Sept. 23, 1969 GIOVANNI DALL'OLIO CONTRI 3,468,162

PRESSURE EQUALIZER FOR DUAL TYRES OF LANDCRAFT OR AIRCRAFT

Filed Nov. 9, 1967

Fig.2

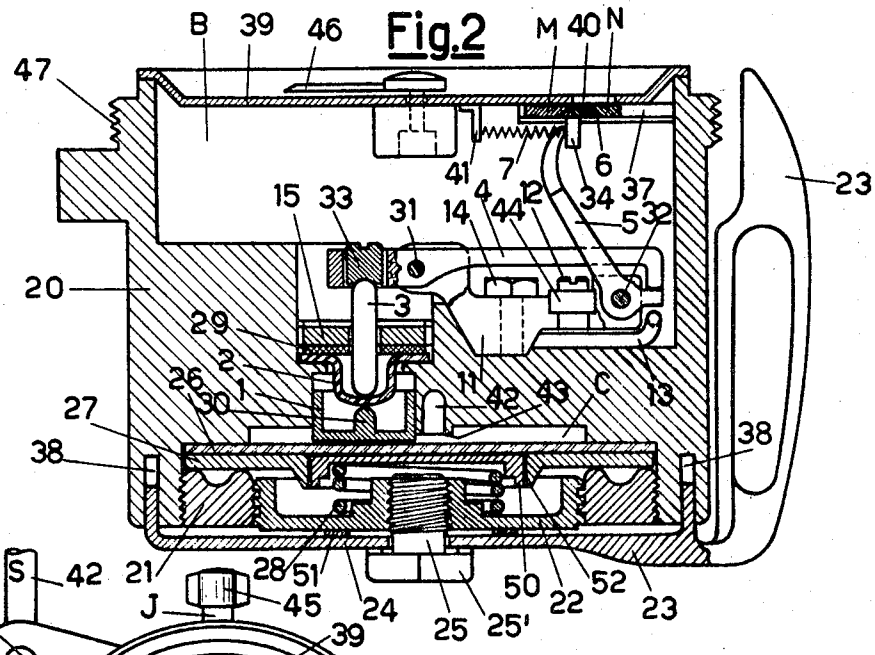


Fig.1

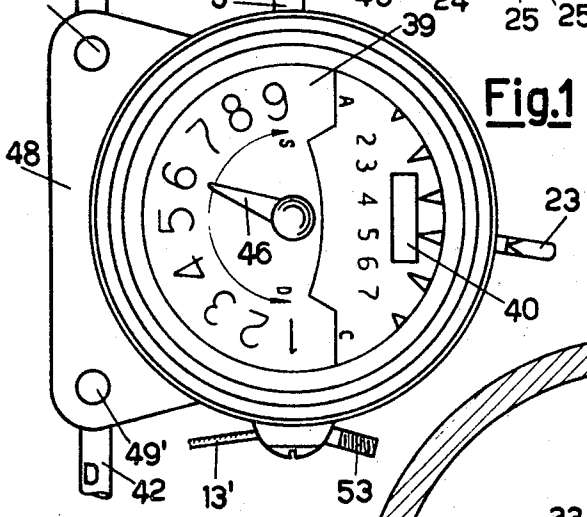


Fig.4

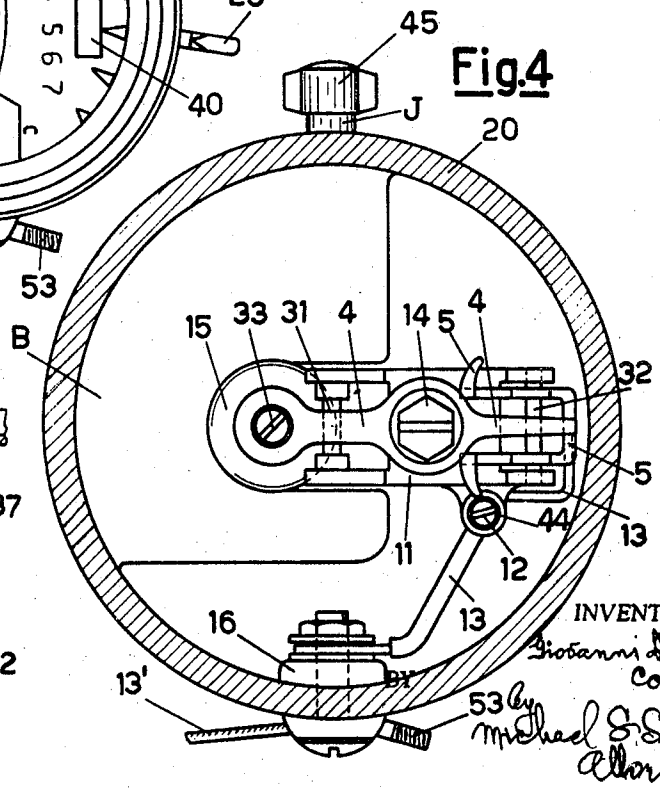
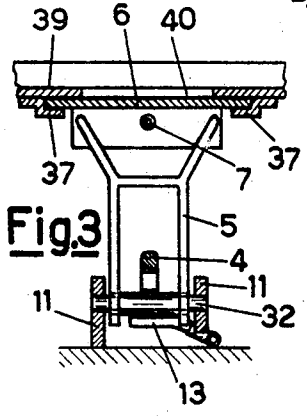


Fig.3



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PRESSURE EQUALIZER FOR DUAL TYRES OF LANDCRAFT OR AIRCRAFT

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ABSTRACT OF THE DISCLOSURE

A pressure equalizing device for dual tyres of vehicles is disclosed, in which a flexible diaphragm is provided, which can be deflected in one direction by the pressure obtaining in the tyres and in the opposite direction under the bias of a spring, the movements of said diaphragm being displayed through a window which shows differently coloured areas of plate according to the inflation conditions of said tyres, means being provided to measure the pressure obtaining in said tyres and for preadjusting it to a preselected value, signalling means of an electrical nature being further provided to give a warning signal to the vehicle's driver.

This invention relates to a device, which can be applied to a air of tyres (dual tyres) for vehicles (heavy duty landcraft in general and aircraft), said device enabling the dual tyres, by connecting them together, to adapt themselves to the road surface as if they were a single large tyre, by reacting with the resiliency of the whole air mass contained in both of them.

This invention has, as its object, that of improving, in an equalizing device of the kind referred to above, the means adapted to signal, at every instant of time, the status of communication between the two tyres, or the lack of communication therebetween whenever, for any accidental reason, a pressure drop has taken place in either type, exceeding a preselected limit.

The device according to the present invention comprises: a casing, a chamber in said casing, a flexible diaphragm which closes said chamber, a spring biassing a face of said diaphragm, means for adjusting from the outside the bias applied by said spring for deflecting said diaphragm towards the interior of said chamber, a pair of ducts within said casing, each duct being susceptible of being connected at either end to either tyre and having its other end opening into said chamber through a port to convey compressed air from said tyres towards said chember so as to deflect said diaphragm towards the exterior of said chamber, said two ports being aranged on a plane substantially parallel to the plane of said diaphragm so as to have said ports closed by said diaphragm when the pressure in said chamber drops below said preselected value as determined by said spring, a rod which can slide axially and has an end contacting said diaphragm with the agency of a retaining cap and flexible cup as a seal-tightness member, and its other end contacting the shorter arm of a lever acting on a second lever which in turn is active, against the bias of a return spring, upon a signalling member, the latter consisting of a plate allowed to slide on the plane of, and below, a window formed through the casing and which can be viewed from the outside, said plate being divided into two differently coloured areas, said areas being alternatingly visible beneath said window.

The accompanying drawing is a diagrammatical showing of an embodiment of the invention device.

In the drawing:

FIGURE 1 is a front view of the device.

FIGURE 2 is a cross-sectional view taken along a plane which is perpendicular to the plane of FIG. 1.

FIGURE 3 shows adetail, and

FIGURE 4 is a detail shown in plan view.

The presser equalizer shown in the drawing comprises a casing **20** which encloses all the component parts.

To the body **20** is screwably affixed a ring **21** which has a right screw thread on its outer peripheral surface and a left, high-speed pitch, screw thread on its inner periphery, to which a hood **22** is screwed: the latter has, in central position, a tapped hole through which a screw **25** is mounted, which is adapted to lock said hood **22** and a lid **24**, integral with a handle **23**, together. In addition, the hood **22** and the lid **24** have two respective sets of small teeth **51**, arranged on a circle and meshing with one another, so that, by virtue of said teeth and said screw **25**, the handle **23** and the hood **22** form an integral unit which can be rotated, screwably, within the ring **21**, the latter remaining, conversely, in fixed position with respect to the casing **20**. The cylindrical sidewall of the lid **24** is received by an annular seat **38** of the casing **20**, in which it can both be rotated and translated (following the motion of hood **22**).

In the casing **20** a chamber C is formed, which is closed, on one side, by a resilient diaphragm **26** (of rubber or rubber-like material), clamped between a face of the casing **20** and a ring **27**, the latter being locked, in turn, by the metal ring **21**. Between the diaphragm **26** and the hood **22** a spring **28** is active, which tends to bias the diaphragm so as to reduce the volume of the chamber C. The spring **28** biasses said diaphragm through a cup **50** housed in an annular wall **52** of ring **27** which guides the cup in its axial motion. It is apparent that, by rotating the handle **23**, thus causing the axial location of the hood **22** to be varied, also the bias of the spring **28** against the diaphragm **26** is varied.

A cylindrical perforation of the casing **20** houses a cylindrical retaining cap **1** which rests, with its bottom, on said diaphragm; a resilient cup **2** (of rubber or the like) is clamped in the casing **20** by a threaded plug **15** which, screwed into said casing **20**, locks a flange of the cup against face of said casing **20**, a washer **29** being catered for between said plug and said flange, so as to avoid friction between said plug and said flange.

The axially bored plug **15** has a rod **3** passing therethrough which contacts at one end, the cup **2**, the latter contacting, in turn, a projection **30** of the retaining cup **1**. Said cup **2** provides the seal-tightness between the chamber C and the space B. To the casing **20** is affixed a framing **11**, by means of a screw **14**: to said framing are pivotally connected two levers **4** and **5** by means of the respective pivots **31** and **32**.

Lever **4** carries at one end an adjustment screw **33** in which is universally received an end of said rod **3**.

Said lever **4** contacts, at its other end, an arm of said lever **5**; the latter is adapted to act, with its two prongs which are placed side by side and form its other end, on a wall **34** solid with a plate **6** which can slide along two parallel ways **37**, the latter being in fixed position with regard to the casing **20**.

To the body **20** is affixed a wall **39** having a window **40** of rectangular outline, through which it is possible to see, according to the one of the two equilibrium positions of the plate **6** which is involved, either area of the two differently coloured areas M and N, for example red or white, of said plate.

A spring **7** is affixed with its two ends to the wall **34** and to a member **41** (in fixed position with respect to the casing **20**), said spring tending to urge the plate **6**

in such a direction as to display the white area N of said plate beneath the window **40**.

Two ducts **42** (one of which only is shown in the drawing) communicate each with the respective tyre of the dual tyre assembly (that is with the two individual component tyres), both ducts being in communication with the chamber C, wherein the two edges **43** of said ducts are coplanar. In FIG. 1, S and D (left and right) connote the two ducts **42** leading to the individual tyres. The drawing shows also an electric conductor wire **13**, an end of which is affixed to an insulating clamp **16**: to the latter clamp can ze affixed, from the outside, a conductor wire **13'** which can be connected to an apparatus, possibly installed on the vehicle, for sound and/or luminous signals as will be explained in more detail hereinafter.

The lever **5** aforementioned is adapted to contact, with one of its ends, the wire **13** thus completing a circuit for energizing said signalling device. An adjustment screw **12**, made of a dielectric material, is screwed in the portion **44** of the frame **11** and contacts the wire **13** so as to adjust the position thereof. A glass-locking ring nut is screwed on the screw-thread **47**. The numeral **46** indicates the pointer of a pressure-gauge (not shown to simplify the drawing) which is housed within the space B and adapted to indicate the pressure obtaining in the chamber C. The subject device is affixed to a wheel of the vehicle concerned by means of the portion **48** of the casing **20**, said portion **48** being fastened, by bolts, to a plate affixed to the wheel hub and carrying, for enabling the portion **48** to be affixed thereto, two bores corresponding to the tapped bores **49** of said portion **48**. Lastly, the numeral **53** indicates a blind adapter to which one of the ducts **42** is affixed, either S or D, which has been disconnected from the corresponding individual tyre when, being either tyre punctured, it is desired to inflate the other one only (through J).

Assume now that the two individual tyres are inflated to their irregular pressure: this pressure, via the ducts **42** which connect the respective individual tyres with the chamber C, is active on the diaphragm **26**. More accurately, said diaphragm undergoes, on one side, said pressure of the tyres (i.e. the pressure obtaining within the chamber C) and, on the opposite side, the pressure given by the bias of the spring **28** which is a function, as outlined above, of the axial position of the hood **22**, that is, of the angular position of the handle **23**. The pressure of the tyres tends to withdraw the diaphragm **26** from the edges **43** of the ducts **42** whereas the bias of the spring **28** tends to press the diaphragm against said edges to cut off the ducts **42** and undo the communication between the two tyres. Now, said handle **23** can be so angularly positioned as to cause the bias of the spring **28** to be insufficient to urge the diaphragm **26** against the ducts **42** to plug them: thus, the diaphragm thus remaining spaced apart by a certain gap from the ports **43**, through which the ducts open into the chamber C. It is apparent that, whenever the pressure in chamber C drops under a preselected limiting value, the diaphragm **26**, under the predominant bias of the spring **28**, will rest on the ports **43** thus closing the ducts **42**. It is likewise apparent that, should the diaphragm **26** be spaced a short distance apart from the ports **43**, a slight pressure drop in C is enough to cause said closing action to take place. The position of the handle **23** aforementioned thus indicates, on a dial from 2 to 7 (on the right, as viewed in FIG. 1), the value at which the pressure in the chamber C should drop to determine the closure of the ducts **42**. This value can be varied by rotating said handle. The pressure drop within the chamber C takes place when either individual tyre has become air-pervious: if so, air leaks into the atmosphere from a tyre but the pressure is equally decreased in both tyres, these being intercommunicating. As the pressure in C is becoming smaller, at a certain stage, as aforesaid, the closure of the conduits takes place by the agency of the diaphragm **26**.

If, for example, there is in the dual tyre (and thus in C) a pressure of 6 atmospheres, as shown, on the dial from 1 to 9 (in the left portion as viewed in FIG. 1) by the pointer **46** of the gauge, and the handle **23** is in the position "five" (5) of said dial from 2 to 7, in the case of a pressure drop in a tyre, the ducts **42** will be cut off by the diaphragm **26** as soon as the pressure in the two tyres (and thus in C) has fallen to 5 atmospheres. Once the ducts **42** have been cut off, the two individual tyres are no longer in communication so that, while either tyre continues to flatten, the other one stays at the preselected pressure of 5 atmospheres. The vehicle is thus enabled to continue its journey on one of the two individual tyres until the other one is replaced or repaired (that which should be made as soon as practicable). In practice, when the tyres are inflated by introducing compressed air through the duct J, the handle **23** is left in the preselected position, e.g. on the position "five"; the inflow of compressed air keeps the ports **43** spaced from the diaphragm **26** so that the tyres are inflated through the ducts **42**. Once the preselected pressure, for example 6 atmospheres, has been attained in the tyres, the feed hose (which was connected to the duct J) is disconnected and, at this stage, the ducts **42** are automatically cut off by the diaphragm **26**: after closing the duct J with a cap **45**, the handle **43** is brought to the position at which the spring **28** impresses a minimum bias on the diaphragm **26** and, by so doing, the communication between the two ducts **42** is restored (the diaphragm is separated from the ports **43**): then the handle **23** is brought to its preselected position, such as, for example the position 5 aforementioned. When in C a pressure obtains which is adapted to keep the diaphragm **26** withdrawn from the edges **43** of the ducts, that is to maintain a communication between the two paired tyres, the spring **7** holds the plate **6** in the position (on the left, as viewed in FIG. 2) in which the white area N of said plate is beneath said window **10** and can be inspected therethrough. When, conversely, a leakage occurs in a tyre, with the ensuing displacement of the diaphragm **26** towards the ports **43**, the diaphragm itself urges the retaining cup **1** and the latter, through the cup **2**, urges the rod **3** upwards, as viewed in FIG. 2. The lever **4** thus effects a slight rotation and acts with its longer arm, on said lever **5**. This lever, in turn, by rotating, urges the plate **6**, against the bias of the spring **7**, shifting under the window **40** the red area M of the plate, which can be clearly seen through said window.

By displacing the handle **26**, in addition, the lever **5** contacts with one end said wire **13** thus completing the circuit which, in turn, actuates the device for signalling to the driver with optical and/or acoustical means, that a cutoff has occurred.

Upon repairing the tyre and inflating (for example to 6 atmospheres) the two paired tyres as aforesaid, the diaphragm **26** is again separated from the ports **43** of the ducts and the retaining cup **1** can be shifted (downwardly as viewed in FIG. 2) so that the spring **7** causes the plate to display a white area with the area N under the window **40**.

In the light of the foregoing, it is clear that an observer, looking at the device (on the ground when the vehicle is stationary), can learn, according to whether white or red is displayed through the window **40**, whether the two paired tyres are in mutual communication or not.

If the device displays a red signal and it is desired to know which tyre is leaking, the handle **23** can be displaced in the direction so as to reduce the bias of the spring **28** so as to cause a flick of the pressure pointer: the direction of said flick indicates which is the leaking tyre.

What is claimed is:

1. A device for signalling the pressure and possible leakages for intercommunicating tyres of landcraft or aircraft, comprising a casing, a chamber in said casing,

a flexible diaphragm which closes said chamber, a spring biassing a face of said diaphragm, means for adjusting from the outside the bias applied by said spring for deflecting said diaphragm towards the interior of said chamber, a pair of ducts within said casing, each duct being susceptible of being connected at either end to either tyre and having its other end opening into said chamber through a port to convey compressed air from said tyres towards said chamber so as to deflect said diaphragm towards the exterior of said chamber, said two ports being arranged on a plane substantially parallel to the plane of said diaphragm so as to have said ports closed by said diaphragm when the pressure in said chamber drops below a preselected value as determined by said spring; a rod which can slide axially and has an end contacting said diaphragm with the agency of a retaining cap and a flexible cup as a sealing member, and its other end contacting the shorter arm of a lever acting on a second lever which in turn is active, against the bias of a return spring, upon a signalling member, the latter consisting of a plate allowed to slide on the plane of and below, a window formed through the casing and which can be viewed from the outside, said plate being divided into two differently coloured areas, said areas being alternatingly visible beneath said window.

2. A device according to claim 1, characterized in that the chamber into which open the two ducts in

communication with the two individual tyres communicates also with a pressure gauge whose dial is affixed to said casing along with a graduated scale for indicating the pressures obtaining within said chamber, carries a second graduated scale for indicating the bias furnished by said spring once that the adjustment has been made.

3. A device according to claim 1, characterized in that in the vicinity of either arm of either lever interposed between said rod and said plate an electric conductor is arranged having a gap adjustable by means of a specially provided screw, said conductor being capable of connection, by an end issuing from said casing, through an insulating member, to a device which is optionally installed for acoustical and/or optical signalling.

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U.S. Cl. X.R.

116—34; 340—58