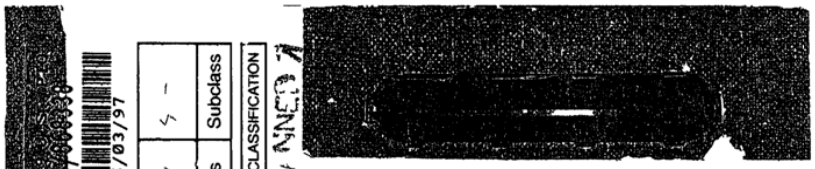
FILE HISTORY

US 6,012,007

PATENT:	6,012,007
INVENTORS:	Fortune, Duane Donald Cashler, Robert John
TITLE:	Occupant detection method and apparatus for air bag system
APPLICATION NO:	US1997868338A
FILED:	03 JUN 1997
ISSUED:	04 JAN 2000
COMPILED:	06 MAY 2014



06/03/97

Class	Subclass
701	5

ISSUE CLASSIFICATION

SCANNED

[redacted]

6012007

UTILITY SERIAL NUMBER	PATENT DATE	PATENT NUMBER
	JAN 04 2000	6012007

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
		701	45	[illegible]	NGUYE

APPLICANTS

BEST COPY

none

none/yes

Foreign priority claimed 35 USC 119 conditions met	☐ yes ☒ no ☐ yes ☐ no	AS FILED	STATE OR COUNTRY	SHEETS DRWGS	TOTAL CLAIMS	INDEP CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO
Verified and Acknowledged	Examiner's Initials							

ADDRESS

TITLE

U S DEPT OF COMM / PAT & TM—PTO 436L (Rev 12 94)

8-18-99

PARTS OF APPLICATION FILED SEPARATELY

Applications Examiner

NOTICE OF ALLOWANCE MAILED		CLAIMS ALLOWED	
8 18 99	Yonel Beaulieu Assistant Examiner	Total Claims: 27	Print Claim: 17
ISSUE FEE FH		DRAWING	
Amount Due: $1210 / Date Paid: 10-5-99	WILLIAM A CUCHLINSKI JR SUPERVISORY PATENT EXAMINER TECHNOLOGY CENTER 3600 Primary Examiner	Sheets Drwg: 5 / Figs Drwg: 10	Print Fig: 5
Label Area	PREPARED FOR ISSUE	ISSUE BATCH NUMBER: A36	

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Form PTO 436A (Rev 8/92)

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FACE

6,012,007

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

Transaction History

Date	Transaction Description
06-03-1997	Information Disclosure Statement (IDS) Filed
06-03-1997	Information Disclosure Statement (IDS) Filed
07-12-1997	Initial Exam Team nn
09-08-1997	IFW Scan & PACR Auto Security Review
10-23-1997	Application Dispatched from OIPE
12-18-1997	Case Docketed to Examiner in GAU
12-19-1997	Change in Power of Attorney (May Include Associate POA)
01-20-1999	Case Docketed to Examiner in GAU
04-07-1999	Non-Final Rejection
04-09-1999	Mail Non-Final Rejection
07-09-1999	Response after Non-Final Action
07-21-1999	Date Forwarded to Examiner
08-18-1999	Mail Notice of Allowance
08-18-1999	Notice of Allowance Data Verification Completed
09-07-1999	Workflow - Drawings Finished
09-07-1999	Workflow - Drawings Matched with File at Contractor
09-07-1999	Workflow - Drawings Received at Contractor
09-17-1999	Workflow - Drawings Sent to Contractor
09-21-1999	Workflow - File Sent to Contractor
10-15-1999	Issue Fee Payment Verified
12-15-1999	Workflow - Complete WF Records for Drawings
12-19-1999	Application Is Considered Ready for Issue
12-23-1999	Issue Notification Mailed
01-04-2000	Recordation of Patent Grant Mailed

65959 U S PTO
08/868338
06/03/97

PATENT APPLICATION

08868338

APPROVED FOR LICENSE ☑

INITIALS _____

CONTENTS

Date Entered or Counted			Date Received or Mailed
	1	Application 4 dwgs papers	
	2	IDS	[illegible]
	3	P/A	[illegible]
4/7	4	Rejection (3)	4/9/99
	5	Amdt A / Print	7/9/99
8/18	6	Notice of Allowance	8/18-99
	7	Notice of Allowability	8 18 99
[illegible]	8	[illegible] (5 shts) [illegible]	[illegible]
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☆ U.S. GOVERNMENT PRINTING OFFICE 1999-450-482 **STAPLE AREA**

PATENT NUMBER

APPLICATION SERIAL NUMBER
08/868,338

APPLICANT'S NAME (PLEASE PRINT)
D Donald et al

IF REISSUE ORIGINAL PATENT NUMBER

ORIGINAL CLASSIFICATION

CLASS	SUBCLASS
701	45

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
701	46			
340	436			
180	271	273		
280	730.1	735		
307	9.1			

INTERNATIONAL CLASSIFICATION

B	60	R		21	12
B	60	R		21	32

GROUP ART UNIT: 3661

ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME): Yonel Beaulieu

PRIMARY EXAMINER (PLEASE STAMP OR PRINT FULL NAME): WILLIAM A CUCHLINSKI

PTO 270 (REV 5 91)

ISSUE CLASSIFICATION SLIP

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

Staple Issue Slip Here

POSITION		ID NO	DATE
CLASSIFIER		43	8/1 [illegible]
EXAMINER		[illegible]	[illegible]
TYPIST			
VERIFIER			
CORPS CORR			
SPEC HAND			
FILE MAINT			
DRAFTING			

INDEX OF CLAIMS

Claim Final	Claim Original	Date
1	(1)	[illegible] =
2	2	
3	3	
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7	7	
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SYMBOLS

✓	Rejected
=	Allowed
(Through numberal)	Canceled
	Restricted
+	Non elected
N	Interference
I	Appeal
A	Objected
O	

Claim Final	Claim Original	Date
	51	
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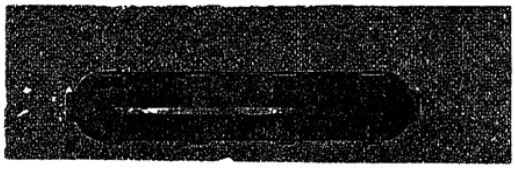
[redacted]



SEARCHED

Class	Sub	Date	Exmr
701	45	4 April 99	YB
	46		
340	438	5 April	
100	271		
	273		
280	730 1		
	↑		
	735		
307	91		
340	400		
Upcharge on	16 Aug 99	81	YB

INTERFERENCE SEARCHED

Class	Sub	Date	Exmr
701	45	17 Aug 99	YB
	46		
[illegible]	[illegible]		
[illegible]	[illegible]		
	[illegible]		
[illegible]	730 1		
	[illegible]		
[illegible]	[illegible]		

SEARCH NOTES

	Date	Exmr
APS Messenger	4,5 April 99	YB

(RIGHT OUTSIDE)

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     (FILE 'USPAT' ENTERED AT 18 00 17 ON 02 APR 1999)
                E FORTUNE/IN
L1            2 S E10
                E CASHLER/IN
L2            2 S E4
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=> d his

     (FILE 'USPAT' ENTERED AT 15 19 43 ON 04 APR 1999)
L1          4226 S SIR
L2           108 S SEAT SENSOR#
L3           293 S WEIGHT PARAMETER#
L4             2 S L2 AND L3
L5             2 S L1 AND L4
L6         12289 S DEPLOYMENT
L7             2 S L5 AND L6
L8         50312 S FLAG#
L9             1 S L7 AND L8
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=> d his

     (FILE 'USPAT' ENTERED AT 15 19 43 ON 04 APR 1999)
L1          4226 S SIR
L2           108 S SEAT SENSOR#
L3           293 S WEIGHT PARAMETER#
L4             2 S L2 AND L3
L5             2 S L1 AND L4
L6         12289 S DEPLOYMENT
L7             2 S L5 AND L6
L8         50312 S FLAG#
L9             1 S L7 AND L8
L10            1 S 5732375/PN
L11            1 S L3 AND L10
L12       711725 S CLEAR###
L13           24 S LOCK THRESHOLD
L14           13 S L12 AND L13
L15            0 S L10 AND L14
L16            0 S L10 AND L12
L17            0 S L10 AND L13
```

```
=> d his

     (FILE 'USPAT' ENTERED AT 15 19 43 ON 04 APR 1999)
L1          4226 S SIR
L2           108 S SEAT SENSOR#
L3           293 S WEIGHT PARAMETER#
L4             2 S L2 AND L3
L5             2 S L1 AND L4
L6         12289 S DEPLOYMENT
L7             2 S L5 AND L6
L8         50312 S FLAG#
L9             1 S L7 AND L8
L10            1 S 5732375/PN
L11            1 S L3 AND L10
L12       711725 S CLEAR###
L13           24 S LOCK THRESHOLD
L14           13 S L12 AND L13
L15            0 S L10 AND L14
L16            0 S L10 AND L12
L17            0 S L10 AND L13
```

US006012007A

United States Patent [19]

Fortune et al.

[11] Patent Number: 6,012,007

[45] Date of Patent: Jan. 4, 2000

[54] **OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM**

[75] Inventors: **Duane Donald Fortune**, Lebanon; **Robert John Cashler**, Kokomo, both of Ind.

[73] Assignee: **Delphi Technologies, Inc.**, Troy, Mich.

[21] Appl. No.: **08/868,338**

[22] Filed: **Jun. 3, 1997**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/566,029, Dec. 1, 1995, Pat. No. 5,732,375.

[51] **Int. Cl.**[7] **B60R 21/12**; B60R 21/32

[52] **U.S. Cl.** **701/45**; 701/46; 340/436; 180/271; 180/273; 280/730.1; 280/735; 307/9.1

[58] **Field of Search** 701/45, 46; 340/438, 340/436; 180/271, 273; 280/730.1–735; 307/9.1

[56] **References Cited**

U.S. PATENT DOCUMENTS

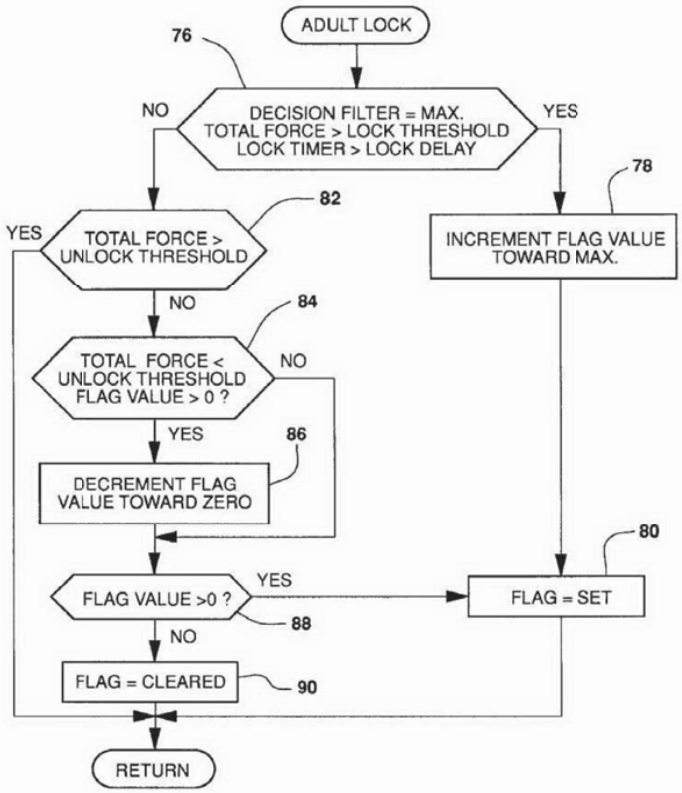
5,430,649	7/1995	Cashler et al.	364/424.05
5,732,375	3/1998	Cashler	701/45

Primary Examiner—William A. Cuchlinski, Jr.
Assistant Examiner—Yonel Beaulieu
Attorney, Agent, or Firm—Jimmy L. Funke

[57] **ABSTRACT**

Pressure sensors on the bottom surface of a seat cushion respond to occupant weight. A microprocessor evaluates the sensor outputs according to total force, load rating, long term average, sensor groups and a fuzzy measure to discriminate between large and small occupants and allow air bag deployment for large but not small occupants. Allow and inhibit decisions are filtered avoid sudden response to transient pressure changes on the seat. When a large occupant is positively detected, an allow decision is locked in place as long as total force exceeds a threshold.

27 Claims, 5 Drawing Sheets



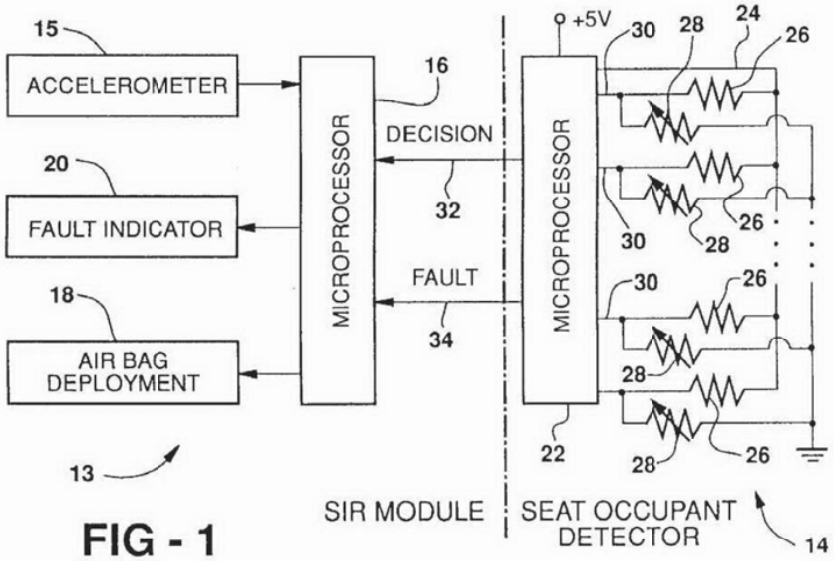


FIG - 1
PRIOR ART

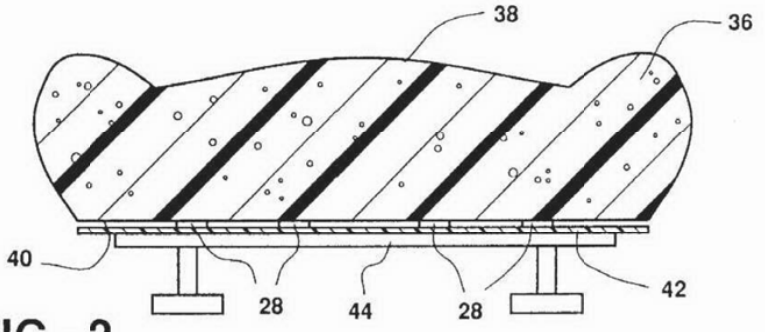


FIG - 2

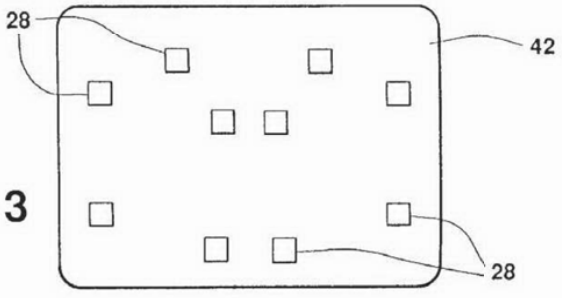


FIG - 3

FIG - 4

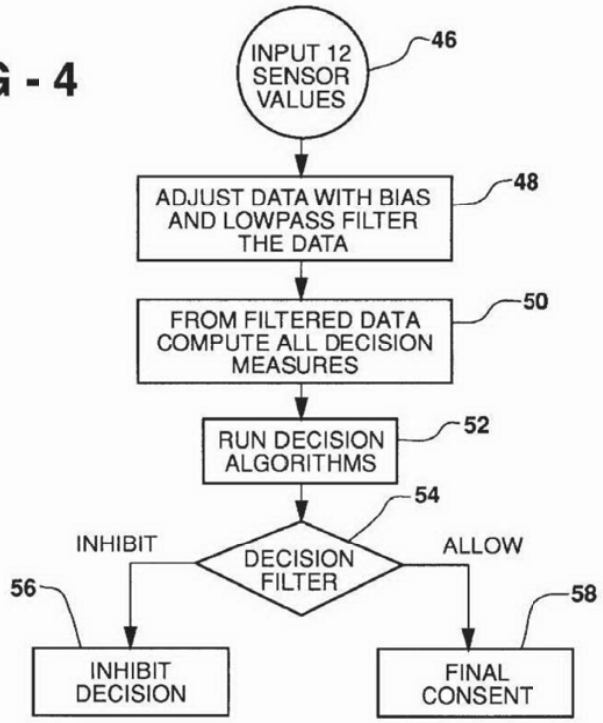

INPUT 12 SENSOR VALUES
46
ADJUST DATA WITH BIAS AND LOWPASS FILTER THE DATA
48
FROM FILTERED DATA COMPUTE ALL DECISION MEASURES
50
RUN DECISION ALGORITHMS
52
54
INHIBIT
DECISION FILTER
ALLOW
56
58
INHIBIT DECISION
FINAL CONSENT

FIG - 5

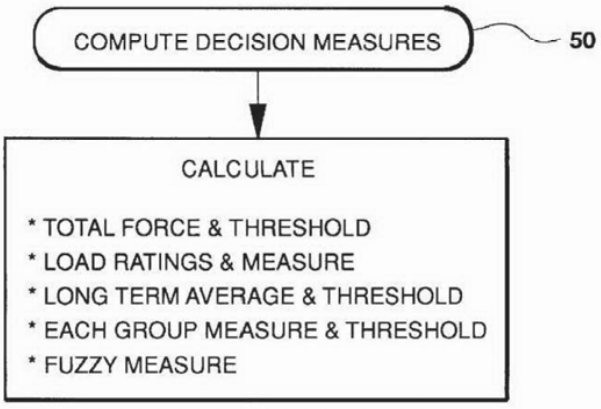

COMPUTE DECISION MEASURES
50
CALCULATE
* TOTAL FORCE & THRESHOLD
* LOAD RATINGS & MEASURE
* LONG TERM AVERAGE & THRESHOLD
* EACH GROUP MEASURE & THRESHOLD
* FUZZY MEASURE

FIG - 6

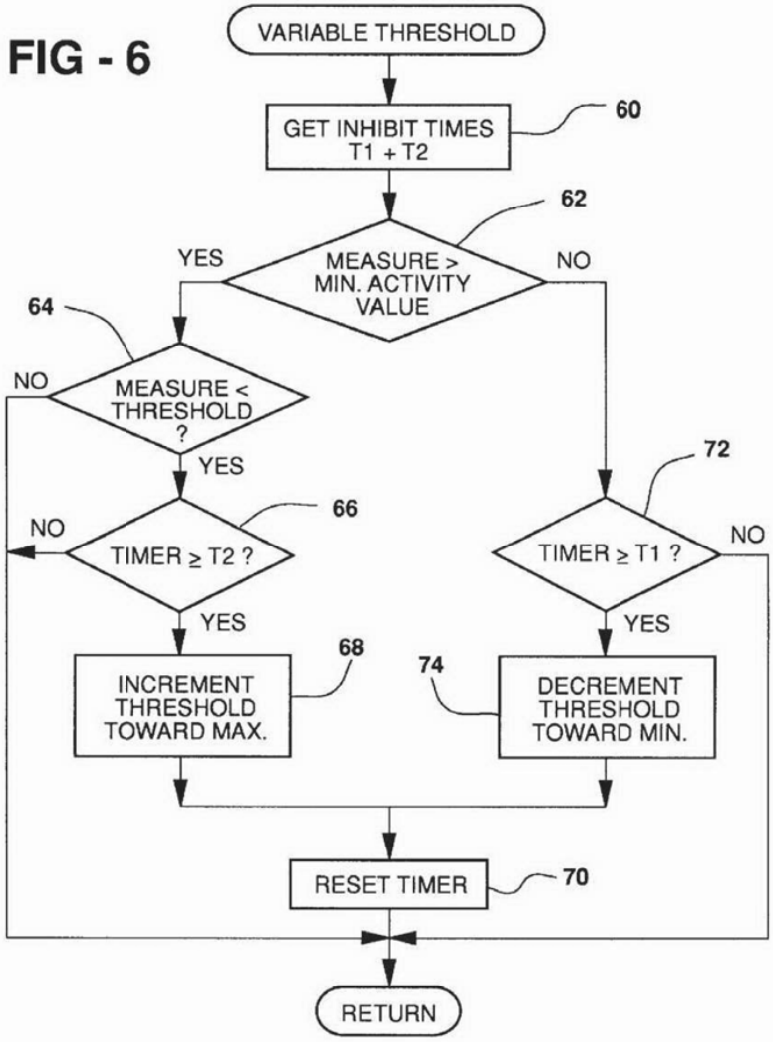

VARIABLE THRESHOLD
GET INHIBIT TIMES T1 + T2
60
62
MEASURE > MIN. ACTIVITY VALUE
YES
NO
64
MEASURE < THRESHOLD ?
NO
YES
66
TIMER ≥ T2 ?
NO
YES
68
INCREMENT THRESHOLD TOWARD MAX.
72
TIMER ≥ T1 ?
NO
YES
74
DECREMENT THRESHOLD TOWARD MIN.
RESET TIMER
70
RETURN

FIG - 7

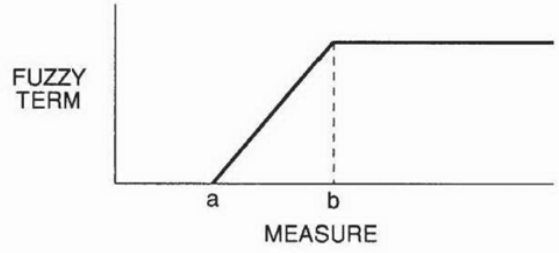

FUZZY TERM
a
b
MEASURE

FIG - 8

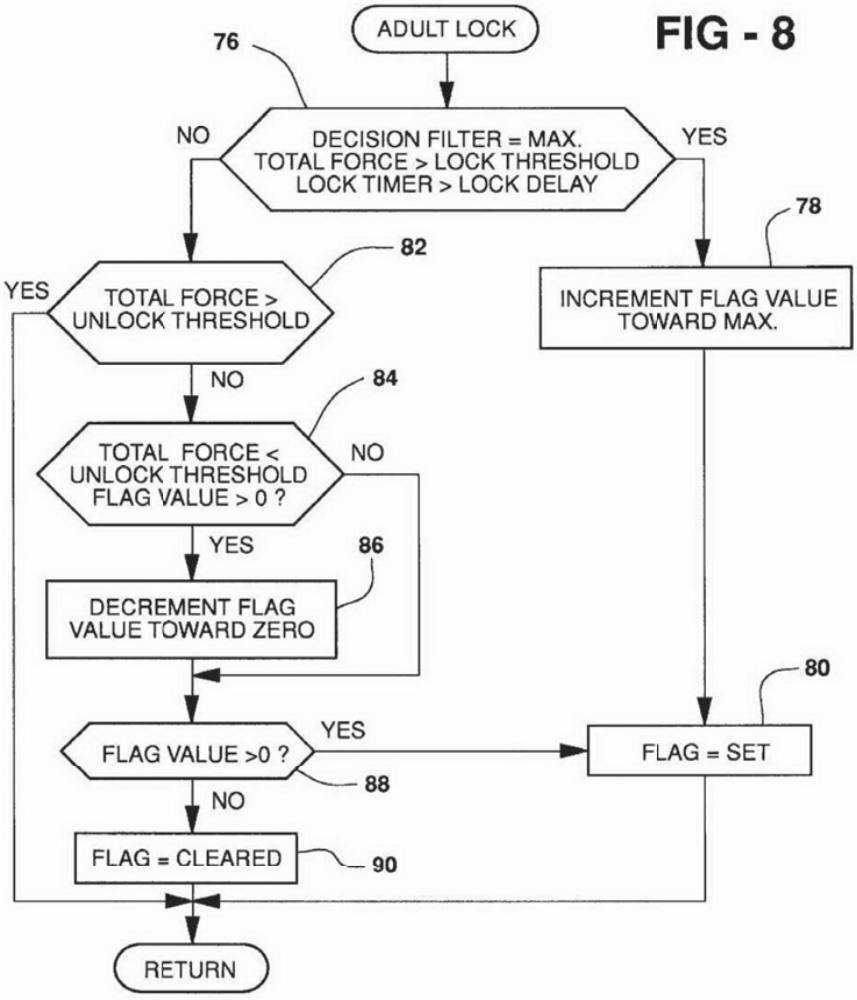

ADULT LOCK
76
DECISION FILTER = MAX.
TOTAL FORCE > LOCK THRESHOLD
LOCK TIMER > LOCK DELAY
NO
YES
78
INCREMENT FLAG VALUE
TOWARD MAX.
82
YES
TOTAL FORCE >
UNLOCK THRESHOLD
NO
84
TOTAL FORCE <
UNLOCK THRESHOLD
FLAG VALUE > 0 ?
NO
YES
86
DECREMENT FLAG
VALUE TOWARD ZERO
80
FLAG VALUE >0 ?
YES
FLAG = SET
88
NO
FLAG = CLEARED
90
RETURN

FIG - 10

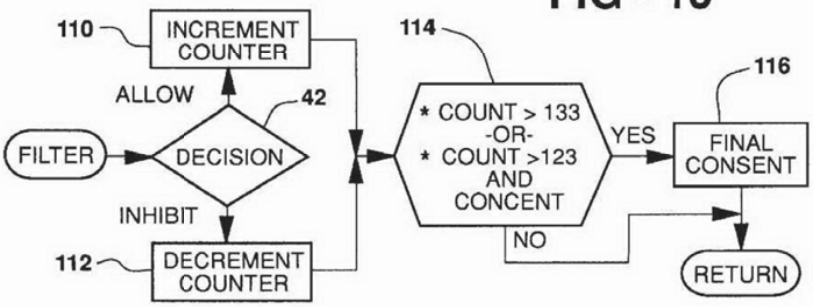
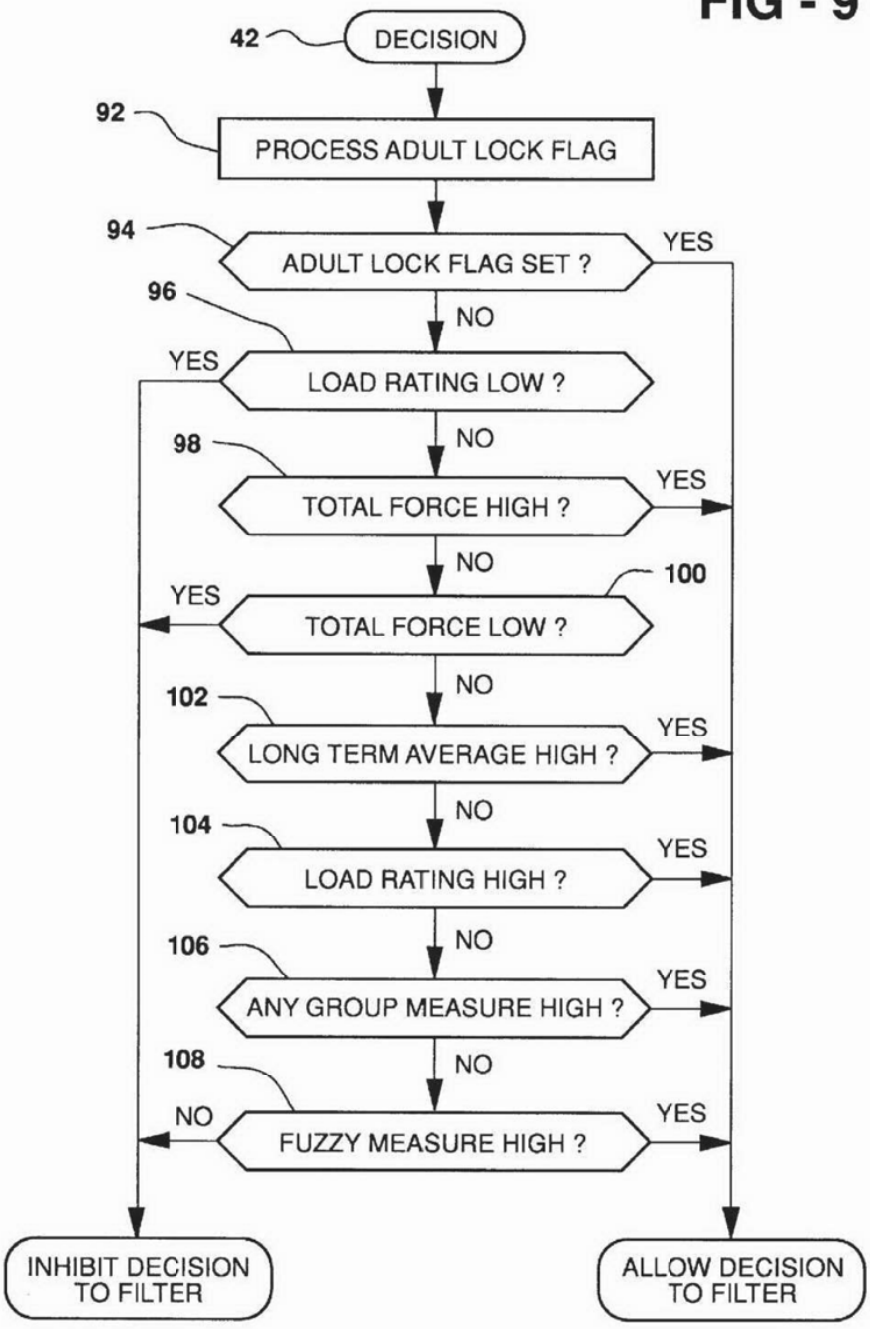

110
INCREMENT
COUNTER
ALLOW
42
FILTER
DECISION
INHIBIT
112
DECREMENT
COUNTER
114
* COUNT > 133
-OR-
* COUNT >123
AND
CONCENT
YES
116
FINAL
CONSENT
NO
RETURN

FIG - 9


42
DECISION
92
PROCESS ADULT LOCK FLAG
94
ADULT LOCK FLAG SET ?
YES
NO
96
LOAD RATING LOW ?
YES
NO
98
TOTAL FORCE HIGH ?
YES
NO
100
TOTAL FORCE LOW ?
YES
NO
102
LONG TERM AVERAGE HIGH ?
YES
NO
104
LOAD RATING HIGH ?
YES
NO
106
ANY GROUP MEASURE HIGH ?
YES
NO
108
FUZZY MEASURE HIGH ?
NO
YES
INHIBIT DECISION TO FILTER
ALLOW DECISION TO FILTER

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

This is a continuation-in-part of U.S. patent application Ser. No. 08/566,029, filed Dec. 1, 1995, now U.S. Pat. No. 5,732,375, issued Mar. 24, 1998, which is also assigned to the assignee of the present invention.

FIELD OF THE INVENTION

This invention relates to an occupant restraint system using an occupant detection device and particularly to an airbag system having seat pressure detectors in the seat.

BACKGROUND OF THE INVENTION

The expanding use of supplemental inflatable restraints (SIRs) or air bags for occupant protection in vehicles increasingly involves equipment for the front outboard passenger seat. The driver side air bag has been deployed whenever an imminent crash is sensed. The position and size of the driver is fairly predictable so that such deployment can advantageously interact with the driver upon a crash. The passenger seat, however, may be occupied by a large or a small occupant including a baby in an infant seat. It can not be assumed that a passenger of any size is at an optimum position (leaning against or near the seat back). In a system designed for effective interaction with a full sized adult, an advantageous interaction with a small person may not be attained. In such cases it is preferred to disable the passenger side airbag when a small person occupies the seat or when the seat is empty.

It has been proposed in U.S. Pat. No. 5,474,327 to Schousek, entitled "VEHICLE OCCUPANT RESTRAINT WITH SEAT PRESSURE SENSOR", and in U.S. Pat. No. 5,732,375, issued Mar. 24, 1998 and assigned to the assignee of this invention, to incorporate pressure sensors in the passenger seat and monitor the response of the sensors by a microprocessor to evaluate the weight and weight distribution, and for inhibiting deployment in certain cases. These disclosures teach the use of sensors on the top surface of the seat, just under the seat cover, and algorithms especially for detecting the presence and orientation of infant seats. Both of these disclosures form a foundation for the present invention and are incorporated herein by reference. It is desirable, however to provide a system which is particularly suited for discriminating between heavy and light occupants and for robust operation under dynamic conditions such as occupant shifting or bouncing due to rough roads.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to discriminate in a SIR system between large and small seat occupants for a determination of whether an airbag deployment should be permitted. Another object in such a system is to maintain reliable operation in spite of dynamic variations in sensed pressures.

A SIR system, as is well known, has an acceleration sensor to detect an impending crash, a microprocessor to process the sensor signal and to decide whether to deploy an air bag, and a deployment unit fired by the microprocessor. An occupant detection system can determine if an occupant or infant seat is positioned in a way to not benefit from deployment, and then signaling the microprocessor whether to allow or inhibit deploying the air bag.

A number of sensors, judicially located in the seat, can garner sufficient load and distribution information to allow determination of the occupant size. Each sensor is a very thin resistive device, having lower resistance as pressure increases. This information is then used to determine whether to inhibit airbag deployment. The sensors are arranged in groups in the seat. A microprocessor is programmed to sample each sensor, determine a total weight parameter by summing the forces, determine the forces on local groups of sensors, and averaging or filtering to provide several different measures of seat occupancy, each of which can be used determine whether to allow deployment.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other advantages of the invention will become more apparent from the following description taken in conjunction with the accompanying drawings wherein like references refer to like parts and wherein:

FIG. **1** is a schematic diagram of a prior art SIR system incorporating a seat occupant detector;

FIG. **2** is a cross section of a seat equipped with pressure sensors, according to the invention;

FIG. **3** is a view of a seat support of FIG. **2** equipped with pressure sensors;

FIG. **4** is flow chart representing an overview of an algorithm for determining deployment consent according to the invention;

FIG. **5** is a flow chart representing a method of computing decision measures used in the algorithm of FIG. **4**;

FIG. **6** is a flow chart representing a method of computing variable thresholds according to the invention;

FIG. **7** is a graphical representation of a function used in fuzzy logic for determining load ratings and a fuzzy measure;

FIG. **8** is a flow chart representing a method of computing an adult lock flag according to the invention;

FIG. **9** is a flow chart for deployment decision according to the invention; and

FIG. **10** is a flow chart representing a method of filtering allow and inhibit decisions according to the invention.

DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, a SIR system includes a SIR module **13** coupled to a seat occupant sensing system **14**. The SIR module **13** includes an accelerometer **15** mounted on the vehicle body for sensing an impending crash, a microprocessor **16** for receiving a signal from the accelerometer and for deciding whether to deploy an air bag. An air bag deployment unit **18** is controlled by the microprocessor **16** and fires a pyrotechnic or compressed gas device to inflate an air bag when a deploy command is received. A fault indicator **20**, also controlled by the microprocessor **16** will show a failure of the seat occupant sensing system **14**.

It is the aim of the seat sensing system **14** to inhibit air bag deployment when a seat is empty or occupied by a small child, while allowing deployment when the occupant is large. For example, the system may be tuned to always inhibit deployment for occupants weighing less than 66 pounds, and always allow deployment for occupants exceeding 105 pounds. The seat occupant sensing system **14** comprises a microprocessor **22** having a 5 volt supply and an enabling line **24** periodically provided with a 5 volt enabling pulse, and a series of voltage dividers coupled between the enabling line **24** and ground. Each voltage divider has a fixed resistor **26** in series with a pressure sensor or variable resistor **28**, and the junction point of each resistor **26** and

variable resistor **28** is connected to an A/D port **30** of the microprocessor **22**. The microprocessor **22** controls the pulse on enabling line **24** and reads each sensor **28** voltage during the pulse period. The microprocessor **22** analyzes the sensor inputs and issues a decision whether to inhibit air bag deployment and the decision is coupled to the microprocessor **16** by a line **32**. The microprocessor **22** also monitors its decisions for consistency and issues a fault signal on line **34** to the microprocessor **16** if faults continue to occur over a long period.

Each fixed resistor **26** is, for example, 10 kohms and the variable resistors vary between 10 kohms at high pressure and 100 kohms at low pressure. Then the voltage applied to the ports **30** will vary with pressure. Each sensor comprises two polyester sheets each having a film of resistive ink connected to a conductive electrode, the two resistive films contacting one another such that the resistance between electrodes decreases as pressure increases. Such pressure sensors are available as ALPS pressure sensors from Alps Electric Co., Ltd., Tokyo, Japan.

FIG. **2** shows a seat cushion **36** having an upper surface **38** for holding an occupant, and a lower surface **40** seated on a rigid sheet or plastic form **42** which in turn is supported by a seat subassembly **44**. The form **42**, also shown in FIG. **3**, holds a dozen pressure sensors **28** on its upper surface so that the sensors are pressed against the bottom surface **40** of the seat cushion **36**. Automotive seat cushions assemblies do not normally have the form **42** but here it serves to hold the sensors **28** and to provide a reaction surface for the sensors, allowing each sensor to detect a force imposed by the weight of a seat occupant.

The method of operation is illustrated by a series of flowcharts wherein the functional description of each block in the chart is accompanied by a number in angle brackets <nn> which corresponds to the reference number of the block. The overall operation is shown in FIG. **4** wherein the sensor values are read by the microprocessor **22** **<46>** and the data is adjusted by bias correction and low pass filtering **<48>**. Once every 100 ms one sensor at a time is turned on and sampled. Then a bias calibrated for each sensor is subtracted from each sensor reading. Then all decision measures are computed **<50>** and decision algorithms are run **<52>**. The algorithm output is filtered to avoid the effects of transient events and ultimately a decision is made to allow or inhibit air bag deployment **<54>**. Then either an inhibit signal is issued **<56>** or an allow signal is issued **<58>**. The microprocessor executes the algorithm every 100 ms.

The computation of decision measures, as shown in FIG. **5**, involves calculating total force and its threshold, sensor load ratings and measure, long term average of sensor readings and its threshold, the measure of each sensor group (right, left, etc.) and corresponding threshold, and a fuzzy measure of sensor readings. A fixed threshold is provided for the fuzzy measure and the load rating measure. The other thresholds are variable.

The variable threshold for a measure will slowly increase if the measure is above a selected minimum activity level (chosen for each measure) and will quickly decrease if the measure is below the level. Inhibit times are chosen for each measure to control the rate of increase or decrease; for increase the time T1 is preferably in the range of 30 to 300 seconds, and for decrease the time T2 is preferably less than 1 second. The threshold is allowed to vary between a minimum value and a maximum value. The variable threshold is calculated as shown in FIG. **6**. For this and subsequent flowcharts the functional description of each block in the chart is accompanied by a number in angle brackets <nn> which corresponds to the reference number of the block. Inhibit times are selected for each measure. The inhibit times T1 and T2 for the particular measure is retrieved from memory **<60>**. If the measure is above the minimum activity level **<62>** and below the variable threshold **<64>**, and a timer is greater than T2 **<66>**, the threshold is incremented **<68>** and the timer is reset **<70>**. When the measure is less than the minimum activity level **<62>** and the timer exceeds T1 **<72>**, the threshold is decremented **<74>** and the timer reset **<70>**.

Referring again to FIG. **5**, the total force is simply the sum of the sensor outputs. The load ratings are determined in the same way as in the above mentioned application Ser. No. 08/566,029 and as reflected in FIG. **7**. There if a measure has a value lower than a it has a zero rating and if it has a value greater than b has a maximum rating, while intermediate values are linearly dependent on the measure. Thus each sensor is given a rating (fuzzy term) depending on its output and reflects the certainty that a load is present. The sum of the ratings gives the load rating measure. The long term average is calculated by 1) averaging all the sensor outputs in each sample period, 2) averaging all of the averages over, say, 16 sample periods, and then 3) long term filtering the result by passing the result through a low pass software filter with a 10 to 20 second time constant. The filter output is the long term average measure. Each group measure is the sum of sensor outputs for various groups of sensors such as a right group, left group, front group, rear group and central group.

The fuzzy measure is calculated by 1) applying the FIG. **7** function to the long term average measure to obtain a long term fuzzy value, 2) applying the FIG. **7** function to the load rating measure to obtain a load rating fuzzy value, and 3) calculating the product of the two fuzzy values.

FIG. **8** is a flowchart for processing an Adult Lock Flag which will be used is the main decision algorithm. The term "Adult" refers not to the age or maturity of an occupant but rather to a weight which is chosen to distinguish from a small child. When the Adult Lock Flag is set, the output decision will always be to allow deployment. The algorithm uses a lock threshold which is above the total force threshold range and an unlock threshold which represents an empty seat. It also uses a lock delay on the order of one to five minutes, and a lock timer which measures the time since vehicle ignition is turned on. If the decision filter **54** is at its maximum value, the total force is greater than the lock threshold, and the lock timer is larger than the lock delay **<76>**, a flag value is increased toward a maximum value **<78>** and the Adult Lock Flag is set **<80>**. If the decision at block **76** is No, it is determined whether the total force is above the unlock threshold **<82>** and if not, whether the total force is below the unlock threshold and the flag value is greater than zero **<84>**. If so, the flag value is decremented toward zero **<86>**, and in either case the flag value is tested **<88>**; if the value is above zero the Flag is set **<80>** and if the value is zero the Flag is cleared **<90>**.

The main decision algorithm **42** is shown in FIG. **9**. Note that this algorithm will result in an allow or an inhibit decision, but this decision is preliminary, subject to subsequent filtering to obtain a final consent to deployment. Each measure is determined to be high or low by comparison with its variable threshold if one has been computed, or against a fixed threshold. The Adult Lock Flag is processed **<92>** according to FIG. **8** and if the Flag is set **<94>** an allow decision is made. If not, and the load rating is low **<96>** an inhibit decision is made. If the rating is not low the total

force is tested <98, 100>. If high, an allow decision is issued and if low an inhibit decision is issued. If neither, it is determined whether the long term average measure <102> the load rating <104>, or a group measure <106> is high, and to issue an allow decision. Finally, if no decision has yet been made, an allow or inhibit decision is made on the basis of the fuzzy measure <108>.

The final judgment of whether to consent to deployment is made in the decision filter as shown in FIG. **10**. An up and down counter starting at zero and having a maximum count of 255 is used. If an allow decision is made <42> the counter is incremented <110> and if an inhibit decision is made the counter is decremented <112>. When the count exceeds 133 <114> final consent to deployment is granted <116>; if consent is already present, a count over 123 is needed to maintain that state to afford hysteresis. When the count falls below 123 the consent is revoked and deployment will be inhibited. Assuming that the increment size is one count, at the 100 ms loop execution rate a minimum of 13.3 seconds will be required to issue the consent, and at least 25.5 seconds are needed to reach the maximum count needed to set the Adult Lock Flag. Similarly, once the maximum count is attained, at least 13.2 seconds are needed to revoke the consent.

It will thus be seen that process of determining whether an adult size person is occupying the seat is carried out by analyzing sensor output with several measures to insure both that deployment will be allowed with a large occupant and will not occur with a small occupant. Rapid detection of large adults is enabled by the total force and load rating measures, while dynamic sensor outputs caused by frequent occupant movement are managed by the long term average measure. The fuzzy measure helps discriminate between large and small occupants in borderline cases. The seat structure with sensors placed on the bottom surface of the seat cushion permits sensing of occupant weight without great sensitivity to localized forces on the top surface of the seat. Off center weight distributions caused by sitting on a seat edge or leaning in one direction are still detectable.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a vehicle restraint system having a controller for deploying air bags and means for selectively allowing deployment according to the outputs of seat sensors responding to the weight of an occupant, a method of allowing deployment according to sensor response including the steps of:

determining measures represented by individual sensor outputs and calculating from the sensor outputs a relative weight parameter;

establishing a first threshold of the relative weight parameter;

allowing deployment when the relative weight parameter is above the first threshold;

establishing a lock threshold above the first threshold;

setting a lock flag when the relative weight parameter is above the lock threshold and deployment has been allowed for a given time;

establishing an unlock threshold at a level indicative of an empty seat;

clearing the flag when the relative weight parameter is below the unlock threshold for a time; and

allowing deployment while the lock flag is set.

2. The method defined in claim **1**, including:

establishing a second threshold of the relative weight parameter; and

inhibiting deployment when the relative weight parameter is below the second threshold.

3. The method defined in claim **1** wherein the relative weight parameter is the total force detected by all the sensors.

4. The method defined in claim **1** wherein the relative weight parameter is a long term average obtained by the following steps:

averaging all sensor outputs over a plurality of sample events to obtain a cumulative average; and

long term filtering the cumulative average to obtain the long term average.

5. The method defined in claim **1** wherein the relative weight parameter is a load rating obtained by:

calculating a load rating for each sensor as a function of the difference between the sensor output and a base value; and

summing the load rating for all the sensors to derive a total load rating.

6. The method defined in claim **1** wherein the relative weight parameter is a fuzzy value obtained by:

calculating a total load rating for all the sensors;

determining a fuzzy load value from the total load rating;

calculating a long term average for all the sensors;

determining a fuzzy average value from the long term average; and

combining the fuzzy average and the fuzzy load value to obtain the fuzzy value.

7. The method defined in claim **1** wherein the step of setting the lock flag is executed in repetitive loops and comprises:

incrementing a flag value toward a maximum value in each loop when the relative weight parameter is above the lock threshold;

decrementing the flag value toward zero in each loop when the relative weight parameter is less than the unlock threshold; and

setting the lock flag when the flag value is greater than zero and clearing the flag when the flag value is zero, so that the flag value at any time determines the minimum time for clearing the flag.

8. The method defined in claim **7** including:

enabling the incrementing step only when a decision filter reaches a maximum count; and

the decision filter includes

incrementing a counter toward a maximum count in each loop when an allow decision is present, and

decrementing the counter when an allow decision is absent.

9. The method defined in claim **1** wherein a step of allowing deployment is a preliminary allow decision and final deployment consent is attained by long term filtering of the allow decision.

10. The method defined in claim **1** wherein a step of allowing deployment is a preliminary allow decision and final deployment consent is attained by the steps of:

beginning at a zero count, periodically incrementing a counter toward a maximum count when an allow decision is present;

periodically decrementing the counter when an allow decision is absent;

establishing an allow threshold; and

issuing deployment consent when the counter count exceeds the threshold.

11. The method defined in claim 10 wherein the allow threshold has a first value when deployment consent is absent and a lower value when deployment consent is present to afford hysteresis.

12. The method defined in claim 1 wherein the step of establishing a first threshold includes varying the first threshold over time as a function of the relative weight parameter when the relative weight parameter is below the first threshold.

13. The method defined in claim 1 wherein the step of establishing a first threshold includes varying the first threshold over time within a defined range by the steps of:

setting a minimum activity level of the relative weight parameter below the defined range;

increasing the first threshold when the relative weight parameter is above the minimum activity level and below the first threshold;

decreasing the first threshold when the relative weight parameter is below the minimum activity level.

14. The method defined in claim 13 wherein increasing the first threshold is permitted only after set adjustment times have elapsed since a previous variation.

15. The method defined in claim 13 wherein increasing or decreasing the first threshold is permitted only after set adjustment times have elapsed since the previous adjustment.

16. In a vehicle restraint system having a controller for deploying air bags and means for inhibiting deployment when a seat is not occupied by an adult including seat sensors responding to the weight of an occupant, a method of inhibiting and allowing deployment according to sensor response including the steps of:

determining forces represented by individual sensor outputs and total force represented by all sensor outputs;

establishing a first threshold of total force and a second threshold below the first threshold;

inhibiting deployment when the total force is below a second threshold, and allowing deployment when the total force is above the first threshold;

establishing a lock threshold above the first threshold;

setting a lock flag when the total force is above the lock threshold and deployment has been allowed for a given time;

establishing an unlock threshold at a level indicative of an empty seat;

clearing the flag when the total force is below the unlock threshold for a time; and

allowing deployment while the lock flag is set.

17. In a vehicle restraint system having a controller for deploying air bags, means for inhibiting and allowing deployment according to whether a seat is occupied by a person of at least a minimum weight comprising:

seat sensors responding to the weight of an occupant to produce sensor outputs;

a microprocessor coupled to the sensor outputs and programmed to inhibit and allow deployment according to sensor response and particularly programmed to

determine measures represented by individual sensor outputs and calculate from the sensor outputs a relative weight parameter,

establish a first threshold of the relative weight parameter,

allow deployment when the relative weight parameter is above the first threshold,

establish a lock threshold above the first threshold,

set a lock flag when the relative weight parameter is above the lock threshold and deployment has been allowed for a given time,

establish an unlock threshold at a level indicative of an empty seat,

clear the flag when the relative weight parameter is below the unlock threshold for a time, and

allow deployment while the lock flag is set.

18. Means for inhibiting and allowing deployment as defined in claim 17 wherein:

the seat comprises a resilient pad having a top surface for bearing an occupant and a bottom surface;

a support mounting the bottom surface; and

the seat sensors are arrayed on the bottom surface for sensing forces imposed by the weight of the occupant.

19. Means for inhibiting and allowing deployment as defined in claim 17 wherein:

the seat comprises a resilient pad having a top surface for bearing an occupant and a bottom surface;

a support including a panel supporting the bottom surface; and

the seat sensors are arrayed in an interface defined by the bottom surface and the panel for sensing forces imposed by the weight of the occupant.

20. Means for inhibiting and allowing deployment as defined in claim 17 wherein the microprocessor is further programmed to inhibit deployment when the relative weight parameter is below a second threshold.

21. Means for inhibiting and allowing deployment as defined in claim 17 wherein the relative weight parameter is the total force detected by all the sensors.

22. Means for inhibiting and allowing deployment as defined in claim 17 wherein relative weight parameter is a long term average of sensor outputs and the microprocessor is further programmed to

average all sensor outputs over a plurality of sample events to obtain a cumulative average, and

long term filter the cumulative average to obtain the long term average.

23. Means for inhibiting and allowing deployment as defined in claim 17 wherein the relative weight parameter is a total load rating of the sensors and the microprocessor is further programmed to

calculate a load rating for each sensor as a function of the difference between the sensor output and a base value; and

sum the load rating for all the sensors to derive a total load rating.

24. Means for inhibiting and allowing deployment as defined in claim 17 wherein to set the lock flag the microprocessor is further programmed to

periodically increment a flag value toward a maximum value when the relative weight parameter is above the lock threshold,

periodically decrement the flag value toward zero when the relative weight parameter is less than the unlock threshold, and

set the lock flag when the flag value is greater than zero and clear the flag when the flag value is zero, so that the flag value at any time determines the minimum time for clearing the flag.

25. Means for inhibiting and allowing deployment as defined in claim 17 wherein a decision to allow deployment is a preliminary decision, and to make a final consent decision the microprocessor is programmed to

periodically increment a counter toward a maximum count when an allow decision is present,

periodically decrement the counter when an allow decision is absent,

establish an allow threshold, and

issue final consent when the counter count exceeds the threshold.

26. Means for inhibiting and allowing deployment as defined in claim **17** wherein to establish a threshold the microprocessor is programmed to vary the first threshold over time as a function of the relative weight parameter when the relative weight parameter is below the first threshold.

27. Means for inhibiting and allowing deployment as defined in claim **17** wherein to establish a first threshold which is variable within a defined range the microprocessor is programmed to

set a minimum activity level of the relative weight parameter below the defined range,

increase the first threshold when the relative weight parameter is above the minimum activity level and below the first threshold, and

decrease the first threshold when the relative weight parameter is below the minimum activity level.

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Sir

Enclosed for filing are the following patent application papers

Docket No H-198088

Inventors DUANE DONALD FORTUNE
ROBERT JOHN CASHLER

Title OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

Filing Fee Formula

Basic Fee	$	770 00
Additional Fees		
Number of independent claims in excess of 3 times $80 00	$	0 00
Number of claims in excess of 20 times $22 00	$	154 00
Multiple dependent claim add $260 00	$	0 00
Total Filing Fee	$	924 00

The patent specification H-198088 entitled OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM and filed in the Patent and Trademark Office herewith is the patent specification for which the inventor(s) executed the Declaration enclosed herewith

Please charge the $924 00 filing fee to Delco Electronics Corporation Deposit Account No 04-0549

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317/451-3481

Enclosures

H-198088

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

Field of the Invention

This invention relates to an occupant restraint system using an occupant detection device and particularly to an airbag system having seat pressure detectors in the seat

Background of the Invention

The expanding use of supplemental inflatable restraints (SIRs) or air bags for occupant protection in vehicles increasingly involves equipment for the front outboard passenger seat The driver side air bag has been deployed whenever an imminent crash is sensed The position and size of the driver is fairly predictable so that such deployment can advantageously interact with the driver upon a crash The passenger seat, however, may be occupied by a large or a small occupant including a baby in an infant seat It can not be assumed that a passenger of any size is at an optimum position (leaning against or near the seat back) In a system designed for effective interaction with a full sized adult, an advantageous interaction with a small person may not be attained In such cases it is preferred to disable the passenger side airbag when a small person occupies the seat or when the seat is empty

It has been proposed in U S Patent No 5,474,327 to Schousek, entitled "VEHICLE OCCUPANT RESTRAINT WITH SEAT PRESSURE SENSOR", and in U S Patent ~~Application SN 08/566,029 to Cashler entitled "METHOD OF INHIBITING OR ALLOWING AIR BAG DEPLOYMENT", filed December 1, 1995,~~ No 5,732,375 issued March 24, 1998 and assigned to the assignee of this invention, to incorporate pressure sensors in the passenger seat and monitor the response of the sensors by a microprocessor to evaluate the weight and weight distribution, and for inhibiting deployment in certain cases These disclosures teach the use of sensors on the top surface of the seat, just under the seat cover, and algorithms especially for detecting the presence and orientation of infant seats Both of these disclosures form a

foundation for the present invention and are incorporated herein by reference It is desirable, however to provide a system which is particularly suited for discriminating between heavy and light occupants and for robust operation under dynamic conditions such as occupant shifting or bouncing due to rough roads

Summary of the Invention

It is therefore an object of the invention to discriminate in a SIR system between large and small seat occupants for a determination of whether an airbag deployment should be permitted Another object in such a system is to maintain reliable operation in spite of dynamic variations in sensed pressures

A SIR system, as is well known, has an acceleration sensor to detect an impending crash, a microprocessor to process the sensor signal and to decide whether to deploy an air bag, and a deployment unit fired by the microprocessor An occupant detection system can determine if an occupant or infant seat is positioned in a way to not benefit from deployment, and then signaling the microprocessor whether to allow or inhibit deploying the air bag

A number of sensors, judicially located in the seat, can garner sufficient load and distribution information to allow determination of the occupant size Each sensor is a very thin resistive device, having lower resistance as pressure increases This information is then used to determine whether to inhibit airbag deployment The sensors are arranged in groups in the seat A microprocessor is programmed to sample each sensor, determine a total weight parameter by summing the forces, determine the forces on local groups of sensors, and averaging or filtering to provide several different measures of seat occupancy, each of which can be used determine whether to allow deployment

Brief Description of the Drawings

The above and other advantages of the invention will become more apparent from the following description taken in conjunction with the accompanying drawings wherein like references refer to like parts and wherein

Figure 1 is a schematic diagram of a prior art SIR system incorporating a seat occupant detector,

Figure 2 is a cross section of a seat equipped with pressure sensors, according to the invention,

Figure 3 is a view of a seat support of Figure 2 equipped with pressure sensors,

Figure 4 is flow chart representing an overview of an algorithm for determining deployment consent according to the invention,

Figure 5 is a flow chart representing a method of computing decision measures used in the algorithm of Figure 4,

Figure 6 is a flow chart representing a method of computing variable thresholds according to the invention,

Figure 7 is a graphical representation of a function used in fuzzy logic for determining load ratings and a fuzzy measure,

Figure 8 is a flow chart representing a method of computing an adult lock flag according to the invention,

Figure 9 is a flow chart for deployment decision according to the invention, and

Figure 10 is a flow chart representing a method of filtering allow and inhibit decisions according to the invention

Description of the Invention

Referring to Figure 1, a SIR system includes a SIR module 13 coupled to a seat occupant sensing system 14 The SIR module 13 includes an accelerometer 15 mounted on the vehicle body for sensing an impending crash, a microprocessor 16 for receiving a signal from the accelerometer and for deciding whether to deploy an air bag An air bag deployment unit 18 is controlled by the microprocessor 16 and fires a pyrotechnic or compressed gas device to inflate an air bag when a deploy command

is received A fault indicator 20, also controlled by the microprocessor 16 will show a failure of the seat occupant sensing system 14

It is the aim of the seat sensing system 14 to inhibit air bag deployment when a seat is empty or occupied by a small child, while allowing deployment when the occupant is large For example the system may be tuned to always inhibit deployment for occupants weighing less than 66 pounds, and always allow deployment for occupants exceeding 105 pounds The seat occupant sensing system 14 comprises a microprocessor 22 having a 5 volt supply and an enabling line 24 periodically provided with a 5 volt enabling pulse, and a series of voltage dividers coupled between the enabling line 24 and ground Each voltage divider has a fixed resistor 26 in series with a pressure sensor or variable resistor 28, and the junction point of each resistor 26 and variable resistor 28 is connected to an A/D port 30 of the microprocessor 22 The microprocessor 22 controls the pulse on enabling line 24 and reads each sensor 28 voltage during the pulse period The microprocessor 22 analyzes the sensor inputs and issues a decision whether to inhibit air bag deployment and the decision is coupled to the microprocessor 16 by a line 32 The microprocessor 22 also monitors its decisions for consistency and issues a fault signal on line 34 to the microprocessor 16 if faults continue to occur over a long period

Each fixed resistor 26 is, for example, 10 kohms and the variable resistors vary between 10 kohms at high pressure and 100 kohms at low pressure Then the voltage applied to the ports 30 will vary with pressure Each sensor comprises two polyester sheets each having a film of resistive ink connected to a conductive electrode, the two resistive films contacting one another such that the resistance between electrodes decreases as pressure increases Such pressure sensors are available as ALPS pressure sensors from Alps Electric Co , Ltd , Tokyo, Japan

Figure 2 shows a seat cushion 36 having an upper surface 38 for holding an occupant, and a lower surface 40 seated on a rigid sheet or plastic form 42 which in turn is supported by

a seat subassembly 44 The form 42, also shown in Figure 3, holds a dozen pressure sensors 28 on its upper surface so that the sensors are pressed against the bottom surface 40 of the seat cushion 36 Automotive seat cushions assemblies do not normally have the form 42 but here it serves to hold the sensors 28 and to provide a reaction surface for the sensors, allowing each sensor to detect a force imposed by the weight of a seat occupant

The method of operation is illustrated by a series of flowcharts wherein the functional description of each block in the chart is accompanied by a number in angle brackets <nn> which corresponds to the reference number of the block The overall operation is shown in Figure 4 wherein the sensor values are read by the microprocessor 22 <46> and the data is adjusted by bias correction and low pass filtering <48> Once every 100 ms one sensor at a time is turned on and sampled Then a bias calibrated for each sensor is subtracted from each sensor reading Then all decision measures are computed <50> and decision algorithms are run <52> The algorithm output is filtered to avoid the effects of transient events and ultimately a decision is made to allow or inhibit air bag deployment <54> Then either an inhibit signal is issued <56> or an allow signal is issued <58> The microprocessor executes the algorithm every 100 ms

The computation of decision measures, as shown in Figure 5, involves calculating total force and its threshold, sensor load ratings and measure, long term average of sensor readings and its threshold, the measure of each sensor group (right, left, etc) and corresponding threshold, and a fuzzy measure of sensor readings A fixed threshold is provided for the fuzzy measure and the load rating measure The other thresholds are variable

The variable threshold for a measure will slowly increase if the measure is above a selected minimum activity level (chosen for each measure) and will quickly decrease if the measure is below the level Inhibit times are chosen for each measure to control the rate of increase or decrease, for increase

the time T1 is preferably in the range of 30 to 300 seconds, and for decrease the time T2 is preferably less than 1 second The threshold is allowed to vary between a minimum value and a maximum value The variable threshold is calculated as shown in Figure 6 For this and subsequent flowcharts the functional description of each block in the chart is accompanied by a number in angle brackets <nn> which corresponds to the reference number of the block Inhibit times are selected for each measure The inhibit times T1 and T2 for the particular measure is retrieved from memory <60> If the measure is above the minimum activity level <62> and below the variable threshold <64>, and a timer is greater than T2 <66>, the threshold is incremented <68> and the timer is reset <70> When the measure is less than the minimum activity level <62> and the timer exceeds T1 <72>, the threshold is decremented <74> and the timer reset <70>

Referring again to Figure 5, the total force is simply the sum of the sensor outputs The load ratings are determined in the same way as in the above mentioned application SN 08/566,029 and as reflected in Figure 7 There if a measure has a value lower than a it has a zero rating and if it has a value greater than b has a maximum rating, while intermediate values are linearly dependent on the measure Thus each sensor is given a rating (fuzzy term) depending on its output and reflects the certainty that a load is present The sum of the ratings gives the load rating measure The long term average is calculated by 1) averaging all the sensor outputs in each sample period, 2) averaging all of the averages over, say, 16 sample periods, and then 3) long term filtering the result by passing the result through a low pass software filter with a 10 to 20 second time constant The filter output is the long term average measure Each group measure is the sum of sensor outputs for various groups of sensors such as a right group, left group, front group, rear group and central group

The fuzzy measure is calculated by 1) applying the Figure 7 function to the long term average measure to obtain a long term fuzzy value, 2) applying the Figure 7 function to the

load rating measure to obtain a load rating fuzzy value, and 3) calculating the product of the two fuzzy values

Figure 8 is a flowchart for processing an Adult Lock Flag which will be used is the main decision algorithm The term "Adult" refers not to the age or maturity of an occupant but rather to a weight which is chosen to distinguish from a small child When the Adult Lock Flag is set, the output decision will always be to allow deployment The algorithm uses a lock threshold which is above the total force threshold range and an unlock threshold which represents an empty seat It also uses a lock delay on the order of one to five minutes, and a lock timer which measures the time since vehicle ignition is turned on If the decision filter 54 is at its maximum value, the total force is greater than the lock threshold, and the lock timer is larger than the lock delay <76>, a flag value is increased toward a maximum value <78> and the Adult Lock Flag is set <80> If the decision at block 76 is No, it is determined whether the total force is above the unlock threshold <82> and if not, whether the total force is below the unlock threshold and the flag value is greater than zero <84> If so, the flag value is decremented toward zero <86>, and in either case the flag value is tested <88>, if the value is above zero the Flag is set <80> and if the value is zero the Flag is cleared <90>

The main decision algorithm 42 is shown in Figure 9 Note that this algorithm will result in an allow or an inhibit decision, but this decision is preliminary, subject to subsequent filtering to obtain a final consent to deployment Each measure is determined to be high or low by comparison with its variable threshold if one has been computed, or against a fixed threshold The Adult Lock Flag is processed <92> according to Figure 8 and if the Flag is set <94> an allow decision is made If not, and the load rating is low <96> an inhibit decision is made If the rating is not low the total force is tested <98, 100> If high, an allow decision is issued and if low an inhibit decision is issued If neither, it is determined whether the long term average measure <102> the load rating <104>, or a group measure

<106> is high, and to issue an allow decision Finally, if no decision has yet been made, an allow or inhibit decision is made on the basis of the fuzzy measure <108>

The final judgment of whether to consent to deployment is made in the decision filter as shown in Figure 10 An up and down counter starting at zero and having a maximum count of 255 is used If an allow decision is made <42> the counter is incremented <110> and if an inhibit decision is made the counter is decremented <112> When the count exceeds 133 <114> final consent to deployment is granted <116>, if consent is already present, a count over 123 is needed to maintain that state to afford hysteresis When the count falls below 123 the consent is revoked and deployment will be inhibited Assuming that the increment size is one count, at the 100 ms loop execution rate a minimum of 13 3 seconds will be required to issue the consent, and at least 25 5 seconds are needed to reach the maximum count needed to set the Adult Lock Flag Similarly, once the maximum count is attained, at least 13 2 seconds are needed to revoke the consent

It will thus be seen that process of determining whether an adult size person is occupying the seat is carried out by analyzing sensor output with several measures to insure both that deployment will be allowed with a large occupant and will not occur with a small occupant Rapid detection of large adults is enabled by the total force and load rating measures, while dynamic sensor outputs caused by frequent occupant movement are managed by the long term average measure The fuzzy measure helps discriminate between large and small occupants in borderline cases The seat structure with sensors placed on the bottom surface of the seat cushion permits sensing of occupant weight without great sensitivity to localized forces on the top surface of the seat Off center weight distributions caused by sitting on a seat edge or leaning in one direction are still detectable

8

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows

1 In a vehicle restraint system having a controller for deploying air bags and means for selectively allowing deployment according to the outputs of seat sensors responding to the weight of an occupant, a method of allowing deployment according to sensor response including the steps of

determining measures represented by individual sensor outputs and calculating from the sensor outputs a relative weight parameter,

establishing a first threshold of the relative weight parameter,

allowing deployment when the relative weight parameter is above the first threshold,

establishing a lock threshold above the first threshold,

setting a lock flag when the relative weight parameter is above the lock threshold and deployment has been allowed for a given time,

establishing an unlock threshold at a level indicative of an empty seat,

clearing the flag when the relative weight parameter is below the unlock threshold for a time, and

allowing deployment while the lock flag is set

2 The method defined in claim 1 wherein the means for allowing deployment also is capable of inhibiting deployment, including

establishing a second threshold of the relative weight parameter, and

inhibiting deployment when the relative weight parameter is below the second threshold

3 The method defined in claim 1 wherein the relative weight parameter is the total force detected by all the sensors

4 The method defined in claim 1 wherein the relative weight parameter is a long term average obtained by the following steps

averaging all sensor outputs over a plurality of sample events to obtain a cumulative average, and

long term filtering the cumulative average to obtain the long term average

5 The method defined in claim 1 wherein the relative weight parameter is a load rating obtained by

calculating a load rating for each sensor as a function of the difference between the sensor output and a base value, and

summing the load rating for all the sensors to derive a total load rating

6 The method defined in claim 1 wherein the relative weight parameter is a fuzzy value obtained by

calculating a total load rating for all the sensors,

determining a fuzzy load value from the total load rating,

calculating a long term average for all the sensors,

determining a fuzzy average value from the long term average, and

combining the fuzzy average and the fuzzy load value to obtain the fuzzy value

7 The method defined in claim 1 wherein the step of setting the lock flag is executed in repetitive loops and comprises

incrementing a flag value toward a maximum value in each loop when the relative weight parameter is above the lock threshold,

10

decrementing the flag value toward zero in each loop when the relative weight parameter is less than the unlock threshold, and

setting the lock flag when the flag value is greater than zero and clearing the flag when the flag value is zero, so that the flag value at any time determines the minimum time for clearing the flag

8 The method defined in claim 7 including

enabling the incrementing step only when a decision filter reaches a maximum count, and

the decision filter includes

incrementing a counter toward a maximum count in each loop when an allow decision is present, and

decrementing the counter when an allow decision is absent

9 The method defined in claim 1 wherein a step of allowing deployment is a preliminary allow decision and final deployment consent is attained by long term filtering of the allow decision

10 The method defined in claim 1 wherein a step of allowing deployment is a preliminary allow decision and final deployment consent is attained by the steps of

beginning at a zero count, periodically incrementing a counter toward a maximum count when an allow decision is present,

periodically decrementing the counter when an allow decision is absent,

establishing an allow threshold, and

issuing deployment consent when the counter count exceeds the threshold

11 The method defined in claim 10 wherein the allow threshold has a first value when deployment consent is absent and

a lower value when deployment consent is present to afford hysteresis

12 The method defined in claim 1 wherein the step of establishing a first threshold includes varying the first threshold over time as a function of the relative weight parameter when the relative weight parameter is below the first threshold

13 The method defined in claim 1 wherein the step of establishing a first threshold includes varying the first threshold over time within a defined range by the steps of

setting a minimum activity level of the relative weight parameter below the defined range,

increasing the first threshold when the relative weight parameter is above the minimum activity level and below the first threshold,

decreasing the first threshold when the relative weight parameter is below the minimum activity level

14 The method defined in claim 13 wherein increasing the first threshold is permitted only after set adjustment times have elapsed since a previous variation

15 The method defined in claim 13 wherein increasing or decreasing the first threshold is permitted only after set adjustment times have elapsed since the previous adjustment

16 In a vehicle restraint system having a controller for deploying air bags and means for inhibiting deployment when a seat is not occupied by an adult including seat sensors responding to the weight of an occupant, a method of inhibiting and allowing deployment according to sensor response including the steps of

determining forces represented by individual sensor outputs and total force represented by all sensor outputs,

establishing a first threshold of total force and a second threshold below the first threshold,

inhibiting deployment when the total force is below a second threshold, and allowing deployment when the total force is above the first threshold,

establishing a lock threshold above the first threshold,

setting a lock flag when the total force is above the lock threshold and deployment has been allowed for a given time,

establishing an unlock threshold at a level indicative of an empty seat,

clearing the flag when the total force is below the unlock threshold for a time, and

allowing deployment while the lock flag is set

17 In a vehicle restraint system having a controller for deploying air bags, means for inhibiting and allowing deployment according to whether a seat is occupied by a person of at least a minimum weight comprising

seat sensors responding to the weight of an occupant to produce sensor outputs,

a microprocessor coupled to the sensor outputs and programmed to inhibit and allow deployment according to sensor response and particularly programmed to

determine measures represented by individual sensor outputs and calculate from the sensor outputs a relative weight parameter,

establish a first threshold of the relative weight parameter,

allow deployment when the relative weight parameter is above the first threshold,

establish a lock threshold above the first threshold,

set a lock flag when the relative weight parameter is above the lock threshold and deployment has been allowed for a given time,

establish an unlock threshold at a level indicative of an empty seat,

clear the flag when the relative weight parameter is below the unlock threshold for a time, and

allow deployment while the lock flag is set

18 Means for inhibiting and allowing deployment as defined in claim 17 wherein

the seat comprises a resilient pad having a top surface for bearing an occupant and a bottom surface,

a support mounting the bottom surface, and

the seat sensors are arrayed on the bottom surface for sensing forces imposed by the weight of the occupant

19 Means for inhibiting and allowing deployment as defined in claim 17 wherein

the seat comprises a resilient pad having a top surface for bearing an occupant and a bottom surface,

a support including a panel supporting the bottom surface, and

the seat sensors are arrayed in an interface defined by the bottom surface and the panel for sensing forces imposed by the weight of the occupant

20 Means for inhibiting and allowing deployment as defined in claim 17 wherein the microprocessor is further programmed to inhibit deployment when the relative weight parameter is below a second threshold

21 Means for inhibiting and allowing deployment as defined in claim 17 wherein the relative weight parameter is the total force detected by all the sensors

22 Means for inhibiting and allowing deployment as defined in claim 17 wherein relative weight parameter is a long

term average of sensor outputs and the microprocessor is further programmed to

average all sensor outputs over a plurality of sample events to obtain a cumulative average, and

long term filter the cumulative average to obtain the long term average

23 Means for inhibiting and allowing deployment as defined in claim 17 wherein the relative weight parameter is a total load rating of the sensors and the microprocessor is further programmed to

calculate a load rating for each sensor as a function of the difference between the sensor output and a base value, and

sum the load rating for all the sensors to derive a total load rating

24 Means for inhibiting and allowing deployment as defined in claim 17 wherein to set the lock flag the microprocessor ~~and~~ is further programmed to

periodically increment a flag value toward a maximum value when the relative weight parameter is above the lock threshold,

periodically decrement the flag value toward zero when the relative weight parameter is less than the unlock threshold, and

set the lock flag when the flag value is greater than zero and clear the flag when the flag value is zero, ~~whereby~~ so that the flag value at any time determines the minimum time for clearing the flag

25 Means for inhibiting and allowing deployment as defined in claim 17 wherein a decision to allow deployment is a preliminary decision, and to make a final consent decision the microprocessor is programmed to

periodically increment a counter toward a maximum count when an allow decision is present,

periodically decrement the counter when an allow decision is absent,

establish an allow threshold, and

issue final consent when the counter count exceeds the threshold

26 Means for inhibiting and allowing deployment as defined in claim 17 wherein to establish a threshold the microprocessor is programmed to vary the first threshold over time as a function of the relative weight parameter when the relative weight parameter is below the first threshold

27 Means for inhibiting and allowing deployment as defined in claim 17 wherein to establish a first threshold which is variable within a defined range the microprocessor is programmed to

set a minimum activity level of the relative weight parameter below the defined range,

increase the first threshold when the relative weight parameter is above the minimum activity level and below the first threshold, and

decrease the first threshold when the relative weight parameter is below the minimum activity level

H-198088

OCCUPANT DETECTION METHOD AND
APPARATUS FOR AIR BAG SYSTEM

Abstract of the Disclosure

Pressure sensors on the bottom surface of a seat cushion respond to occupant weight A microprocessor evaluates the sensor outputs according to total force, load rating, long term average, sensor groups and a fuzzy measure to discriminate between large and small occupants and allow air bag deployment for large but not small occupants Allow and inhibit decisions are filtered avoid sudden response to transient pressure changes on the seat When a large occupant is positively detected, an allow decision is locked in place as long as total force exceeds a threshold

PRINT OF DRAWINGS
AS ORIGINALLY FILED

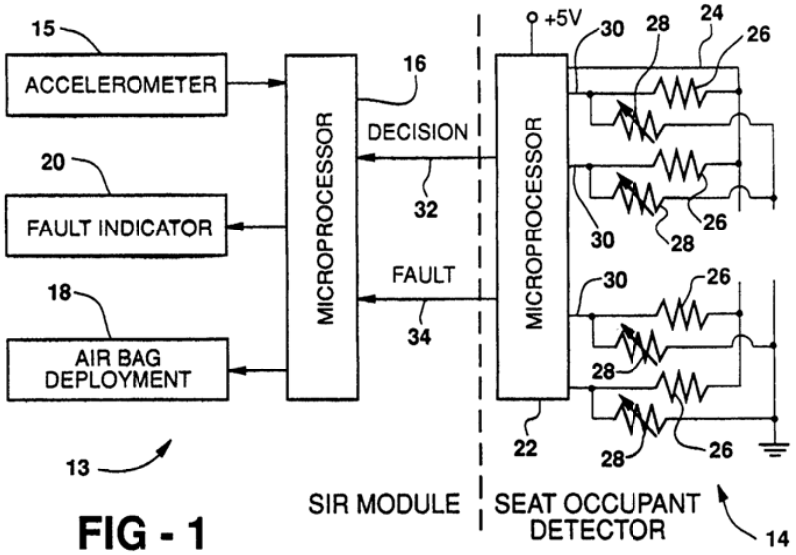


FIG - 1

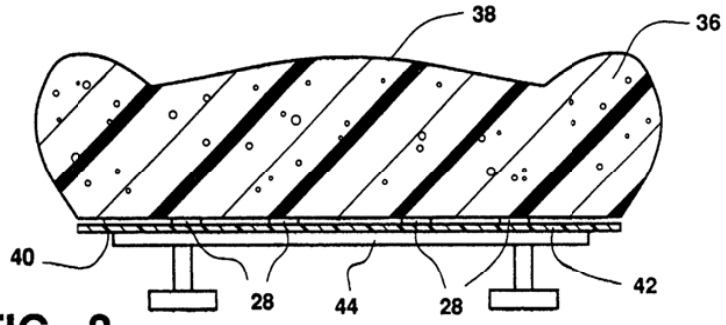


FIG - 2

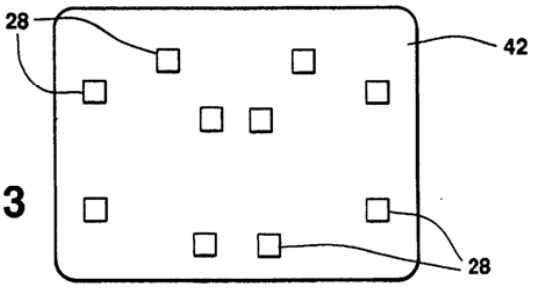


FIG - 3

FIG - 4

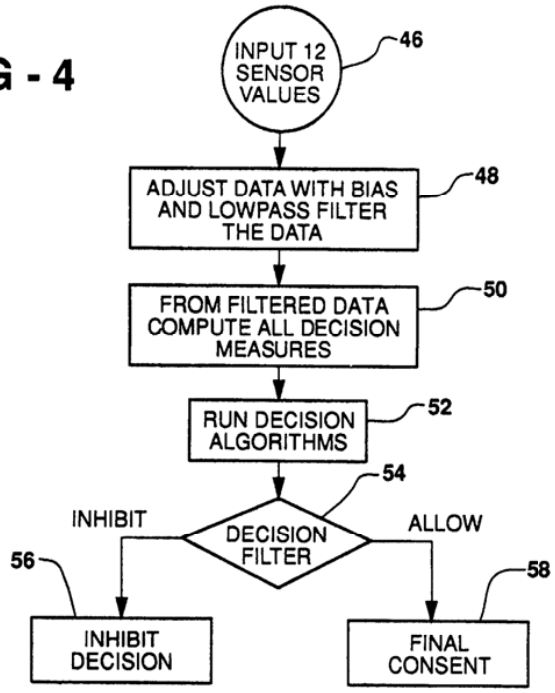

INPUT 12 SENSOR VALUES
46
ADJUST DATA WITH BIAS AND LOWPASS FILTER THE DATA
48
FROM FILTERED DATA COMPUTE ALL DECISION MEASURES
50
RUN DECISION ALGORITHMS
52
54
INHIBIT
DECISION FILTER
ALLOW
56
58
INHIBIT DECISION
FINAL CONSENT

FIG - 5

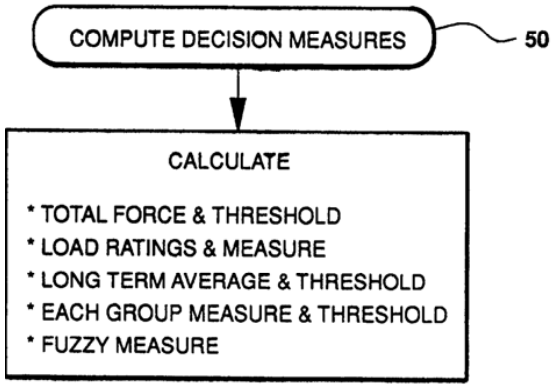

COMPUTE DECISION MEASURES
50
CALCULATE
* TOTAL FORCE & THRESHOLD
* LOAD RATINGS & MEASURE
* LONG TERM AVERAGE & THRESHOLD
* EACH GROUP MEASURE & THRESHOLD
* FUZZY MEASURE

FIG - 6

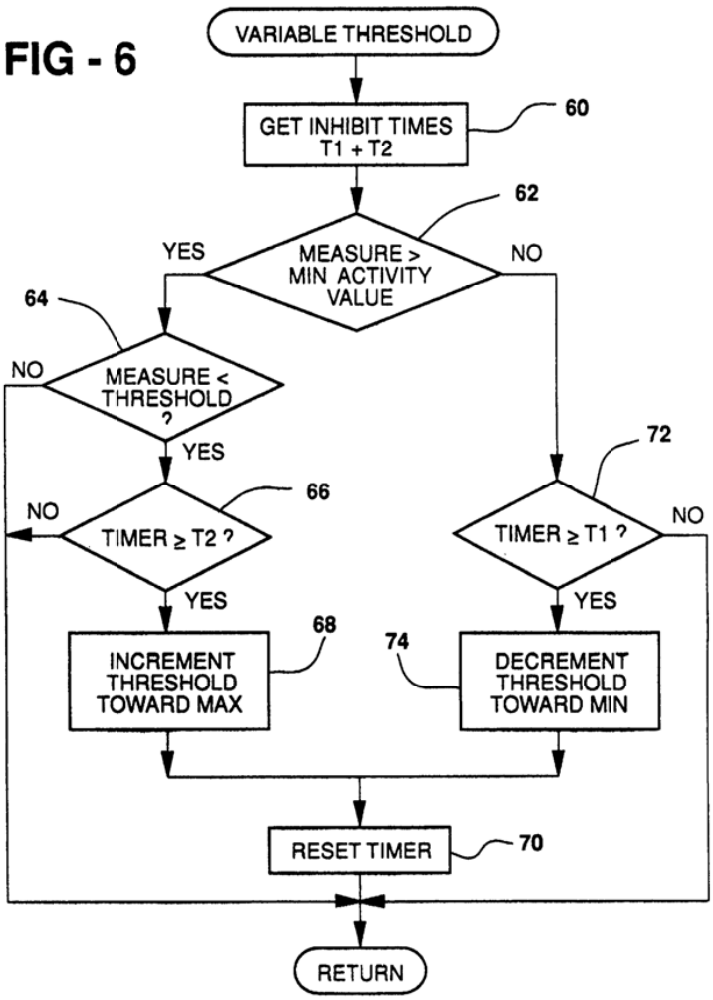

VARIABLE THRESHOLD
GET INHIBIT TIMES T1 + T2
60
62
MEASURE > MIN ACTIVITY VALUE
YES
NO
64
MEASURE < THRESHOLD ?
NO
YES
72
66
TIMER ≥ T2 ?
NO
TIMER ≥ T1 ?
NO
YES
YES
68
74
INCREMENT THRESHOLD TOWARD MAX
DECREMENT THRESHOLD TOWARD MIN
RESET TIMER
70
RETURN

FIG - 7

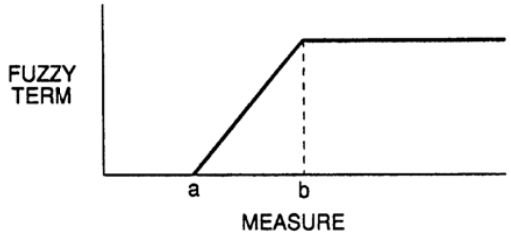

FUZZY TERM
a
b
MEASURE

FIG - 9

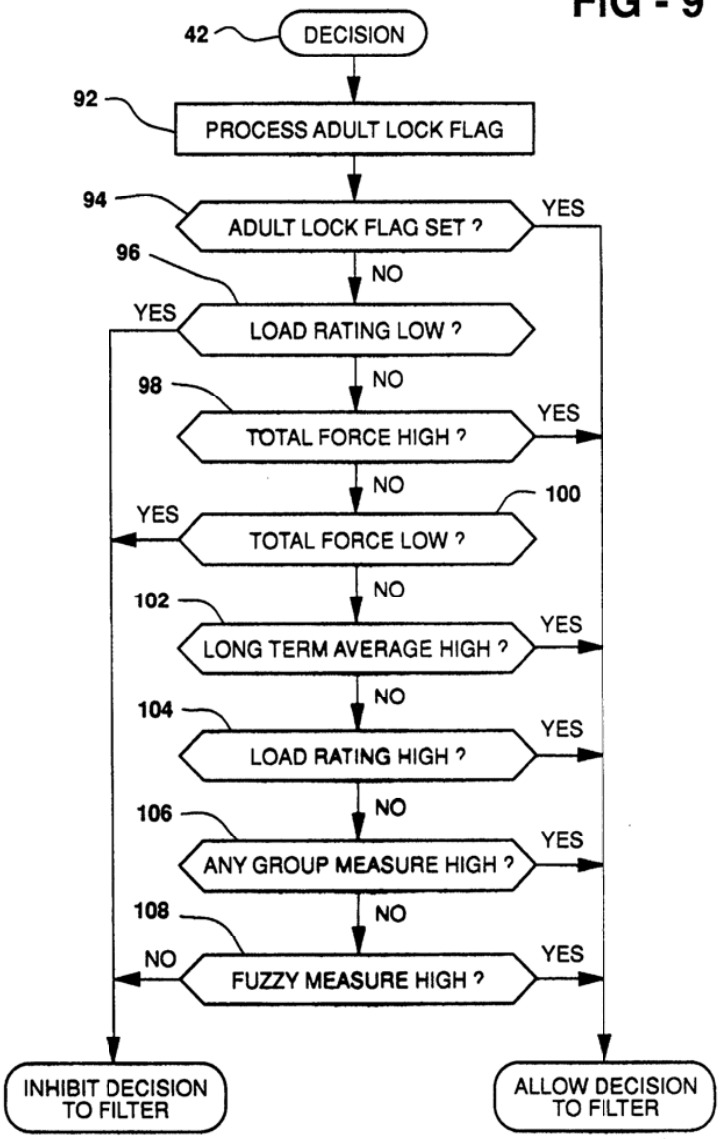

42
DECISION
92
PROCESS ADULT LOCK FLAG
94
ADULT LOCK FLAG SET ?
YES
NO
96
LOAD RATING LOW ?
YES
NO
98
TOTAL FORCE HIGH ?
YES
NO
100
TOTAL FORCE LOW ?
YES
NO
102
LONG TERM AVERAGE HIGH ?
YES
NO
104
LOAD RATING HIGH ?
YES
NO
106
ANY GROUP MEASURE HIGH ?
YES
NO
108
FUZZY MEASURE HIGH ?
NO
YES
INHIBIT DECISION TO FILTER
ALLOW DECISION TO FILTER

FIG - 8

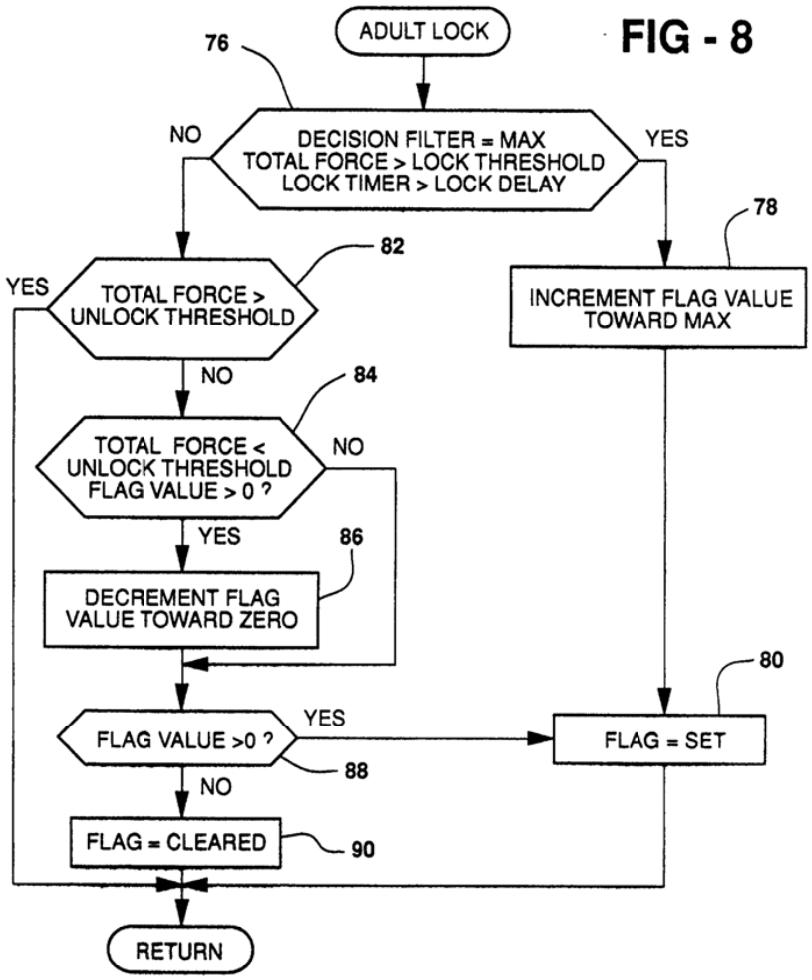
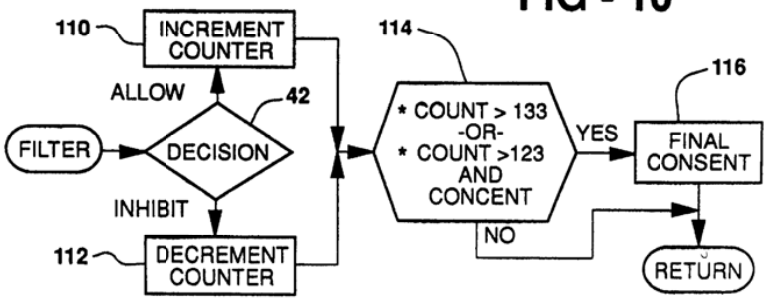

ADULT LOCK
76
DECISION FILTER = MAX
TOTAL FORCE > LOCK THRESHOLD
LOCK TIMER > LOCK DELAY
NO
YES
78
INCREMENT FLAG VALUE
TOWARD MAX
82
YES
TOTAL FORCE >
UNLOCK THRESHOLD
NO
84
TOTAL FORCE <
UNLOCK THRESHOLD
FLAG VALUE > 0 ?
NO
YES
86
DECREMENT FLAG
VALUE TOWARD ZERO
80
FLAG VALUE >0 ?
YES
FLAG = SET
88
NO
FLAG = CLEARED
90
RETURN

FIG - 10


110
INCREMENT
COUNTER
ALLOW
42
FILTER
DECISION
INHIBIT
112
DECREMENT
COUNTER
114
* COUNT > 133
-OR-
* COUNT >123
AND
CONCENT
YES
116
FINAL
CONSENT
NO
RETURN

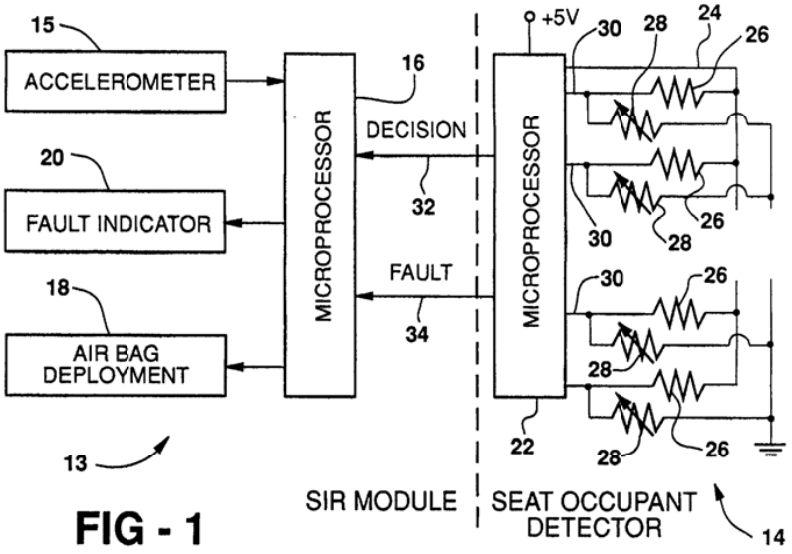


FIG - 1

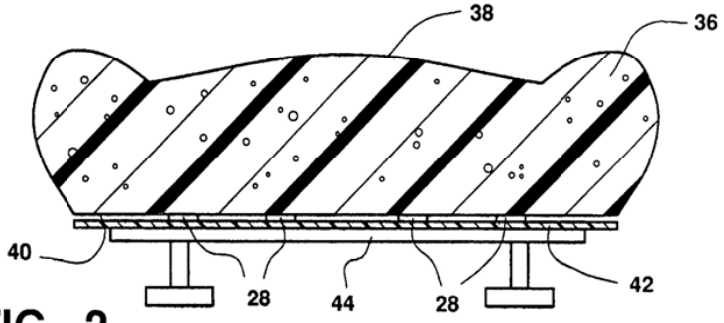


FIG - 2

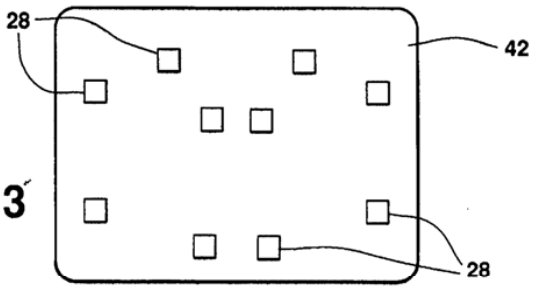


FIG - 3

10 Flop

FIG - 4

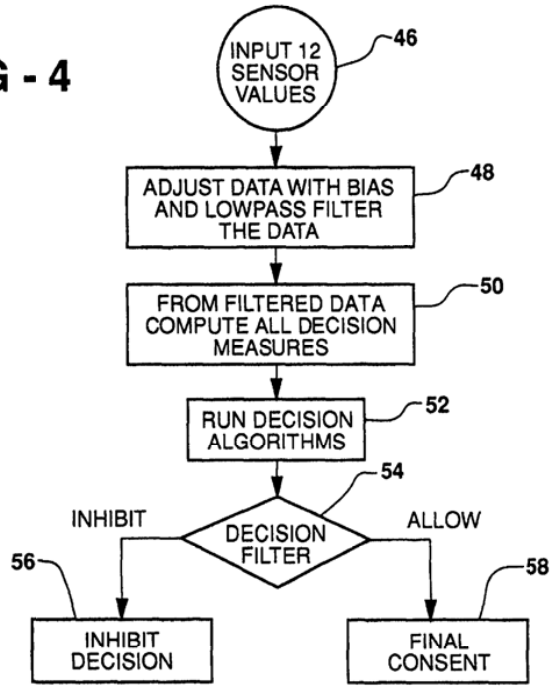

INPUT 12 SENSOR VALUES
46
ADJUST DATA WITH BIAS AND LOWPASS FILTER THE DATA
48
FROM FILTERED DATA COMPUTE ALL DECISION MEASURES
50
RUN DECISION ALGORITHMS
52
54
INHIBIT
DECISION FILTER
ALLOW
56
58
INHIBIT DECISION
FINAL CONSENT

FIG - 5

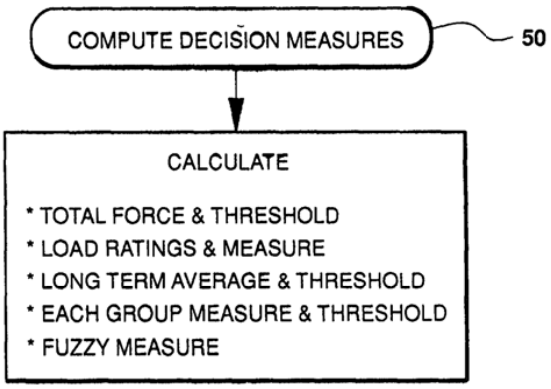

COMPUTE DECISION MEASURES
50
CALCULATE
* TOTAL FORCE & THRESHOLD
* LOAD RATINGS & MEASURE
* LONG TERM AVERAGE & THRESHOLD
* EACH GROUP MEASURE & THRESHOLD
* FUZZY MEASURE

FIG - 6

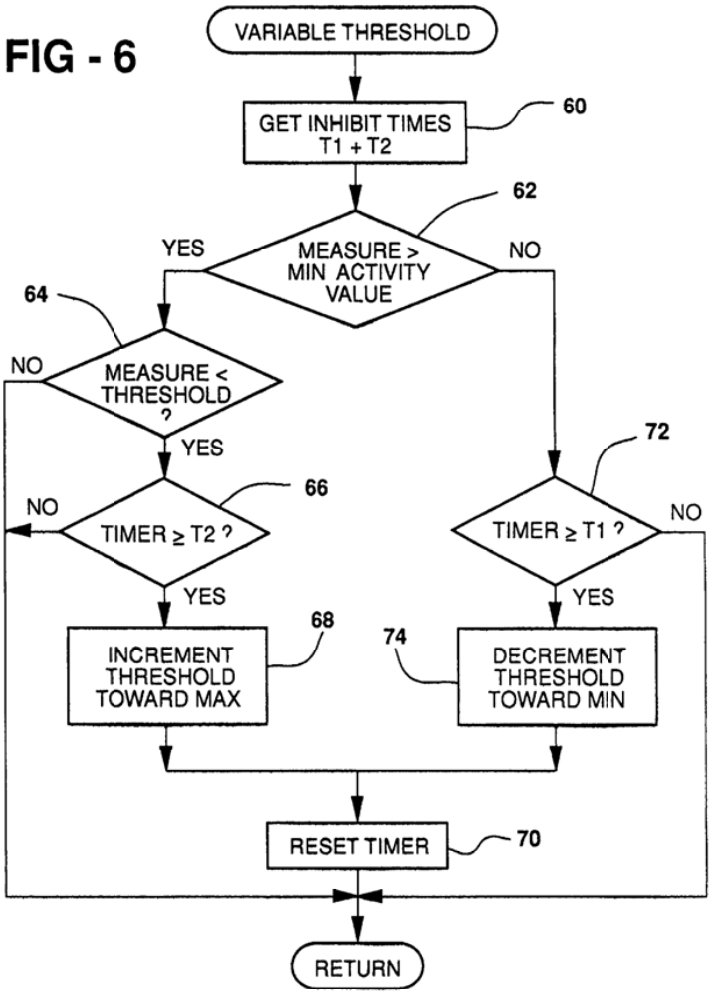

VARIABLE THRESHOLD
GET INHIBIT TIMES T1 + T2
60
62
MEASURE > MIN ACTIVITY VALUE
YES
NO
64
MEASURE < THRESHOLD ?
NO
YES
66
TIMER ≥ T2 ?
NO
YES
72
TIMER ≥ T1 ?
NO
YES
68
INCREMENT THRESHOLD TOWARD MAX
74
DECREMENT THRESHOLD TOWARD MIN
RESET TIMER
70
RETURN

FIG - 7

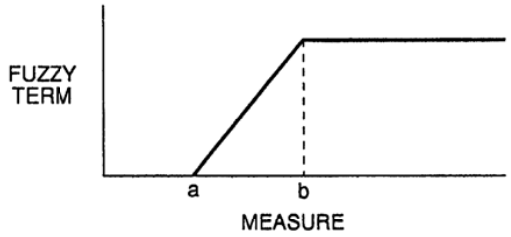

FUZZY TERM
a
b
MEASURE

FIG - 9

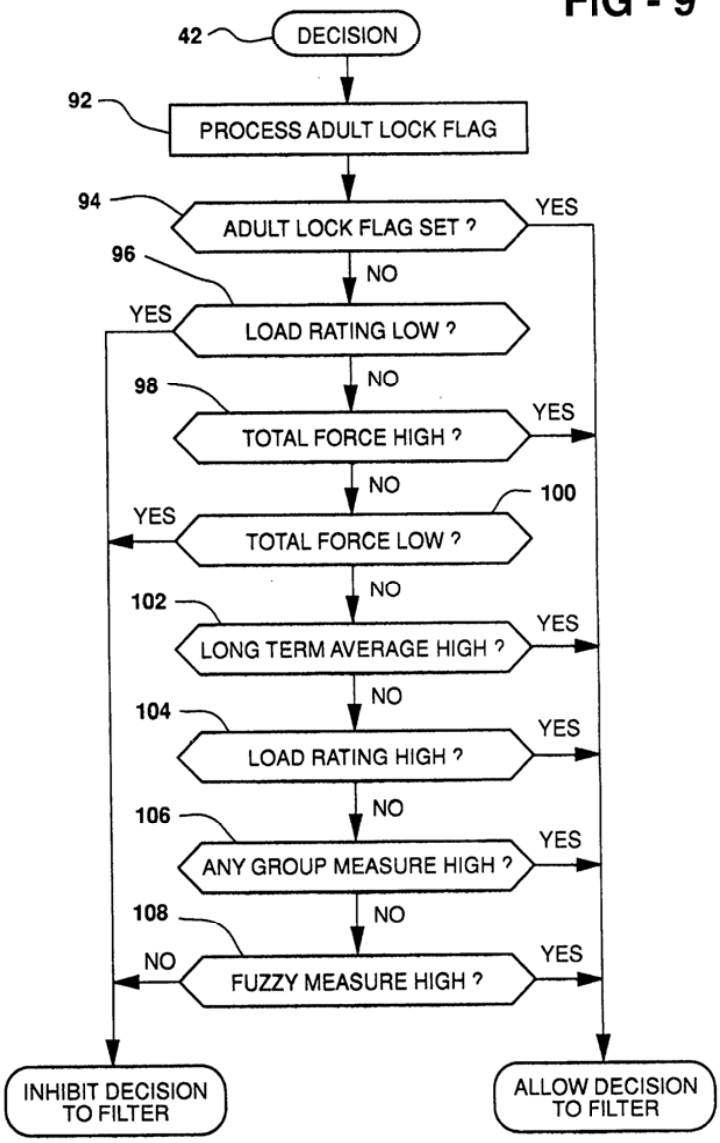

42
DECISION
92
PROCESS ADULT LOCK FLAG
94
ADULT LOCK FLAG SET ?
YES
NO
96
LOAD RATING LOW ?
YES
NO
98
TOTAL FORCE HIGH ?
YES
NO
100
TOTAL FORCE LOW ?
YES
NO
102
LONG TERM AVERAGE HIGH ?
YES
NO
104
LOAD RATING HIGH ?
YES
NO
106
ANY GROUP MEASURE HIGH ?
YES
NO
108
FUZZY MEASURE HIGH ?
NO
YES
INHIBIT DECISION TO FILTER
ALLOW DECISION TO FILTER

FIG - 8

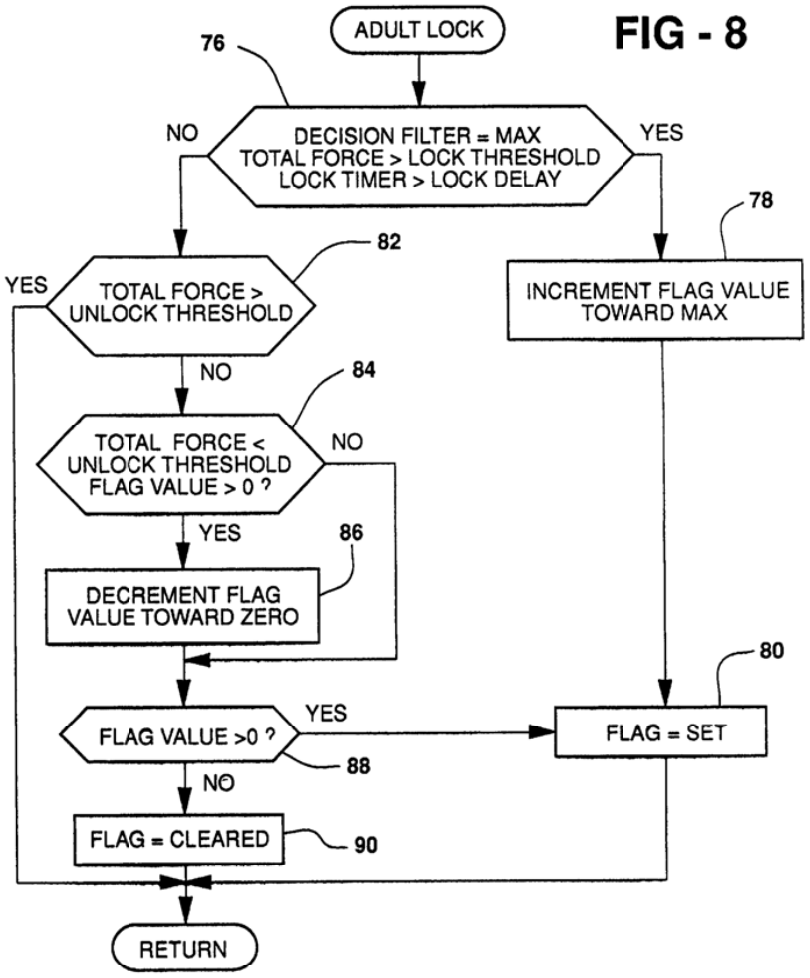
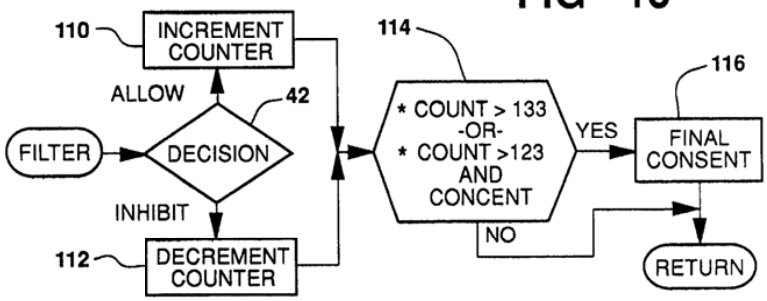

ADULT LOCK
76
DECISION FILTER = MAX
TOTAL FORCE > LOCK THRESHOLD
LOCK TIMER > LOCK DELAY
NO
YES
78
INCREMENT FLAG VALUE
TOWARD MAX
82
YES
TOTAL FORCE >
UNLOCK THRESHOLD
NO
84
TOTAL FORCE <
UNLOCK THRESHOLD
FLAG VALUE > 0 ?
NO
YES
86
DECREMENT FLAG
VALUE TOWARD ZERO
80
FLAG VALUE >0 ?
YES
FLAG = SET
88
NO
FLAG = CLEARED
90
RETURN

FIG - 10


110
INCREMENT
COUNTER
ALLOW
42
FILTER
DECISION
INHIBIT
112
DECREMENT
COUNTER
114
* COUNT > 133
-OR-
* COUNT >123
AND
CONCENT
YES
116
FINAL
CONSENT
NO
RETURN

DECLARATION
and
DESIGNATION OF CORRESPONDENCE ADDRESS

As an inventor named below I hereby declare that

My residence post office address and citizenship are stated below next to my name

I believe I am the original first and sole inventor (if only one inventor is named below) or an original first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought in the specification H-198088 entitled

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

I have reviewed and understand the contents of the above identified specification including the claims as amended by any amendment referred to in this Declaration

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in title 37 Code of Federal Regulations section 1 56

I further declare that all statements made above of my own knowledge are true that all statements made above on information and belief are believed to be true and that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment or both under title 18 United States Code section 1001 and may jeopardize the validity of the application or any patent issuing thereon

Address all communications to JIMMY L FUNKE
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P O BOX 9005
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Telephone 317/451-3481

Inventor s signature Duane Donald Fortune Date 5-28-97

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Post office address 6605 NORTH CALDWELL ROAD
LEBANON IN 46052

Inventor s signature Robert John Cashler Date 5/28/97

Full name ROBERT JOHN CASHLER Citizenship US
Residence KOKOMO IN
Post office address 803 WILLIAMSBURG DRIVE
KOKOMO IN 46902

RS-9 REV 2/23/96

H-198088

AD

68188 U S PTO 06/03/97

DELCO ELECTRONICS CORPORATION
P O BOX 9005
ERC BUILDING - MS D-32
KOKOMO IN 46904

5/30/97

Assistant Commissioner for Patents
Washington D C 20231

Enclosed for recording is Assignment documentation for the following patent application

Docket No	H-198088
(1) Assignor/Inventors	DUANE DONALD FORTUNE ROBERT JOHN CASHLER
(2) Assignee	DELCO ELECTRONICS CORPORATION ERC Building - Mail Stop D-32 - Kokomo IN 46904
(3) Assignment of patent application	
(4) Application number If blank this documentation is filed together with the patent application	
(5) Address correspondence to	JIMMY L FUNKE Delco Electronics Corporation - P O BOX 9005 ERC Building - Mail Stop D-32 - Kokomo IN 46904
(6) Number of applications Total Fee	1 40 00
(7) Date documentation executed	5/28/97
(8) Not applicable	
(9) To the best of my knowledge and belief the information contained on this cover sheet is true and correct and any copy submitted is a true copy of the original document	
Title	OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

Please charge the $40 00 assignment recording fee to Delco Electronics Corporation Deposit Account No 04-0549

Jimmy L Funke

JIMMY L FUNKE
317/451-3481

Total number of pages including cover sheet attachments and document 3

Enclosures

ASSIGNMENT

Pursuant to an agreement relating to work I have performed for DELCO ELECTRONICS CORPORATION I formally assign to DELCO ELECTRONICS CORPORATION a corporation of DELAWARE having a place of business at KOKOMO INDIANA the entire right title and interest, in all countries in the improvements set forth in the United States patent application H-198088 entitled

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

for which I executed a declaration dated as indicated below I further acknowledge that I was obligated to so assign such improvements at the time such improvements were made If the patent application has been filed I authorize attorney JIMMY L FUNKE to insert the application number and filing date of said application here in parentheses (_____ filed _____) when known

Inventor s signature Duane Donald Fortune Date 5-28-97

Full name DUANE DONALD FORTUNE Declaration dated 5-28-97

Residence LEBANON IN

Inventor s signature Robert John Cashler Date 5/28/97

Full name ROBERT JOHN CASHLER Declaration dated 5/28/97

Residence KOKOMO IN

On this 28th day of May 1997 before me personally appeared DUANE DONALD FORTUNE known to me to be the person who executed the foregoing instrument and acknowledged that he/she executed the same

Carole J Murdock
Notary Public
My commission expires 9/13/97
County of Authorization Howard

(SEAL)

On this 28th day of May 1997 before me personally appeared ROBERT JOHN CASHLER known to me to be the person who executed the foregoing instrument and acknowledged that he/she executed the same

Carole J. Murdock
Notary Public
My commission expires 9/13/97
County of Authorization Howard

(SEAL)

#2
cc
1217

PAGE 1 of 1 OMB NO 0651-0011(12/31/86)

INFORMATION DISCLOSURE CITATION WITH DOCUMENT COPIES

Submitted by

Jimmy L. Funke

JIMMY L FUNKE
Registration No 34166

Atty Docket No H-198088

Serial No 08/868,338

Applicant DUANE DONALD FORTUNE

Filing Date 3 June 1997

Group Art Unit 3661

U S PATENT DOCUMENTS

Exam Init	Document Number	Date	Name	Class	Subclass	Filing Date (if approp)
YB	5,474,327	12/12/95	Schousek	280	730-1	
YB	5,430,649	7/4/95	Cashler, et al	364	424 05	
YB	~~08/566,029~~ 5,732,375	3/24/98	Cashler	701	45	12/1/95

65959 U S PTO
08/868338
06/03/97

FOREIGN PATENT DOCUMENTS

Exam Init	Document Number	Date	Country	Class	Subclass	Translation Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc)

Examiner Beaulieu

Date Considered 3 April 1999

*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

Form PTO-FB-A820 (also PTO-1449) Patent & Trademark Office - U S Dept of Commerce

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner of Patents and Trademarks Washington D C 20231 on

May 30 1997
Date

Carole J. Murdock
Signature

Carole J Murdock
Name

Transaction History Date 1997-12-19.
Date information retrieved from USPTO Patent Application Information Retrieval (PAIR) system records at www.uspto.gov

#3 KW 12-19-97 (Criterion)

RS-7 REV 8/31/95 H-198088

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

H-198088

DUANE DONALD FORTUNE
ROBERT JOHN CASHLER

OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

POWER OF ATTORNEY AND
DESIGNATION OF CORRESPONDENCE ADDRESS

As an agent of Delco Electronics Corporation who is the assignee of this patent application I hereby appoint the following attorney employed by Delco Electronics Corporation to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith

JIMMY L FUNKE (Reg No 34166)

Address all communications to

JIMMY L FUNKE
Delco Electronics Corporation - P O BOX 9005
ERC Building - Mail Stop D-32 - Kokomo IN 46904
Telephone 317/451-3481

I hereby declare and certify that I am an agent of Delco Electronics Corporation and Delco Electronics Overseas Corporation and am empowered to make the above appointment that the assignee s ownership of this patent application is established by the attached assignment documentation that the attached documentation is a true copy of the original documentation that the original or a true copy of the attached documentation has been or is concurrently being submitted to the Patent and Trademark Office for recording that the attached documentation has been reviewed and that to the best of the assignee s knowledge and belief title is in the assignee seeking to take the action I further declare that the foregoing statements made of my own knowledge are true and made on information and belief are believed to be true and made with the understanding that willful false statements and the like are punishable by fine or imprisonment or both under title 18 United States Code section 1001 and may jeopardize the validity of this application or any patent issuing thereon

By Jimmy L. Funke

Name JIMMY L. FUNKE- Agent

Date 5/30/97

Transaction History Date) 999-04-09
Date information retrieved from USPTO Patent Application Information Retrieval (PAIR) system records at www.uspto.gov

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UNITED STA S DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address COMMISSIONER OF PATENTS AND TRADEMARKS
Washington D C 20231

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

EXAMINER
[illegible]

ART UNIT	PAPER NUMBER
[illegible]	4

DATE MAILED [illegible]

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

Commissioner of Patents and Trademarks

PTO 90C (Rev 2/95)

1 File Copy

Office Action Summary	Application No 08/868 338	Applicant(s) Fortune et al
	Examiner Yonel Beaulieu	Group Art Unit 3661

☐ Responsive to communication(s) filed on _____

☐ This action is **FINAL**

☐ 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

A shortened statutory period for response to this action is set to expire 3 month(s) or thirty days whichever is longer from the mailing date of this communication Failure to respond within the period for response will cause the application to become abandoned (35 U S C § 133) Extensions of time may be obtained under the provisions of 37 CFR 1 136(a)

Disposition of Claims

☒ Claim(s) 1 27 is/are pending in the application

Of the above claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed

☒ Claim(s) 1 27 is/are rejected

☐ Claim(s) _____ is/are objected to

☐ Claims _____ are subject to restriction or election requirement

Application Papers

☒ See the attached Notice of Draftsperson s Patent Drawing Review PTO 948

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The proposed drawing correction filed on _____ is ☐approved ☐disapproved

☐ The specification is objected to by the Examiner

☐ The oath or declaration is objected to by the Examiner

Priority under 35 U S C § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U S C § 119(a) (d)

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received

☐ received in Application No (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17 2(a))

*Certified copies not received _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U S C § 119(e)

Attachment(s)

☒ Notice of References Cited PTO 892

☒ Information Disclosure Statement(s) PTO 1449 Paper No(s) 2

☐ Interview Summary PTO 413

☒ Notice of Draftsperson s Patent Drawing Review PTO 948

☐ Notice of Informal Patent Application PTO 152

SEE OFFICE ACTION ON THE FOLLOWING PAGES

DETAILED ACTION

Information Disclosure Statement

1 The listing of reference 5,474,374 in the specification (see page 1 bridging lines 26/27) is not a proper information disclosure statement 37 CFR 1 98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper " Therefore, unless the reference 5,474,327 has been cited by the examiner on form PTO-892, it has not been considered

Specification

2 The disclosure is objected to because of the following informality Applicant is kindly requested to update the status of Application SN 08/566,029 to Cashler (see Specification at page 1, line 28) in response to this Office action Appropriate correction is required

Drawings

3 Figure 1 should be designated by a legend such as --Prior Art-- (see specification at page 3, lines 5/6) because only that which is old is illustrated See MPEP § 608 02(g)

Claim Objections

4 Claims 2, 7, and 24 are objected to because of the following informalities it is noted in claim 2, the use of the phrase "capable of" (line 2), however, it has been held that the recitation that an element is "capable of" performing a function is not a positive limitation but only requires the ability to so perform It does not constitute a limitation in any patentable sense *In re Hutchison*, 69 USPQ 138

It is further noted in claims 7 and 24 the use of the clause "whereby" (lines 12, respectively), however, it has been held that the functional "whereby" statement does not define any structure and accordingly can not serve to distinguish *In re Mason*, 114 USPQ 127, 44 CCPA 937 (1957)

Moreover, in claim 24 at line 3, the word "and" appears to be extraneous, deletion of such is suggested Appropriate correction is required

Claim Rejections - 35 USC § 103

5 The following is a quotation of 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 of this title 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

6 Claims 1 - 3, 5 9 - 21, and 23 - 27 are rejected under 35 U S C 103(a) as being unpatentable over Cashler (US 5732375)

7 Regarding claims 1 - 3, 10, 11, 16, 17, 20, 21, and 23 - 27, Cashler teaches in a vehicle restraint system having a controller for deploying air bags and means for selectively allowing deployment according to seat sensors' outputs responding to an occupant's weight (col 1, lines 6 - 8), a method of allowing and inhibiting deployment (Title) including the steps of determining measures represented by individual sensor outputs and calculating from the outputs a relative weight parameter (at least col 2, lines 1-2 and 12 - 21), establishing a first threshold of the weight parameter and allowing deployment when the weight is above the threshold (col 5, lines 12 - 14 and 40 - 48), establishing and setting a threshold lock flag (utilizing fuzzy logic in system 14 when the seat is occupied) in order to allow deployment upon detecting the occupant's weight is above the threshold (see fig 8, note col 5, lines 12 - 18), establishing an unlock threshold at a level indicative of an empty seat (col 3, lines 48 - 54), inhibiting deployment when the relative weight parameter is below a second threshold (<72> in fig 8, col 3, lines 60/61 and col 5, lines 12 - 21), Cashler's relative weight parameter is the total force detected by all the sensors (col 2, lines 1 - 11, col 3, lines 49 - 51)

8 Regarding claims 4, 5, 9, 12, and 22 Cashler further teaches calculating a load rating for each sensor as a function of the difference between the sensor output and a base value and summing the load rating for all the sensors to derive the a total load rating (figs

4 - 6, at least col 4, lines 1 - 11), allowing deployment being attained by long term filtering of the allow decision (fig 3, col 2, lines 32 - 34, col 3, lines 33 - 40)

9 Regarding claims 18 and 19, Cashler's seat sensors (1 - 12 in figs 2 and 7) are arrayed in an interface on the seat's bottom surface for sensing forces imposed by the occupant's weight (col 1, lines 59 - 67, col 3, lines 21 - 32)

10 As discussed above, Cashler teaches all of the limitations except for explicitly reciting clearing the flag when the relative weight parameter is below the unlock threshold for a time (claims 1, 16, and 17)

11 However, because Cashler teaches a programmable microprocessor (col 1, line 67) along with other necessary features known in the SIR art, one skilled artisan at the time of the invention would have readily understood Cashler's system/method to be at least fully functionally equivalent to the system/method claimed because Cashler has been shown to suggest all of the structural required features necessary in order to achieve the same end result of discriminating between large and small seat occupants for determining of whether an airbag deployment should be permitted

12 Claims 6 - 8 and 13 - 15 are rejected under 35 U S C 103(a) as being unpatentable over Cashler as applied to claim 1 above

13 Regarding claims 6 - 8 and 13 - 15, while Cashler teaches utilizing fuzzy logic rule and establishing variation of the threshold over time with a specified range, Cashler fails to specifically teach a fuzzy value obtained by the calculating, determining, and combining steps as claimed in claim 6 and the steps of setting a minimum activity level of the relative weight, increasing and decreasing the threshold when the weight parameter is above and below the level, respectively

14 However, as earlier maintained, because Cashler teaches a programmable microprocessor (col 1, line 67) along with other necessary features known in the SIR art one skilled artisan at the time of the invention would have readily understood Cashler's system/method to be at least fully functionally equivalent to the system/method claimed because Cashler has been shown to suggest all of the structural required features necessary in order to achieve the same end result of discriminating between large and small seat occupants for determining of whether an airbag deployment should be permitted

15 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yonel Beaulieu whose telephone number is (703) 305-

4072 The examiner can normally be reached on Monday through Friday from 0800 to 1500

16 If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr Cuchlinski, can be reached on (703) 308-3873 The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687

17 Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1113

Y. Beaulieu
5 April 1999

WILLIAM A CUCHLINSKI, JR
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

Notice of References Cited	Application No 08/868 338	Applicant(s) Fortune et al	
	Examiner Yonel Beaulieu	Group Art Unit 3661	Page 1 of 1

U S PATENT DOCUMENTS

		DOCUMENT NO	DATE	NAME	CLASS	SUBCLASS
	A	5 732 375	03 24 98	Cashler	701	45
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO	DATE	COUNTRY	NAME	CLASS	SUBCLASS
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON PATENT DOCUMENTS

		DOCUMENT (Including Author Title Source and Pertinent Pages)	DATE
	U		
	V		
	W		
	X		

FORM PTO 948 (REV 01 97) U S DEPARTMENT OF COMMERCE Patent and Trademark Office Application No 08/868338

NOTICE OF DRAFTPERSON'S PATENT DRAWING REVIEW

The drawings filed (insert date) 6/13/97 are

A ~~X~~ not objected to by the Draftperson under 37 CFR 1 84 or 1 152

B _____ objected to by the Draftperson under 37 CFR 1 84 or 1 152 as indicated below The Examiner will require submission of new corrected drawings whe necessary Corrected drawings must be submitted according to the instructions on the back of this notice

1 DRAWINGS 37 CFR 1 84(a) Acceptable categories of drawings Black ink Color

_____ Color drawing are not acceptable until petition is granted Fig (s) _____

_____ Pencil and non black ink is not permitted Fig(s)_____

2 PHOTOGRAPHS 37 CFR 1 84(b)

_____ Photographs are not acceptable until petition is granted

_____ 3 full tone sets are required Fig(s)_____

_____ Photographs not properly mounted (must brystol board or photographic double weight paper) Fig(s)_____

_____ Poor quality (half tone) Fig(s)_____

3 TYPE OF PAPER 37 CFR 1 84(e)

_____ Paper not flexible strong white and durable Fig (s)_____

_____ Erasures alterations overwritings interlineations folds copy machine marks not acceptable (too thin)

_____ Mylar vellum paper is not acceptable (too thin) Fig(s)_____

4 SIZE OF PAPER 37 CFR 1 84(F) Acceptable sizes

_____ 21 0 cm by 29 7 cm (DIN size A4)

_____ 21 6 cm by 27 9 cm (8 1/2 x 11 inches)

_____ All drawings sheets not the same size Sheet(s)_____

5 MARGINS 37 CFR 18 4(g) Acceptable margins

Top 2 5 cm Left 2 5 cm Right 1 5 cm Bottom 1 0 cm SIZE A4 Size

Top 2 5 cm Left 2 5 cm Right 1 5 cm Bottom 1 0 cm SIZE 8 1/2 x 11

_____ Margins not acceptable Fig(s)_____

_____ Top (T) _____ Left (L)

_____ Right (R) _____ Bottom (B)

6 VIEWS CFR 1 84(h)

REMINDER Specification may require revision to correspond to drawing changes

_____ Views connected by projection lines or lead lines Fig (s)_____

Partial views 37 CFR 1 84(h)(2)

_____ Brackets needed to show figure as one entity Fig (s)_____

_____ Views not labeled separately or properly Fig (s)_____

_____ Enlarged view not labeled separately or properly Fig (s)_____

7 SECTIONAL VIEWS 37 CFR 1 84(h)(3)

_____ Hatching not indicated for sectional portions of an object Fig (s)_____

_____ Sectional designation should be noted with Arabic or Roman numbers Fig (s)_____

8 ARRANGEMENT OF VIEWS 37 CFR 1 84(i)

_____ Words do not appear on a horizontal left to right fashion when page is either upright or turned so that the top becomes the right side except for graphs Fig (s)_____

_____ Views not on the same plane on drawing sheet Fig (s)_____

9 SCALE 37 CFR 1 84(k)

_____ Scale not large enough to show mechanism with crowding when drawing is reduced in size to two thirds in reproduction Fig (s)_____

10 CHARACTER OF LINES NUMBERS & LETTERS 37 CFR 1 84(l)

_____ Lines numbers & letters not uniformly thick and well defined clean durable and black (poor line quality) Fig (s)_____

11 SHADING 37 CFR 1 84(m)

_____ Solid black areas pale Fig (s)_____

_____ Solid black shading not permitted Fig (s)_____

_____ Shade lines pale rough and blurred Fig (s)

12 NUMBERS LETTERS & REFERENCE CHARACTERS 37 CFR 1 48(p)

_____ Numbers and reference characters not plain and legible Fig (s)_____

_____ Figure legends are poor Fig (s)_____

_____ Numbers and reference characters not oriented in the same direction as the view 37 CFR 1 84(p)(3) Fig (s)_____

_____ Englgh alphabet not used 37 CFR 1 84(p)(3) Fig (s)_____

_____ Numbers letters and reference characters must be at least 32 cm (1/8 inch) in height 37 CFR 1 84(p)(3) Fig (s)_____

13 LEAD LINES 37 CFR 1 84(q)

_____ Lead lines cross each other Fig (s)_____

_____ Lead lines missing Fig (s)_____

14 NUMBERING OF SHEETS OF DRAWINGS 37 CFR 1 48(t)

_____ Sheets not numbered consecutively and in Ababic numerals beginning with number 1 Fig (s)_____

15 NUMBERING OF VIEWS 37 CFR 1 84(u)

_____ Views not numbered consecutively and in Abrabic numerals beginning with number 1 Fig (s)_____

16 CORRECTIONS 37 CFR 1 84(w)

_____ Corrections not made from PTO 948 dated _____

17 DESIGN DRAWINGS 37 CFR 1 152

_____ Surface shading shown not appropriate Fig (s)_____

_____ Solid black shading not used for color contrast Fig (s)_____

COMMENTS

REVIEWER _____ DATE 10/22/97 TELEPHONE NO 305-8404

ATTACHMENT TO PAPER NO 4

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OIPE JC17
JUL 0 9 1999
PATENT & TRADEMARK OFFICE

GP3661

PATENT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner of Patents and Trademarks, Washington, D C 20231 on July 6, 1999

Carole J. Murdock

Carole J Murdock

5/a Print 7/21/99 Holmes

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Fortune et al

Group Art Unit 3661

Occupant Detection Method And Apparatus For Air Bag System

Examiner Yonel Beaulieu

U S Serial No 08/868,338

Filed June 3, 1997

Paper No 5

AMENDMENT

RECEIVED
TECHNOLOGY CENTER 3600
99 JUL 21 AM 7 47

Commissioner of Patents and Trademarks
Washington, D C 20231

Sir

In response to the Office Action dated April 9, 1999, please amend the above-identified patent application as follows

IN THE SPECIFICATION

On page 1, line 4, insert --This is a continuation-in-part of co-pending U S Patent Application Serial No 08/566,029, filed December 1, 1995, now U S Patent No 5,732,375, issued March 24, 1998, which is also assigned to the assignee of the present invention --

On page 1, lines 26-27, delete "Application SN 08/566,029 to Cashler entitled "METHOD OF INHIBITING OR ALLOWING AIR BAG DEPLOYMENT", filed December 1, 1995", and insert --No 5,732,375, issued March 24, 1998 - in place thereof

IN THE CLAIMS

Please amend Claims 2, 7 and 24 as follows

2 (amended) The method defined in claim 1 [wherein the means for allowing deployment also is capable of inhibiting deployment] , including

establishing a second threshold of the relative weight parameter, and

inhibiting deployment when the relative weight parameter is below the second threshold

In Claim 7, line 12, delete "whereby", and insert --so that-- in place thereof

In Claim 24, line 3, after "microprocessor", delete "and", and in line 12, delete "whereby", and insert --so that-- in place thereof

IN THE DRAWINGS

Please amend Figure 1 of the drawings as shown in red on the attached drawing sheet

REMARKS

In the subject Office Action, the examiner objected to the specification and drawings and claims, and rejected Claims 1-27 under 35 USC 103(a) in view of Cashler '375 Applicants request reconsideration of their application in view of this response, which amends the application to overcome the rejections, and traverses the rejection

The Objection to the Specification

The specification has been amended to update the status of the referenced U S Patent Application Serial No 08/566,029 Such application issued into U S Patent No 5,732,375 on March 24, 1998 Accordingly, the objection is considered to have been overcome

The Objection to the Drawings

Figure 1 of the drawings has been amended to include a PRIOR ART legend The amendment is submitted at this point as a proposal for approval of the examiner, a substitute formal drawing incorporating the amendment will be submitted by Applicants when their application has been allowed

The Objection to Claims 2, 7, 24

Claims 2, 7 and 24 have been amended to overcome the objection In Claim 2, the phrase "wherein the means for allowing deployment also is capable of inhibiting deployment" has been deleted In Claims 7 and 24, the word "whereby" has been replaced with "so that" Also, the extraneous "and" in Claim 24 has been deleted Accordingly, the objection is considered to have been overcome

The Rejection Under 35 USC 103(a)

Applicants respectfully traverse the rejection of Claims 1-27 under 35 USC 103(a) in view of Cashler '375, for two reasons First, Claims 1-27 recite subject matter that is neither shown nor suggested in Cashler, and second, the present application is entitled to consideration as a continuation-in-part of Cashler

First While the Cashler patent admittedly is foundational to the present invention, the rejected claims recite non-obvious enhancements in the form of apparatus

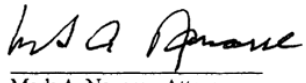
and method steps which are particularly useful for discriminating between heavy and light occupants under dynamic conditions due, for example, to occupant shifting or bouncing Such enhancements are neither shown nor suggested in Cashler Independent method Claims 1 and 16 both recite the steps of (1) establishing a lock threshold above the normal allow threshold, (2) setting a lock flag when the total force or relative weight parameter is above the lock threshold AND deployment has been allowed for a given time, (3) clearing the lock flag when the total force or relative weight parameter is below an empty seat threshold for a time, and (4) allowing deployment while the lock flag is set Independent apparatus Claim 17 includes nearly identical recitations, but in the context of functions performed by a programmed microprocessor These steps/functions are not found in Cashler, rather, they enhance Cashler by addressing dynamic operating conditions not even recognized in the Cashler patent The remaining claims depend, either directly or indirectly from Claims 1 or 17, and are patentable over Cashler for at least the same reasons as the independent claims Accordingly, Cashler cannot obviate the subject matter of Claims 1-27, the rejection under 35 USC 103(a) is in error and should be withdrawn

Second The present application, filed on June 3, 1997, was co-pending with the Cashler patent, filed December 1, 1995, issued March 24, 1998, and Robert Cashler is a named inventor on both the present application and the Cashler patent Accordingly, the present application, although not originally filed as such, is rightfully entitled to be considered as a continuation-in-part of the Cashler patent, through the proper amendment of this application Accordingly, Applicants have amended this application to state that it "is a continuation-in-part of co-pending U S Patent Application Serial No 08/566,029, filed December 1, 1995, now U S Patent No 5,732,375, issued March 24, 1998, which is also assigned to the assignee of the present invention " Accordingly, Cashler '375 cannot rightfully be used as a reference against the present application Accordingly, the rejection under 35 USC 103(a) should be withdrawn

Summary

For the above stated reasons, Claims 1-27 are believed to be in condition for allowance, and such allowance is respectfully requested

Respectfully submitted,



Mark A Navarre, Attorney
Registration No 29572
Telephone (937) 653-3501

Approved: YB
16 August 1995

#5

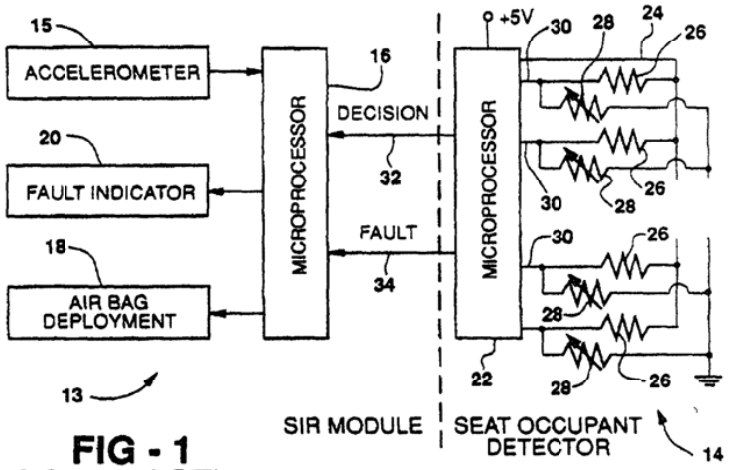


FIG - 1
PRIOR ART

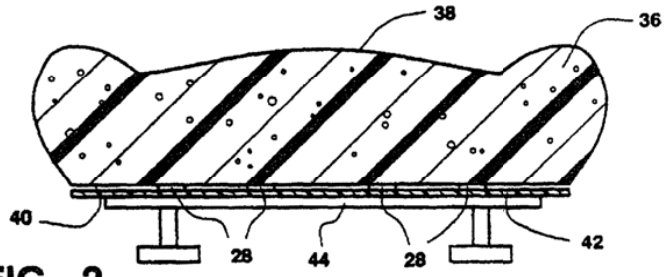


FIG - 2

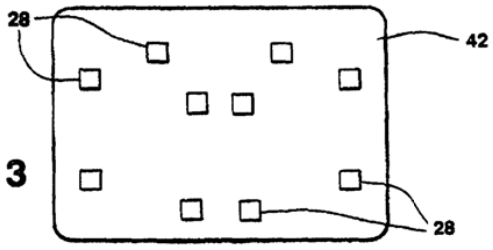


FIG - 3

Transaction History Date 1999-08-18
Date information retrieved from USPTO Patent Application Information Retrieval (PAIR) system records at www.uspto.gov

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Washington D C 20231

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO
[illegible]	[illegible]	[illegible]	[illegible]

FM92/[illegible]

[illegible] L [illegible]
[illegible] ELECTRONICS CORPORATION
[illegible] BOX [illegible]
[illegible] MAIL STOP [illegible]
[illegible] IN [illegible]

EXAMINER
BEAULIEU

ART UNIT	PAPER NUMBER
3 61	6

DATE MAILED [illegible]

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

Commissioner of Patents and Trademarks

PTO 90C (Rev 2/95)

1 File Copy

Notice of Allowability

Application No	Applicant(s)
08/868 338	Fortune et al
Examiner	**Group Art Unit**
Yonel Beaulieu	3661

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 and Issue Fee Due or other appropriate communication will be mailed in due course

☒ This communication is responsive to *amendment filed on 9 July 1999*

☒ The allowed claim(s) is/are *1 27*

☐ The drawings filed on _____ are acceptable

☐ Acknowledgement is made of a claim for foreign priority under 35 U S C § 119(a) (d)

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received

☐ received in Application No (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17 2(a))

*Certified copies not received _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U S C § 119(e)

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE **THREE MONTHS FROM THE DATE MAILED** of this Office action Failure to timely comply will result in ABANDONMENT of this application Extensions of time may be obtained under the provisions of 37 CFR 1 136(a)

☐ Note the attached EXAMINER S AMENDMENT or NOTICE OF INFORMAL APPLICATION PTO 152 which discloses that the oath or declaration is deficient A SUBSTITUTE OATH OR DECLARATION IS REQUIRED

☒ Applicant MUST submit NEW FORMAL DRAWINGS

☐ because the originally filed drawings were declared by applicant to be informal

☐ including changes required by the Notice of Draftsperson s Patent Drawing Review PTO 948 attached hereto or to Paper No _____

☒ including changes required by the proposed drawing correction filed on *Jul 9 1999* which has been approved by the examiner

☐ including changes required by the attached Examiner s Amendment/Comment

Identifying indicia such as the application number (see 37 CFR 1 84(c)) should be written on the reverse side of the drawings The drawings should be filed as a separate paper with a transmittal lettter addressed to the Official Draftsperson

☐ Note the attached Examiner s comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL

Any response to this letter should include in the upper right hand corner the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER) If applicant has received a Notice of Allowance and Issue Fee Due the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included

Attachment(s)

☐ Notice of References Cited PTO 892

☐ Information Disclosure Statement(s) PTO 1449 Paper No(s) _____

☐ Notice of Draftsperson s Patent Drawing Review PTO 948

☐ Notice of Informal Patent Application PTO 152

☐ Interview Summary, PTO 413

☐ Examiner s Amendment/Comment

☐ Examiner s Comment Regarding Requirement for Deposit of Biological Material

☒ Examiner s Statement of Reasons for Allowance

WILLIAM A CUCHLINSKI JR
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

U S Patent and Trademark Office
PTO 37 (Rev 9 95) **Notice of Allowability** Part of Paper No 6

DETAILED ACTION

Allowable Subject Matter

1 Claims 1 - 27 are allowable over the art of record and the following is a statement of reasons for such an indication

2 As specifically claimed, the art of record fall short of a method in a vehicle restraint system having a controller for deploying air bags and means for selectively allowing and inhibiting the deployment in accordance with the occupancy of a seat by a person of at least a minimum weight, the system comprising seat sensors responding to the weight of the person to produce sensor outputs and a microprocessor coupled to the sensor outputs and programmed to inhibit and allow and to determine measures represented by individual sensor outputs and calculate from the sensor outputs a relative weight parameter - the relative weight parameter being a total load rating of the sensors, establish a first threshold of the relative weight parameter, allow deployment when the relative weight parameter is above the first threshold, establish a lock threshold above the first threshold, set a lock flag when the relative weight parameter is above the lock threshold and deployment has been allowed for a given time, establish an unlock threshold at a level indicative of an empty seat, clear the flag when the relative weight parameter is below the unlock threshold for a time, and allow deployment while the lock flag is set

3 In the above system, the microprocessor is further programmed to calculate a load rating for each sensor as a function of the difference between the sensor output and a base value, sum the load rating for all the sensors ti derive a total load rating, periodically increment a flag value toward a maximum value when the relative weight parameter is above the lock threshold, periodically decrement the flag value toward zero when the relative weight parameter is less than the unlock threshold, set the lock flag when the flag value is greater than zero and clear the flag is zero so that the flag value determines at any time the minimum time for clearing the flag

Conclusion

4 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yonel Beaulieu whose telephone number is (703) 305-4072 The examiner can normally be reached on Monday through Friday from 0800 to 1500

5 If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr Cuchlinski, can be reached on (703) 308-3873 The fax phone number for the organization where this application or proceeding is assigned is (703) 305-7687

6 Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308 1113

Y Beaulieu
17 August 1999

WILLIAM A CUCHLINSKI, JR
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

[illegible]

APPLICATION NO	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
First Named Applicant	[illegible]		37 CFR 1.53(b) Term [illegible]	

TITLE OF INVENTION [illegible]

ATTY'S DOCKET NO	CLASS SUBCLASS	BATCH NO	APPLN TYPE	SMALL ENTITY	FEE DUE	DATE DUE
[illegible]	[illegible]	[illegible]	UTILITY	NO	[illegible]	[illegible]

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT PROSECUTION ON THE MERITS IS CLOSED

THE ISSUE FEE 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

HOW TO RESPOND TO THIS NOTICE

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If the SMALL ENTITY is shown as NO

A Pay FEE DUE shown above or

B File verified statement of Small Entity Status before or with payment of 1/2 the FEE DUE shown above

II Part B Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE Even if the ISSUE FEE has already been paid by charge to deposit account Part B Issue Fee Transmittal should be completed and returned If you are charging the ISSUE FEE to your deposit account, section "4b of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted

III All communications regarding this application must give application number and batch number Please direct all communications prior to issuance to Box 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

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PTOL 85 (REV 10 96) Approved for use through 06/30/99 (0651 0033)

U S GPO 1998-437-639/80023

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Carole J. Murdock

Carole J Murdock

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Duane Donald Fortune
Robert John Cashler

Group Art Unit 3661

Occupant Detection Method And Apparatus For Air Bag System

Examiner Yonel Beaulieu

Serial No 08/868,338

Filed June 3, 1997

Allowed August 18, 1999

Batch No A36

ATTENTION OF OFFICIAL DRAFTSMAN

Drawing Review Branch
Commissioner of Patents
and Trademarks
Washington, D C 20231

AMENDMENT TO THE DRAWINGS

Sir

The above application was allowed subject to the corrections of drawing informalities Please substitute the enclosed formal drawings for those presently in the application

H 198088
S 1 of 5
USSN 08/868 338 Filed June 3 1997

Title Occupant Detection Method And Apparatus For Air Bag System

Inventors Duane Donald Fortune
Robert John Cashler

Group Art 3661 Examiner Yonel Beaulieu

Allowed August 18 1999 Batch No A36

Delphi Delco Electronics Systems

Attorney Jimmy L Funke
Telephone 248 267 5554
Reg No 34 166

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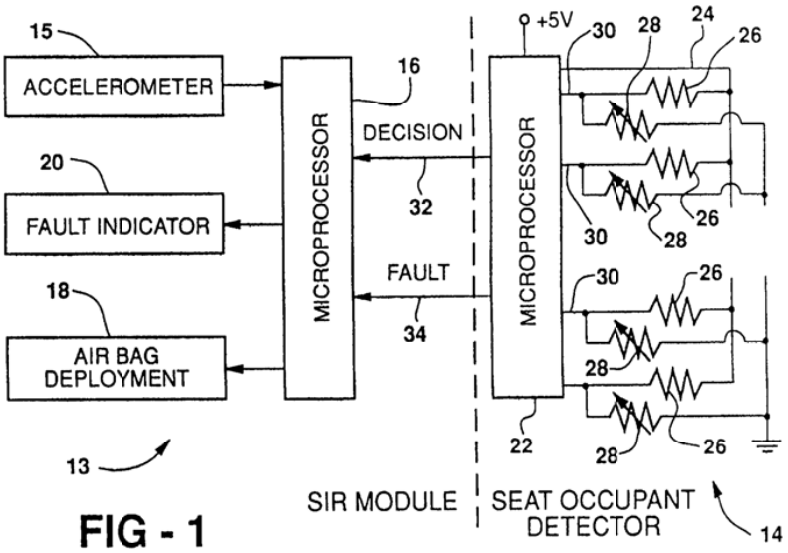


FIG - 1
PRIOR ART

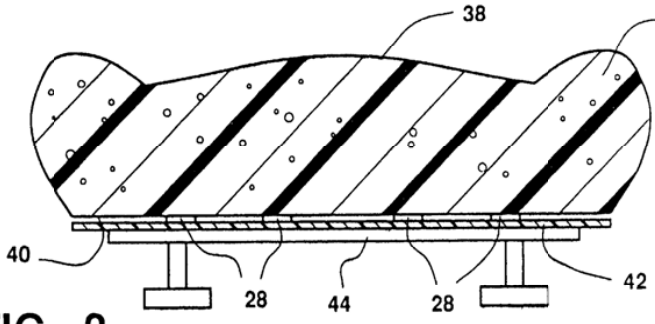


FIG - 2

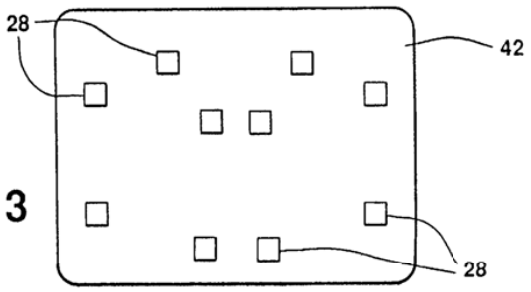


FIG - 3

FIG - 4

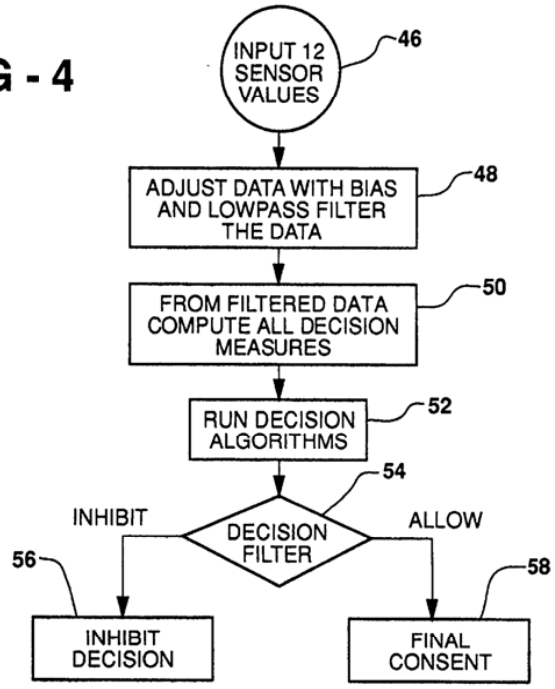

INPUT 12 SENSOR VALUES
46
ADJUST DATA WITH BIAS AND LOWPASS FILTER THE DATA
48
FROM FILTERED DATA COMPUTE ALL DECISION MEASURES
50
RUN DECISION ALGORITHMS
52
DECISION FILTER
54
INHIBIT
ALLOW
56
58
INHIBIT DECISION
FINAL CONSENT

FIG - 5

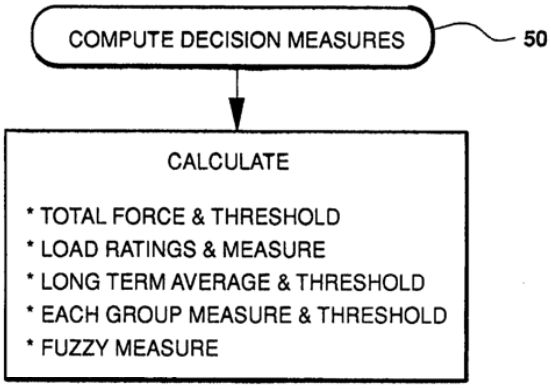

COMPUTE DECISION MEASURES
50
CALCULATE
* TOTAL FORCE & THRESHOLD
* LOAD RATINGS & MEASURE
* LONG TERM AVERAGE & THRESHOLD
* EACH GROUP MEASURE & THRESHOLD
* FUZZY MEASURE

FIG - 6

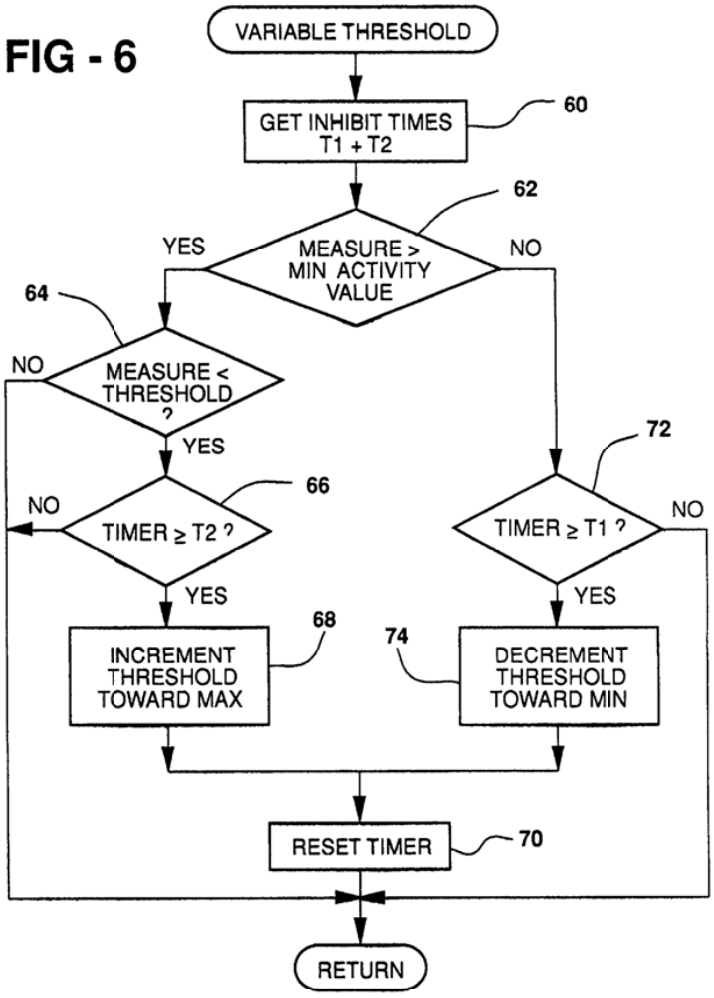

VARIABLE THRESHOLD
GET INHIBIT TIMES T1 + T2
60
62
MEASURE > MIN ACTIVITY VALUE
YES
NO
64
MEASURE < THRESHOLD ?
NO
YES
66
TIMER ≥ T2 ?
NO
YES
72
TIMER ≥ T1 ?
NO
YES
68
INCREMENT THRESHOLD TOWARD MAX
74
DECREMENT THRESHOLD TOWARD MIN
RESET TIMER
70
RETURN

FIG - 7

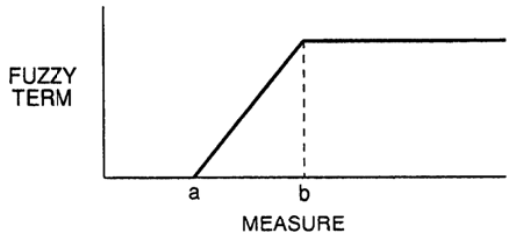

FUZZY TERM
a
b
MEASURE

FIG - 9

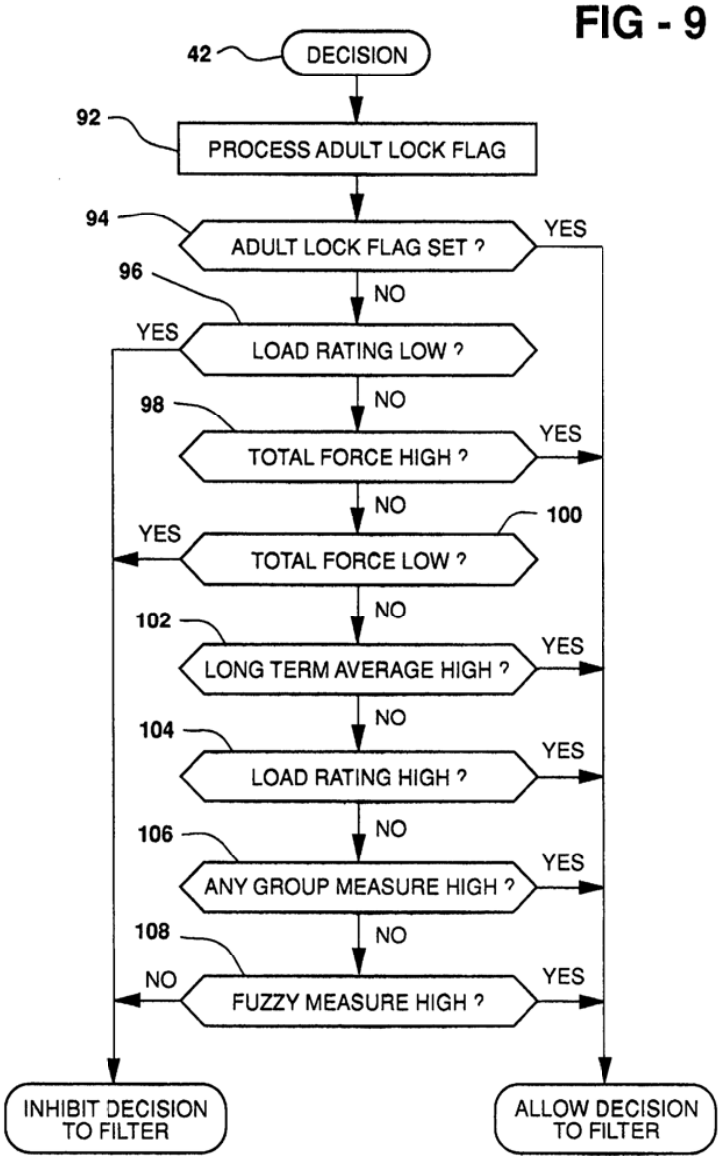

42
DECISION
92
PROCESS ADULT LOCK FLAG
94
ADULT LOCK FLAG SET ?
YES
NO
96
LOAD RATING LOW ?
YES
NO
98
TOTAL FORCE HIGH ?
YES
NO
100
TOTAL FORCE LOW ?
YES
NO
102
LONG TERM AVERAGE HIGH ?
YES
NO
104
LOAD RATING HIGH ?
YES
NO
106
ANY GROUP MEASURE HIGH ?
YES
NO
108
FUZZY MEASURE HIGH ?
NO
YES
INHIBIT DECISION TO FILTER
ALLOW DECISION TO FILTER

FIG - 8

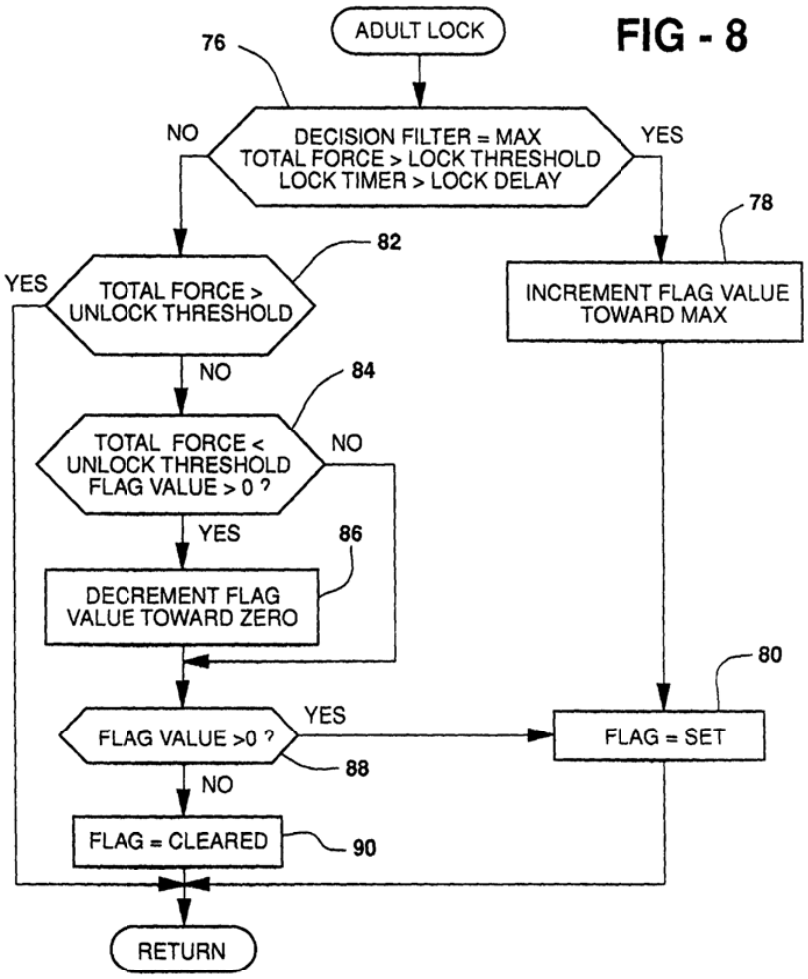
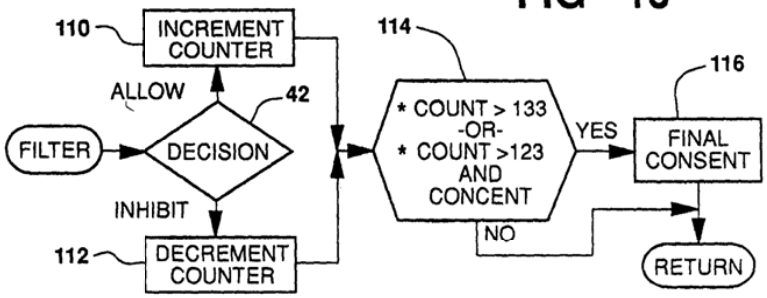

ADULT LOCK
76
DECISION FILTER = MAX
TOTAL FORCE > LOCK THRESHOLD
LOCK TIMER > LOCK DELAY
NO
YES
78
INCREMENT FLAG VALUE
TOWARD MAX
82
YES
TOTAL FORCE >
UNLOCK THRESHOLD
NO
84
TOTAL FORCE <
UNLOCK THRESHOLD
FLAG VALUE > 0 ?
NO
YES
86
DECREMENT FLAG
VALUE TOWARD ZERO
80
FLAG VALUE >0 ?
YES
FLAG = SET
88
NO
FLAG = CLEARED
90
RETURN

FIG - 10


110
INCREMENT
COUNTER
ALLOW
42
FILTER
DECISION
INHIBIT
112
DECREMENT
COUNTER
114
* COUNT > 133
-OR-
* COUNT >123
AND
CONCENT
YES
116
FINAL
CONSENT
NO
RETURN

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OCT 15 1999

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DELPHI TECHNICAL CORPORATION
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Carole J Murdock (Depositor's name)

Carole J. Murdock (Signature)

October 12, 1999 (Date)

APPLICATION NO	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

First Named Applicant: [illegible]

TITLE OF INVENTION: [illegible]

ATTY'S DOCKET NO	CLASS/SUBCLASS	BATCH NO	APPLN TYPE	SMALL ENTITY	FEE DUE	DATE DUE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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1 Jimmy L Funke

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. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Delphi Technologies, Inc

(B) RESIDENCE: (CITY & STATE OR COUNTRY) Troy, MI

Please check the appropriate assignee category or categories (will not be printed on the patent):

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P O BOX 9005
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Carole J Murdock (Depositor's name)
Carole J. Murdock (Signature)
October 12, 1999 (Date)

APPLICATION NO	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
08/968 338	06/03/97	027	BEAULIEU Y 3661	08/18/99

First Named Applicant FORTUNE 35 USC 154(b) term ext = 0 Days

TITLE OF INVENTION OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM

ATTY'S DOCKET NO	CLASS SUBCLASS	BATCH NO	APPLN TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2 H-198088	701-045	0000	A36	UTILITY NO	$1210 00	11/18/99

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1 Jimmy L Funke
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 Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover Completion of this form is NOT a subsitiue for filing an assignment

(A) NAME OF ASSIGNEE Delphi Technologies, Inc

(B) RESIDENCE (CITY & STATE OR COUNTRY) Troy, MI

Please check the appropriate assignee category indicated below (will not be printed on the patent)

☐ individual ☒ corporation or other private group entity ☐ government

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(Authorized Signature) Jim Funke (Date) 10/12/99

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File History Content Report

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Document Date - 2000-01-04

Document Title - USPTO Grant

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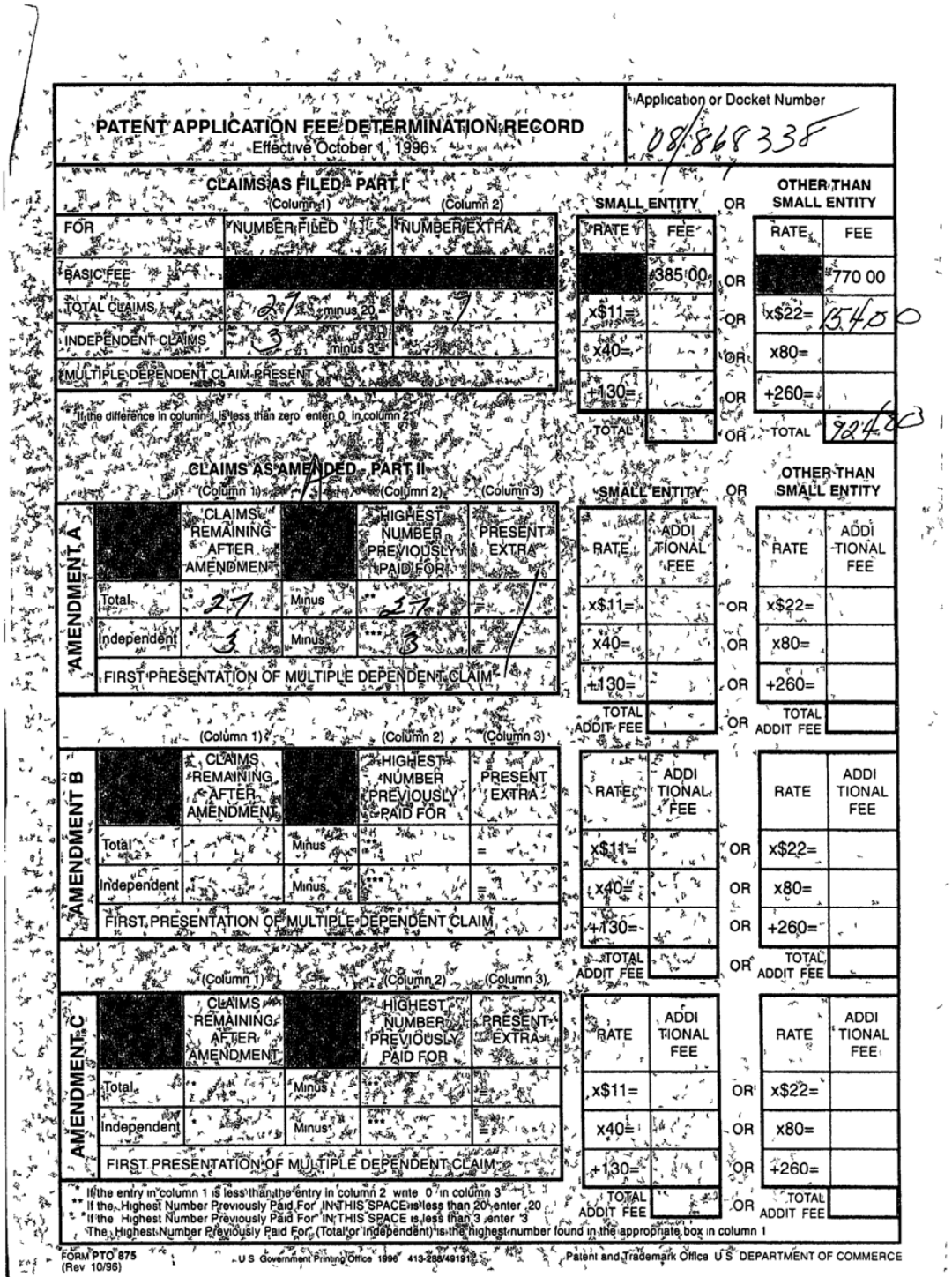


PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 1996

Application or Docket Number: 08/868338

CLAIMS AS FILED - PART I

	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
FOR							
BASIC FEE	[redacted]		[redacted]	385 00	OR	[redacted]	770 00
TOTAL CLAIMS	21 minus 20 =	1	x$11=		OR	x$22=	13400
INDEPENDENT CLAIMS	3 minus 3 =		x40=		OR	x80=	
MULTIPLE DEPENDENT CLAIM PRESENT			+130=		OR	+260=	
If the difference in column 1 is less than zero, enter 0 in column 2			TOTAL		OR	TOTAL	92400

CLAIMS AS AMENDED - PART II

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
AMENDMENT A	[redacted]	[redacted]	[redacted]						
Total	21	Minus	** 21	=	x$11=		OR	x$22=	
Independent	3	Minus	*** 3	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT FEE		OR	TOTAL ADDIT FEE	

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
AMENDMENT B	[redacted]	[redacted]	[redacted]						
Total		Minus	**	=	x$11=		OR	x$22=	
Independent		Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT FEE		OR	TOTAL ADDIT FEE	

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
AMENDMENT C	[redacted]	[redacted]	[redacted]						
Total		Minus	**	=	x$11=		OR	x$22=	
Independent		Minus	***	=	x40=		OR	x80=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+130=		OR	+260=	
					TOTAL ADDIT FEE		OR	TOTAL ADDIT 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.

FORM PTO-875 (Rev 10/96) — U.S. Government Printing Office: 1996 413-288/49191 — Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Form PTO 1130
(REV 2/94)

PACE DATA ENTRY CODING SHEET

U S DEPARTMENT OF COMMERCE
Patent and Trademark Office

1ST EXAMINER	DATE
2ND EXAMINER	DATE

65959 U S PTO
08/868338
06/03/97

APPLICATION NUMBER | TYPE APPL | FILING DATE (MONTH DAY YEAR) | SPECIAL HANDLING | GROUP ART UNIT | CLASS | SHEETS OF DRAWING

TOTAL CLAIMS | INDEPENDENT CLAIMS | SMALL ENTITY? | FILING FEE | FOREIGN LICENSE | ATTORNEY DOCKET NUMBER

CONTINUITY DATA

CONT CODE	STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE (MONTH DAY YEAR)
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		
			PCT/ /		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE (MONTH DAY YEAR)

Thomson Innovation Patent Export, 2014-05-06 02:59:53 -0500

Table of Contents

1. US6012007A Occupant detection method and apparatus for air bag system

Family 1/1

2 record(s) per family

Record 1/2 US5732375A Method of inhibiting or allowing airbag deployment

Publication Number: US5732375A 19980324

Title: Method of inhibiting or allowing airbag deployment

Title - DWPI: Vehicle airbag control method allowing deployment if total force is above total threshold force, determining local pressure area when total force is concentrated in one seat area, and allowing deployment if local force is greater than seat threshold force

Priority Number: US1995566029A

Priority Date: 1995-12-01

Application Number: US1995566029A

Application Date: 1995-12-01

Publication Date: 1998-03-24

IPC Class Table:

IPC	Section	Class	Subclass	Class Group	Subgroup
B60R002101	B	B60	B60R	B60R0021	B60R002101
G06K000900	G	G06	G06K	G06K0009	G06K000900
G06K000932	G	G06	G06K	G06K0009	G06K000932
B60R0021015	B	B60	B60R	B60R0021	B60R0021015

IPC Class Table - DWPI:

IPC - DWPI	Section - DWPI	Class - DWPI	Subclass - DWPI	Class Group - DWPI	Subgroup - DWPI
B60R002132	B	B60	B60R	B60R0021	B60R002132
G06F001740	G	G06	G06F	G06F0017	G06F001740

Assignee/Applicant: Delco Electronics Corp.,Kokomo,IN,US

JP F Terms:

JP FI Codes:

Assignee - Original: Delco Electronics Corp.

Any CPC Table:

Type	Invention	Additional	Version	Office
Current	**B60R 21/015**	B60R 2021/01516	20130101	EP
Current	G06K 9/00362		20130101	EP
Current	G06K 9/3241		20130101	EP

ECLA: B60R0021015 | G06K000900H | G06K000932R1 | L60R0021015G2

Abstract:

An array of pressure sensors on a vehicle passenger seat senses the presence of an occupant including an infant seat and determines whether the infant seat faces forward or rearward. A microprocessor coupled to the sensors determines whether to allow or inhibit deployment based on the sensor load forces and the pattern of loading. The pattern can identify an infant seat and pattern and loading determine its orientation. Local areas are checked to detect child occupants. Fuzzy logic is used to determine loading and to recognize patterns.

Language of Publication: EN

INPADOC Legal Status Table:

Gazette Date	Code	INPADOC Legal Status Impact
2014-03-26	AS	-
Description: ASSIGNMENT LOOPBACK TECHNOLOGIES, INC., VIRGINIA ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:DELPHI TECHNOLOGIES, INC.; REEL/FRAME:032534/0636 2013-12-18		
2014-03-26	AS	-
Description: ASSIGNMENT SIGNAL IP, INC., CALIFORNIA ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:LOOPBACK TECHNOLOGIES, INC.; REEL/FRAME:032534/0803 2014-03-26		
2014-03-26	AS	-
Description: ASSIGNMENT DELPHI TECHNOLOGIES, INC, MICHIGAN CONFIRMATORY ASSIGNMENT; ASSIGNOR:DELCO ELECTRONICS LLC; REEL/FRAME:032536/0496 2005-09-30		
2009-08-26	FPAY	+
Description: FEE PAYMENT		
2005-09-30	AS	-
Description: ASSIGNMENT DELPHI TECHNOLOGIES INC., MICHIGAN ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:DELCO ELECTRONICS CORPORATION; REEL/FRAME:017115/0208 2005-09-30		

2005-09-02	FPAY	+
Description: FEE PAYMENT		
2001-08-30	FPAY	+
Description: FEE PAYMENT		

Post-Issuance (US):

Reassignment (US) Table:

Assignee	Assignor	Date Signed	Reel/Frame	Date
SIGNAL IP INC.,LOS ANGELES,CA,US	LOOPBACK TECHNOLOGIES, INC.	2014-03-26	032534/0803	2014-03-26
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
LOOPBACK TECHNOLOGIES INC.,ALEXANDRIA,VA,US	DELPHI TECHNOLOGIES, INC.	2013-12-18	032534/0636	2014-03-26
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
DELPHI TECHNOLOGIES INC,TROY,MI,US	DELCO ELECTRONICS LLC	2005-09-30	032536/0496	2014-03-26
Conveyance: CONFIRMATORY ASSIGNMENT				
Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
DELPHI TECHNOLOGIES INC.,TROY,MI,US	DELCO ELECTRONICS CORPORATION	2005-09-30	017115/0208	2005-09-30
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: JIMMY L. FUNKE P.O. BOX 5052 M/C 480 410 202 TROY, MI 48007				
DELCO ELECTRONICS CORPORATION,KOKOMO,IN,US	CASHLER, ROBERT JOHN	1995-11-28	007801/0847	1995-12-01
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: DELCO ELECTRONICS CORPORATION MARK A. NAVARRE P. O. BOX 9005 ERC BLDG., M/S D-32				

KOKOMO, IN 46904

Maintenance Status (US):

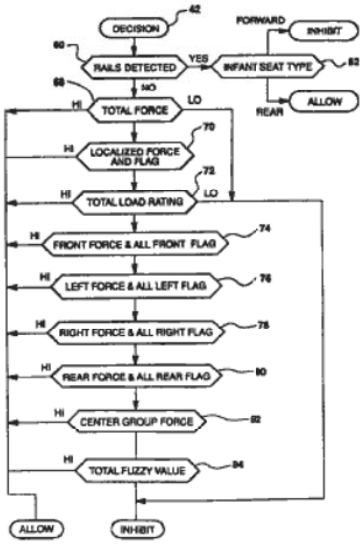
Litigation (US): 2004-05-27 2004 Takata Seat Belts Inc., a Delaware Corporation Delphi Automotive Systems LLC W.D. Texas | 2014-04-01 2014 Signal IP, Inc. a California Corporation American Honda Motor Co., Inc. a California Corporation Honda of America Mfg., Inc. an Ohio Corporation C.D. California 2:14cv02454 | 2014-04-01 2014 Signal IP, Inc. a California Corporation KIA Motors America, Inc. a California Corporation C.D. California 2:14cv02457 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mazda Motor of America, Inc. a California Corporation C.D. California 2:14cv02459 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mitsubishi Motors North America, Inc. a California Corporation C.D. California 2:14cv02462 | 2014-04-17 2014 Signal IP, Inc. a California Corporation Nissan North America, Inc. a California Corporation C.D. California 2:14cv02962

Opposition (EP):

License (EP):

EPO Procedural Status:

Front Page Drawing:



Record 2/2 US6012007A Occupant detection method and apparatus for air bag system

Publication Number: US6012007A 20000104

Title: Occupant detection method and apparatus for air bag system
Title - DWPI: Occupant detection method for air bag system of vehicle
Priority Number: US1995566029A
Priority Date: 1995-12-01
Application Number: US1997868338A
Application Date: 1997-06-03
Publication Date: 2000-01-04
IPC Class Table:

IPC	Section	Class	Subclass	Class Group	Subgroup
B60R002101	B	B60	B60R	B60R0021	B60R002101
G06K000900	G	G06	G06K	G06K0009	G06K000900
G06K000932	G	G06	G06K	G06K0009	G06K000932
B60R0021015	B	B60	B60R	B60R0021	B60R0021015

IPC Class Table - DWPI:

IPC - DWPI	Section - DWPI	Class - DWPI	Subclass - DWPI	Class Group - DWPI	Subgroup - DWPI
B60R002101	B	B60	B60R	B60R0021	B60R002101
G06K000900	G	G06	G06K	G06K0009	G06K000900
G06K000932	G	G06	G06K	G06K0009	G06K000932
B60R002112	B	B60	B60R	B60R0021	B60R002112
B60R002132	B	B60	B60R	B60R0021	B60R002132

Assignee/Applicant: Delphi Technologies Inc.,Troy,MI,US
JP F Terms:
JP FI Codes:
Assignee - Original: Delphi Technologies Inc.
Any CPC Table:

Type	Invention	Additional	Version	Office
Current	**G06K 9/00362**	B60R 2021/01516	20130101	EP
Current	B60R 21/015		20130101	EP
Current	G06K 9/3241		20130101	EP

ECLA: G06K000900H | B60R0021015 | G06K000932R1 | L60R0021015G2

Abstract:
Pressure sensors on the bottom surface of a seat cushion respond to occupant weight. A microprocessor evaluates the sensor outputs according to total force, load rating, long term average, sensor groups and a fuzzy measure to discriminate between large and small occupants and allow air bag deployment for large but not small occupants. Allow and inhibit decisions are filtered avoid sudden response to transient pressure changes on the seat. When a large occupant is positively detected, an allow decision is locked in place as long as total force exceeds a threshold.

Language of Publication: EN

INPADOC Legal Status Table:

Gazette Date	Code	INPADOC Legal Status Impact
2014-03-27	AS	-
Description: ASSIGNMENT LOOPBACK TECHNOLOGIES, INC., VIRGINIA ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:DELPHI TECHNOLOGIES, INC.; REEL/FRAME:032546/0176 2013-12-18		
2014-03-27	AS	-
Description: ASSIGNMENT DELPHI TECHNOLOGIES, INC., MICHIGAN CONFIRMATORY ASSIGNMENT; ASSIGNOR:DELCO ELECTRONICS LLC; REEL/FRAME:032552/0247 2005-09-30		
2014-03-27	AS	-
Description: ASSIGNMENT SIGNAL IP, INC., CALIFORNIA ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:LOOPBACK TECHNOLOGIES, INC.; REEL/FRAME:032546/0190 2014-03-27		
2011-06-01	FPAY	+
Description: FEE PAYMENT		
2008-04-14	AS	-
Description: ASSIGNMENT DELPHI TECHNOLOGIES, INC., MICHIGAN RELEASE OF SECURITY AGREEMENT; ASSIGNOR:JPMORGAN CHASE BANK, N.A.; REEL/FRAME:020808/0583 2008-02-25		
2007-06-08	FPAY	+
Description: FEE PAYMENT		
2005-09-30	AS	-
Description: ASSIGNMENT DELPHI TECHNOLOGIES INC., MICHIGAN ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNOR:DELCO ELECTRONICS CORPORATION; REEL/FRAME:017115/0208 2005-09-30		
2005-07-07	AS	-

Description: ASSIGNMENT JPMORGAN CHASE BANK, N.A., TEXAS SECURITY AGREEMENT; ASSIGNOR:DELPHI TECHNOLOGIES, INC.; REEL/FRAME:016237/0402 2005-06-14		
2003-07-23	REMI	-
Description: MAINTENANCE FEE REMINDER MAILED		
2003-06-30	FPAY	+
Description: FEE PAYMENT		
1997-06-03	AS	-
Description: ASSIGNMENT DELCO ELECTRONICS CORPORATION, INDIANA ASSIGNMENT OF ASSIGNORS INTEREST; ASSIGNORS:FORTUNE, DUANE DONALD; CASHLER, ROBERT JOHN; REEL/FRAME:008647/0573 1997-05-28		

Post-Issuance (US):
Reassignment (US) Table:

Assignee	Assignor	Date Signed	Reel/Frame	Date
SIGNAL IP INC.,LOS ANGELES,CA,US	LOOPBACK TECHNOLOGIES, INC.	2014-03-27	032546/0190	2014-03-27
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
LOOPBACK TECHNOLOGIES INC.,ALEXANDRIA,VA,US	DELPHI TECHNOLOGIES, INC.	2013-12-18	032546/0176	2014-03-27
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
DELPHI TECHNOLOGIES INC.,TROY,MI,US	JPMORGAN CHASE BANK, N.A.	2008-02-25	020808/0583	2008-04-14
Conveyance: RELEASE OF SECURITY AGREEMENT				
Corresponent: MICHAEL D. SMITH DELPHI CORPORATION LEGAL STAFF - M/S 480-410-202 5725 DELPHI DRIVE TROY, MI 48098				
DELPHI TECHNOLOGIES INC.,TROY,MI,US	DELCO ELECTRONICS LLC	2005-09-30	032552/0247	2014-03-27
Conveyance: CONFIRMATORY ASSIGNMENT				

Corresponent: ASCENDA LAW GROUP, PC 84 W SANTA CLARA ST. SUITE 550 SAN JOSE, CA 95113				
DELPHI TECHNOLOGIES INC.,TROY,MI,US	DELCO ELECTRONICS CORPORATION	2005-09-30	017115/0208	2005-09-30
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: JIMMY L. FUNKE P.O. BOX 5052 M/C 480 410 202 TROY, MI 48007				
JPMORGAN CHASE BANK N.A.,HOUSTON,TX,US	DELPHI TECHNOLOGIES, INC.	2005-06-14	016237/0402	2005-07-07
Conveyance: SECURITY AGREEMENT				
Corresponent: MARK SOLOMON, ESQ. SIMPSON THACHER & BARTLETT LLP 425 LEXINGTON AVENUE NEW YORK, NY 10017				
DELCO ELECTRONICS CORPORATION,KOKOMO,IN,US	FORTUNE, DUANE DONALD	1997-05-28	008647/0573	1997-06-03
	CASHLER, ROBERT JOHN	1997-05-28		
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).				
Corresponent: DELCO ELECTRONICS CORPORATOIN P.O. BOX 9005 ERC BUILDING, MAIL STOP D-32 KOKOMO, IN 46904				

Maintenance Status (US):

Litigation (US): 2004-05-27 2004 Takata Seat Belts Inc., a Delaware Corporation Delphi Automotive Systems LLC W.D. Texas | 2014-04-01 2014 Signal IP, Inc. a California Corporation American Honda Motor Co., Inc. a California Corporation Honda of America Mfg., Inc. an Ohio Corporation C.D. California 2:14cv02454 | 2014-04-01 2014 Signal IP, Inc. a California Corporation KIA Motors America, Inc. a California Corporation C.D. California 2:14cv02457 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mazda Motor of America, Inc. a California Corporation C.D. California 2:14cv02459 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mitsubishi Motors North America, Inc. a California Corporation C.D. California 2:14cv02462 | 2014-04-01 2014 Signal IP, Inc. a California Corporation American Honda Motor Co., Inc. a California Corporation Honda of America Mfg., Inc. an Ohio Corporation C.D. California 2:14cv02454 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mazda Motor of America, Inc. a California Corporation C.D. California 8:14cv00491 | 2014-04-01 2014 Signal IP, Inc. a California Corporation Mitsubishi Motors North America, Inc. a California Corporation C.D.. California 8:14cv00497 | 2014-04-17 2014 Signal IP, Inc. a California Corporation Subaru of America, Inc. a New Jersey Corporation C.D. California 2:14cv02963 | 2014-04-17 2014 Signal IP, Inc. a California Corporation Suzuki Motor of America, Inc. A California Corporation C.D. California 8:14cv00607 | 2014-04-17 2014 Signal IP, Inc. a California Corporation Nissan North America, Inc. a California Corporation C.D. California 2:14cv02962

Opposition (EP):

License (EP):

EPO Procedural Status:

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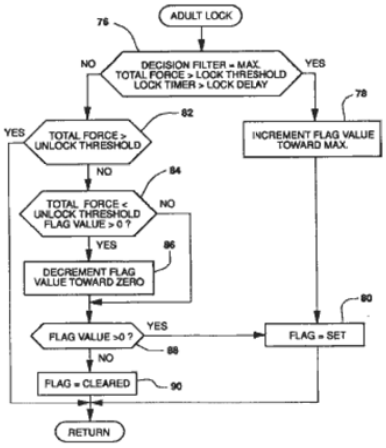

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USPTO Maintenance Report					
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Issue Date:	01/04/2000		Filing Date:	06/03/1997	
Title:	OCCUPANT DETECTION METHOD AND APPARATUS FOR AIR BAG SYSTEM				
Status:	4th, 8th and 12th year fees paid			Entity:	LARGE
Window Opens:	N/A	Surcharge Date:	N/A	Expiration:	N/A
Fee Amt Due:	Window not open	Surchg Amt Due:	Window not open	Total Amt Due:	Window not open
Fee Code:					
Surcharge Fee Code:					
Most recent events (up to 7):	06/01/2011 06/08/2007 07/23/2003 06/30/2003	Payment of Maintenance Fee, 12th Year, Large Entity. Payment of Maintenance Fee, 8th Year, Large Entity. Maintenance Fee Reminder Mailed. Payment of Maintenance Fee, 4th Year, Large Entity. --- End of Maintenance History ---			
Address for fee purposes:	JIMMY L FUNKE DELCO ELECTRONICS CORPORATION P O BOX 9005 ERC BUILDING MAIL STOP D-32 KOKOMO IN 46904				