

NISSAN 1002

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 | 741 | 5 |
| Class | Subclass | |
| ISSUE CLASSIFICATION | | |



6012007

| | | |
|-----------------------|---------------------------|---------------|
| UTILITY SERIAL NUMBER | PATENT DATE 24 04 2000 | PATENT NUMBER |
|-----------------------|---------------------------|---------------|

| | | | | | |
|---------------|-------------|--------------|----------------|-------------------------|-------------------|
| SERIAL NUMBER | FILING DATE | CLASS 101 | SUBCLASS 45 | GROUP ART UNIT 32142 | EXAMINER NGUYE |
|---------------|-------------|--------------|----------------|-------------------------|-------------------|

APPLICANTS

BEST COPY

money
money

| | | | | | | | | | |
|-------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|----------|------------------|--------------|--------------|--------------|---------------------|----------------------|
| Foreign priority claimed 35 USC 119 conditions met | <input type="checkbox"/> yes <input checked="" type="checkbox"/> no | <input type="checkbox"/> yes <input checked="" type="checkbox"/> 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)

| | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------|---------------------------|
| PARTS OF APPLICATION FILED SEPARATELY | | 8-18-99 Coler Applications Examiner | |
| NOTICE OF ALLOWANCE MAILED 8 18 99 | | CLAIMS ALLOWED | |
| Yonel Beaulieu Assistant Examiner | | Total Claims 27 | Print Claim 17 |
| ISSUE FEE Amount Due \$1210 Date Paid 10-5-99 | | DRAWING | |
| Label Area | | Sheets Drwg 5 | Figs Drwg 10 |
| | | Print Fig 5 | ISSUE BATCH NUMBER A36 |
| PREPARED FOR ISSUE | | | |
| WARNING The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35 Sections 122, 181 and 368. Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only. | | | |

Form PTO 436A (Rev 8/92)

T D Y A
S H
S H
S H

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 _____

Date Entered or Counted

CONTENTS

Date Received or Mailed

| | | |
|-----------------|-------------------------------------------|-----------------|
| 1 | Application <i>4 drawings</i> papers | |
| 2 | <i>IDS</i> | <i>11-11-97</i> |
| 3 | <i>P/A</i> | <i>11-11-97</i> |
| <i>4/79</i> | 4 <i>Rejections (3)</i> | <i>4/9/99</i> |
| | <i>Amendment / Print</i> | <i>7/9/99</i> |
| <i>8/18</i> | 6 <i>Notice of Allowance</i> | <i>8/18/99</i> |
| | 7 <i>Notice of Allowance</i> | <i>8/18/99</i> |
| <i>11/15/99</i> | 8 <i>Final Rejection (5 sheets) and 1</i> | <i>11/15/99</i> |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |
| 30 | | |
| 31 | | |
| 32 | | |

(FRONT)

Staple Issue Slip Here

| POSITION | ID NO | DATE |
|------------|-------|---------|
| CLASSIFIER | 48 | 8/1/75 |
| EXAMINER | 1211 | 11/2/75 |
| TYPIST | | |
| VERIFIER | | |
| CORPS CORR | | |
| SPEC HAND | | |
| FILE MAINT | | |
| DRAFTING | | |

INDEX OF CLAIMS

| Claim | Date |
|-------|------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| 17 | |
| 18 | |
| 19 | |
| 20 | |
| 21 | |
| 22 | |
| 23 | |
| 24 | |
| 25 | |
| 26 | |
| 27 | |
| 28 | |
| 29 | |
| 30 | |
| 31 | |
| 32 | |
| 33 | |
| 34 | |
| 35 | |
| 36 | |
| 37 | |
| 38 | |
| 39 | |
| 40 | |
| 41 | |
| 42 | |
| 43 | |
| 44 | |
| 45 | |
| 46 | |
| 47 | |
| 48 | |
| 49 | |
| 50 | |

| Claim | Date |
|-------|------|
| 51 | |
| 52 | |
| 53 | |
| 54 | |
| 55 | |
| 56 | |
| 57 | |
| 58 | |
| 59 | |
| 60 | |
| 61 | |
| 62 | |
| 63 | |
| 64 | |
| 65 | |
| 66 | |
| 67 | |
| 68 | |
| 69 | |
| 70 | |
| 71 | |
| 72 | |
| 73 | |
| 74 | |
| 75 | |
| 76 | |
| 77 | |
| 78 | |
| 79 | |
| 80 | |
| 81 | |
| 82 | |
| 83 | |
| 84 | |
| 85 | |
| 86 | |
| 87 | |
| 88 | |
| 89 | |
| 90 | |
| 91 | |
| 92 | |
| 93 | |
| 94 | |
| 95 | |
| 96 | |
| 97 | |
| 98 | |
| 99 | |
| 100 | |

SYMBOLS
 ✓ Rejected
 = Allowed
 (Through numeral) Cancelled
 + Restricted
 N Non elected
 I Interference
 A Appeal
 O Objected

(1 SET INSIDE)



| SEARCHED | | | |
|----------|-------------|------------|------|
| Class | Sub | Date | Exmr |
| 701 | 45 | 4 April 95 | YB |
| | 46 | 1 | |
| 340 | 438 | 5 April | |
| 104 | 271 | | |
| | 273 | | |
| 280 | 730 1 | | |
| | ↑ | | |
| | 735 | | |
| 307 | 91 | | |
| 340 | 400 | | |
| ----- | | | |
| | Update on | | |
| | 16 April 95 | | YB |

| SEARCH NOTES | | |
|--------------|-----------------|------|
| | Date | Exmr |
| APS Message | 4.5 April 95 | YB |

| INTERFERENCE SEARCHED | | | |
|-----------------------|-------|-------------|------|
| Class | Sub | Date | Exmr |
| 741 | 45 | 17 April 95 | YB |
| | 46 | | |
| 100 | 276 | | |
| 100 | 27 | | |
| | 27 | | |
| 430 | 130 1 | | |
| | 711 | | |
| | 1 | | |

(PRINT OUTSIDE)

=> d his

(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 |

=> 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
```

=> 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

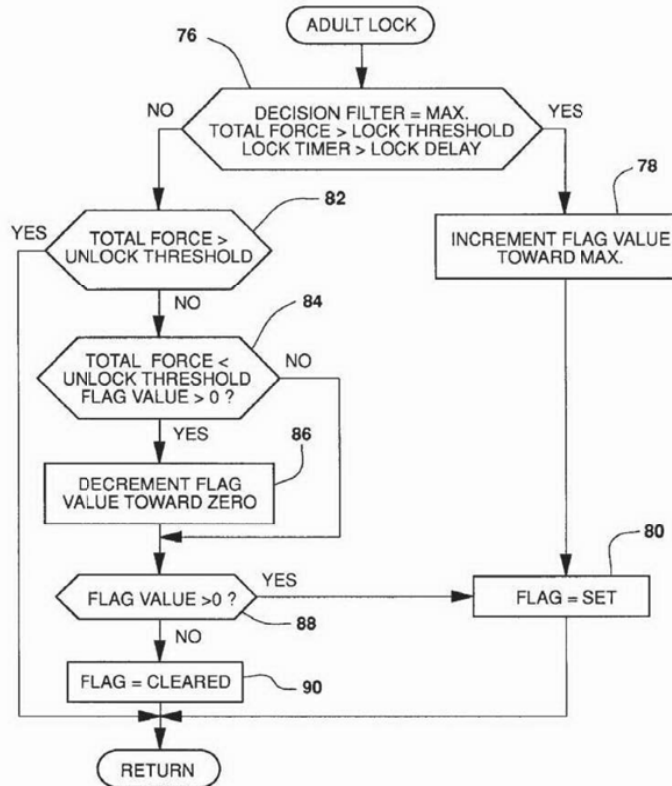
- [56] **References Cited**
- U.S. PATENT DOCUMENTS
- 5,430,649 7/1995 Cashler et al. 364/424.05
- 5,732,375 3/1998 Cashler 701/45

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



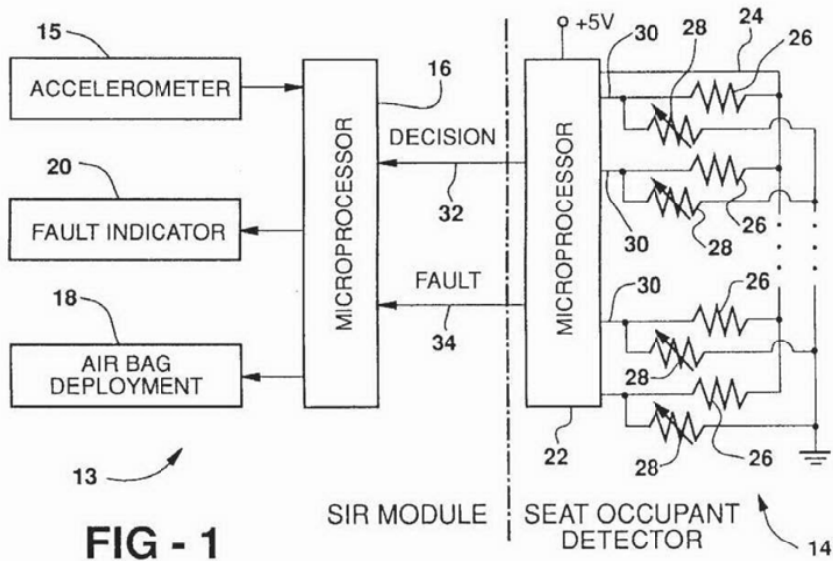


FIG - 1
PRIOR ART

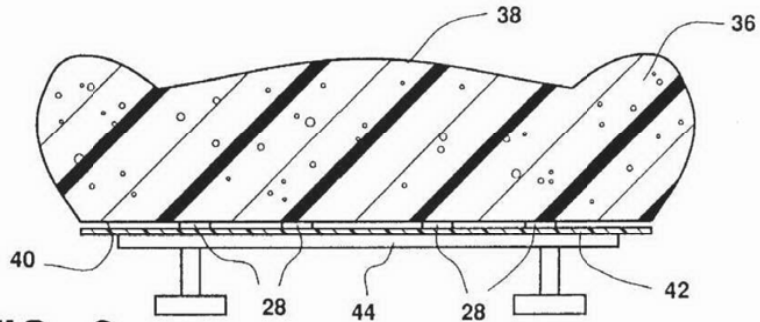


FIG - 2

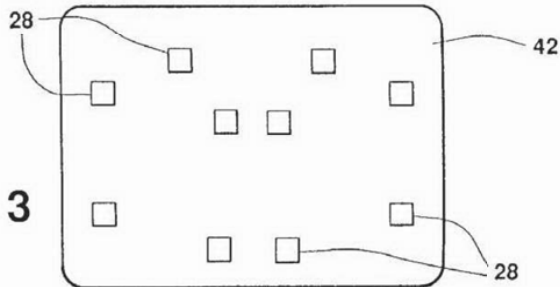


FIG - 3

FIG - 4

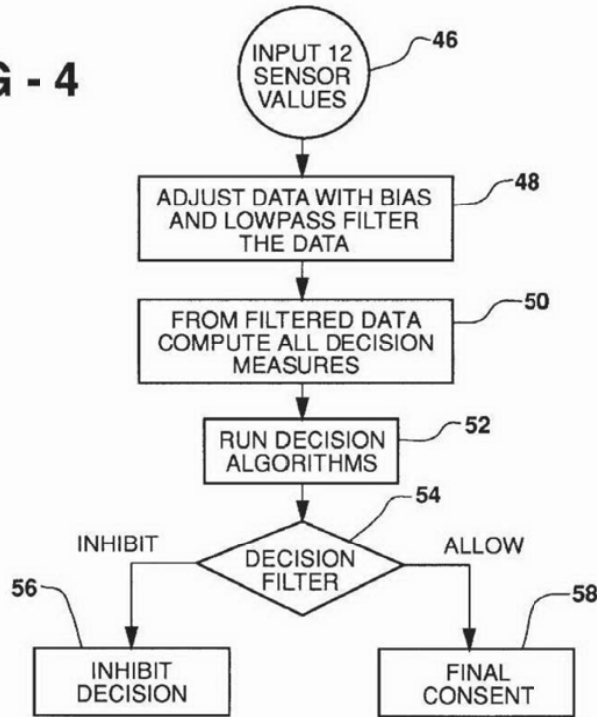


FIG - 5

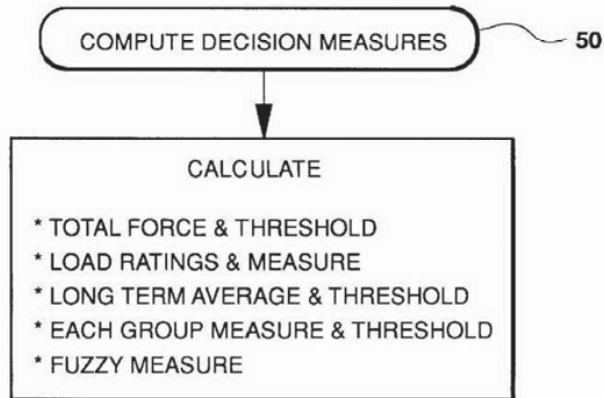


FIG - 6

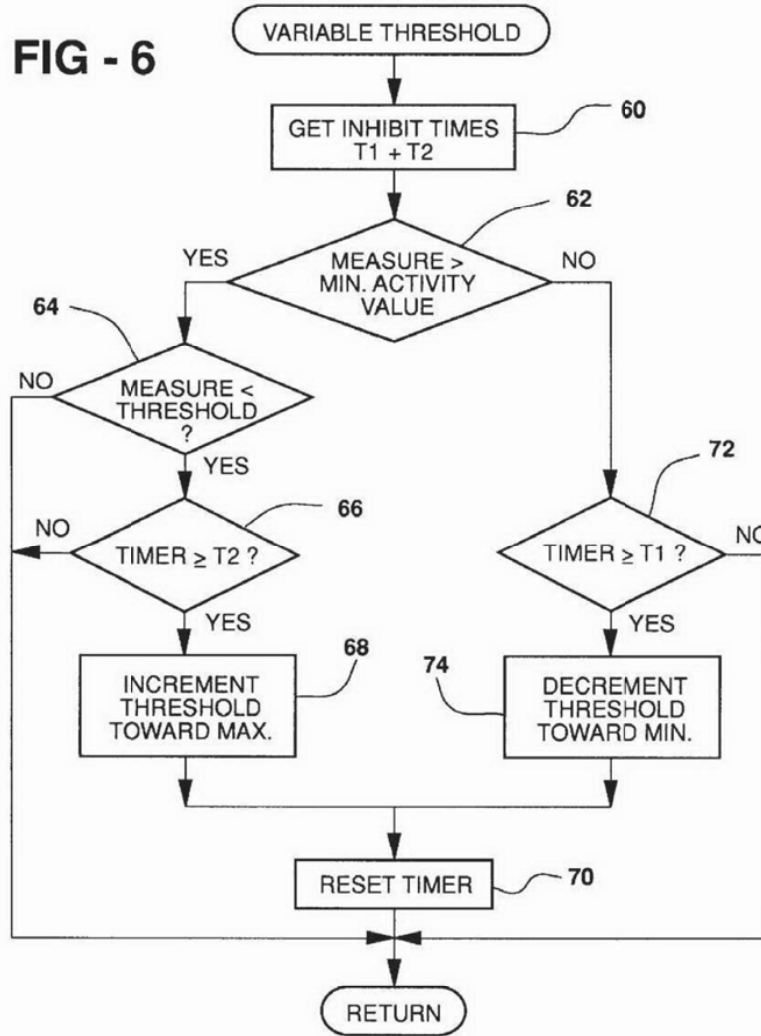
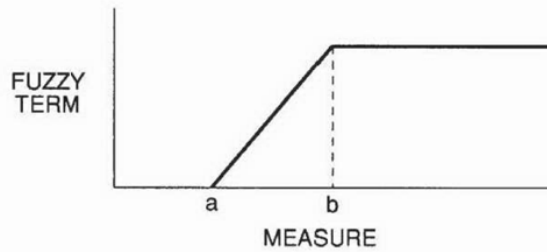


FIG - 7



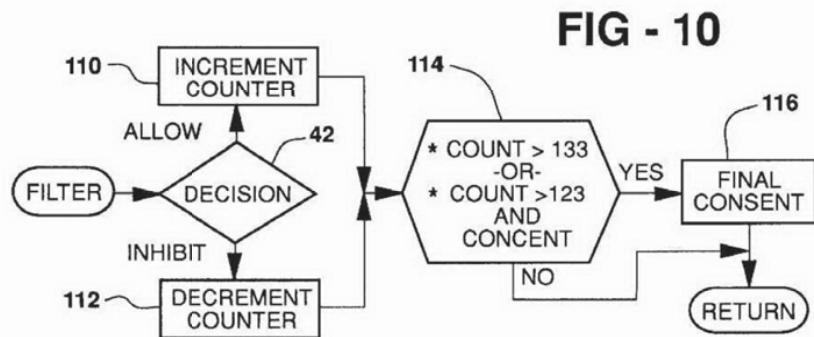
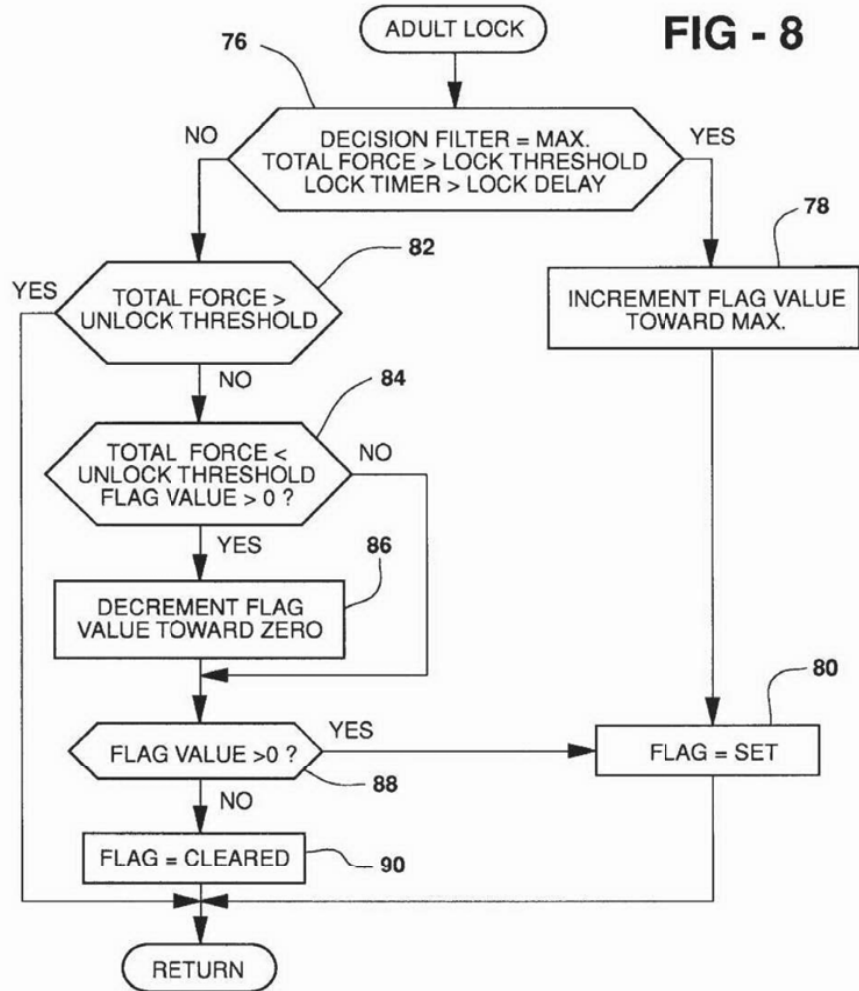
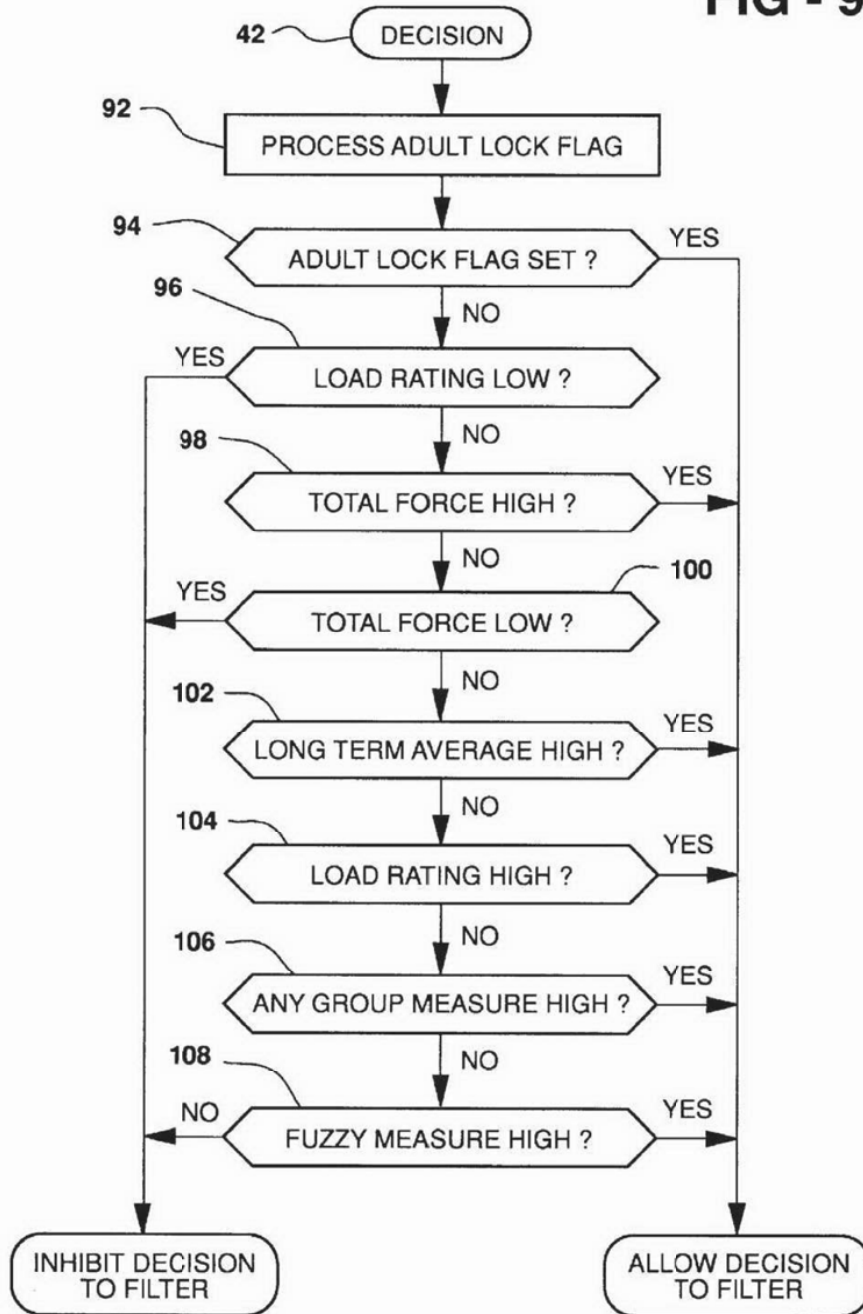


FIG - 9



1

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, judiciously located in the seat, can garner sufficient load and distribution information to allow

2

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

5

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

6

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.

7

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,

8

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

9

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.

10

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

- 5 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
- 10 decrease the first threshold when the relative weight parameter is below the minimum activity level.

* * * * *

65959 U S PTO

08/868338



06/03/97

PATENT APPLICATION SERIAL NO _____

U S DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

07/15/1997 EKURTZ 00000040 DAN 040549 08868338
01 FC 101 770 00 CH
02 FC 103 154 00 CH

PTO 1556
(5/87)

RS-8 REV 9/29/95

H-198088

A



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

5/30/97

Commissioner of Patents and Trademarks
Box Patent Application
Washington D C 20231

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

Jimmy L Funke
JIMMY L FUNKE
Reg No 34166
317/451-3481

Enclosures

OCCUPANT DETECTION METHOD AND
APPARATUS FOR AIR BAG SYSTEM

Invs. A1 →

5 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

10 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 ^{No. 5,732,375, issued March 24, 1998} 08/566,029 to Cashier, ~~entitled "METHOD OF INHIBITING OR ALLOWING AIR BAG DEPLOYMENT",~~ filed December 1, 1995, 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
5 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
10 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
15 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
20 signaling the microprocessor whether to allow or inhibit
deploying the air bag

A number of sensors, judiciously located in the seat,
can garner sufficient load and distribution information to allow
determination of the occupant size. Each sensor is a very thin
25 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,
30 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

35 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

5 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,

10 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,

15 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,

20 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

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

Description of the Invention

30 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
35 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
5 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
10 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
15 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
20 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
25 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
30 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
35 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
5 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
10 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
15 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
20 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
25 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
30 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
35 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 as 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.

35

CLAIMS

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

5 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
 10 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,
 15 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
 20 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
 25 below the unlock threshold for a time, and
 allowing deployment while the lock flag is set

Sub A2 → 2 The method defined in claim 1 wherein the means for
 allowing deployment also is capable of inhibiting deployment,
 30 including
 establishing a second threshold of the relative weight
 parameter, and
 inhibiting deployment when the relative weight
 parameter is below the second threshold
 35

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
5 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
10 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
15 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
20 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,
25 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
30 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
35 threshold,

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

5 setting the lock flag when the flag value is greater
 than zero and clearing the flag when the flag value is zero,
 a ^{so that} ~~whereby~~ the flag value at any time determines the minimum time
 for clearing the flag

8 The method defined in claim 7 including
 10 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
 15 decrementing the counter when an allow decision is
 absent

9 The method defined in claim 1 wherein a step of
 20 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
 25 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,
 30 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
 35 threshold has a first value when deployment consent is absent and

a lower value when deployment consent is present to afford hysteresis

5 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

10 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,
 15 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

20 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

25 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

30 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
 35 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
 5 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,
 10 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
 15 -

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
 20 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
 25 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,
 30 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
 35 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
5 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
10 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
20 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
35 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

5 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

15 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

20 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

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

30 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

35 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
5 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
10 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
15 is variable within a defined range the microprocessor is
programmed to

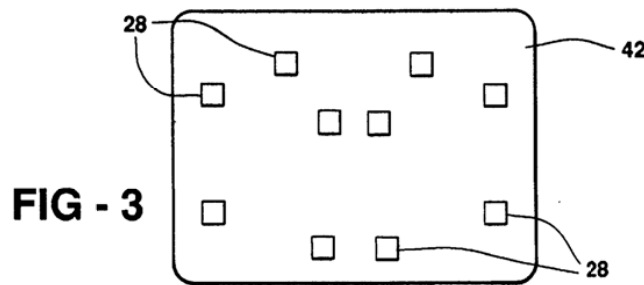
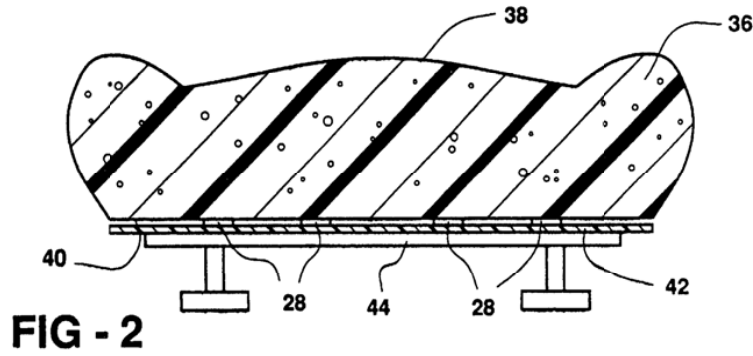
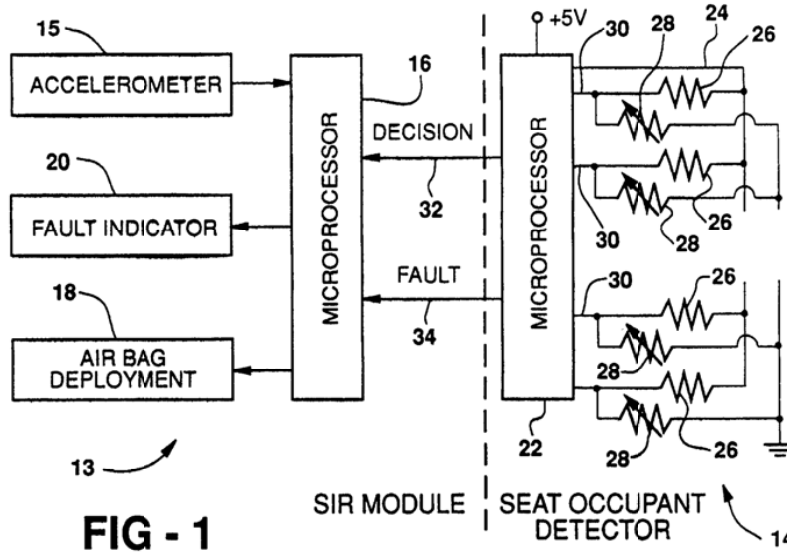
set a minimum activity level of the relative
weight parameter below the defined range,
increase the first threshold when the relative
20 weight parameter is above the minimum activity level
and below the first threshold, and
decrease the first threshold when the relative
weight parameter is below the minimum activity level

H-198088

OCCUPANT DETECTION METHOD AND
APPARATUS FOR AIR BAG SYSTEM

5 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
10 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
15 allow decision is locked in place as long as total force exceeds
a threshold.



Handwritten signature

FIG - 4

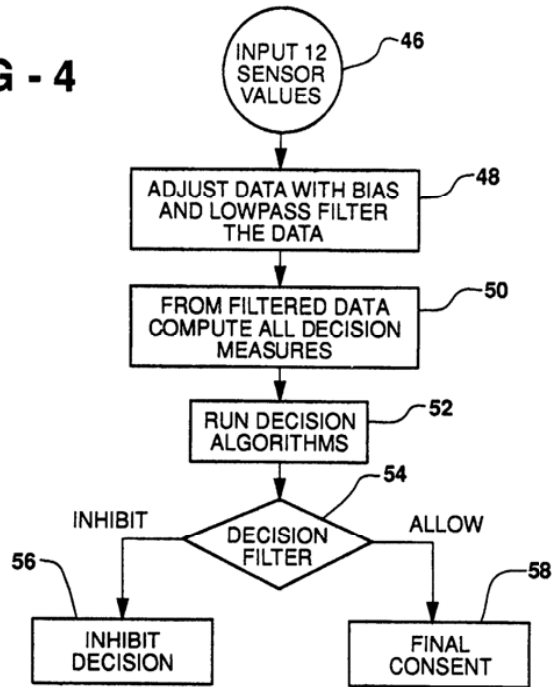


FIG - 5

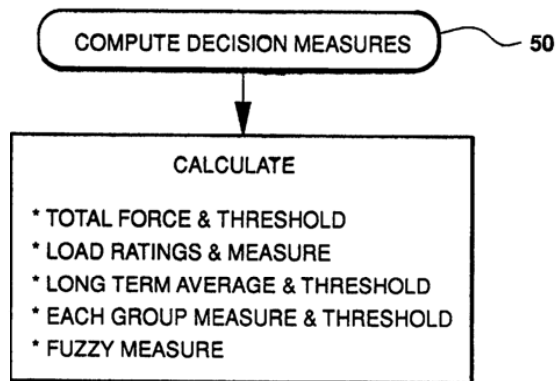


FIG - 6

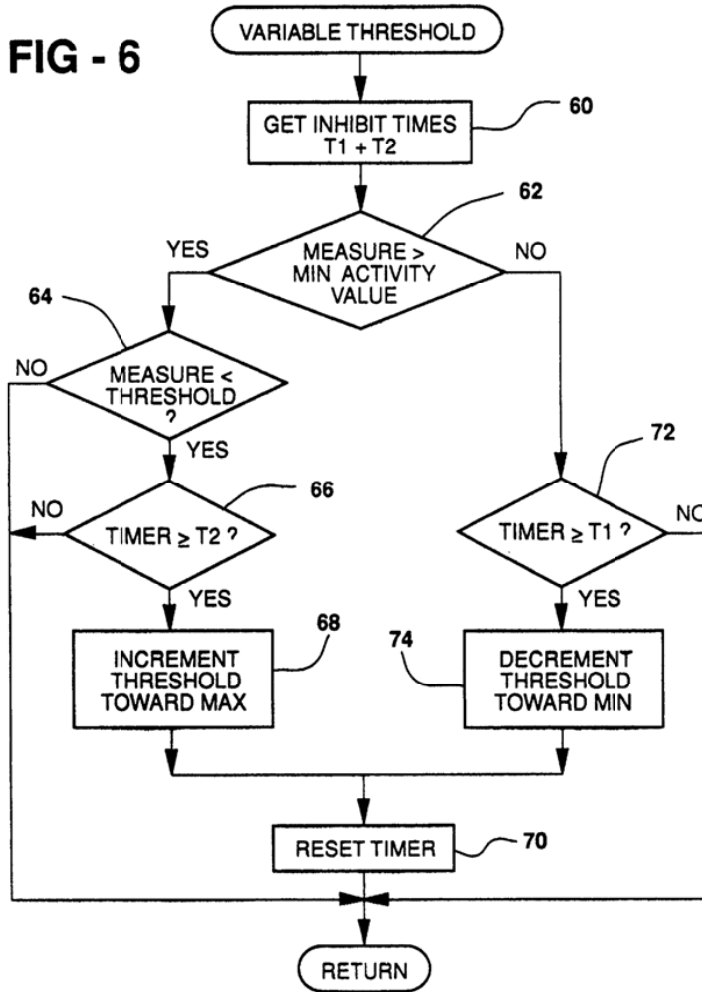


FIG - 7

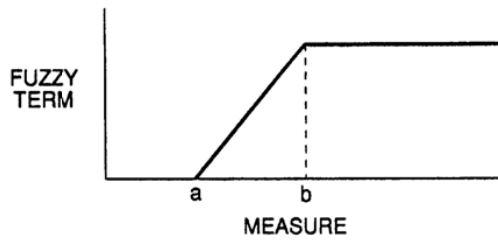
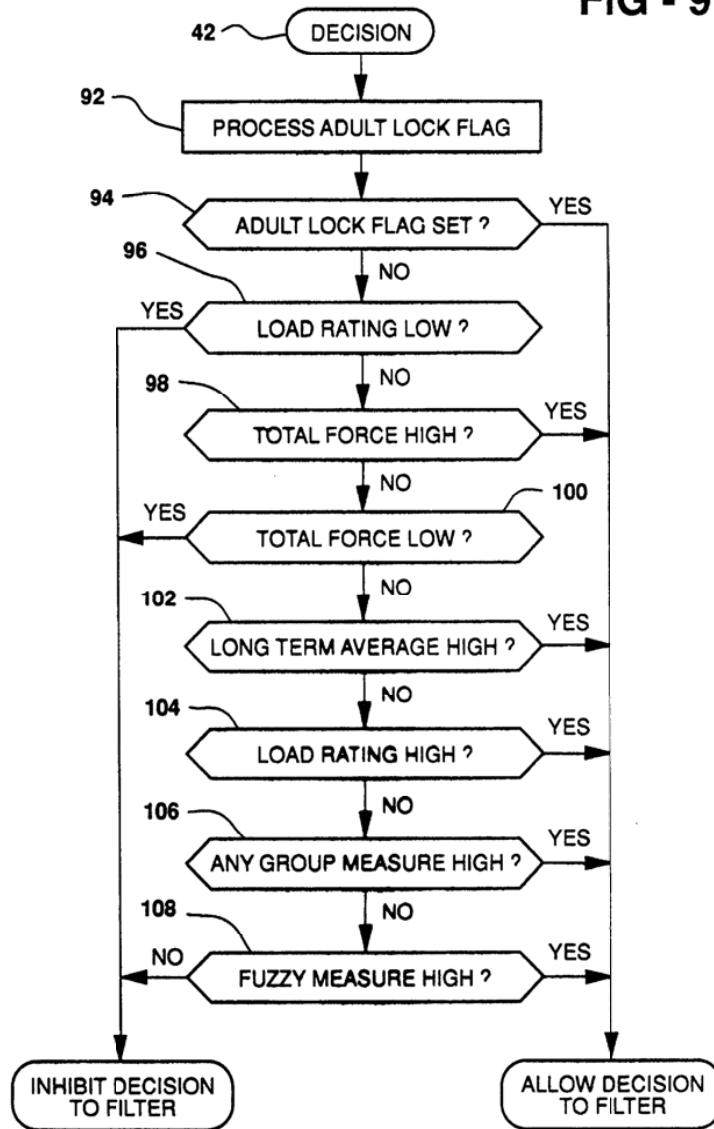
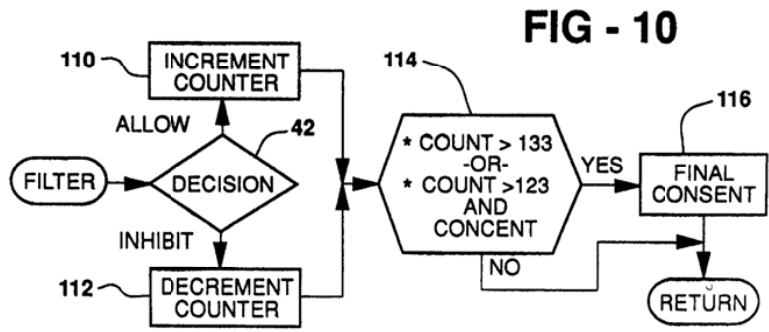
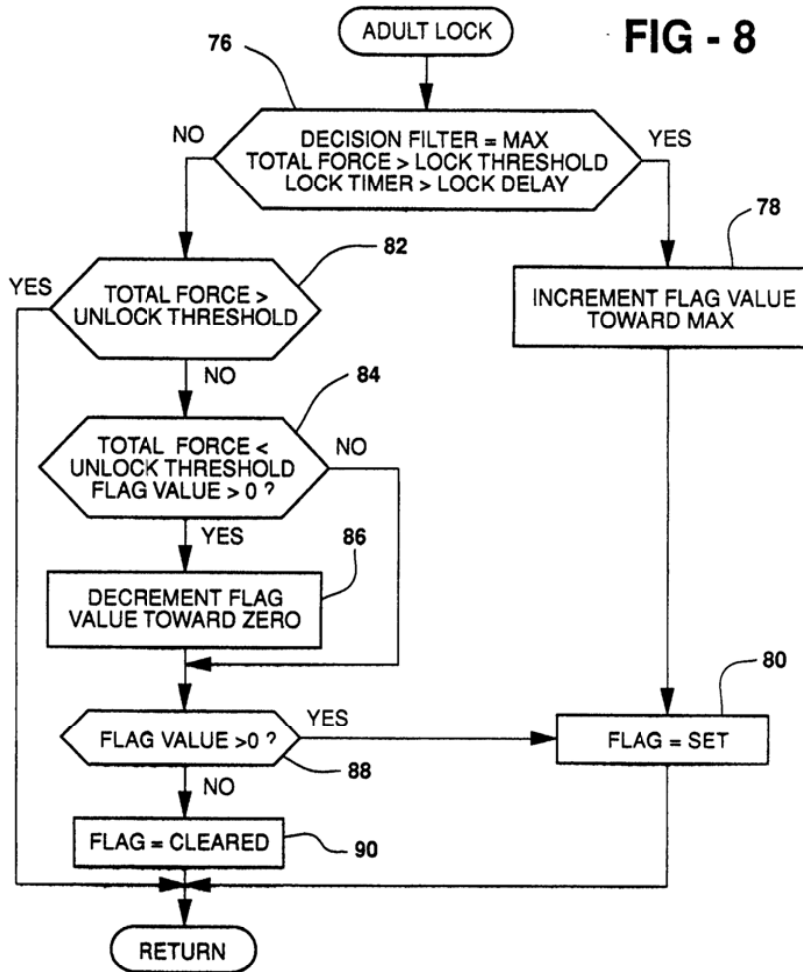
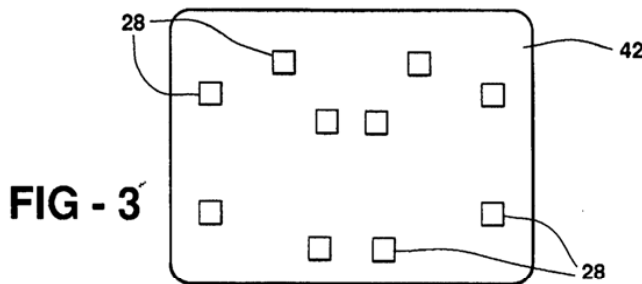
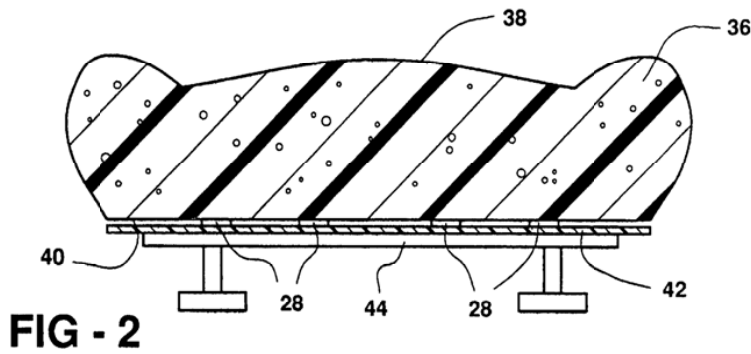
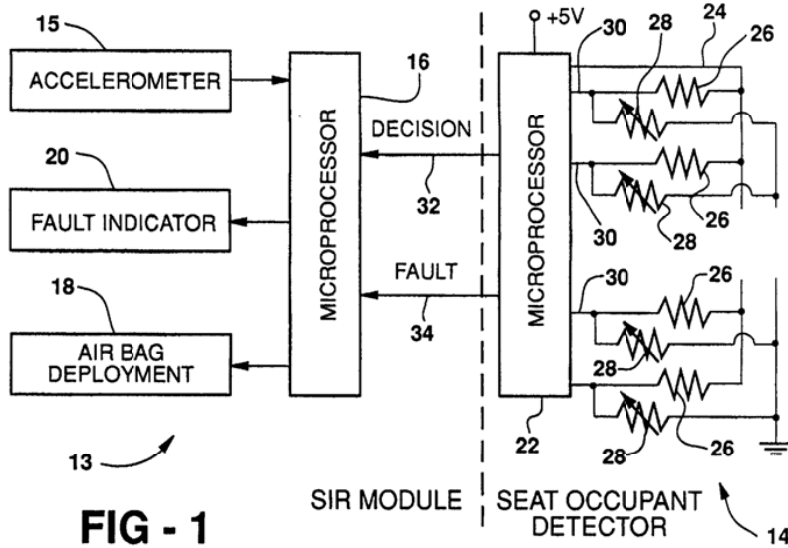


FIG - 9







*10
Fig*

FIG - 4

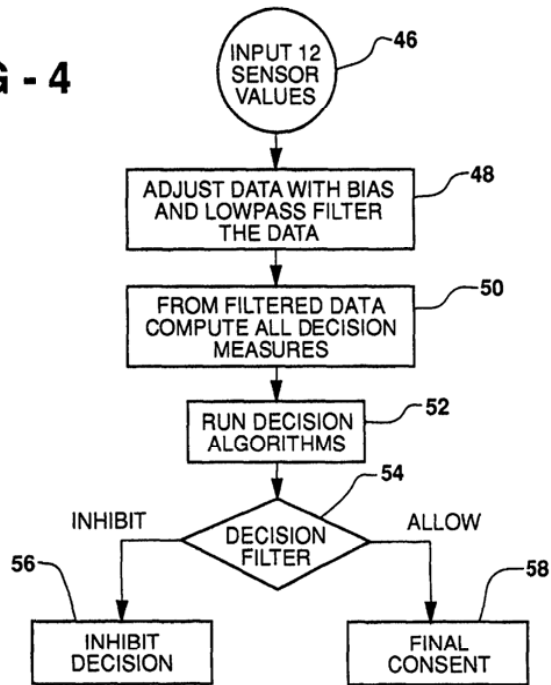


FIG - 5

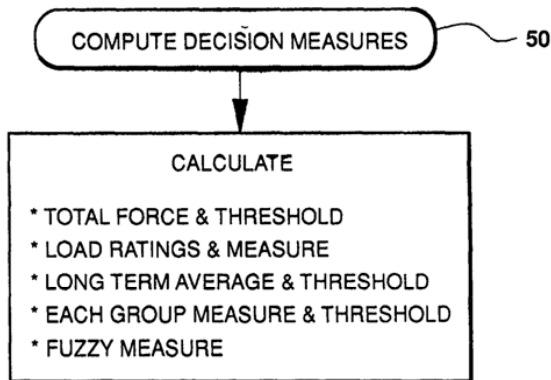


FIG - 6

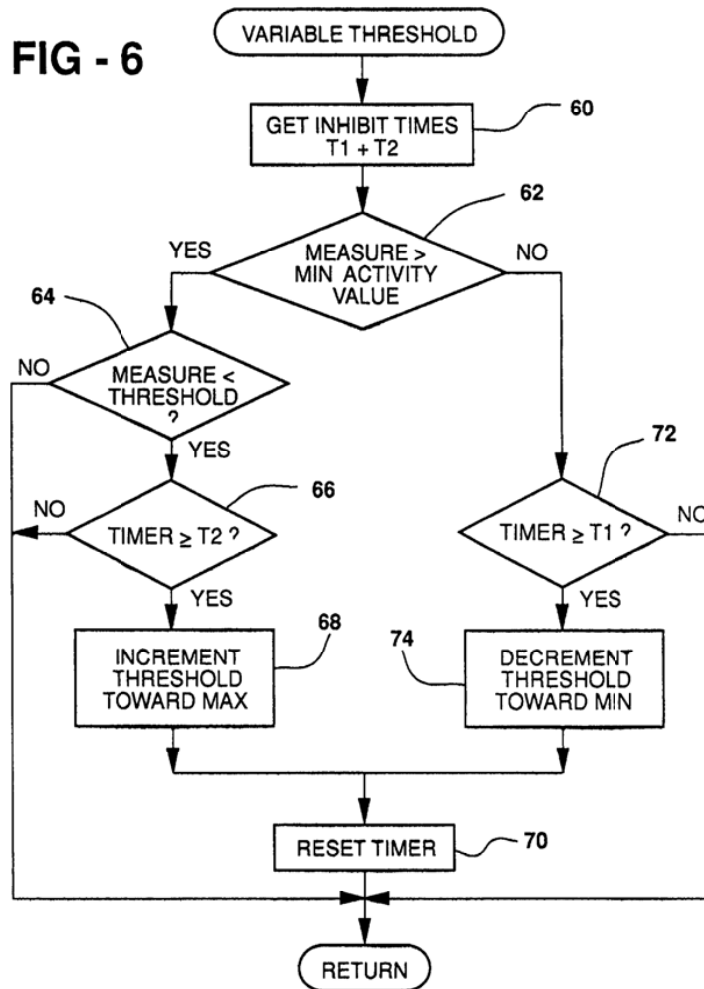
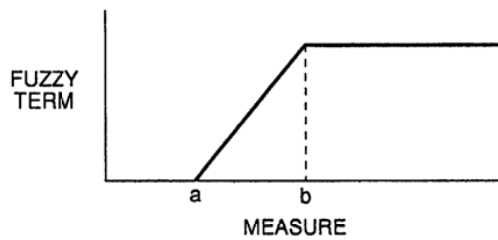
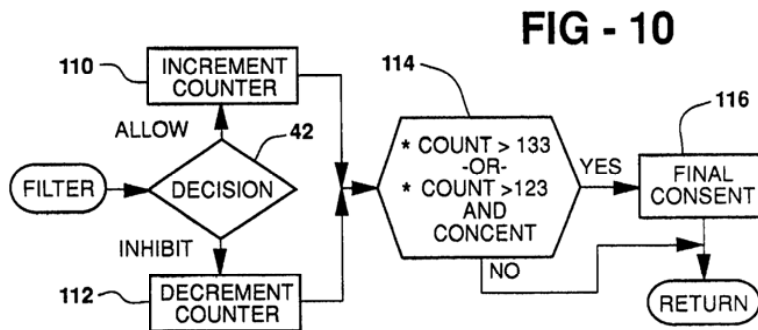
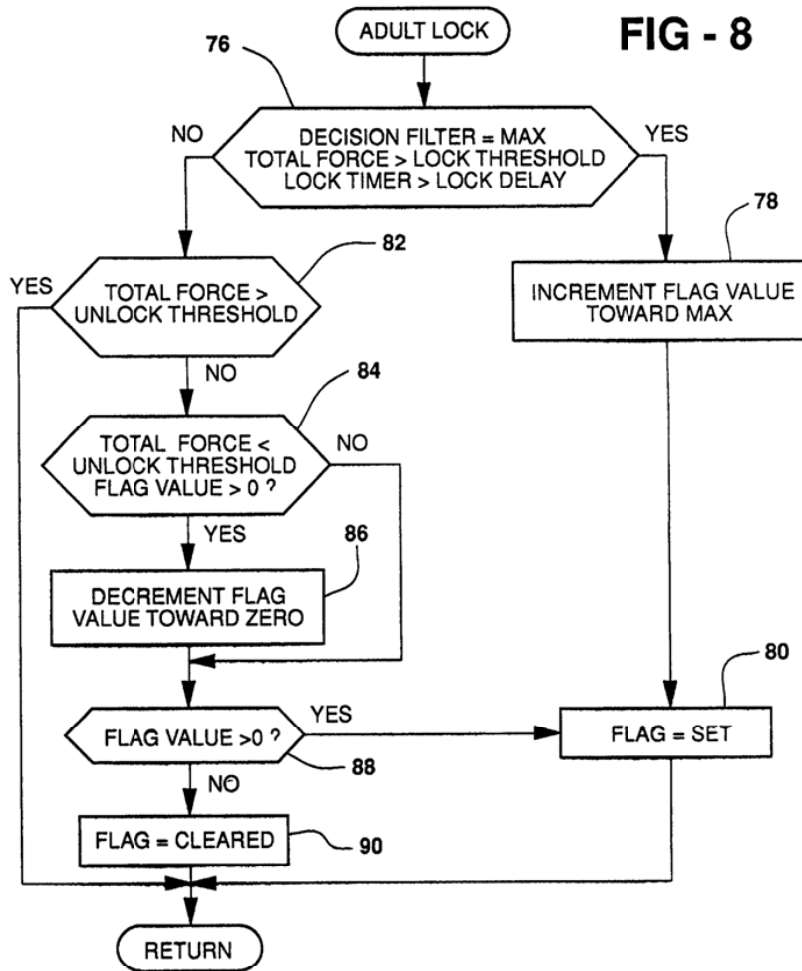


FIG - 7





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
Delco Electronics Corporation
P O BOX 9005
ERC Building - Mail Stop D-32
Kokomo IN 46904

Telephone 317/451-3481

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

Full name DUANE DONALD FORTUNE Citizenship US
Residence LEBANON IN
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

68188 U S PTO
06/03/97

PS-9 REV 2/23/96

H-198088

AD

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 1
Total Fee 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 | <u><i>Duane Donald Fortune</i></u> | Date | <u>5-28-97</u> |
| Full name | DUANE DONALD FORTUNE | Declaration dated | <u>5-28-97</u> |
| Residence | LEBANON IN | | |

| | | | |
|----------------------|-----------------------------------|-------------------|----------------|
| Inventor s signature | <u><i>Robert John Cashler</i></u> | Date | <u>5/28/97</u> |
| Full name | ROBERT JOHN CASHLER | Declaration dated | <u>5/28/97</u> |
| 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

(SEAL)

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

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

(SEAL)

Carole J. Mudlock
Notary Public
My commission expires 9/13/97
County of Authorization Heward

#2
cc
12/17/97

INFORMATION DISCLOSURE CITATION WITH DOCUMENT COPIES

| | | |
|----------------------------------------------------------------------------------|--------------------------------|-------------------------|
| Submitted by <i>Jimmy L. Funke</i> 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 | Scheusek | 280 | 730-1 | |
| YB | 5,430,649 | 7/4/95 | Cashler, et al | 364 | 424 05 | |
| YB | 5,732,375 08/566,029 | 3/24/98 | Cashler | 701 | 45 | 12/1/95 |

65953 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

Date May 30 1997
Signature Carole J. Murdock
Name Carole J Murdock

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

RS-7 REV 8/31/95

H-198088

#3
KW
12-19-97
Carter

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

| | | |
|------------------------------|-------------------------------------|--------------------------------------|
| 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)

Art Unt 3661

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 negated 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).

Art Unit 3661

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

Art Unit 3661

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

Art Unit 3661

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 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-

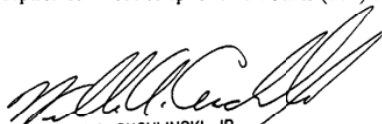
Art Unit 3661

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 | Cashier | 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 | | | | | | |

NOTICE OF DRAFTPERSON'S PATENT DRAWING REVIEW

The drawing filed (insert date) 6/3/97 are

A 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 where 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 bristol board or photographic double weight paper) Fig(s)
Poor quality (half tone) Fig(s)
3 TYPE OF PAPER 37 CFR 1 84(c)
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 1 84(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)
English 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 Arabic numerals beginning with number 1 Fig (s)
15 NUMBERING OF VIEWS 37 CFR 1 84(u)
Views not numbered consecutively and in Arabic 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



GP2661

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

5/A
Print
7/21/99
H/ma

Carole J. Murdock
Carole J Murdock

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

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

RECEIVED
TECHNOLOGY CENTER 3000
99 JUL 21 AM 7 47

U S Serial No 08/868,338 -- 2

IN THE SPECIFICATION

On page 1, line 4, insert --
a1 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

a2 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

U S Serial No 08/868,338 -- 3

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.

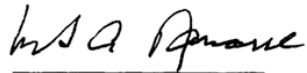
Second. The present application, filed on June 3, 1997, was co-pending with the Cashler patent, filed December 1, 1995, issued March 24, 1998, and Robert Cashler is a named inventor on both the present application and the Cashler patent. Accordingly, the present application, although not originally filed 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.

U S Serial No 08/868,338 -- 5

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,

A handwritten signature in cursive script, appearing to read "Mark A. Navarre".

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

Approved: YB
16 August 1999

#5

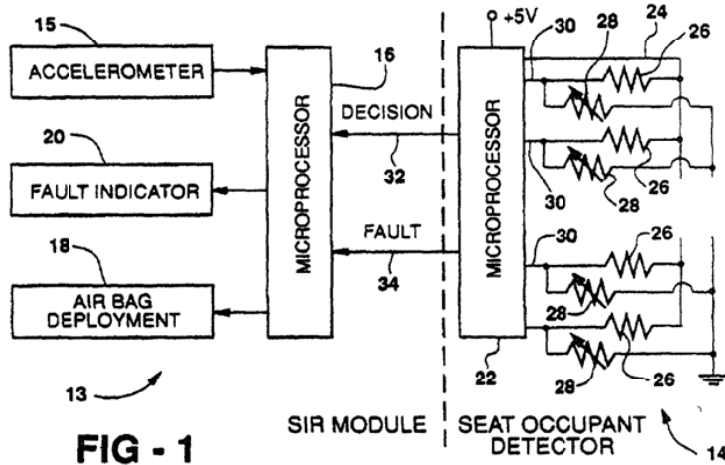


FIG - 1
PRIOR ART

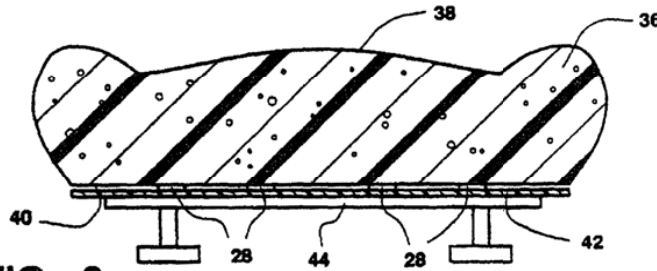


FIG - 2

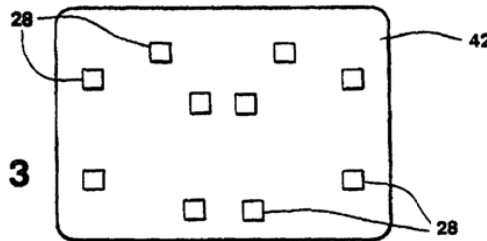


FIG - 3

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

BEST COPY



UNITED STATES 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 |
|----------------|-------------|----------------------|--------------------|
|----------------|-------------|----------------------|--------------------|

0 0 - 37 11/11/97 FUTURE H 1 - 11

7
 FM72/11-1-
 TIM L GUNF
 ELECTRONICS CORPORATION
 P O BOX 400
 401 PUTTINING MAIL STOP 172
 11500 IN 47014

EXAMINER

BEAII JEU

ART UNIT PAPER NUMBER

3 61


DATE MAILED 11/1/97

(Handwritten mark)

6

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

Commissioner of Patents and Trademarks

| | | | |
|-------------------------------|-------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------|
| Notice of Allowability | Application No 08/868 338 | Applicant(s) Fortune et al |  |
| | Examiner Yonel Beaulieu | Group Art Unit 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 letter 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

Art Unit 3661

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

Art Unit 3661

- 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 to 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 to zero so that the flag value determines at any time the minimum time for clearing the flag

Conclusion

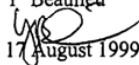
- 4 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yonel Beaulieu whose telephone number is (703) 305-4072. The examiner can normally be reached on Monday through Friday from 0800 to 1500.
- 5 If attempts to reach the examiner by telephone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

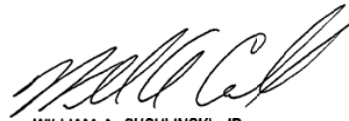
Application/Control Number 08/868,338

Page 4

Art Unit 3661

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

THREE MONTHS
FROM THE MAILING DATE OF THIS NOTICE
TO PAY THE ISSUE FEE
AND TO FILE THE PATENT APPLICATION
WITH THE PATENT AND TRADEMARK OFFICE

| APPLICATION NO | FILING DATE | TOTAL CLAIMS | EXAMINER AND GROUP ART UNIT | DATE MAILED |
|---------------------------------------------------|-------------|--------------|-----------------------------|-------------|
| 08/11/88 | 08/11/88 | 10 | 10/11/88 Y | 08/11/88 |
| First Named Applicant: NISSAN NORTH AMERICA, INC. | | | | |

TITLE OF INVENTION: METHOD AND APPARATUS FOR THE ISSUANCE OF A PATENT

| ATTY'S DOCKET NO. | CLASS SUBCLASS | BATCH NO. | APPLN TYPE | SMALL ENTITY | FEE DUE | DATE DUE |
|-------------------|----------------|-----------|------------|--------------|---------|----------|
| 08-11-11 | 01 04 | 0001 | AR | UTILITY | NO | 08/11/88 |

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

- I Review the SMALL ENTITY status shown above
 - If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status
 - 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

PATENT AND TRADEMARK OFFICE COPY

PTOL 85 (REV 10 96) Approved for use through 08/30/89 (0651 0033)

U S GPO 1998-437-639/80023



LSRH
B

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

September 1, 1999
Carole J. Murdock
Carole J Murdock

RECEIVED

SFP 17 1999

Publishing Division
14

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|------------------------------------------------------------|-------------------------|
| Duane Donald Fortune | Group Art Unit 3661 |
| Robert John Cashler | |
| 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
1 of 5
USPN 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

RECEIVED

SEP 17 1999

Publishing Division
14



6012007

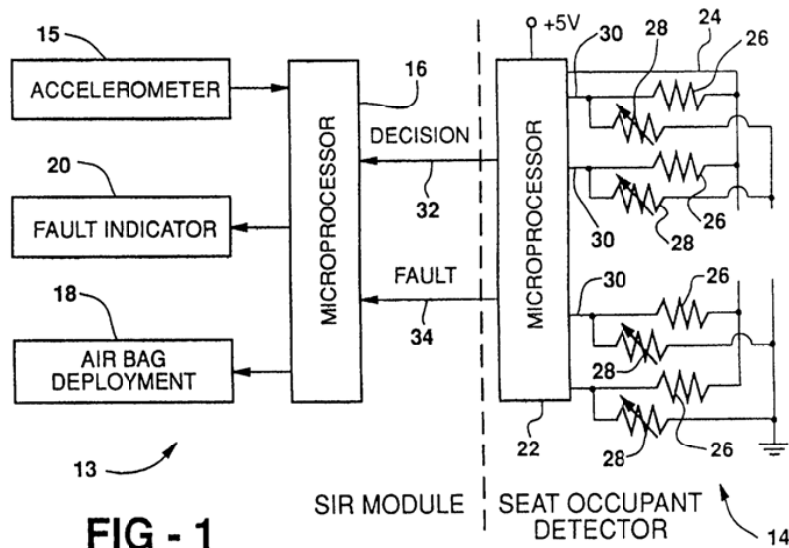


FIG - 1
PRIOR ART

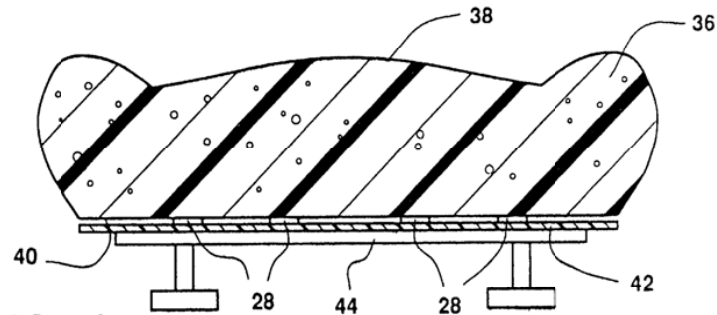


FIG - 2

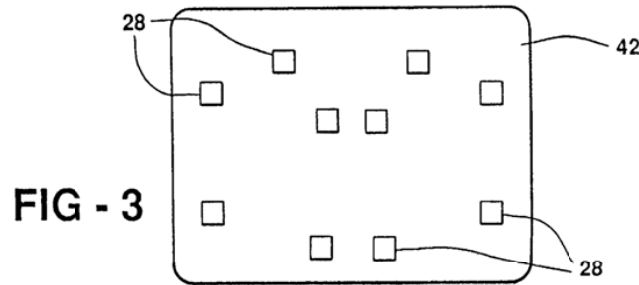


FIG - 3

FIG - 4

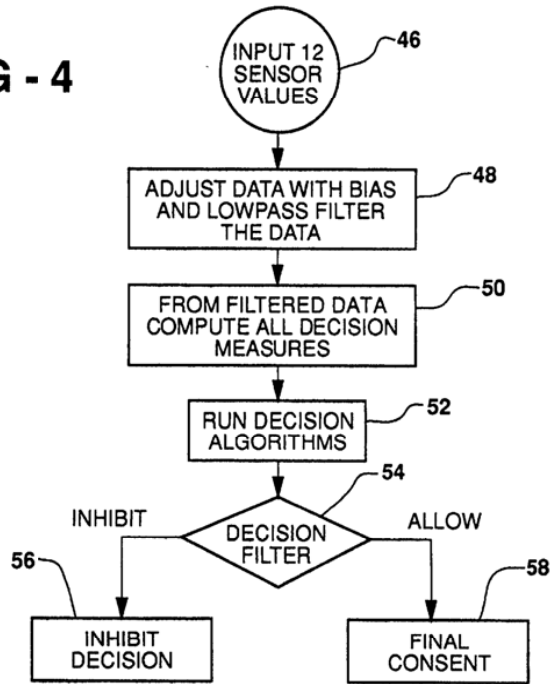


FIG - 5

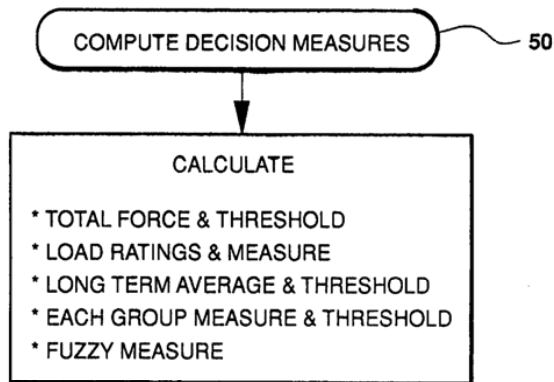


FIG - 6

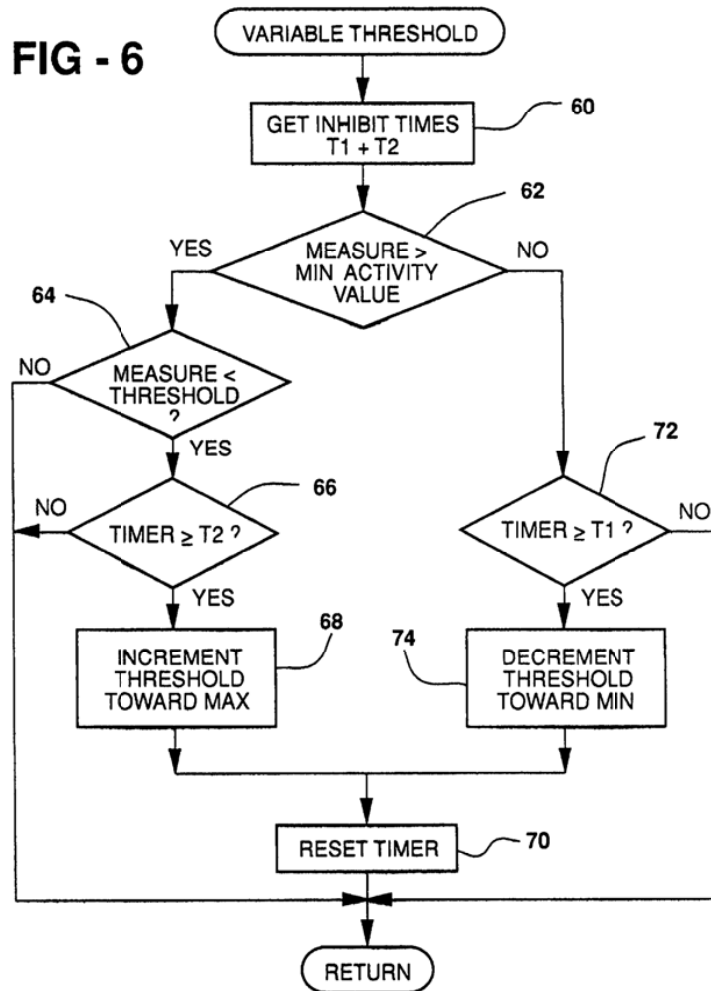


FIG - 7

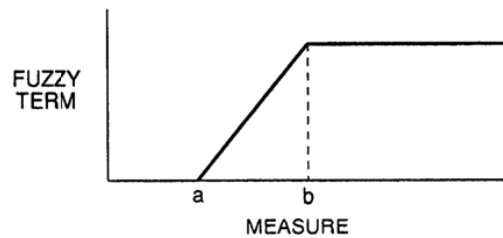
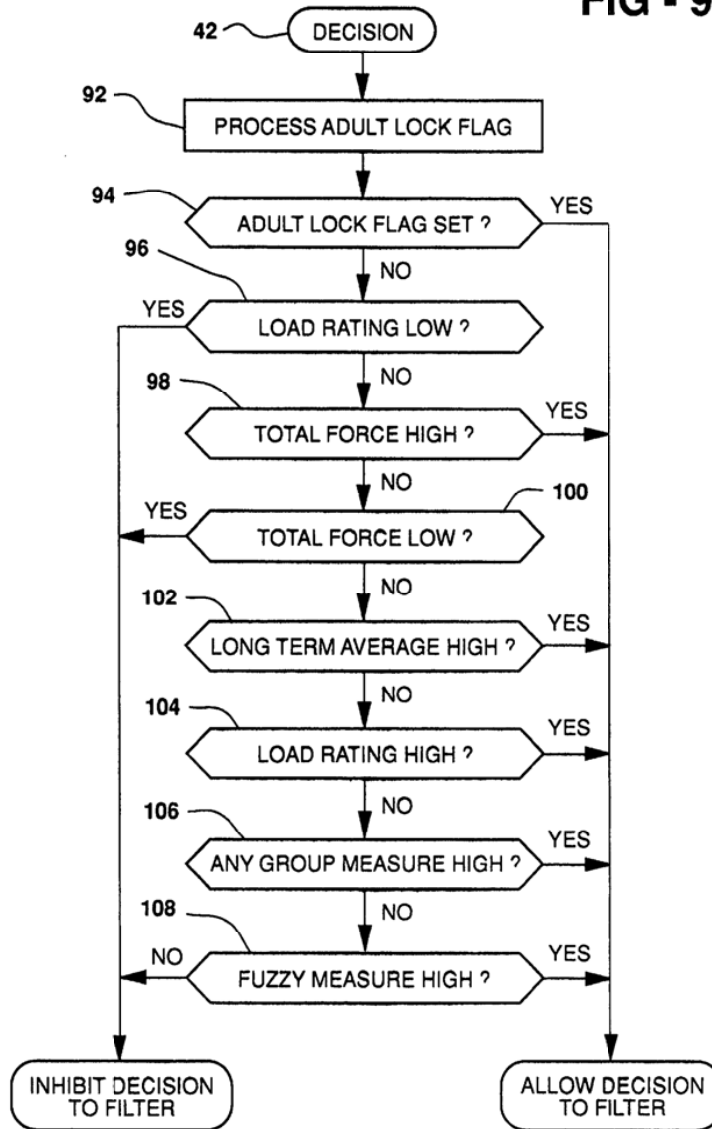
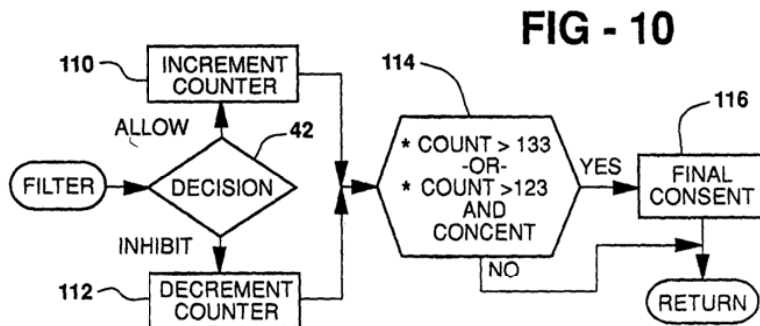
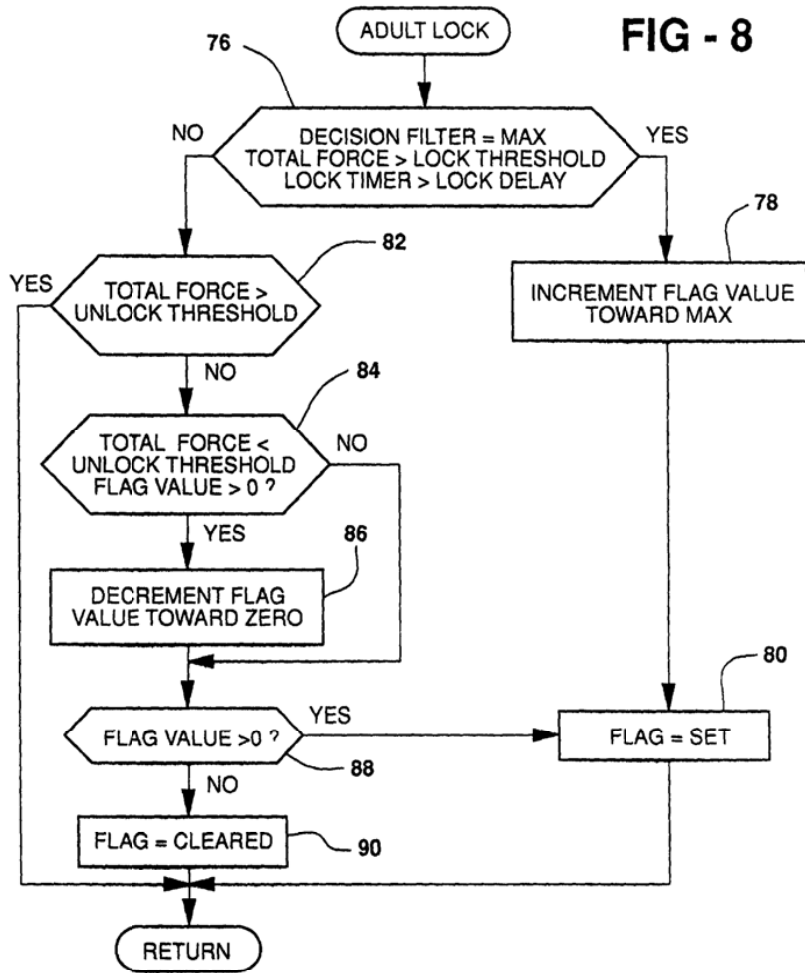


FIG - 9





BEST COPY

PART B—ISSUE FEE TRANSMITTAL

Complete and mail this form together with applicable fees to Box ISSUE FEE Assistant Commissioner for Patents Washington D C 20231

OCT 15 1999 RECEIVED

3/4 SK

MAILING INSTRUCTIONS This form should be used for transmitting the ISSUE FEE Blocks 1 through 4 should be completed when appropriate All further correspondence including the Issue Fee Receipt the Patent advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1 by (a) specifying a new correspondence address and/or (b) indicating a separate FEE ADDRESS for maintenance fee notifications

Note The certificate of mailing below can only be used for domestic mailings of the Issue Fee Transmittal This certificate cannot be used for any other accompanying papers Each additional paper such as an assignment or formal drawing must have its own certificate of mailing

Certificate of Mailing

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below

Carole J Murdock (Depositor's name)

Carole J. Murdock (Signature)

October 12, 1999 (Date)

CURRENT CORRESPONDENCE ADDRESS (Note Legibly mark up with any corrections or use Block 1)

JIMMY L FUNKE
DELPHI TECHNOLOGIES CORPORATION
P O BOX 1000
ELM HURST NJ 07631

Table with columns: APPLICATION NO, FILING DATE, TOTAL CLAIMS, EXAMINER AND GROUP ART UNIT, DATE MAILED. Includes Applicant: JIMMY L FUNKE.

TITLE OF INVENTION DELPHI ANTENNA LOCATION METHOD AND APPARATUS FOR AIR BEARING ANTENNA

Table with columns: ATTY'S DOCKET NO, CLASS SUBCLASS, BATCH NO, APPLN TYPE, SMALL ENTITY, FEE DUE, DATE DUE.

1 Change of correspondence address or indication of Fee Address (37 CFR 1.363) Use of PTO form(s) and Customer Number are recommended but not required

- Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached
Fee Address indication (or Fee Address Indication form PTO/SB/47) attached

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

1 Jimmy L Funke

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 indicated below (will not be printed on the patent)
Individual
[checked] Corporation or other private group entity
Government

4a The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks)

- Issue Fee
Advance Order # of Copies

4b The following fees or deficiency in these fees should be charged to DEPOSIT ACCOUNT NUMBER 50-0831 (ENCLOSE AN EXTRA COPY OF THIS FORM)

- [checked] Issue Fee
Advance Order # of Copies

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above

Authorized Signature [Signature]

(Date) 10/12/99

NOTE The Issue Fee will not be accepted from anyone other than the applicant a registered attorney or agent or the assignee or other party in interest as shown by the records of the Patent and Trademark Office

Burden Hour Statement This form is estimated to take 0.2 hours to complete Time will vary depending on the needs of the individual case Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer Patent and Trademark Office Washington D C 20231 DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS SEND FEES AND THIS FORM TO Box Issue Fee Assistant Commissioner for Patents Washington D C 20231

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

TRANSMIT THIS FORM WITH FEE

PTOL 85B (REV 10 96) Approved for use through 08/30/99 OMB 0651 0033

Patent and Trademark Office U S DEPARTMENT OF COMMERCE

PART B—ISSUE FEE TRANSMITTAL

Complete and mail this form together with applicable fees to
 Box ISSUE FEE
 Assistant Commissioner for Patents
 Washington D C 20231

OCT 15 1999
 3024

JK

MAILING INSTRUCTIONS This form should be used for transmitting the ISSUE FEE Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt the Patent advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1 by (a) specifying a new correspondence address and/or (b) indicating a separate FEE ADDRESS for maintenance fee notifications

Note The certificate of mailing below can only be used for domestic mailings of the Issue Fee Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper such as an assignment or formal drawing must have its own certificate of mailing

Certificate of Mailing

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below

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

CURRENT CORRESPONDENCE ADDRESS (Note Legibly mark-up with any corrections or use block 1)

FMR2/11E1F
 TIMM, L FUNKE
 IELCO ELECTRONICS CORPORATION
 F O BOX 71115
 ERC BUILDING MAIL STOP D-3L
 FORT MONROE IN 47314

| APPLICATION NO | FILING DATE | TOTAL CLAIMS | EXAMINER AND GROUP ART UNIT | DATE MAILED |
|----------------------------------------------------------------------|-------------|--------------|-----------------------------|-------------|
| 11E/3E3 33E | 11E/103/97 | 1127 | BEAULIEU Y 3661 | 11E/1E/99 |
| First Named Applicant: FUNKE TIMM L 35 USC 154(b) term ext = 11 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-19E11E3 | 711-1145 11111 | A3E | UTILITY | NO | \$1211 1111 | 11/1E/99 |

1 Change of correspondence address or indication of Fee Address (37 CFR 1.363) Use of PTO form(s) and Customer Number are recommended but not required
 Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached
 Fee Address Indication (or Fee Address Indication form PTO/SB/47) attached

2 For printing on the patent front page list (1) the names of up to 3 registered patent attorneys or agents OR alternatively (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed no name will be printed
 1 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 indicated below (will not be printed on the patent)
 Individual Corporation or other private group entity government

4a The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks)
 Issue Fee
 Advance Order # of Copies _____
 4b The following fees or deficiency in these fees should be charged to DEPOSIT ACCOUNT NUMBER 50-0831 (ENCLOSE AN EXTRA COPY OF THIS FORM)
 Issue Fee
 Advance Order # of Copies _____

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above

(Authorized Signature) [Signature] (Date) 10/12/99

NOTE: The Issue Fee will not be accepted from anyone other than the applicant, a registered attorney or agent, or the assignee or other party in interest as shown by the records of the Patent and Trademark Office

Burden Hour Statement This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington D C 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO Box Issue Fee, Assistant Commissioner for Patents, Washington D C 20231.

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

TRANSMIT THIS FORM WITH FEE

PTOL-85B (REV 10 96) Approved for use through 08/30/99 OMB 0651-0033

Patent and Trademark Office U S DEPARTMENT OF COMMERCE

File History Content Report

The following content is missing from the original file history record obtained from the United States Patent and Trademark Office. No additional information is available.

Document Date - 2000-01-04

Document Title - USPTO Grant

This page is not part of the official USPTO record. It has been determined that content identified on this document is missing from the original file history record.

BEST COPY

| PATENT APPLICATION FEE DETERMINATION RECORD | | | | | Application or Docket Number <i>08/868335</i> | | | | | |
|---------------------------------------------------------------------|------------------------------------------------|------------------------------------|---------------|----------|--------------------------------------------------|--------|------------------|----------|--------------------------------|----------------|
| Effective October 1, 1996 | | | | | | | | | | |
| CLAIMS AS FILED - PART I | | | | | SMALL ENTITY | | OR | | OTHER THAN SMALL ENTITY | |
| FOR | NUMBER FILED (Column 1) | NUMBER EXTRA (Column 2) | RATE | FEE | RATE | FEE | RATE | FEE | RATE | FEE |
| BASIC FEE | | | | \$385.00 | | | | \$770.00 | | |
| TOTAL CLAIMS | 27 | minus 20 | x\$11= | | x\$22= | 1540 | | | | |
| INDEPENDENT CLAIMS | 3 | minus 3 | x40= | | x80= | | | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT | | | +130= | | +260= | | | | | |
| TOTAL | | | | | TOTAL | | TOTAL | | TOTAL | |
| 92400 | | | | | | | | | | |
| If the difference in column 1 is less than zero enter 0 in column 2 | | | | | | | | | | |
| CLAIMS AS AMENDED - PART II | | | | | SMALL ENTITY | | OR | | OTHER THAN SMALL ENTITY | |
| AMENDMENT A | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | ADDITIONAL FEE |
| | Total | 27 | minus 27 | x\$11= | | x\$22= | | x\$22= | | |
| | Independent | 3 | minus 3 | x40= | | x80= | | x80= | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | +130= | | +260= | | +260= | | |
| TOTAL ADDIT. FEE | | | | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | |
| | | | | | | | | | | |
| AMENDMENT B | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | ADDITIONAL FEE |
| | Total | | minus | x\$11= | | x\$22= | | x\$22= | | |
| | Independent | | minus | x40= | | x80= | | x80= | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | +130= | | +260= | | +260= | | |
| TOTAL ADDIT. FEE | | | | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | |
| | | | | | | | | | | |
| AMENDMENT C | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | RATE | ADDITIONAL FEE | ADDITIONAL FEE |
| | Total | | minus | x\$11= | | x\$22= | | x\$22= | | |
| | Independent | | minus | x40= | | x80= | | x80= | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM | | | +130= | | +260= | | +260= | | |
| TOTAL ADDIT. FEE | | | | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | | TOTAL ADDIT. FEE | |
| | | | | | | | | | | |

Form PTO 875 (Rev 10/95)

U.S. Government Printing Office 1995 413-288/4919

Patent and Trademark Office U.S. DEPARTMENT OF COMMERCE

PACE DATA ENTRY CODING SHEET

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

1ST EXAMINER
2ND EXAMINER

DATE
DATE

0595 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 STATUS CODE | PARENT APPLICATION SERIAL NUMBER | PCT APPLICATION SERIAL NUMBER | PARENT PATENT NUMBER | PARENT FILING DATE MONTH DAY YEAR |
|------------------|----------------------------------|-------------------------------|----------------------|-----------------------------------|
| P | C | T | / | / |
| P | C | T | / | / |
| P | C | T | / | / |
| P | C | T | / | / |
| P | C | T | / | / |

PCT/FOREIGN APPLICATION DATA

| FOREIGN PRIORITY CLAIMED | COUNTRY CODE | PCT/FOREIGN APPLICATION SERIAL NUMBER | FOREIGN FILING DATE MONTH DAY YEAR |
|--------------------------|--------------|---------------------------------------|------------------------------------|
| | | | |
| | | | |
| | | | |
| | | | |

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):

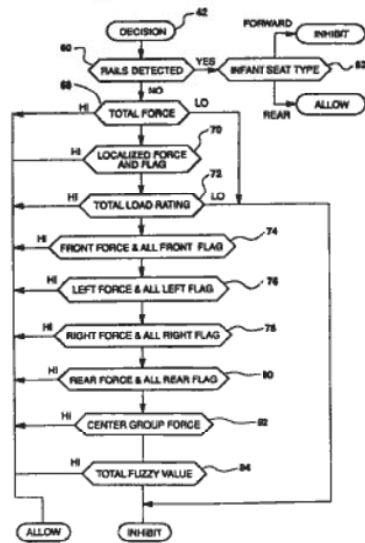
Litigation (US): 2004-05-27 2004 Takata Seat Belts Inc., a Delaware Corporation Delphi Automotive Systems LLC W.D. Texas | 2014-04-01 2014 Signal IP, Inc. a California Corporation American Honda Motor Co., Inc. a California Corporation Honda of America Mfg., Inc. an Ohio Corporation C.D. California 2:14cv02454 | 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,I N,US | FORTUNE, DUANE DONALD CASHLER, ROBERT JOHN | 1997-05-28 1997-05-28 | 008647/0573 | 1997-06-03 |
| 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):

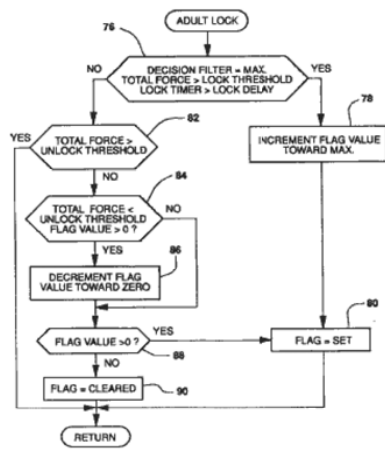
Litigation (US): 2004-05-27 2004 Takata Seat Belts Inc., a Delaware Corporation Delphi Automotive Systems LLC W.D. Texas | 2014-04-01 2014 Signal IP, Inc. a California Corporation American Honda Motor Co., Inc. a California Corporation Honda of America Mfg., Inc. an Ohio Corporation C.D. California 2:14cv02454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

Front Page Drawing:



Copyright 2007-2014 THOMSON REUTERS

| | | | | | |
|-------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------|-----------------|
| USPTO Maintenance Report | | | | | |
| Patent Bibliographic Data | | | | 05/06/2014 12:58 AM | |
| Patent Number: | 6012007 | Application Number: | 08868338 | | |
| 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 | | | | |