustrates a flowchart of a sample control logic sequence of a second pressure adjustment method 150A according of the present invention. Pressure adjustment method 150A is similar to pressure adjustment method 150 previously described, but includes several additional steps to further optimize operation of the pressure adjustment method.

[0072] In addition to the steps previously described above in reference to FIG. 6, pressure adjustment method 150A further includes steps 151, 182, and 173. In particular, steps 151 and 182 involve maintaining a count of the number of pressure adjustment attempts remaining during a pressure adjustment operation, while step 173 involves tracking elapsed time during an inflation or deflation cycle.

[0073] With regard to steps 151 and 182, the number of pressure adjustment "attempts" may be tracked to limit the number of pressure adjustment iterations that pressure adjustment method 150A may perform after a new pressure setpoint has been selected. In particular, prior to sensing manifold pressure in step 152, microprocessor 36 determines if the number of remaining attempts is greater than zero. If the number of attempts remaining is greater than zero, then the method continues at step 154 where microprocessor 36 determines if a pressure adjustment is required. However, if the number of attempts remaining is not greater than zero, then the method instead continues at step 156 where the pressure adjustment is presumed to be complete. Thus, pressure adjustment method 150A may allow for a predetermined number of iterations before the pressure adjustment method "times out." In one exemplary embodiment, the default number of attempts may be set to four. However, any number of attempts are possible and within the intended scope of the present invention.

[0074] If the pressure adjustment factor (either inflate or deflate) is modified in step 180, then the number of remaining attempts is decremented by one attempt in step 182. Therefore, if the desired pressure setpoint is not reached within four attempts, no further pressure adjustment is attempted and the pressure adjustment factor corresponding to the final iteration will be used to update the temporary default adjustment constant as previously discussed.

[0075] With regard to step 173, the amount of time elapsed during a pressure adjustment operation may also be also be tracked. As discussed above, if it is determined in step 170 that the pressure target has not been achieved, pressure adjustment method 150A returns along path 172 to either deflate operation 162 or inflate operation 166, depending upon whether the manifold pressure sampled in step 168 was less than or greater than the manifold pressure target. However, prior to reaching either deflate operation step 162 or inflate operation step 166, the method first enters step 173 where microprocessor 36 monitors the time that has elapsed since the initial determination was made in step 170 regarding

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whether or not the manifold pressure target has been achieved. Thus, if the amount of elapsed time is less than a maximum, predetermined time period, the sequence continues within loop 172 to inflate or deflate first chamber 14A as necessary in an attempt to achieve the manifold pressure target. However, if the desired pressure target has not been reached when microprocessor 36 determines that the maximum time period has expired, then the method exits loop 172 and advances directly to step 156, where no further adjustment will be attempted.

[0076] The maximum, predetermined time period may be any value greater than zero. However, in one exemplary embodiment of pressure adjustment method 150A, the maximum time period may be about 30 minutes. Generally speaking, the maximum time period may be selected such that the manifold pressure target is not achieved prior to the expiration of the maximum time period only if air bed system 10 is not functioning properly. For example, if first tube 48A becomes disconnected from first chamber 14A, it will most likely not be possible to attain the manifold pressure target in step 170. Under these circumstances, and without the addition of the time tracking step 173, pump 20 may continue to run until the user disconnects power from the pump or notices that first tube 48A has been disconnected from first chamber 14A.

[0077] Workers skilled in the art will appreciate that although the features added in steps 151, 173, and 182 are not necessary components of the present invention, their presence helps to optimize the operation of the pressure adjustment method by preventing the method from being trapped in a "continuous loop" of attempting to reach the desired pressure setpoint. Furthermore, it will be obvious to those skilled in the art that the order and number of steps described in reference to FIGS. 5-7 may be modified without departing from the intended scope of the present invention.

[0078] Referring now to FIG. 8, in yet another alternate embodiment in accordance with the present invention, microprocessor 36 may be integrated within network 200 for remote accessing and use of a pressure

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adjustment method according to the present invention for improving the accuracy and minimizing the time of pressure adjustments. This allows for centralized data storage and archival of air bed system information (such as customized pressure adjustment factors) by, for example, the customer service department of the air bed system manufacturer. Additionally, networking may provide for information input and retrieval, as well as remote access of control box 24 to operate the air bed system.

[0079] Network 200 may be integrated either locally or accessible via a public network protocol such as the Internet 202 and optionally through an Internet service provider 204. Connection to network 200 may be wired or wireless, and may incorporate control from a detached device (e.g., handheld, laptop, tablet, or other mobile device). In addition, microprocessor 36 may be accessible remotely by a third party user 206 via Internet 202 and/or Internet service provider 204.

[0080] Network 200 may be configured to enable remote pressure adjustment of an air bed system by a third party user 206, such as by a customer service representative at a remote location. In particular, the customer service representative may be able to remotely connect to Internet 202 and assist the user in performing a pressure adjustment set-up, such as pressure adjustment method 150 previously described, in order to optimize the accuracy and operation of the pressure adjustment method. Network 200 may also be configured to allow the customer service representative to access and store the customized pressure adjustment factors in, for example, a central storage system in case of a power loss or similar event. Numerous other advantages of network 200 will be appreciated by those having ordinary skill in the art.

[0081] Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

We Claim:

1. A method for adjusting pressure within an air bed comprising:

providing an air bed, the air bed including an air chamber and a pump having a pump housing;

selecting a desired pressure setpoint for the air chamber;

calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error; and

modifying the pressure adjustment factor based upon the adjustment factor error.

2. The method of claim 1 , wherein the step of adjusting pressure within the air chamber further comprises simultaneously sensing pressure within the pump housing.

3. The method of claim 1 or 2, wherein pressure is sensed with a pressure transducer.

4. The method of any one of the preceding claims, wherein the pressure target is a deflate pressure target.

5. The method of claim 4, wherein the pressure adjustment factor is a multiplicative pressure adjustment factor.

6. The method of claim 5, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by the multiplicative pressure adjustment factor.

7. The method of any one of claims 1 to 3, wherein the pressure target is an inflate pressure target.

8. The method of claim 7, wherein the pressure adjustment factor is an additive pressure adjustment factor.

9. The method of claim 7, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and the additive pressure adjustment factor.

10. A method for adjusting pressure within an air bed comprising:

providing an air bed having an air chamber, a pump, a pump manifold, and a tube extending between the chamber and the pump;

selecting a desired pressure setpoint for the air chamber;

calculating a manifold pressure target, wherein the manifold pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

sensing pressure within the pump manifold;

adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target;

determining an actual chamber pressure within the air chamber;

comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

modifying the pressure adjustment factor based upon the adjustment factor error; and

storing the modified pressure adjustment factor in memory.

11. The method of claim 10, wherein pressure is sensed with a pressure transducer.

12. The method of claim 10 or 11, wherein the pressure target is a deflate pressure target.

13. The method of claim 12, wherein the deflate pressure target is calculated by dividing the desired pressure setpoint by a deflate pressure adjustment factor.

14. The method of claim 10 or 11, wherein the pressure target is an inflate pressure target.

15. The method of claim 14, wherein the inflate pressure target is calculated by determining the sum of the desired pressure setpoint and an inflate pressure adjustment factor.

16. A method for adjusting pressure within an air bed comprising:

(a) providing an air bed, the air bed including an air chamber and a pump having a pump housing;

(b) selecting a desired pressure setpoint for the air chamber;

(c) calculating a pressure target, wherein the pressure target is calculated based upon the desired pressure setpoint and a pressure adjustment factor;

(d) adjusting pressure within the air chamber until a pressure within the pump housing is substantially equal to the pressure target;

(e) determining an actual chamber pressure within the air chamber;

(f) comparing the actual chamber pressure to the desired pressure setpoint to determine an adjustment factor error;

(g) calculating an updated pressure adjustment factor based upon the adjustment factor error; and

(h) repeating steps (b)-(g) with the updated pressure adjustment factor.

17. A pressure adjustment system for an air bed comprising:

an air chamber;

a pump in fluid communication with the air chamber, the pump including a pump manifold and at least one valve;

an input device adapted to receive a desired pressure setpoint selected by a user;

a pressure sensing means adapted to monitor pressure within the pump manifold; and

a control device operably connected to the input device and to the pressure sensing means, the control device having control logic that is capable of calculating a manifold pressure target based upon the desired pressure setpoint and a pressure adjustment factor, monitoring pressure within the pump manifold, adjusting pressure within the air chamber until the sensed manifold pressure is within an acceptable pressure target error range of the manifold pressure target, comparing an actual chamber pressure to the desired pressure setpoint to quantify an adjustment factor error, and calculating an updated pressure adjustment factor based upon the adjustment factor error.

18. The pressure adjustment system of claim 17, wherein the pressure sensing means is a pressure transducer.

19. The pressure adjustment system of claim 17 or 18, wherein the input device is a remote control having pressure selecting means.

20. The pressure adjustment system of claim 19, wherein the remote control is a wireless remote control.

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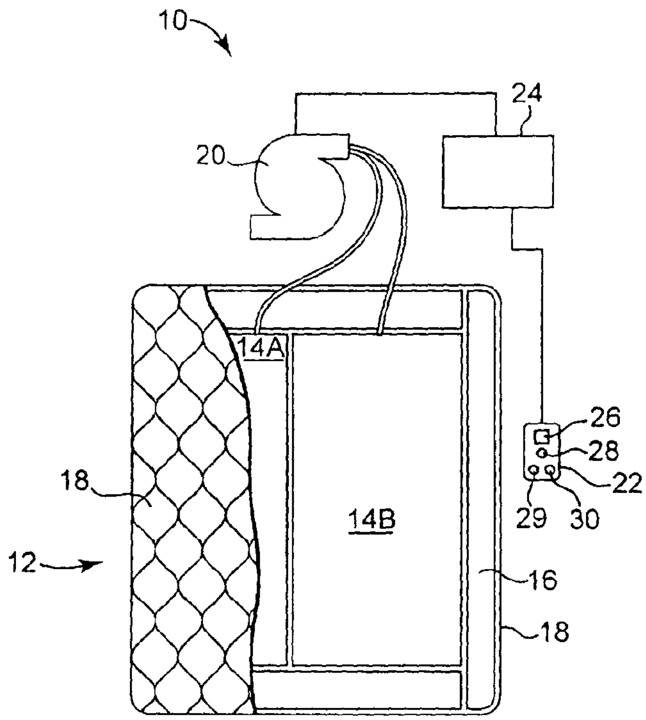

Fig. 1

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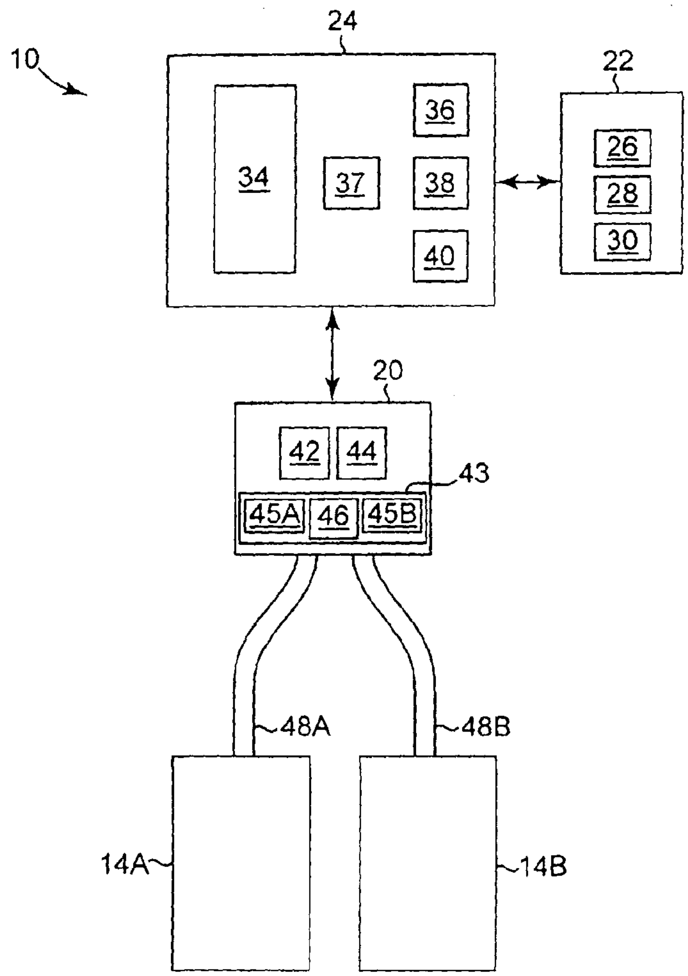

Fig. 2

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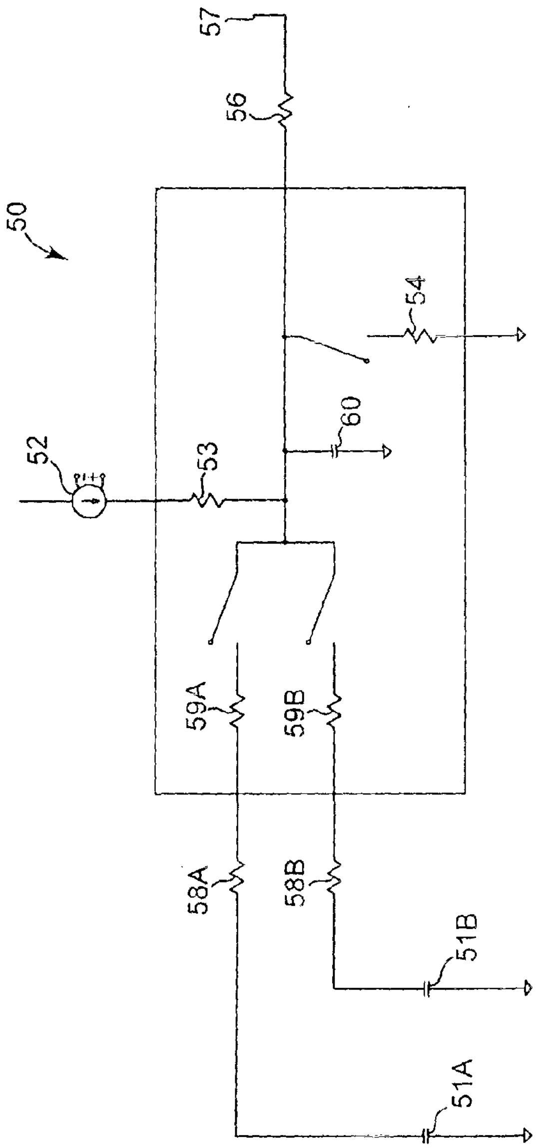

Fig. 3

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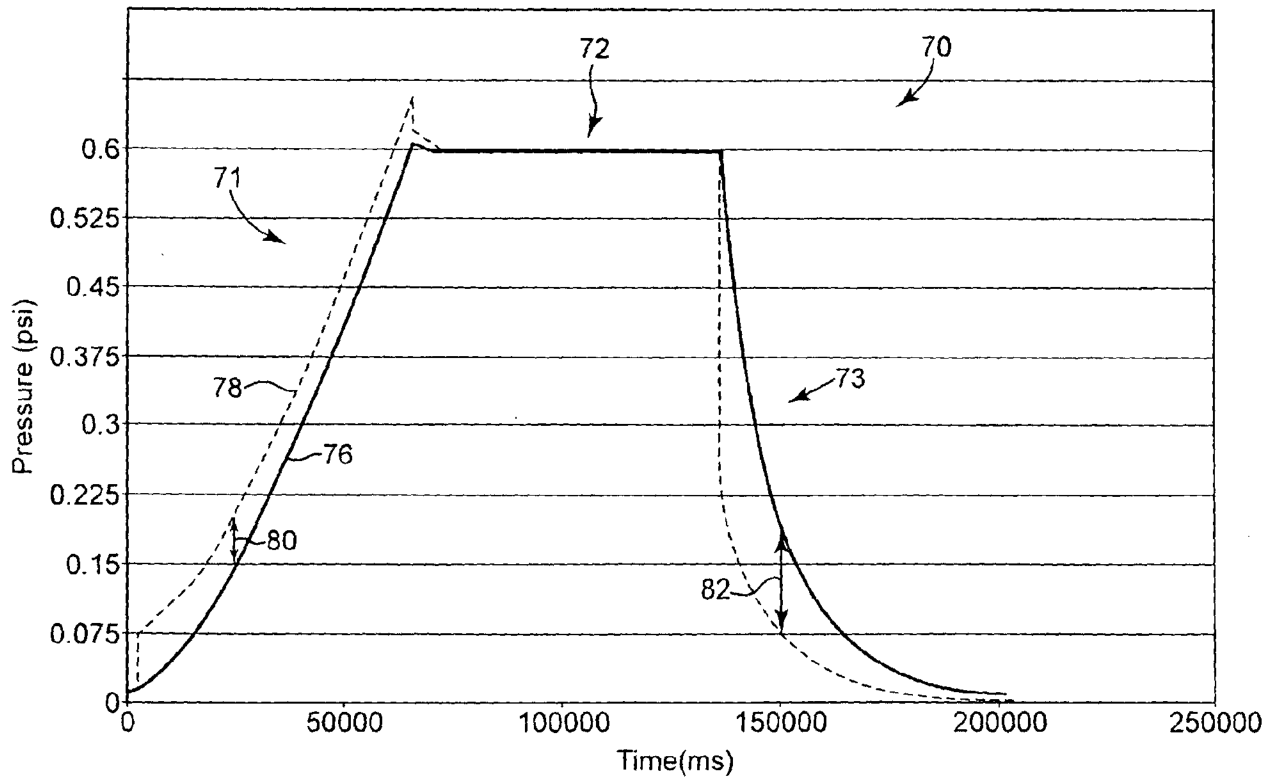

Fig. 4

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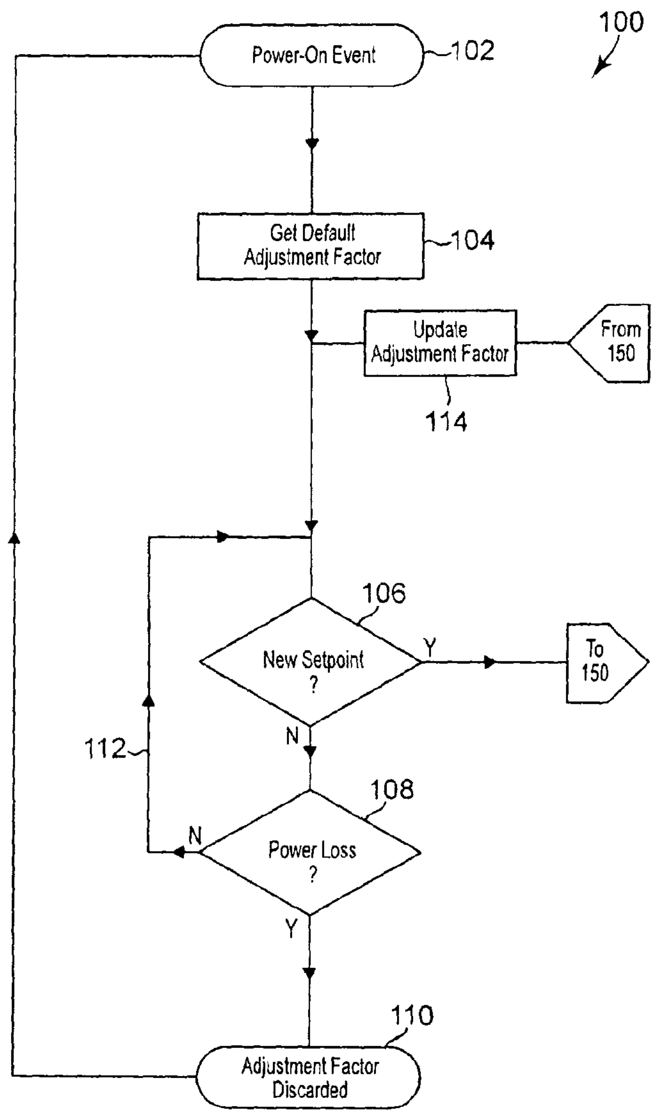

Fig. 5

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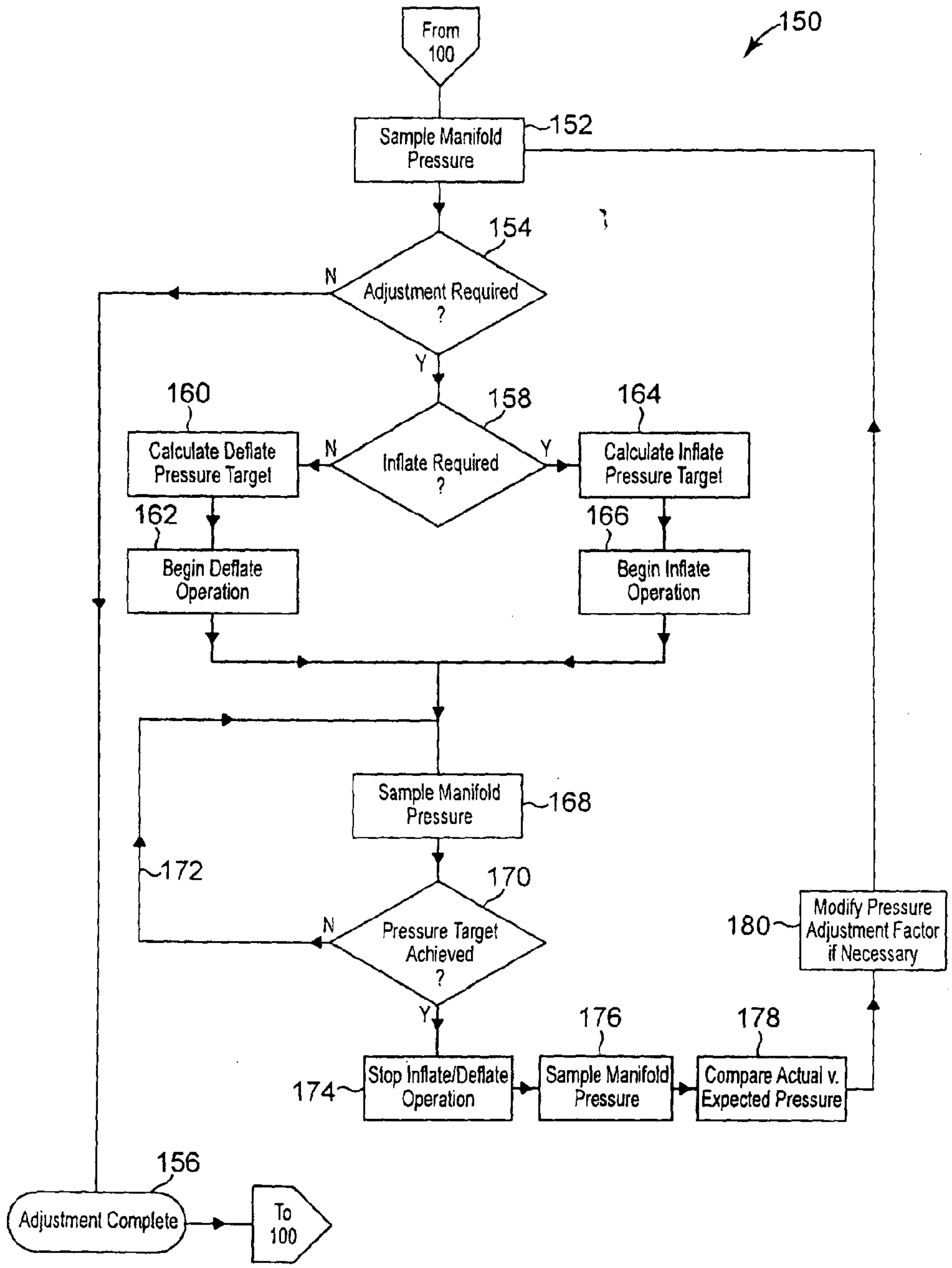
150
From 100
Sample Manifold Pressure
152
154
Adjustment Required ?
N
Y
160
158
164
Calculate Deflate Pressure Target
N
Inflate Required ?
Y
Calculate Inflate Pressure Target
162
166
Begin Deflate Operation
Begin Inflate Operation
Sample Manifold Pressure
168
172
170
N
Pressure Target Achieved ?
Y
180
Modify Pressure Adjustment Factor if Necessary
176
178
174
Stop Inflate/Deflate Operation
Sample Manifold Pressure
Compare Actual v. Expected Pressure
156
Adjustment Complete
To 100

Fig. 6

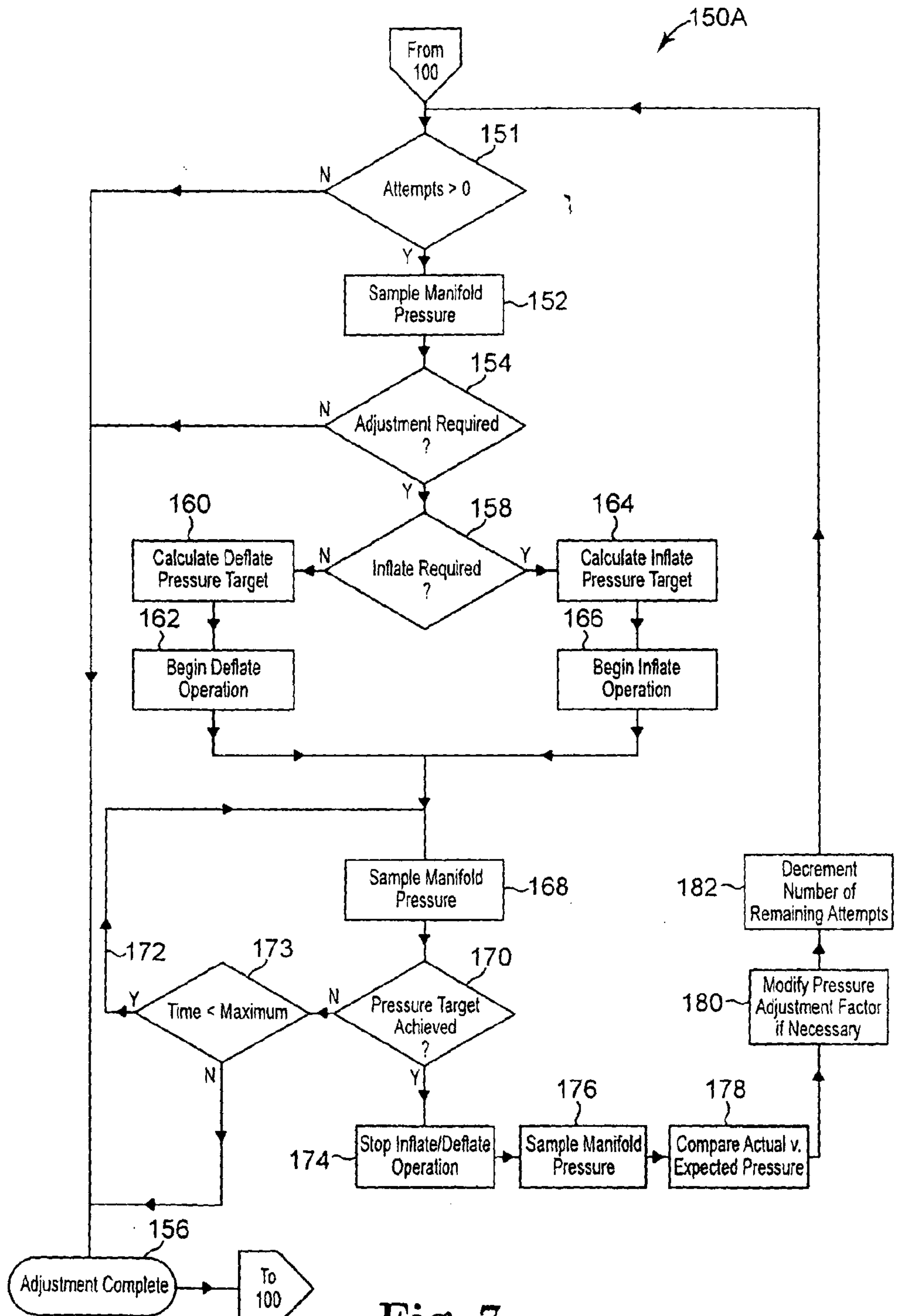

Fig. 7

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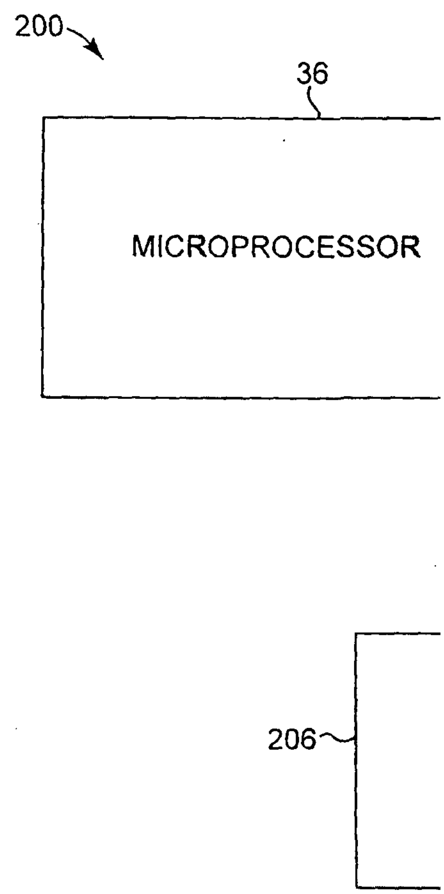
SUBSTITUTE SHEET (RULE 26)



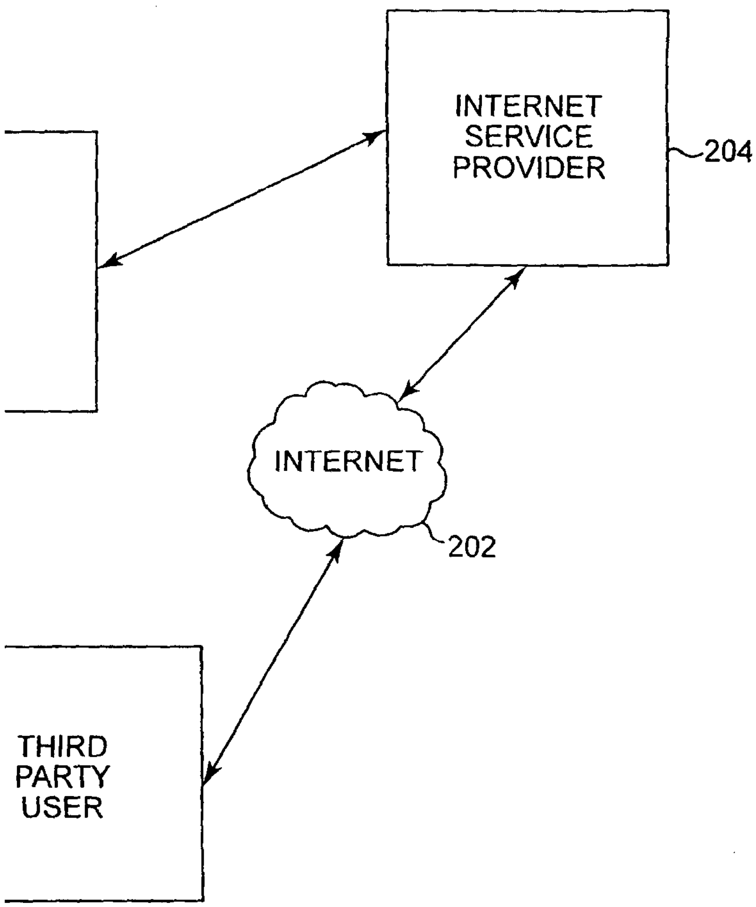

INTERNET SERVICE PROVIDER
204
INTERNET
202
THIRD PARTY USER

Fig. 8

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney et al.
Filer:	Rigel J. Menard/Jamie Ehlers
Attorney Docket Number:	3500.019US2

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	420	420
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2020**

Electronic Acknowledgement Receipt

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Application Number:	14283675
International Application Number:	
Confirmation Number:	5177
Title of Invention:	SYSTEM AND METHOD FOR IMPROVED PRESSURE ADJUSTMENT
First Named Inventor/Applicant Name:	Paul James Mahoney et al.
Customer Number:	21186
Filer:	Rigel J. Menard/Jamie Ehlers
Filer Authorized By:	Rigel J. Menard
Attorney Docket Number:	3500.019US2
Receipt Date:	21-MAY-2014
Filing Date:	
Time Stamp:	15:02:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		3500019US2ConApplicationFILED.pdf	1777327 51dbae1930fb6e78317a55b1592d7e2d525abd2a	yes	49

	Multipart Description/PDF files in .zip description		
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3	Non Patent Literature	0005_3500019us1_foar_011013.pdf	619329 f9da46e8290e800eadd6e324b7826ba0078fc1fd	no	16

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6	Non Patent Literature	0010_3500019us1_aarf_051013.pdf	344701 c718d7c814812249dbf5462aa8b8b6bfe1400619	no	13
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7	Non Patent Literature	0011_3500019us1_aarn_092713.pdf	356862 b467b7916326902c09ee0307836ae9255ef67a79	no	14
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11	Non Patent Literature	0016_3500019ep1_aarn_122310.pdf	131664 f1a492cddffa9da30fcb494b227486541f035910	no	4
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14	Non Patent Literature	0019_written_opiniion_8_15_08.pdf	939990 735765d72ac22d8eb2b9d2c33c3f5999ba49d92f	no	5
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