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(54) **TIRE PRESSURE MONITORING METHOD**

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(52) **U.S. Cl.** **73/146.2**

(58) **Field of Classification Search** 73/146–146.8; 340/442–448; 152/415, 419
See application file for complete search history.

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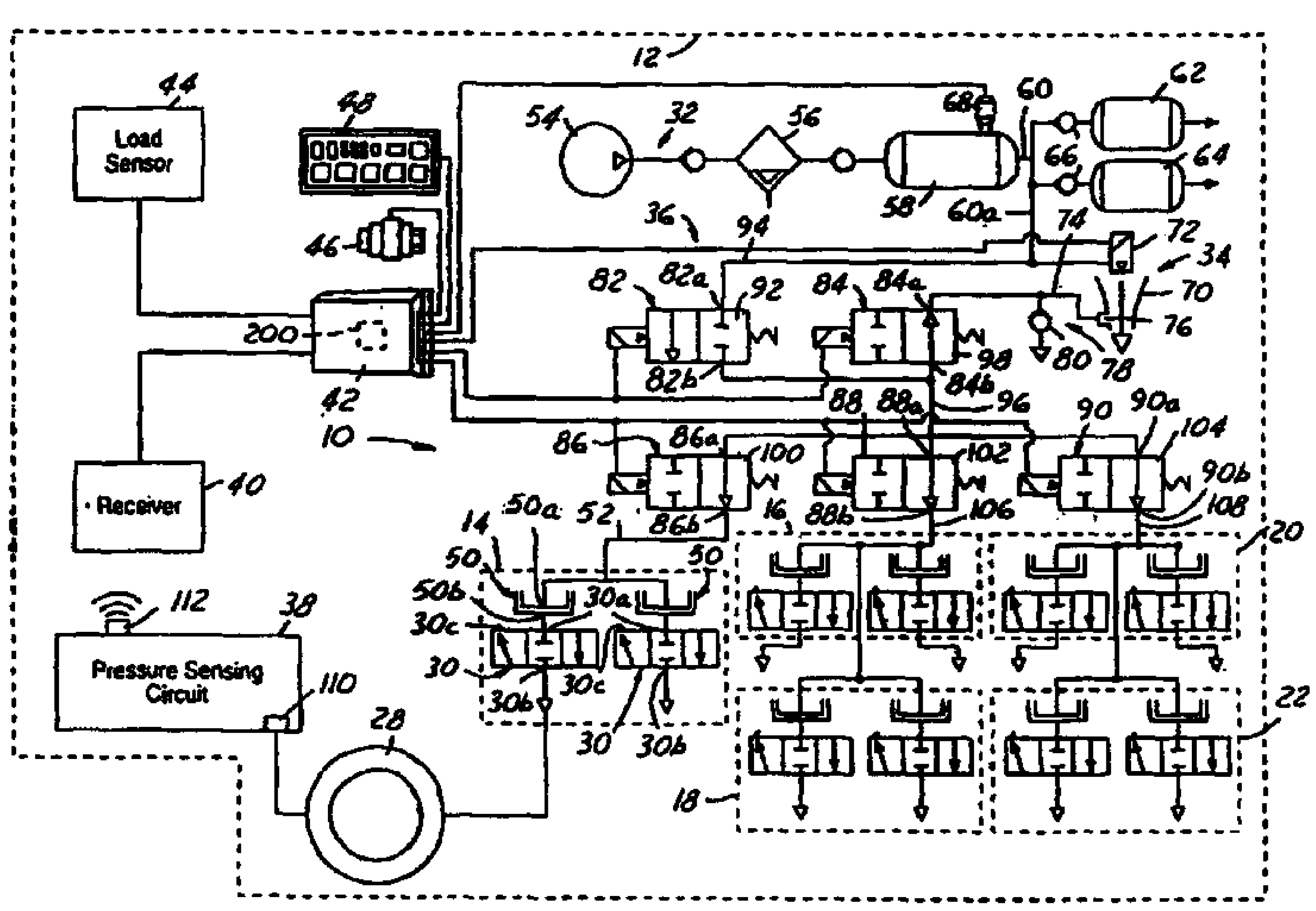
(57) **ABSTRACT**

A method of monitoring the fluid pressure of, with a sensor of a tire pressure management system disposed without, a tire that prevents overinflation of same. The method of monitoring a fluid pressure of a tire with a sensor, disposed in conduit assemblies for conducting fluid to or from the tire, of a tire pressure management system includes providing a pulse of compressed fluid to the conduit assemblies, unless a counter exceeds a count, the fluid in the conduit assemblies thereafter having a conduit pressure. The pulse has a duration that corresponds to a ratio defined by a first predetermined amount divided by a second predetermined amount.

38 Claims, 3 Drawing Sheets



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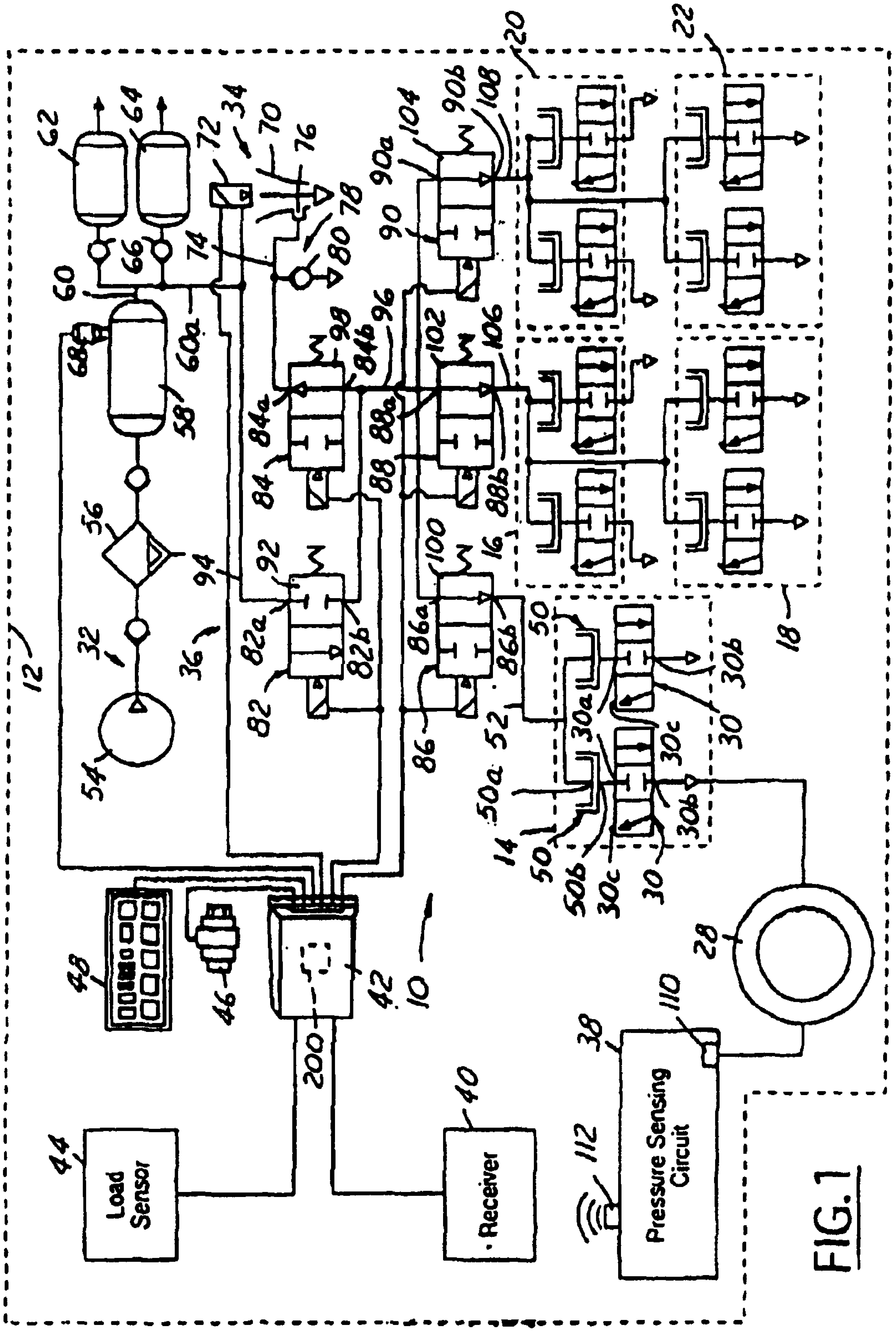

FIG. 1

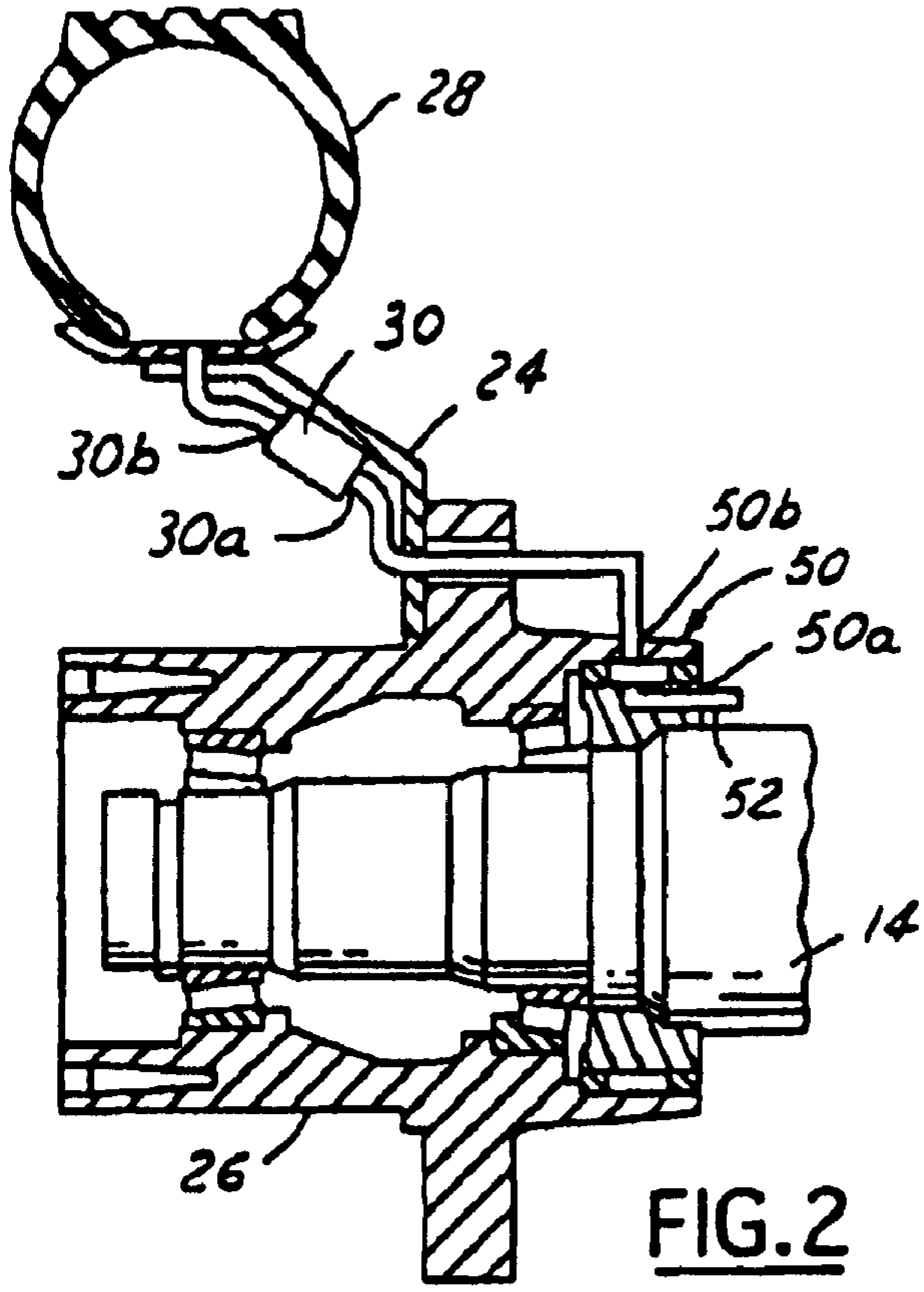
28
30
24
30b
30a
50b
50
50a
52
14
26

FIG. 2

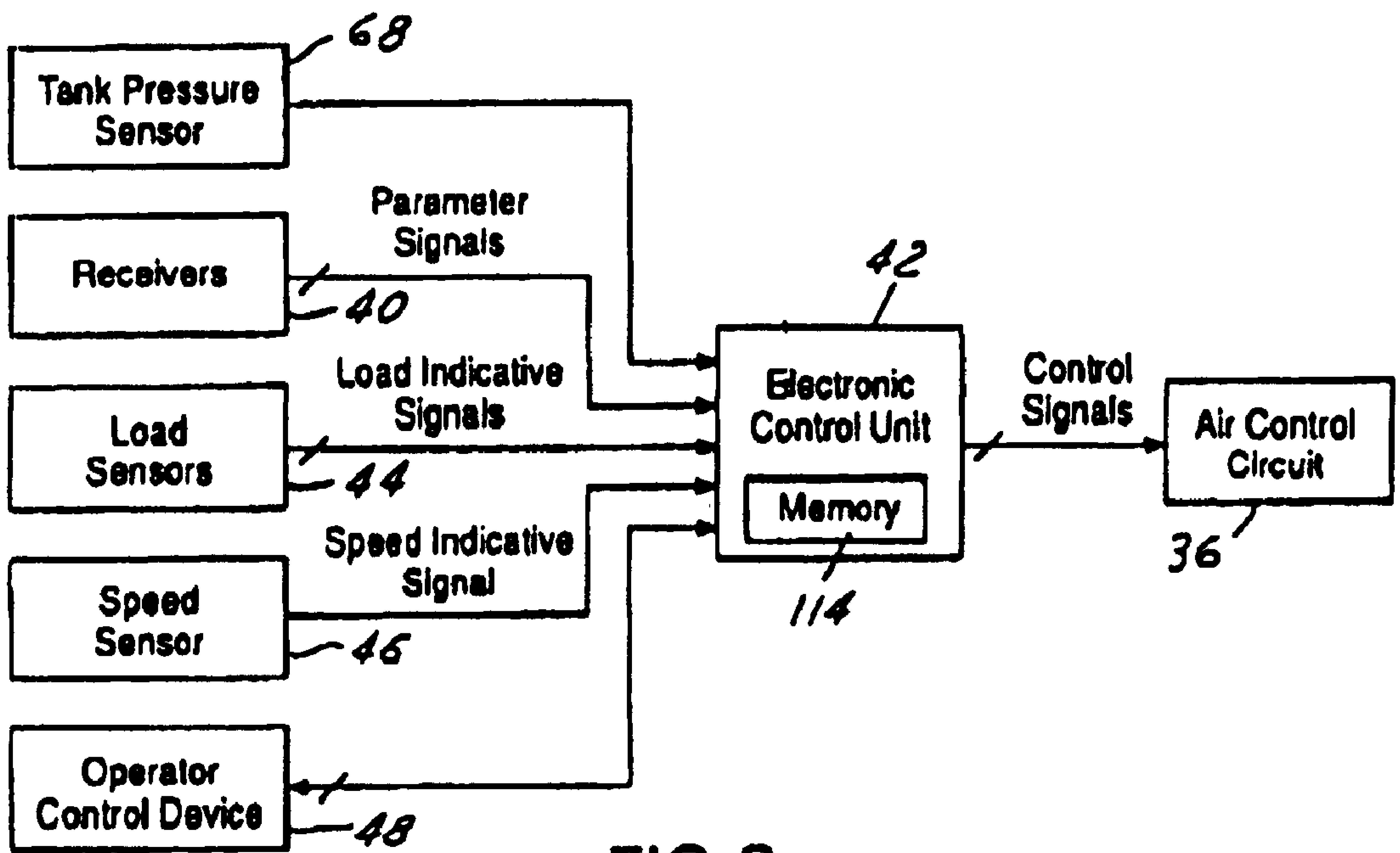
68
Tank Pressure Sensor
Receivers
Parameter Signals
40
42
Load Indicative Signals
Electronic Control Unit
Control Signals
Air Control Circuit
Load Sensors
44
Memory
Speed Indicative Signal
36
114
Speed Sensor
46
Operator Control Device
48

FIG. 3

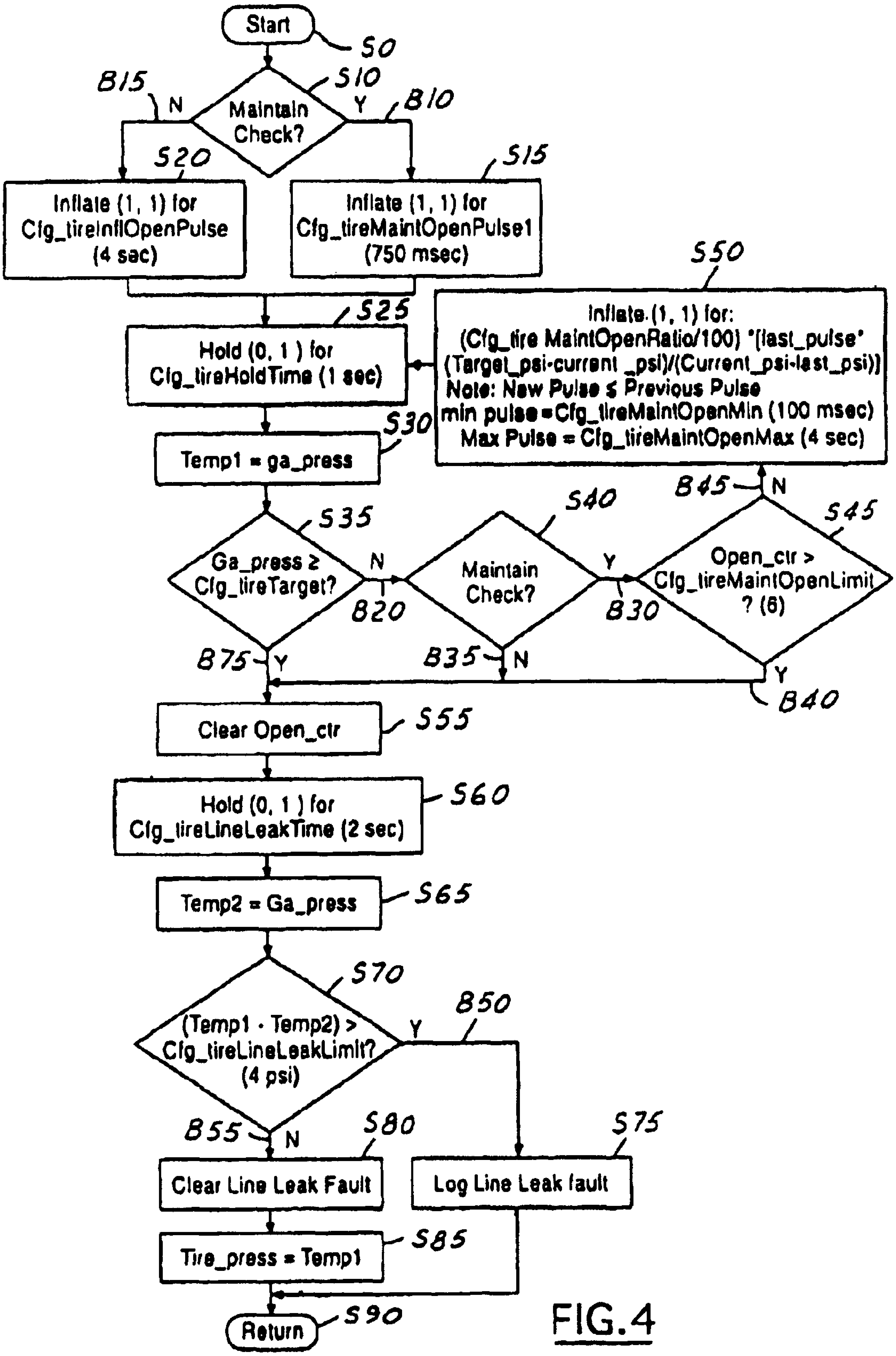
Start
S0
S10
B15
N
Maintain Check?
Y
B10
S20
Inflate (1, 1) for Cfg_tireInflOpenPulse (4 sec)
S15
Inflate (1, 1) for Cfg_tireMaintOpenPulse1 (750 msec)
S50
Inflate (1, 1) for: (Cfg_tire MaintOpenRatio/100) *(last_pulse* (Target_psi-current _psi)/(Current_psi-last_psi)) Note: New Pulse ≤ Previous Pulse min pulse = Cfg_tireMaintOpenMin (100 msec) Max Pulse = Cfg_tireMaintOpenMax (4 sec)
S25
Hold (0, 1) for Cfg_tireHoldTime (1 sec)
S30
Temp1 = ga_press
S40
B45
N
S45
S35
Ga_press ≥ Cfg_tireTarget?
N
B20
Maintain Check?
Y
B30
Open_ctr > Cfg_tireMaintOpenLimit ? (6)
B75
Y
B35
N
Y
B40
Clear Open_ctr
S55
Hold (0, 1) for Cfg_tireLineLeakTime (2 sec)
S60
Temp2 = Ga_press
S65
S70
B50
(Temp1 - Temp2) > Cfg_tireLineLeakLimit? (4 psi)
Y
B55
N
S80
S75
Clear Line Leak Fault
Log Line Leak fault
Tire_press = Temp1
S85
Return
S90

FIG.4

TIRE PRESSURE MONITORING METHOD

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

Conventional tire pressure management systems typically have central tire inflation systems (CTI systems), also known as on-board inflation systems and traction systems, These tire pressure management systems are well known, as may be seen by reference to the following U.S. Pat. Nos. 5,516,379; 5,313,995; 5,273,064; 5,253,687; 5,180,456; 5,179,981; 5,174,839; 5,121,774; 4,924,926; 4,922,946; 4,917,163; 4,893,664; 4,883,106; 4,883,105; 4,825,925; 4,782,879; 4,754,792; 4,724,879; 4,678,017; 4,640,331; and 4,619,303. The entire disclosure of each of these patents is incorporated herein.

Generally, tire pressure management systems employ a pneumatically controlled wheel valve that is affixed to each vehicle wheel assembly for controlling tire pressure in response to pressure signals from a fluid control circuit. The fluid control circuit is connected to each wheel valve via a rotary seal assembly associated with each wheel valve. Tire pressure may be monitored with of a sensor disposed in a conduit assembly in the fluid control circuit. When the wheel valve and certain control valves are opened, the pressure in the conduit assembly equalizes to tire pressure which can be sensed by the sensor. An electronic control unit receives electrical pressure signals generated by the sensor and appropriately controls the fluid control circuit in response thereto for inflating or deflating a selected tire.

A tire inflation management system that monitors tire pressure with a central sensor typically will add a small amount of fluid to a tire so monitored because fluid in the conduits must have a pressure that exceeds the pressure of fluid in the tire to overcome the bias of the normally-closed wheel valve and initiate fluid communication among the tire and conduit assemblies. Because tire inflation management systems typically cycle through pressure monitoring routines regularly, for example every ten minutes, the small amounts of fluid input into a tire eventually can increase the overall pressure beyond a target pressure of, or overinflate, the tire. Tire overinflation can cause undesirable uneven and/or rapid wear. Thus, what is needed is a method of monitoring the fluid pressure of, with a sensor of a tire pressure management system disposed without, a tire that prevents overinflation of same.

SUMMARY OF THE INVENTION

The invention provides a method of monitoring the fluid pressure of, with a sensor of a tire pressure management system disposed without, a tire that prevents overinflation of same. The method of monitoring a fluid pressure of a tire with a sensor, disposed in conduit assemblies for conducting fluid to or from the tire, of a tire pressure management system includes providing a pulse of compressed fluid to the conduit assemblies, unless a counter exceeds a count, the fluid in the conduit assemblies thereafter having a conduit pressure. The pulse has a duration that corresponds to a ratio defined by a first predetermined amount divided by a second predetermined amount.

The invention provides improved elements and arrangements thereof, for the purposes described, which are inexpensive, dependable and effective in accomplishing

intended purposes of the invention. Other features and advantages of the present invention will become apparent from the following description of the preferred embodiments, which refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail below with reference to the following figures, throughout which similar reference characters denote corresponding features consistently, wherein:

FIG. **1** is a diagrammatic view of a tire pressure management system for a vehicle, a vehicle incorporating same being shown in dotted line;

FIG. **2** is a cross-sectional detail view of a conventional vehicle wheel assembly;

FIG. **3** is a schematic view of components of the system of FIG. **1**; and

FIG. **4** is a schematic view of a flow chart for a method configured according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention is a method of monitoring the fluid pressure of, with a sensor of a tire pressure management system disposed without, a tire that prevents overinflation of same. The method may be achieved with known tire pressure management systems, such as the exemplary tire pressure management system described below.

FIG. **1** shows a tire pressure management system **10** for a vehicle **12** for describing, but not limiting applicability of the invention. Vehicle **12** may be, but is not limited to being a tractor-trailer. The system may be used in connection with a wide variety of vehicles, including automobiles.

Vehicle **12** may include a plurality of axles, including a steer axle **14**, a tandem axle assembly having drive axles **16**, **18** and another tandem axle assembly having trailer axles **20**, **22**. As shown in greater detail in FIG. **2**, each axle, such as drive axle **14**, may include wheels **24** affixed to wheel hubs **26** disposed at each outboard end of the axle and rotationally supported on axle **14**. Each wheel **24** may include one or more inflatable tires **28** mounted thereon.

System **10** monitors and controls pressure within each tire **28** of vehicle **12**. System **10** may include wheel valve assemblies **30**, a fluid source **32**, a vacuum source **34**, and a fluid control circuit **36**. System **10** may further include at least a sensor **200**, one or more electronic control units **42**, one or more load sensors **44**, a speed sensor **46**, and an operator control device **48**.

Wheel valve assemblies **30** are provided to control the flow of pressurized fluid into and out of tires **28**. Valve assembly **30** is mounted to each end of each axle and is connected to the remainder of system **10** through a rotary seal connection **50**. Wheel valve assembly **30** is conventional and may include the wheel valve assembly described and illustrated in U.S. Pat. No. 5,253,687 or U.S. Pat. No. 6,250,327, the entire disclosures of which are incorporated herein.

Rotary seal assembly **50** also is conventional and may include the rotary seal assembly described and illustrated in U.S. Pat. No. 5,174,839, the entire disclosure of which also is incorporated herein.

Referring again to FIG. **2**, wheel valve assembly **30** may include an inlet port **30**a coupled to a rotatable port **50**b of rotary seal assembly **50**, an outlet port **30**b in fluid communication with the interior of tire **28**, and an exhaust port **30**c, best shown in FIG. **1**. Rotary seal assembly **50** may further include a non-rotatable port **50**a connected to a conduit **52** of fluid control circuit **36**. Valve assembly **30** assumes a closed position, as illustrated in FIG. **1**, when the fluid pressure at inlet port **30**a is substantially atmospheric, an open position connecting inlet port **30**a and outlet port **30**b when the fluid pressure at inlet port **30**a is a positive pressure, and an exhaust position connecting outlet port **30**b and exhaust port **30**c when the fluid pressure at inlet port **30**a is a negative pressure.

Fluid source **32** provides positive pressurized fluid to system **10** and tires **28**. Fluid source **32** is conventional and may include a pressure source, such as a pump **54**, an air dryer **56**, and a first fluid tank **58** connected via a conduit **60** to the brake system fluid tanks **62**, **64** and to the fluid control circuit **36** via a branch conduit **60**a. Check valves **66** prevent sudden loss of fluid pressure in brake tanks **62**, **64** in the event of upstream pressure loss. A pressure sensor **68** monitors pressure within tank **58** and provides a pressure indicative signal to electronic control unit **42**.

Vacuum source **34** produces a negative pressure in system **10** to decrease fluid pressure in tires **28** of vehicle **12**. Vacuum source **34** also is conventional and may include a vacuum generator **70** controlled through a solenoid valve **72**. A low pressure zone is produced by passing fluid through a venturi like portion of vacuum generator **70**. Upon urging solenoid valve **72** into an open position via a control signal from electronic control unit **42**, a vacuum or negative fluid pressure, relative to atmospheric pressure, is introduced in a conduit **74**, which has a small orifice **76** disposed proximate the low pressure zone produced by generator **70**. Conduit **74** also is connected to a one-way vent valve **78** for rapid venting of positive fluid pressure from conduit **74**. Vent valve **78** includes a valving member **80** that is drawn into a closed position in response to negative fluid pressure in conduit **74** and is urged into an open position in response to positive pressure fluid in conduit **74**.

Fluid control circuit **36** directs the flow of pressurized fluid within system **10** for controlling pressure in tires **28** of vehicle **12**. Control circuit **36** may include a pair of pressure control valves **82**, **84** and a plurality of axle distribution valves **86**, **88**, **90**. As shown, a single fluid control circuit **36** controls pressure in all of the tires **28** of vehicle **12**. However, control circuit **36**, and other portions of system **10**, may be replicated so that, for example, one control circuit **36** may control tire pressures in the tractor portion of vehicle **12** and another control circuit **36** may control tire pressure in the trailer portion of vehicle **12**.

Pressure control valve **82** directs positive pressurized fluid from fluid source **32** to tires **28** of vehicle **12**. Valve **82** may include a conventional two position-two way, solenoid a controlled and pilot fluid operated valve. Valve **82** includes a valving member **92** that is spring biased toward a closed position, as shown in FIG. **1**. Valving member **92** assumes an open position in response to energizing of a solenoid operatively associated therewith via control signals from electronic control unit **42**. Valve **82** has a first port **82**a coupled to a conduit **94** leading to fluid source **32**. Valve **82** has a second port **82**b coupled to another conduit **96** leading to axle distribution valves **86**, **88**, **90**.

Pressure control valve **84** vents control circuit **36**. Valve **84** is conventional and may also include a two position-two way, solenoid controlled and pilot fluid operated valve. Valve **84** includes a valving member **98** that is spring biased toward an open position, as shown in FIG. **1**. Valving member **98** assumes a closed position in response to energizing a solenoid operatively associated therewith via control signals from electronic control unit **42**. Valve **84** has a first port **84**a coupled to conduit **74** leading to orifice **76**. Valve **84** has a second port **84**b coupled to conduit **96** leading to axle distribution valves **86**, **88**, **90**.

Axle distribution valves **86**, **88**, **90** limit the supply of positive pressurized fluid to, or the release of fluid from, the tires **28** of one or more axles **14**, **16**, **18**, **20**, **22** of vehicle **12**. Valves **86**, **88**, **90** are conventional and may include two position-two way, solenoid controlled and pilot fluid operated valves. Valves **86**, **88**, **90** direct the flow of fluid to and from the tires **28** of axles **14**, **16** and **18**, and **20** and **22**, respectively. Each of valves **86**, **88**, **90** includes a valving member **100**, **102**, **104**, respectively, that is spring-biased toward an open position, as shown in FIG. **1**, and which assumes a closed position in response to energizing a solenoid operatively associated therewith via electrical signals from electronic control unit **42**. Each of valves **86**, **88**, **90** respectively has first ports **86**a, **88**a, **90**a coupled to conduit **96**. Each of valves **86**, **88**, **90** respectively has second ports **86**b, **88**b, **90**b leading to respective corresponding conduits **52**, **106**, **108** for each axle or tandem axle of vehicle **12**.

Although axle distribution valves **86**, **88**, **90** are shown, individual tire distribution valves could be used in conjunction with axle distribution valves **86**, **88**, **90** or as an alternative to axle distribution valves **86**, **88**, **90** to further control the flow of fluid to and from individual tires **28** of vehicle **12**. Further, although only three axle distribution valves **86**, **88**, **90** are shown, the number of axle distribution valves may be varied depending upon the number of axles of vehicle **12** and to allow for greater individual control of the tires **28** of vehicle **12**.

Sensor **200** may be electrically integrated with electronic control unit **42**. Sensor **200** is disposed in fluid communication with conduit assemblies for conducting fluid to and/or from tires **28**. Sensor **200** may transmit a parameter signal indicative of a measured parameter associated with a corresponding tire **28** of vehicle **12**. The parameter may correspond to fluid pressure or another value, such as temperature, that may be indicative of pressure.

Referring to FIG. **3**, electronic control unit **42** controls fluid control circuit **36**. Control unit **42** may include a microprocessor operating under the, control of a set of programming instructions commonly referred to as software. Electronic control unit **42** may include a memory **114** in which the programming instructions are stored. Memory **114** also may contain identification codes for each tire **28** of vehicle **12** to uniquely identify the particular tire **28** to which a particular parameter signal corresponds. Memory **114** also may be used to record tire pressure values or user inputs over a period of time to assist in evaluating tire pressure management.

Control unit **42** may receive input signals from central presser sensor **200**, one or more load sensors **44**, speed sensor **46**, and operator control device **48**. Control unit **42** outputs a plurality of control signals to control valves **82**, **84**, **86**, **88**, **90** of fluid control circuit **36** and solenoid valve **72** of vacuum source **34**. Control unit **42** also may generate a plurality of output signals to a display device which may include a part of operator control device **48** or a freestanding device. The latter signals may be used to trigger the display pressure readings and/or deflection levels for each vehicle tire **28**, the load on vehicle **12** or a portion of it, and the speed of vehicle **12**. The signals may also be used to trigger warnings to the operator of vehicle **12** in the event that pressure cannot be maintained in one of the vehicle tires **28**, the pressure exceeds or falls below predetermined maximum and minimum tire pressure values, or the pressure differs from a target pressure value by more than a predetermined amount.

In operation, to be able to sense pressure in any of tires **28**, the conduit assemblies for conducting fluid to or from tires **28** in which sensor **200** is disposed must be in equilibrium with tires **28**. To bring the pressure in the conduit assemblies and tires **28** into substantial equilibrium, valve assembly **30** must open to permit the fluid communication needed for conduit assemblies and tires **28**. As described above, valve assembly **30** closes when pressure in the conduit a assemblies is neutral or at equilibrium with the pressure in tires **28**. Thus, to obtain a pressure in the conduit assemblies equivalent to the pressure in tires **28**, control unit **42** must instruct system **10** to provide compressed fluid to the conduit assemblies which is sufficient to open valve assembly **30**. In practice, such pulse will increase the pressure in tire **28**. However, as described below, because cyclical monitoring of tires **28** can lead to overinflation, such pressure should be minimized.

Load sensors **44** provide an indication as to the load on vehicle **12** and, consequently, tires **28** of vehicle **12**, or the load on some portion of vehicle **12** and, consequently, select tires **28** of vehicle **12**. Load sensors **44** are conventional and load sensing may be provided in a variety of known ways, including through analysis of pneumatic pressure in the suspension of vehicle **12**, analysis of powertrain parameters, the use of displacement transducers, or the implementation of load beams and strain gauges. Each load sensor **44** may provide one or more signals to electronic control unit **42** indicative of the load bearing on vehicle **12** or a portion thereof.

Electronic control unit **42** may initiate pressure adjustment in tires **28** of vehicle **12** in response to signals from load sensors **44** in a variety of ways. For example, electronic control unit may cause an increase or decrease in the pressure in one or more tires **28** responsive to a corresponding increase or decrease in vehicle load based on a variety of linear or non-linear functions. One or more tire deflection tables may be stored in a memory, such as memory **114**, and accessed by electronic control unit **42** responsive to the signals from load sensors **44**.

Speed sensor **46** measures the speed of vehicle **12** to further control deflection levels for tires **28**. High deflection levels can create safety concerns and reduce tire life if maintained while vehicle **12** is operating at relatively high speeds. Speed sensor **46** is conventional and provides a signal to electronic control unit **42** corresponding to speed.

Operator control device **48** may allow the operator, of vehicle **12** to exert at least some level of control over system **10**. Device **48** is conventional and may include a plurality of input/output devices, such as a keypad, touch screen, switches or similar input devices, and a display screen, sound generator, lights or similar output devices. Thus, device **48** permits an operator of vehicle **12** to transmit control signals to electronic control unit **42** to adjust pressure levels within the tires **28** of vehicle **12**. The control signals may, for example, correspond to deflection levels for tires **28** of vehicle **12**. As a result, the operator is able to adjust the deflection level of the tires **28** to correspond to the terrain over which vehicle **12** is traveling. Such control is desirable to provide improved floatation and traction on certain terrain.

The sequencing and interaction of components of system **10** may be appreciated more readily in the context of the following description of the present method.

FIG. **4** shows a flow chart of the present method. The method may be called during the execution of a master tire pressure maintenance program (not shown). For example, control unit **42** may pass control to step S**0** if a routine of the master tire pressure maintenance program instructs control unit **42** to measure or ascertain the current tire pressure of at least one of tires **28**. Control unit **42** then passes control to step S**10**.

At step S**10**, the invention provides for determining whether system **10** is maintaining or monitoring tire pressure. During tire pressure maintenance, tire pressure is adjusted; during tire pressure monitoring, tire pressure is not adjusted, only ascertained. As described above, control unit **42** ascertains the pressure of at least one of tires with central sensor **200**. Ascertaining pressure in any of tires **28** with central sensor **200** requires increasing the pressure of the conduit assemblies for conducting fluid to or from tires **28** in an amount sufficient to open the appropriate valve assembly **30**, initiating fluid communication and attaining equilibrium among the conduit assemblies and the target tire **28**. If maintaining pressure is occurring, pressure in tire **28** is low, therefore adding fluid, hence increasing pressure of, tire **28** is of minimal concern. However, if only monitoring pressure is occurring, adding fluid may cause overinflation because tire inflation management systems typically cycle through pressure monitoring routines regularly, thus any addition of fluid to tires **28** from which would eventually increase the pressure in tires **28** beyond a target pressure. Accordingly, if control unit **42** does not detect the existence of a maintenance flag, which may have been set during execution of the master tire pressure maintenance program, control unit **42** may instruct pertinent components of system **10** to direct a large pulse of compressed fluid into the conduit assemblies which is likely to open valve assemblies **30** and increase the pressure thereof slightly. To this end, control unit **42** passes control along branch B**15** to step S**20**, described below. If control unit **42** detects a maintenance flag, the invention provides for pressurizing the conduit assemblies incrementally to bring the conduit assemblies up to or slightly over the target pressure, causing the valve assembly **30** associated with a tire **28** having a lower pressure to open and permit attainment of equilibrium among the conduit assemblies and the tire **28**. To that end, control unit **42** passes control along branch B**10** to step S**15**.

At step S**15**, the invention provides for pressurizing the conduit assemblies with a short pulse of compressed fluid. Control unit **42** instructs solenoid **82** and any of solenoids **86**, **88** and/or **90** to open, and solenoid **84** to close, as described above, for a relatively brief duration, such as 750 msec, thereby forming a small pulse of compressed fluid. This pulse is configured to pressurize the conduit assemblies in an amount that is not sufficient to open a valve assembly **30**, thereby restrict fluid from entering or overinflating a tire **28**. The duration may be set by the manufacturer in an amount deemed appropriate. Control unit **42** then passes control to step S**25**, described below.

At step S**20**, the invention provides for supplying a large pulse of compressed fluid to the conduit assemblies. Control unit **42** instructs solenoid **82**, and any of solenoids **86**, **88** and/or **90** to open, and solenoid **84** to close, as described above, for a relatively long duration, such as 4 sec, thereby forming a large pulse of compressed fluid. Unlike in step S**15**, this pulse is configured to pressurize the conduit assemblies in an amount that is sufficient to open a valve assembly **30**, thereby promote fluid communication and subsequent equilibrium among the conduit assemblies and tire **28**. Subsequent pressure measurement at the manifold would yield a pressure corresponding to the current pressure in tires **28**. The duration of the large pulse may be set by the manufacturer in an amount deemed appropriate. Thereafter, control unit **42** passes control to step S**25**.

At step S**25**, the invention provides for pausing for a first pause duration. The first pause duration extends as long as needed to attain pressure stabilization, for measuring static pressure, of the fluid in the conduit assemblies. Control unit **42** instructs solenoid **82** to close while leaving open solenoids **86**, **88** and/or **90**. Control unit **42** then passes control to step S**30**.

At step S**30**, the invention provides for measuring the current gage pressure in the conduit assemblies and saving same as a variable "temp1." Control unit **42** then passes control to step S**35**.

At step S**35**, the invention provides for determining whether the current tire pressure, or measured gage pressure in the conduit assemblies, equals or exceeds an operator-configured, or operator designated, target tire pressure. If the measured gage pressure equals or exceeds the target pressure, no further tire pressure adjustment is required, therefore control passes onto line leak checking routines. Accordingly, if "temp1" exceeds the target tire pressure, control unit **42** passes control along branch B**25** to step S**55**, described below. If "temp1" does not exceed the target tire pressure, control unit **42** passes control along branch B**20** to step S**40**.

Step S**40** is similar to step S**10**, described above, therefore is described no further. If the maintenance flag is set, control unit **42** passes control along branch B**30** to step S**45**, described below. If the maintenance flag is not set, control unit **42** passes control along branch B**35**, to branch B**40** and thereafter to step S**55**, described below.

At step S**45**, the invention provides for incrementing a counter then determining whether the value of the counter exceeds a manufacturer-configured, or manufacturer designated, limit. If control unit **42** repeatedly increases conduit assembly pressure in incremental amounts more than, for example, six times, control unit **42** operates under the assumption that the pressure in tires **28** is below the target pressure and require inflation. Thus, if the counter value exceeds the limit, control unit **42** passes control along branch **340** to step S**55**, described below. If the counter value does not exceed the limit, control unit **42** passes control along branch B**45** to step S**50**.

At step S**50**, the invention provides for providing a pulse of compressed fluid, having a proportioned pulse duration, to tires **28**. The pulse duration is the amount of time that solenoids **82** and solenoids **86**, **88** and/or **90** are open, and solenoid **84** is closed, to provide fluid communication between source **32** and tires **28**. The pulse duration is proportioned according to the current pressure shortfall with respect to the target pressure divided by the pressure increase realized from the last pulse of compressed fluid introduced into the conduit assemblies. Pulse duration is calculated according to:

$$D_1=n*D_0*[(P_T-\text{temp1})/(\text{temp1}-P_L)]$$

where D_1 is the pulse duration for the next pulse; n is a manufacturer-configurable, or manufacturer designated, adjustment factor for fine tuning, the pulse duration in consideration of characteristics of the tire maintenance system, if necessary; D_0 is the pulse duration of the last pulse of compressed fluid introduced into the conduit assemblies, such as at steps S**15** or S**50**; P_T is the target pressure; temp1 is the current gage pressure measured; and P_L is the pressure measured during the last execution of the routine. The pulse duration is based on a previous a pulse duration employed to closed the gap between the measured current gage pressure, measured at step S**30**, and the target pressure. Because the gap following the previous pulse should be smaller, the duration of a subsequent pulse is reduced correspondingly. Thus, pulse duration is diminished by a fraction, or ratio, wherein the dividend is the target pressure less the current measured gage pressure and the divisor is the current measured gage pressure less the pressure measured during the last execution of the routine. As the current and target pressures approach equality, the pulse duration diminishes correspondingly. Pulses of compressed fluid having a pulse duration as calculated above will bring conduit assembly pressure up to, but not over the target pressure. Thus, during monitoring, no fluid is added to tires **28**, avoiding overinflation of same. Control unit **42** then passes control to step S**25**, described above.

At step S**55**, the invention provides for clearing the counter described with respect to step S**45**. Control unit **42** then passes control to step S**60**.

At step S**60**, the invention provides for pausing for a second pause duration. The second pause duration extends as long as needed to determine whether line leaks exist in the conduit assemblies. Thus, the second pause duration is long enough to allow an amount of fluid to escape from the conduit assemblies if a line leak exists therein. Similar to step S**25**, control unit **42** instructs solenoid **82** to close while leaving open solenoids **86**, **88** and/or **90**. Control unit **42** then passes control to step S**65**.

At step S**65**, the invention provides for measuring the post-adjustment gage pressure in the conduit assemblies and saving same as a variable "temp2." Control unit **42** then passes control to step S**70**.

At step S**70**, the invention provides for determining whether the difference between the pressure measured after the first, brief settling period, at step S**25**, and the second, extended stabilization period, at step S**60**, exceeds a manufacturer-configured, or manufacturer designated, limit. The limit represents an amount deemed symptomatic of a line leak. When the difference between "temp1" and "temp2" does not exceed the limit, control unit **42** passes control along branch B**55** to step S**80**, described below. When the difference exceeds the limit, control unit **42** passes control along branch B**50** to step S**75**.

At step S**75**, the invention provides for logging a line leak fault. Control unit **42** then passes control to step S**90**, described below.

At step S**80**, the invention provides for clearing a line leak fault which may have been logged at step S**75**, for example, during a previous execution of the present method. Control unit **42** then passes control to step S**85**.

At step S**85**, the invention provides for saving the measured gage pressure "temp1" as the current pressure P_L. This accommodates the possibility that tires **28** are below the target pressure. Thus, the invention provides for setting the target pressure to the pressure that exists in the conduit assemblies. Control unit **42** then passes control to step S**90**.

At step S**90**, the invention provides for returning control to the main tire pressure maintenance program (not shown). Thereafter control unit **42** may initiate an inflation routine (not shown) to bring the pressure of tires **28** up to the target pressure.

While the invention has been particularly shown and described with reference to the preferred embodiment thereof, it is well understood by those skilled that various changes and modifications can be made in the invention without departing from the spirit and scope of the invention.

We claim:

1. A method of determining a tire pressure in a vehicle tire comprising the steps of:

ascertaining a first fluid pressure in a conduit disposed between a fluid source and said tire using a sensor disposed in said conduit;

comparing said first fluid pressure to a target pressure;

providing a pulse of compressed fluid to said conduit when said first fluid pressure is less than said target pressure, said pulse having a duration determined responsive to a duration of a previous pulse of compressed fluid provided to said conduit and a change in pressure in said conduit resulting from said previous pulse; and,

repeating said ascertaining, comparing, and providing steps until said first fluid pressure in said conduit reaches said target pressure.

2. The method of claim **1** wherein said first fluid pressure is ascertained following a predetermined hold time that begins after said previous pulse is provided to said conduit.

3. The method of claim **1** wherein said duration of said previous pulse is a preset period.

4. The method of claim **1** wherein said duration of said pulse is determined in accordance with the following formula:

$$D_1=n*D_0*[(P_T-temp_1)/(temp1-P_L)]$$

wherein n is a predetermined value, D_0 is said duration of said previous pulse, P_T is said target pressure, temp1 is said first fluid pressure and P_L is a previous fluid pressure in said conduit resulting from said previous pulse.

5. The method of claim **1** further comprising the steps of:

determining a second fluid pressure in said conduit following a predetermined line leak hold time; and,

comparing said first and second fluid pressures.

6. The method of claim **5** wherein said tire pressure equals said first fluid pressure if a difference between said first and second fluid pressures is less than a predetermined amount.

7. The method of claim **5** further comprising the step of logging a line leak fault if a difference between said first and second fluid pressures is greater than a predetermined amount.

8. A method of determining a tire pressure in a vehicle tire comprising the steps of:

ascertaining a first fluid pressure in a conduit disposed between a fluid source and said tire using a sensor disposed in said conduit;

comparing said first fluid pressure to a target pressure; incrementing a counter when said first fluid pressure is less than said target pressure;

comparing said counter to a predetermined value;

providing a pulse of compressed fluid to said conduit when said first fluid pressure is less than said target pressure and said counter is less than said predetermined value, said pulse having a duration determined responsive to a duration of a previous pulse of compressed fluid provided to said conduit and a change in pressure in said conduit resulting from said previous pulse; and,

repeating said ascertaining, comparing, and providing steps until said first fluid pressure in said conduit reaches said target pressure or said counter reaches said predetermined value.

9. The method of claim **8** wherein said first fluid pressure is ascertained following a predetermined hold time that begins after said previous pulse is provided to said conduit.

10. The method of claim **8** wherein said duration of said previous pulse is a preset period.

11. The method of claim **8** wherein said duration of said pulse is determined in accordance with the following formula:

$$D_1=n*D_0*[(P_T-temp1)/(temp1-P_L)]$$

wherein n is a predetermined value, D_0 is said duration of said previous pulse, P_T is said target pressure, temp1 is said first fluid pressure and P_L is a previous fluid pressure in said conduit resulting from said previous pulse.

12. The method of claim **8**, further comprising the steps of:

determining a second fluid pressure in said conduit following a predetermined line leak hold time; and,

comparing said first and second fluid pressures.

13. The method of claim **12** wherein said tire pressure equals said first fluid pressure if a difference between said first and second fluid pressures is less than a predetermined amount.

14. The method of claim **12** further comprising the step of logging a line leak fault if a difference between said first and second fluid pressures is greater than a predetermined amount.

15. A system for determining whether a vehicle tire is at a target pressure, comprising:

a conduit disposed between a fluid tank on said vehicle and said vehicle tire;

a first valve disposed between said fluid tank and said conduit;

a sensor in fluid communication with said conduit and generating a fluid pressure signal indicative of fluid pressure in said conduit;

an electronic control unit configured to perform a control operation in which said unit controls said first valve to introduce a pulse of compressed fluid into said conduit, a determination operation in which said unit determines a fluid pressure in said conduit responsive to said fluid pressure signal, a comparison operation in which said unit compares said fluid pressure in said conduit to a target pressure, and a repeat operation in which said unit repeats said control, determination, and compare operations if said fluid pressure in said conduit does not meet a first predetermined condition relative to said target pressure.

16. The system of claim 15 wherein said electronic control unit is further configured to perform an update operation in which said unit updates a value of a counter if said fluid pressure does not meet said first predetermined condition relative to said target pressure.

17. The system of claim 16 wherein said electronic control unit is further configured to determine whether said value of said counter meets a second predetermined condition.

18. The system of claim 17 wherein said electronic control unit is further configured to reset said counter to a predetermined value if said value of said counter meets said second predetermined condition.

19. The system of claim 16 wherein said electronic control unit is further configured to perform said update operation prior to said repeat operation.

20. The system of claim 15 wherein said electronic control unit is further configured to perform said determination operation after a predetermined hold time following said control operation.

21. The system of claim 15 wherein said pulse has a predetermined duration.

22. The system of claim 15 wherein said first valve is a solenoid valve.

23. The system of claim 15, further comprising a second valve disposed between said first valve and said vehicle tire.

24. The system of claim 23 wherein said second valve is a solenoid valve.

25. The system of claim 23 wherein said electronic control unit is configured to control said second valve.

26. The system of claim 23 wherein said second valve is configured to selectively vent said conduit.

27. The system of claim 15, further comprising a rotary seal assembly disposed between said conduit and said vehicle tire.

28. A method for determining whether a vehicle tire is at a target pressure, comprising the steps of:

controlling a first valve disposed between a fluid tank on said vehicle and a conduit that is disposed between said fluid tank and said tire to introduce a pulse of compressed fluid into said conduit;

determining a fluid pressure in said conduit responsive to a fluid pressure signal generated by a sensor in fluid communication with said conduit, said fluid pressure signal indicative of fluid pressure in said conduit;

comparing said fluid pressure in said conduit to a target pressure;

providing a pulse of compressed fluid to said conduit when said fluid pressure is less than said target pressure; and,

repeating said controlling, determining, and comparing steps if said fluid pressure in said conduit does not meet a first predetermined condition relative to said target pressure.

29. The method of claim 28, further comprising step of updating a value of a counter if said fluid pressure does not meet said first predetermined condition relative to said target pressure.

30. The method of claim 29, further comprising the step of determining whether said value of said counter meets a second predetermined condition.

31. The method of claim 30, further comprising the step of resetting said counter to a predetermined value if said value of said counter meets said second predetermined condition.

32. The method of claim 29 wherein said updating step occurs prior to said repeating step.

33. The method of claim 28 wherein said determining step is performed after predetermined hold time following said controlling step.

34. The method of claim 28 wherein said pulse has a predetermined duration.

35. The method of claim 28 wherein said first valve is a solenoid valve.

36. The method of claim 28, further comprising the step of controlling a second valve disposed between said first valve and said tire.

37. The method of claim 36 wherein said second valve is a solenoid valve.

38. The method of claim 36 wherein said second valve is configured to selectively vent said conduit.

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