United States Patent [19]

Johnsson et al.

[11] **3,759,147**

[45] **Sept. 18, 1973**

[54] DIAPHRAGM BRAKE ACTUATOR

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[22] Filed: **Feb. 24, 1971**

[21] Appl. No.: **118,440**

[52] **U.S. Cl.** **92/19**, 92/24, 92/25, 92/63, 92/64, 92/65

[51] **Int. Cl.** **F01b 19/02**, F15b 15/26

[58] **Field of Search** 92/134, 97, 24, 28, 92/27, 48, 49, 62, 18, 19, 25, 63–65; 188/170

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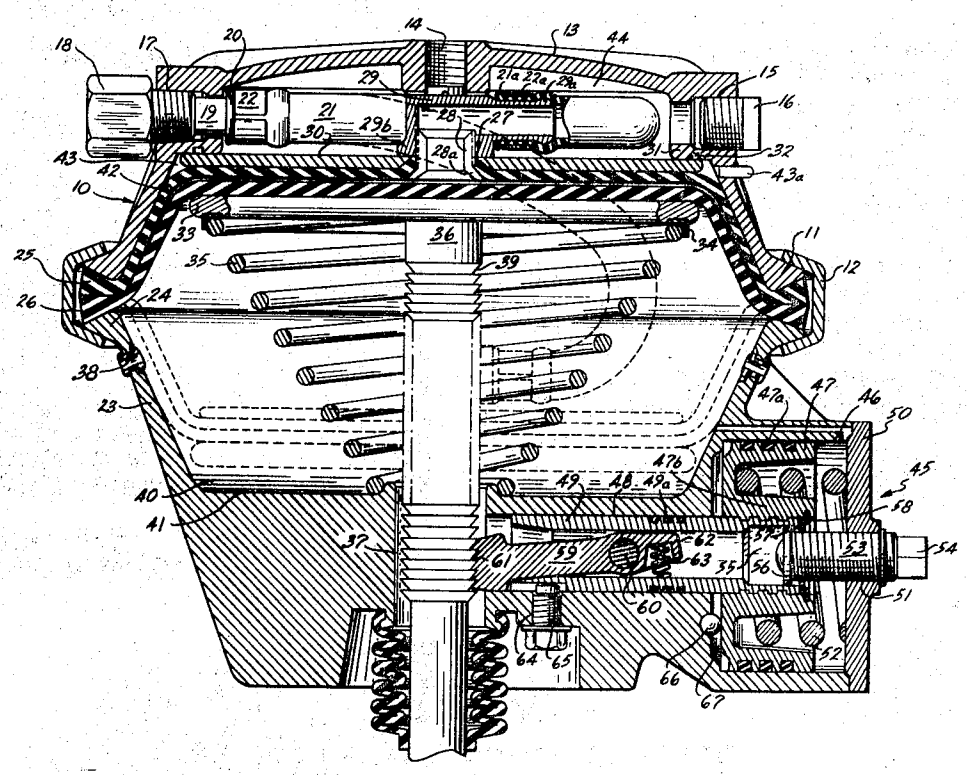
[57] ABSTRACT

An improved service brake air diaphragm chamber having two diaphragms placed close to each other therewithin and held in position inside the service chamber by a single clamp band, the outer of said diaphragms having an air hose fitting, whereby air pressure may be fed through said fitting to the space between the diaphragms by means of a flexible air hose connected to the fitting and an inlet port on the outer pressure plate of the service chamber, the service chamber having its rear cover or pressure plate made with a cavity behind the outer diaphragm for lodging the half-coil flexible hose and a second inlet port outboard of the outboard diaphragm to feed air pressure outboard thereof.

Service brake locking means including a push rod made with saw-tooth grooves on a length thereof spaced from a push rod disc on one end thereof abutting the inner of said two diaphragms, the saw-tooth grooves operating as a ratchet to be held in a locked position by means of a spring actuated pawl, when the diaphragms have transmitted their force to the push rod (locking the brake in on position), the pawl being part of a piston which, on one side thereof, is actuated by spring force and the other side actuated by air pressure;

The combination of the service brake air diaphragm chamber with two diaphragms and the air hose fitting with, as a first option, an outboard spring emergency and parking brake unit and, as a second option, an inboard spring emergency and parking brake power unit, neither of these two latter forms employing a lock mechanism.

7 Claims, 4 Drawing Figures



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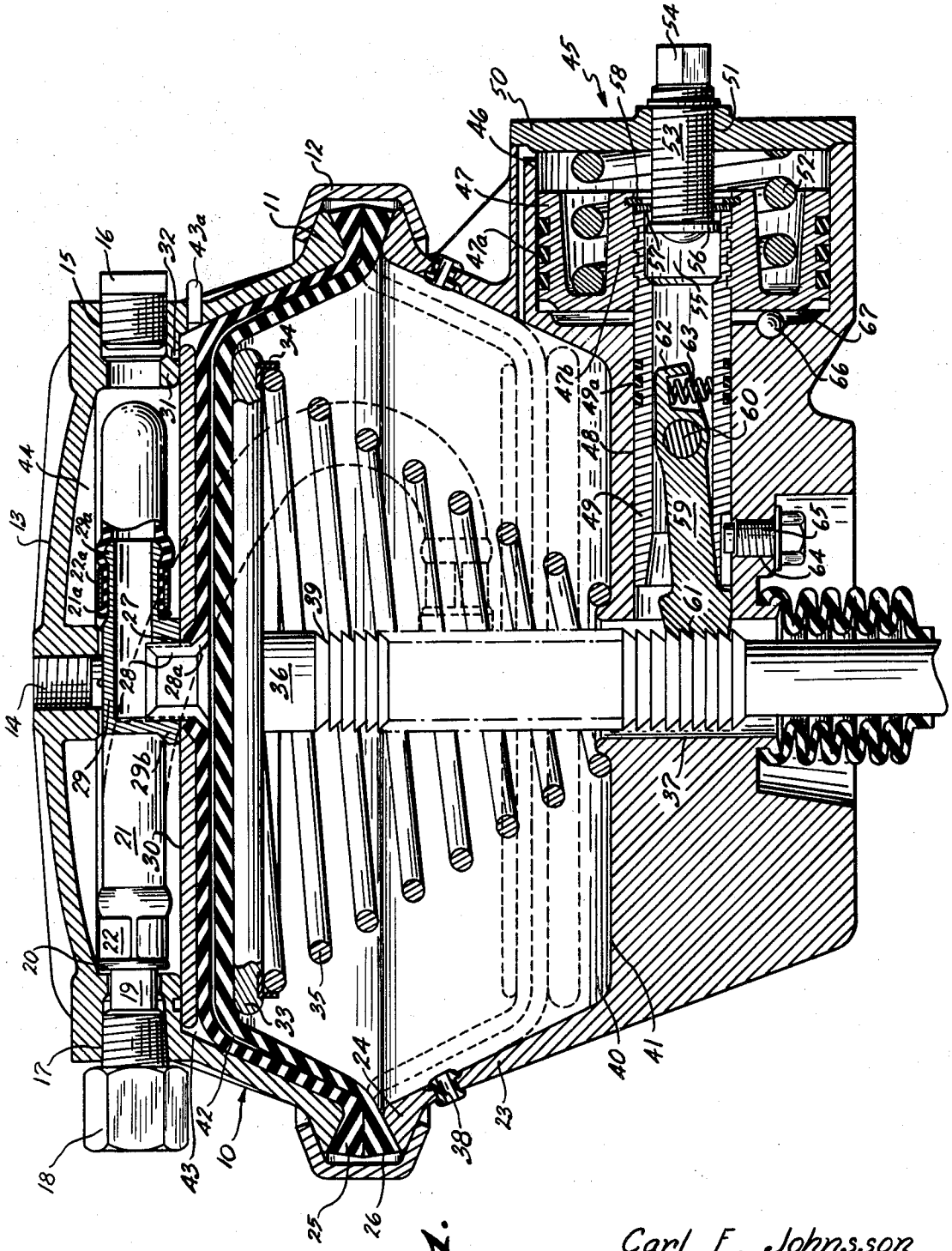


Fig. 1.

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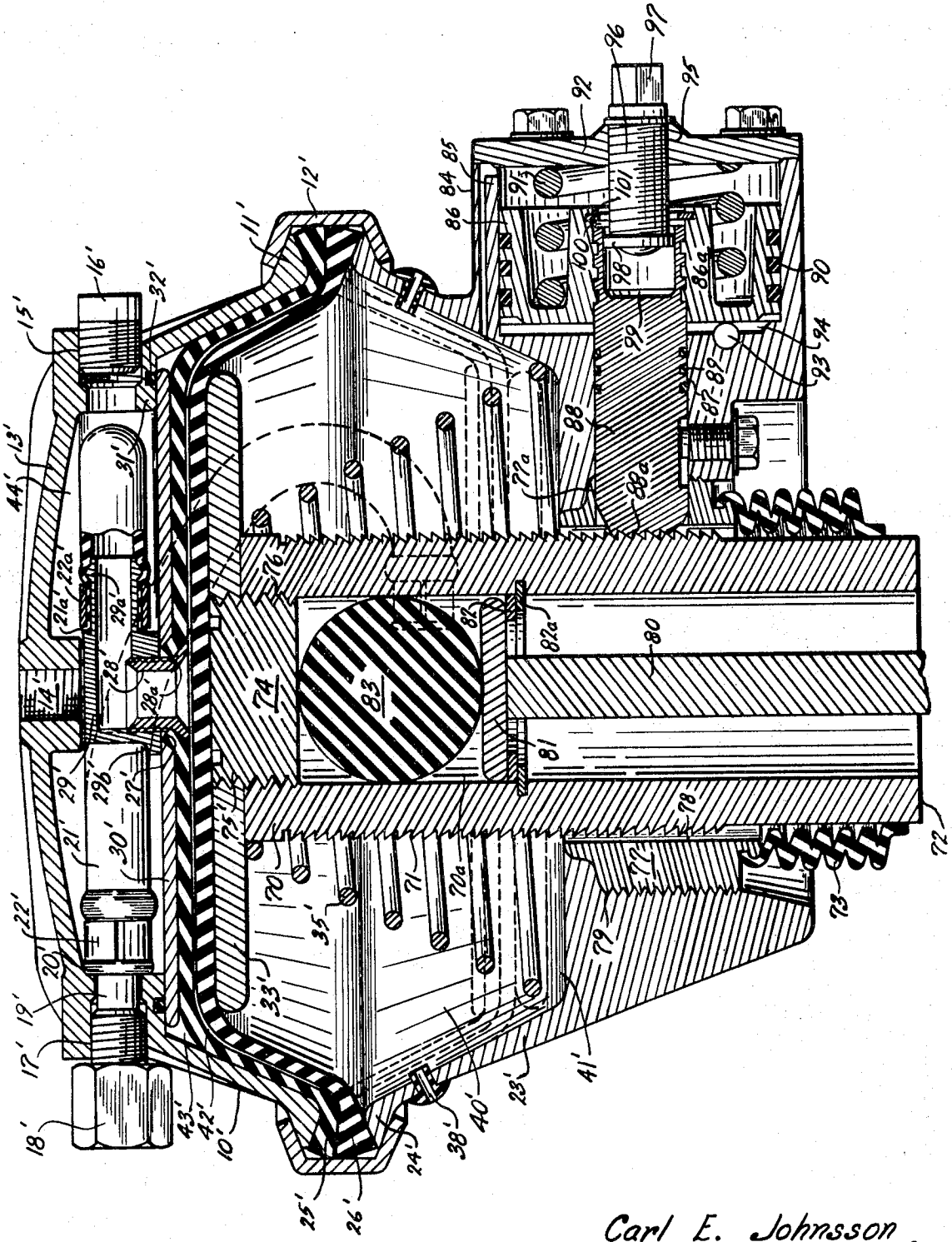


Fig. 2.

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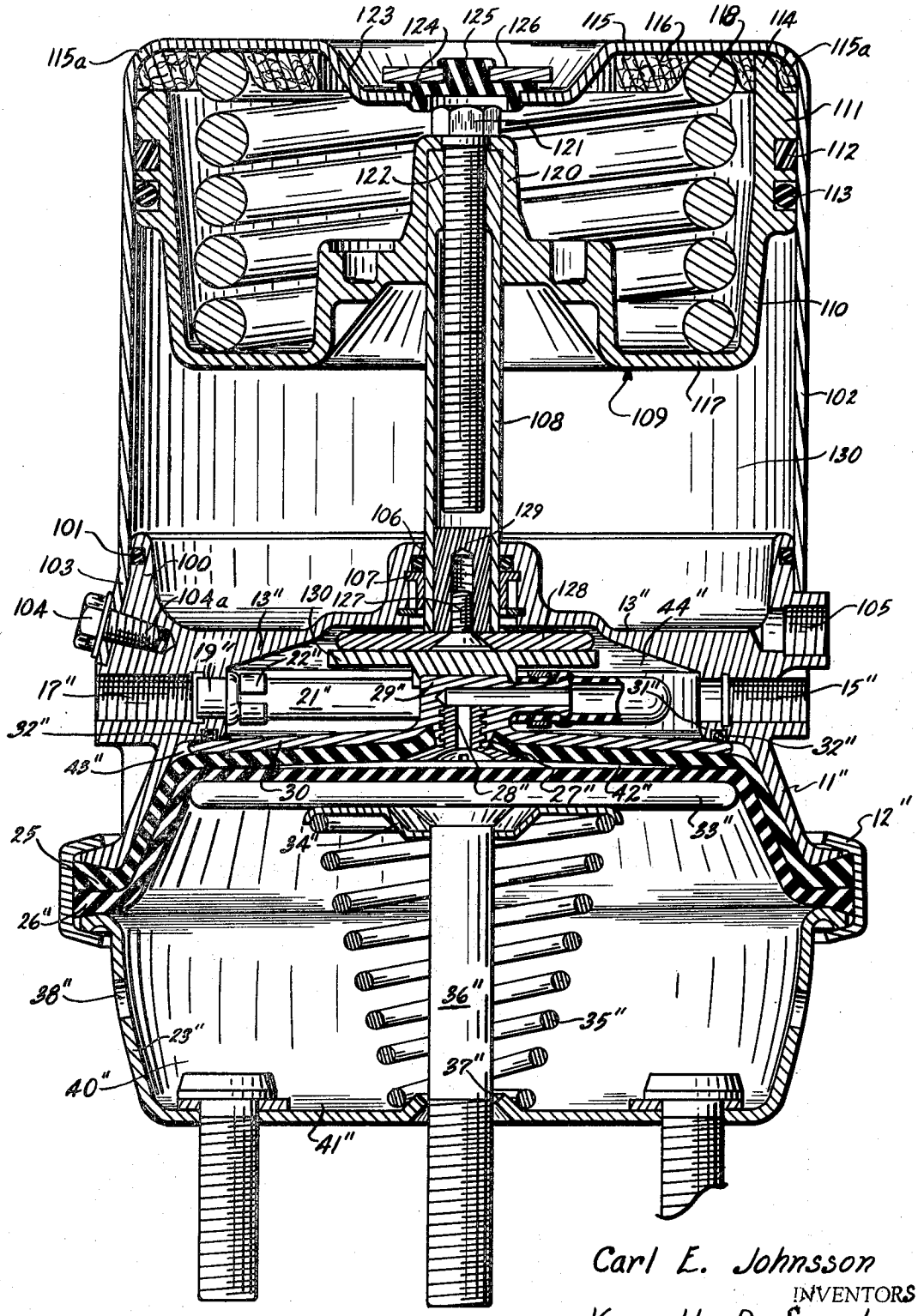


Fig. 3.

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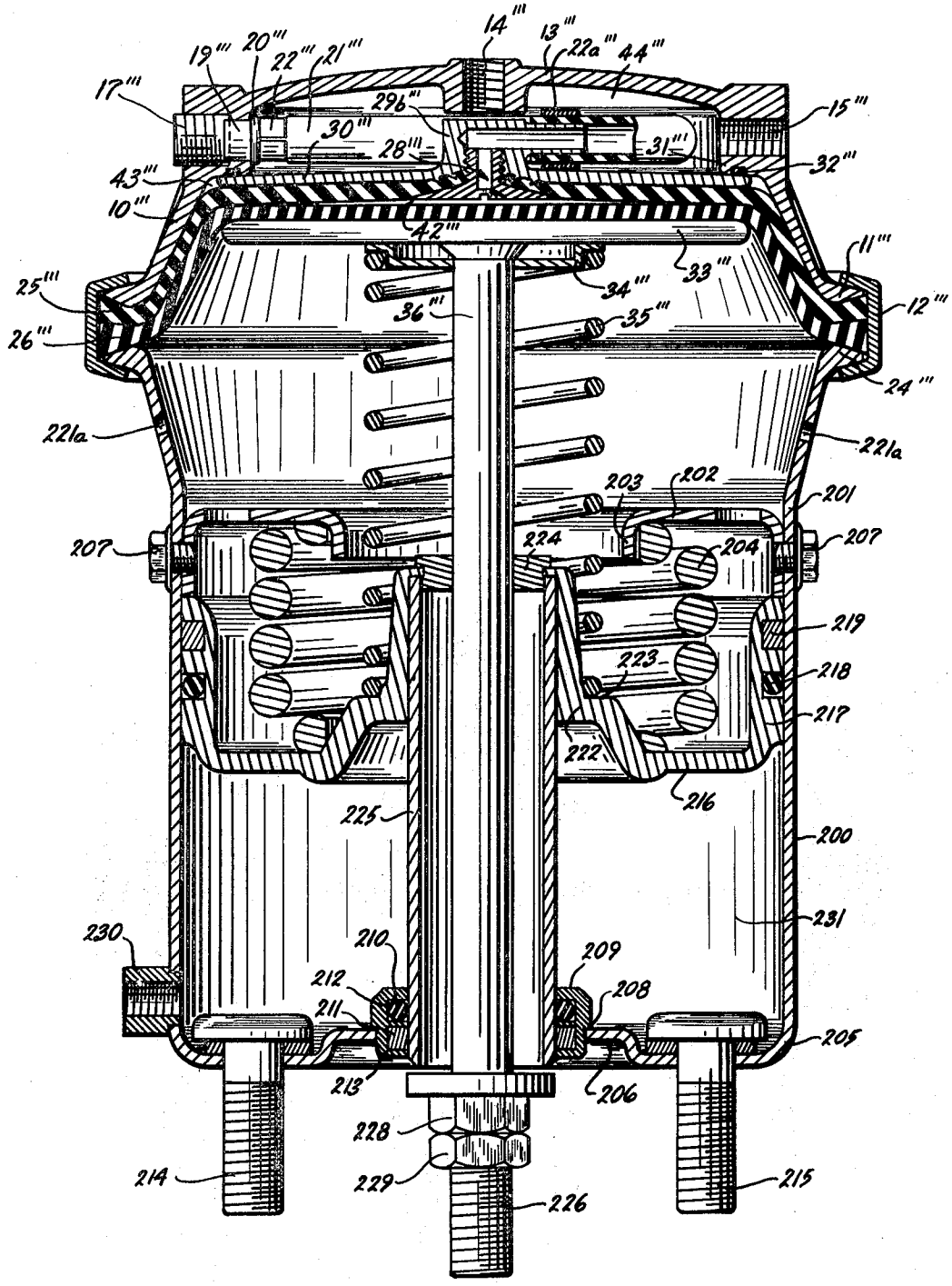


Fig. 4.

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DIAPHRAGM BRAKE ACTUATOR

THE PRIOR ART

The prior art has typically shown numerous examples of service brake chambers utilizing a plurality of service chamber diaphragms. Typically, these involve the two enclosing sections of the service chamber, disc-like or arcuate in cross-section (or truncated cone), with the two diaphragms retained peripherally at their edges between the two discs and an intermediate central ring member therebetween, with fastening means provided to couple the two service chamber halves and the intermediate ring into a single sealed assembly. An air pressure inlet is provided into the outboard disc of the service chamber and the second air inlet into the ring member between the two diaphragms. A push rod connecting to a brake or the work is attached to or abutted against the diaphragm which is adjacent the side of the service chamber not penetrated by the outboard air inlet means.

Thus, see Holman, Jr., U.S. Pat. No. 2,649,169, issued 8-18-53; Horn, U.S. Pat. No. 2,770,799, issued Nov. 13, 1956; Euga, U.S. Pat. No. 3,011,832, issued Dec. 5, 1961; Washnock et al., U.S. Pat. No. 3,064,685, issued Nov. 20, 1962.

There are additionally known devices of the sort immediately described which incorporate, in addition, mechanical locking means to hold in abeyance a provided spring emergency function. Examples of these are seen in Berg et al., U.S. Pat. No. 3,182,566, issued May 11, 1965; Leighton, U.S. Pat. No. 3,282,169, issued Nov. 1, 1966; Valentine et al., U.S. Pat. No. 3,267,819, issued Aug. 23, 1966 and Cumming, U.S. Pat. No. 3,453,030, issued July 1, 1969.

Analogous to the first described type above, but providing a locking means for retaining the brake in applied position, is Schubert, U.S. Pat. No. 3,228,729, issued Jan. 11, 1966.

DESCRIPTION OF THE INVENTION

The instant device as represented in FIGS. 1 and 2 provides both a double diaphragm service chamber and a parking device (via an associated lock to secure the brake in the on position). In the instant design, the two service chamber diaphragms are placed close to (next) one another save in that the outboard or secondary diaphragm has a punched center hole to receive an air-tight fitting with a flexible hose connected at one end thereto. The latter is placed in a half-coil in the rear space of the outboard service chamber pressure plate which overlies the outer face of the outer diaphragm. By utilizing this construction, we provide a double diaphragm air brake chamber which is both short and light and which can use normal, standard rubber diaphragms with a single clamp band around the joint of the service chamber discs or halves.

Further in the devices of FIGS. 1 and 2, the push rod is provided with saw-tooth grooves on a length thereof from the push rod disc which is not less than the maximum stroke the diaphragms are able to create. These saw-tooth grooves operate as a ratchet to be held in a locked position by means of a spring actuated pawl when the diaphragms have transmitted their force to the push rod. The pawl is part of a piston which, on one side, is actuated by spring force, and on the other side, actuated by air pressure.

With respect to the spring actuated locking mechanism, the springs typically may have a force of about 225 pounds and the piston can produce a release force of up to a maximum of 425 pounds. The spring will be compressed at 60 p.s.i. air pressure. The pawl and ratchet actuated by the spring provide a good locking device, with high release force from the air piston. In case of no air pressure available, there is provided a strong release bolt in the spring cylinder (a backoff).

In order to handle reverse force reactions due to hold forces, as well as drum contraction forces, specific means are provided, comprising resilient elements, which constitute the main differences between the modifications of FIGS. 1 and 2.

In the modifications of FIGS. 3 and 4, the structural advantages (as well as functional) of the double diaphragm system in the service chamber with the half-coil input air fitting between the diaphragms is retained, but the locking means for the push rod from the inboard diaphragm is removed. There is provided, alternatively, the combination with the improved service chamber of (FIG. 3) an outboard spring emergency power unit and (FIG. 4) an inboard spring emergency power unit.

FIG. 1 is a side, sectional view of an air brake service chamber utilizing a pair of diaphragms and two separate air inputs into the service chamber, one outboard of the outer diaphragm, the other between the diaphragms, locking means provided to lock the brake in and release the brake from the "on" position.

FIG. 2 is a view of a service brake chamber and locking mechanism analogous to that of FIG. 1, but differing in the resilient element which takes care of reverse force reactions due to holding forces, as well as drum contraction forces.

FIG. 3 is a sectional view through a combined service brake chamber and spring emergency brake chamber, the former utilizing the improved double diaphragm arrangement in the service chamber, the latter positioned outboard of the service chamber.

FIG. 4 is a view of a combined service and spring emergency brake unit, the service chamber outboard of the spring emergency unit and involving the improved double diaphragm service chamber construction and function.

OBJECTS OF THE INVENTION

An object of the invention is to improve dual circuit air brake systems, particularly those involving the use of a pair of diaphragms in the service brake chamber.

An object of the invention is to provide an improved air brake chamber where one always has an intact and working, or acting, emergency brake (at full effect) due to the assumption that "a double failure will rarely occur," at least not at the same moment.

Another object of the invention is to provide an improved double diaphragm air brake service chamber which is provided with a parking brake or parking device, either via a lock or by virtue of combination therewith of a power spring unit.

Another object of the invention is to improve parking locks usable in conjunction with double diaphragm service chambers by virtue of the fact that resilient push rod engaging means are provided to compensate for reverse force reactions due to hold forces, as well as drum contraction forces.

Another object of the invention is to provide improved application and release means for parking locks associated with double diaphragm brake service chambers, particularly in that a spring loaded piston is used to apply the lock, air pressure on the piston releasing the same.

Another object of the invention is to provide an improved service brake chamber construction utilizing a pair of ordinary or standard rubber diaphragms where a single clamp band may be employed.

Another object of the invention is to provide a double diaphragm service brake chamber where force is applied to the outer of said diaphragms through the outer service chamber wall and to the space between the diaphragms by virtue of a half-coil hose and an inlet fitting received in a plate in the same diaphragm.

Another object of the invention is to provide means for sealing the outboard diaphragm against the inside surface of the outer service chamber during normal operation of the inboard diaphragm so that, even if the outboard emergency diaphragm is ruptured, an effective seal is provided so air pressure is not lost in the service brake chamber.

Another object of the invention is to provide positive release means for disengaging the parking lock under all conditions in the utilization of the double diaphragm service chamber (a backoff device coupled with the spring loaded piston previously described).

Other and further objects of the invention will appear in the course of the following description.

The conventional mode of operation of a double diaphragm service chamber is as follows. In a normal service application, air is delivered between the two diaphragms, forcing the inward diaphragm toward the brake and the outward diaphragm outwardly (maintaining its stationary position), thus applying the brakes through the push rod inboard of and driven by the inboard diaphragm. In a secondary (emergency) brake application, or if the inward diaphragm fails, air is delivered to the space between the outboard diaphragm and the service chamber outer wall, thus forcing the outboard diaphragm (and the plate which is attached thereto in these figures) inwardly to apply the brakes.

In the construction shown in FIGS. 1 and 2 there are three circuits. The main system or circuit is the input through the flexible hose in the outer diaphragm to the space between the diaphragms, which serves to work the inner diaphragm only. The second circuit or input is through the outboard cap or cover of the service chamber which operates to force the whole assembly inward. The third circuit is air pressure input to the piston on the lock which keeps the lock off when that air pressure is up. Thus, there is provided both a service system (the first described) plus an emergency system (the second described) in a single service chamber, as well as the lock release.

There is particularly provided a seal which, in the case of the outer diaphragm rupturing or failing (outboard diaphragm) under constant use of the first circuit, will seal the space inboard, toward the brake, of the circular plate on the top of the outboard diaphragm whereby to permit the inboard diaphragm to continue working under the pressure fed through the half-coil hose.

Another advantage of the instant system is that no space or spacer is required between the diaphragms in the service chamber. This accomplishes a main objective, namely, to condense space.

FIG. 1 CONSTRUCTION

Referring to FIG. 1, at 10 is generally designated the outboard pressure plate, or member of a service air brake chamber. Member 10 has an inboard circumferential flange 11 adapted to be gripped by a clamp band 12. The outer cap 13 thereof has preferably central air input opening 14 which is internally threaded for attachment of an air pressure fitting or a plug. A second air input opening 15, internally threaded, with plug 16 sealing same, is provided within the lateral portion of outer cap 13. A third air input opening 17, also internally threaded, has air pressure input fitting 18 threaded sealingly thereinto, the inwardly extending portion 19 thereof receiving one end 20 of a resilient air hose 21 thereon in pressure sealing fashion with retainer 22.

The inboard portion 23 of the service air brake chamber has an outboard peripheral flange 24 also received within the clamp band 12 in conjunction with flange 11, the peripheral edges of a pair of standard rubber or other resilient composition material diaphragms 25 and 26 also being gripped in air sealing fashion circumferentially between the flanges 11 and 24, fixed by clamp band 12. (Removably). Diaphragm 26 is the inboard or normally operating (in service brake applications) diaphragm of the pair. Diaphragm 25 is the outboard and emergency diaphragm.

An opening 27 is formed centrally of the outboard diaphragm 25 and receives therewithin an outwardly flanged air passage 28. The latter is removably screwed into a metallic pipe or tube 29 at one end thereof in air sealing fashion whereby to receive air therefrom. The other end of the angled tube 29, as at 29*a* receives the other end of rubber hose 21, as at 21*a*, the same fixed thereover by removable retainer 22*a*. By virtue of this structure, air pressure input through fitting 18 and passing through extension 19 goes into resilient air hose 21, thereafter into pipe 29, through fitting 28 and between the diaphragms 25 and 26.

There is further provided a circular disc or plate 30 overlying the outboard side of diaphragm 25 and fixed thereto centrally of the diaphragm by virtue of the wedging action of the circumferential flange lips 28*a* of fitting 28, plate 30 itself and the overlying portion 29*b* of pipe 29. The diameter of plate 30 is sufficient that it underlies circumferentially the circumferential shelf 31 defining the inward end of the outer cap 13 of the outer plate or shell 10 of the service brake chamber. Positioned on the underside of this shelf is a circumferential groove 32 or slot which receives therewithin a resilient sealing means which, when plate 30 is forced against the shelf 31, operates to seal against the upper surface of plate 30.

The inboard diaphragm 26 abuts on its inboard or inner face a circular pad or plate 33 which has spring retainer 34 received in a slot or groove in the face thereof and fixed thereto. Plate or pad 33 with the retainer 34 receives the diaphragm return spring 35 thereagainst, the latter encircling the push rod 36 fixedly mounting plate 33 which extends through an opening 37 in the inboard wall of shell or member 23, centrally thereof, whereby to pass the push rod 36 out of the service brake chamber toward the braking member or means. Air exhuast openings 38 are provided

spaced around the lower shell 23 of the service brake chamber.

All of the above described structure, save for the precise structure of the push rod 36 is identical with the service brake chamber structure of FIG. 2, whereby, with respect to that Figure, same will not be described in detail, the numbers remaining the same in both views, but primed with respect to FIG. 2.

Turning now to the means provided for locking the brake in applied position, when desired, saw-toothed grooves 39 are provided on push rod 36 inboard of its connection to plate 33 from a position at the ultimate extension of push rod 36 from the service brake chamber (the ultimate application position of the two diaphragms as shown in dotted lines) to the inboard portion of the push rod which will be opposite the engaging pawl of the locking device when the return spring 35 is at its full effect. This is the situation seen in FIG. 1, namely, with the locking pawl of the lock engaging the most inboard portion of the push rod and no air pressure acting on either of the diaphragms to apply the brakes by extending the push rod out of the service brake chamber.

The service brake chamber has basically four zones. These comprise the inboard zone or space 40 defined between the inboard face of the inboard diaphragm 26 and the inboard wall (inner) of shell or member 23. This zone 40 breathes through openings 38 as the diaphragms, or one of them, move toward and away from the inner face 41 of member 23 in service (or emergency) applications of the brakes and releasings thereof. The second zone of the service chamber is that space numbered 42 between diaphragms 25 and 26 and which is served by air input through fitting 28 and hose 21. The third zone of the service air brake chamber is numbered 43 and comprises that space below plate 30 and above the outboard diaphragm 25. A whistle 43a may be provided communicating with zone 43 as shown to warn of rupture of diaphragm 25. The fourth zone of the service brake chamber is numbered 44 and is the zone defined by the shelf 31 and the outer cap wall 13 where the resilient hose 21 and its attachment fittings to the service brake chamber cap 10 and the outboard diaphragm 25 are retained. This is above plate 30. These latter described relationships with respect to the zones of the service air brake chamber are the same for FIG. 2 and will not be described, these zones numbered the same but primed in FIG. 2.

A housing generally designated 45 is provided laterally of and below the service brake chamber just described and is of the following construction. A cylinder 46 is provided in the outer portion thereof adapted to receive in sliding sealed fashion piston 47 therewithin. An opening or passageway 48 radially inward toward the opening 37 and connecting therewith receives in sliding sealed fashion therewithin a hollow piston rod 49. The sealing means for piston 47 are seen at 47*a* and for the piston rod 49 at 49*a*, consisting of O-rings in grooves in the members described. A cap 50 is removably secured to the outside portion of cylinder 46 and has an internally threaded opening 51 therethrough. A power spring 52 abuts the inside surface of cap 50 at one end thereof and the piston 47 at the other end thereof. A threaded plug 53 having a square or hexagonal outer head 54 thereon is threaded through opening 51 and cap 50 and extends into a central passage or opening 55 in the central hub 47b of piston 47 and the outer portion of piston rod 49. A flange 56 on the inner end of plug 53 is engagable by the inner member 57 of a pair of rings 57 and 58, the latter received in a groove in the piston hub and retaining ring 57 therebetween and between the end of the piston rod 49. Rotating plug 53 to screw or thread same outwardly through cap 50 causes flange 56 to engage ring 57 and draw piston 47 toward cap 50 against the action of drive or power spring 52.

The engaging pawl for the saw-tooth 39 on push rod 36 is generally designated 59 and comprises an elongate member pivotally mounted by pin 60 within the hollow piston rod 49 and having saw-teeth 61 formed in the inboard head thereof. The outboard end past pin 60 is recessed at 62 to receive spring 63 therewithin, the other end of the spring abutting against the inner wall of the hollow piston rod. The purpose of spring 63 is to normally position pawl 59 so teeth 61 thereof are in the position of FIG. 1 (namely, toward the brake). An opening 64 is provided in the inboard side of passage 48, internally threaded, receiving externally threaded bolt or plug 65 which centers barrel 49 in its reciprocatory motion.

Referring, then, to the operation of the service air brake illustrated in FIG. 1, including the lock means therefor, in ordinary service applications of the brake, air is input through passage 66 inboard of piston 47 in the lock assembly, thereby forcing piston 47 to the right in the view shown and disengaging the teeth 61 of pawl 59 from the teeth on push rod 36. While there is air pressure in the normal brake actuation circuits, piston 47 is retained in that position unless air is bled from the space 67 by act of the operator. In this manner, the is no problem of accidentally locking the brake at an intermediate level of application or while the truck is moving and merely slowing, or the like.

To actuate push rod 36 downwardly in the view, or toward the observer or inboard toward the brake, air pressure is input through fitting 17, extension 19, hose 21, fitting 29, fitting 28 to space 42 between the diaphragms 26 and 25. The action of this air pressure is two-fold. In the first place, it acts to maintain plate 30 sealed against shelf 31 and the sealing means in groove 32 whereby to isolate the space 44 from the space 43, air pressure-wise. Secondly, such air pressure and force drives diaphragm 26 inboard towards the dotted line position shown against the force of the return spring 35 to extrude the push rod 36 opening 37 and, through whatever linkage is employed, actuate the brakes. As the air pressure ebbs and flows in the space 42 between the diaphragms, this relationship maintains true, namely, plate 30 sealed against shelf 31 and a diaphragm 26 working inwardly and outwardly to actuate and release the brake to a greater or lesser degree as the vehicle operator applies and releases the brakes.

One event that can happen under the normal service operation of the brakes is that the outboard diaphragm 25 could perforate or rupture, this event generally happening in the zone between the outer portion of the plate 30 and the portion of the diaphragm clamped between flanges 24 and 11. Should such occur, there is no loss of pressure between the diaphragms due to the seal between plate 30 and shelf 31. Whistle means in the opening below 16 gives warning of this.

In the event of the other eventuality with respect to the diaphragms, namely, rupture or perforation of inboard diaphragm 26, or, alternatively, in the event of

an emergenecy application of the brakes, air pressure is input through opening 14 (via a conventional fitting attached to a hose (not shown)) whereby to unseat plate 30 from shelf 31 and force the outboard diaphragm 25 downwardly in the view or toward the viewer or inboard to effect actuation of the brakes.

In operation of the lock mechanism seen, at any time when air pressure is exhausted from space 67, piston 47, under the impetus of power spring 52, moves left in the view whereby the saw-teeth 61 on pawl 59 will tend to engage the saw-teeth 39 on push rod 36. When the push rod is moving inboard, that is, during the application of the brakes, the teeth on the push rod ride past the teeth on the pawl due to the fact that air pressure in space 67 has moved piston 47 to the right in the view. However, when push rod 36 is moving outboard or upwardly in the view of FIG. 1, and air pressure is removed from space 67, the teeth 61 will positively engage with teeth 39 and the outboard motion of push rod 36 and plate 33, in response to the action of return spring 35, will cease. The ability of pawl 59 tp pivot around pin 60 enables the lock mechanism to compensate for return forces and for cooling of the brake drum. Once the brake lock is set, it can be removed only by input of air pressure through opening 66 into space 67 or backing off of the piston 57 by means of threaded plug 53.

FIG. 2 CONSTRUCTION

Referring now to FIG. 2, as previously noted, all the identical parts thereof compared to FIG. 1 will be numbered the same, but primed.

A minor distinction in the return springs of FIGS. 1 and 2 is that spring 35' of FIG. 2 is inverted with its larger diameter end inboard of the diaphragm plate it returns rather than outboard as in FIG. 1. This is due to the construction of the means for actuating the brake and taking up the return forces and effects due to cooling and contraction of the brake drums. Thus, at 70 is seen a hollow cylindrical member saw-toothed on a portion of the outside surface thereof as at 71 and having an end thereof 72 shortly below th attachment of seal 73 inboard of the service brake housing when the diaphragms 25' and 26' are in their extreme outboard position as shown in the view of FIG. 2. Member 70 is connected to pad or disc 33' by a removable plug 74 which threadably engages an opening 75 in disc 33' and the hollow upper center end of cylinder 70 at its internal threaded portion 76. A frictional bushing 77 having a smooth central opening 78 therewithin is threaded as at 79 into the inner portion of housing member 23'. This bushing also has an opening 77*a* in the righthand side thereof in the view for purposes to be described. The lower end thereof receives the seal 73 as in the manner of the unnumbered seal seen in like position in FIG. 1. The saw-tooth grooves 71 run the length of the outside surface of cylinder 70 from a position below or inward of the inward edge of opening 77*a* when the diaphragms are in outward full extension as in FIG. 2 and next to the pad or disc 33' so that, when the diaphragms and their attached plates 30' and 33' are in the dotted line position of FIG. 2, the saw-tooth grooves are just slightly outboard of the outboard edge of opening 77*a*. A push rod 80 is centrally received within the hollow center 70*a* of member 70 and has an enlarged disc outward head 81. This head is slidingly received above a pair of rings 82 and 82*a*, the latter received in a circumferential groove in the wall 70*a*. The inward end of rod 80 is connected to the brake linkage. A spherical rubber or otherwise resilient composition ball 83 is received between the inboard face of plug 74 and the outboard face of disc 81.

Turning to the lock construction of FIG. 2, in a housing generally designated 84, there is provided cylindrical recess 85 which receives, slidable therewithin, piston 86. Inboard of housing 84 and inboard radially toward push rod 80 there is formed an opening or passage 87 which is in line with and the same diameter as passage 77a in bushing 77. Piston rod 88 having sealing means 89 in peripheral grooves thereof slides to and fro within passages 87 and 77a as the piston 86 moves to the right and to the left in the view. Sealing means 90 seal the outer wall of the piston 86 to the inner wall of cylinder 85. A power spring 91 tends to move piston 86 to the left in the view toward member 70 and push rod 80, same being received in a piston recess and against the inner face of a removable outer wall or plate 92. Plate 92 is removably secured to piston 84 by bolts (not seen).

Air input passage 93 serves space 94 inboard of piston 86 whereby to drive the piston to the right in the view against the power spring 91 if it is so desired. Outer wall 92 has threaded passage 95 therewithin to receive outwardly threaded plug 96 having hexagonal or square head 97 for application of a wrench thereto. The inward end of plug 96 has a larger diameter flange 98 thereon which is received in an opening 99 formed centrally of the piston's central hub and piston rod radially outward end. Flange 98 engages ring 100 removably retained by ring 101 received in a groove in the inner face of the recess centrally of the piston hub 86a.

Mounting studs of conventional type are provided (not seen) for mounting the service brake units of FIGS. 1 and 2 with respect to an axle.

Referring to the operation of the device of FIG. 2, the action of the diaphragms in response to air pressure and failure of either of them is as previously described. However, it should be noted that, in application of the brake, force is applied to the brake mechanism via only push rod 80, through its head 81 in contact with resilient ball 83 abutting against the outboard face of plug 74. Return forces or forces due to contraction of brake drums are transmitted back through piston rod 80 against ball 83 compressing same, as well as exerting force against (1) diaphragm 26', if same is intact and acting, (2) both of the diaphragms if emergency brake actuation is occurring with air pressure going in fitting 14' and (3) against diaphragm 25' if diaphragm 26' has ruptured and air pressure impetus is applied only through fitting 14.

The operation of the lock mechanism differs also in that, as the diaphragm pad 33' and the attached member 70 move in and out with respect to the brake or up and down in the view as air pressure is variously applied, against the return spring 35', piston 86 is held off due to air pressure in space 94 input through opening 93. Should the air pressure be released out of space 94 by loss of pressure in the system or operator action, power spring 91 drives piston 86 and attached piston rod 88 to the left in the view so that teeth 88*a* engage the teeth 71 on member 70. So long as the member 70 is moving inboard toward the brake or downwardly in the view, teeth 71 can move past the teeth 88a to further apply the brake. However, if the teeth are in en-

gagement and, for whatever reason, force is not applied to one or both of the diaphragms to move them toward the dotted line position of FIG. 2 or hold them thereat, the lock engages. This holds tube **70** in solid, unmoving engagement with piston rod **88**. However, the presence of resilient ball **83** in the chamber between the inward face of the plug **74** and the outward face of the disc **81** permits push rod **80** to move outwardly compressing the ball due to return forces or cooling of the brake drums. This action, then, substitutes for the pivotal action of the pawl **59** in FIG. **1**.

THE OTHER FIGURES

Referring, then, to FIGS. **3** and **4**, the portions thereof which are essentially identical to the structure of FIG. **1** will be numbered the same as the parts in that view, but double primed in FIG. **3** and triple primed in FIG. **4**. To be more specific, with respect to FIG. **3**, there is no substantial structural or functional difference between the parts of FIG. **1** (omitting the lock structure) and the lower half of the device in FIG. **3**. That is, the double diaphragm service chamber of FIG. **1** utilizing the half-coil hose feed between the two diaphragms is utilized in the lower half of the structure of FIG. **3** as an air brake service chamber. Similarly, referring to FIG. **4**, essentially the outer half of the Figure, (the upper half of the drawing or upper smaller half thereof) is also identical in structure and function to the double diaphragm air brake service chamber of FIG. **1**, save for the omission of the lock on the latter.

FIG. 3

Formed integral with or attached to the peripheral upper surface of the outer wall **13''** of the service brake chamber is a circumferential flange **100** having a circumferential groove **101** in the outer upper face thereof having sealing means of resilient character positioned therewithin. A cylindrical can or container **102** having an outwardly flared inward end **103** is fixedly connected to said flange **100** by means of suitable screws or bolts **104** received in internally threaded or tapped holes **104a**. The outward flanging of the cylindrical can **102** serves to make a sealed sliding fit particularly with respect to the material in the groove **101**. An air input passage **105** feeds air into the lower portion of flange **100**. Centrally of the outer wall **13''** of the service brake chamber is an opening **106** having conventional sealing means **107** received in the grooved side wall thereof. A piston rod **108** passes in sliding sealing fashion through said opening **106**.

Received within the can or cylinder **102** is a piston generally designated **109** having an outer (extending upwardly in the view) peripheral wall **110** of relatively lesser outer diameter surmounted by a wall engaging or abutting portion **111** having circumferential grooves **112** and **113** therein with suitable sealing rings of synthetic rubber, felt or the like. The upper portion of the piston wall **110** has a plurality of fingers or extensions **114** operative to engage the outer wall **115** of the can or housing through suitable filter, plastic foam or the like **116** for the purpose of filtering air through vents **115*a***. The lower wall **117** of the piston receives the inward end of a power spring **118**, the outer end of the power spring abutting the outer wall **115** of the can or cylinder.

The central hub of the piston **120** has fixed centrally thereof and extending inwardly thereof piston rod **108**. A threaded bolt **121** with an enlarged head is threadably and removably engaged with the internally threaded portion **122** of the piston rod **108**. The outer end **115** of can **102** is preferably inwardly formed as at **123** with a central opening **124**. A resilient plug **125** carries a perforated steel or other strong metal washer **126** whereby to be usable in a backoff function cooperating with bolt **121** and the threaded portion **122** of piston rod **108**.

The mechaism of such action is simple and previously disclosed in other patents, consisting of (1) removing plug **125**, (2) unscrewing bolt **121**, (3) passing bolt **121** through the opening of washer **126** with the latter lying outside opening **124**, (4) threaing the end of bolt **121** back into engaging portion **122** and (5) withdrawing piston **109** toward wall **115** by the screw action of the mechanical release.

Fixed to the inward end of piston rod **108** by a screw **127** is a plate **128**. Screw **127** is threadably received in a plug **129** fixed within the lower hollow end of piston rod **108**. Plate **128** operates to abut in force transmitting fashion plate **130** which is fixed to the top of hose pipe member **29''**.

The mode of operation of the device in FIG. **3** is as follows. In the first place, air pressure through passage **17''**, extension **19''**, hose **21''**, and pipe fitting **29''** passes between the diaphragms **26''** and **25''**. This forces the push rod **36''** via plate **33''** and against the action of diaphragm return spring **35''** out the inward end of the service chamber housing **41''** to apply the brake via mechanism connected to the inward end of push rod **36'** of conventional type. Likewise, should service diaphragm **24''** perforate or rupture or there be an emergency brake application, air is input through passage **15''** into space **44''** above the outward or emergency diaphragm whereby to also apply the brake.

During all service and emergency brake applications via the diaphragms in the service air brake chamber, air pressure is maintained in chamber **130** between piston **109** and wall **13''**. Thus, plate **128** and piston rod **108** are in the outward position with power spring **119** compressed. All of the structural and functional features of the double diaphragm service chamber previously described apply to the operation of the service chamber, per se, and its air sources and the like, as previously described with respect to FIGS. **1** and **2**, omitting the lock function. However, should the air supply into passages **17''** and **15''** fail or, under certain circumstances deliberately upon decision of the operator or in a parking situation, air is exhausted from chamber **130** through passage **105**. Power spring **119**, through piston rod **108**, plate **128**, plate **130** and via plates **30''** and **33''**, as well as push rod **36**, applies the brakes. The vehicle may not be moved until air pressure is restored into chamber **130**.

It whould be noted that the function of the spring emergency and parking chamber utilizing piston **109** affects the function of the locking pawl **59** in FIG. **1** and the locking piston **88** in FIG. **2**, with the resilience of the power spring **119** permitting correction against return forces and brake drum contraction upon cooling and the like.

FIG. 4

Referring to FIG. **4**, in this brake construction, the spring emergency and parking unit is inboard of the double diaphragm service brake chamber. A cylindri-

cal can **200** has inwardly connected thereto, at the outward end **201** thereof, central inwardly extending spring retainer **202** having opening **203** centrally thereof. Thus, outer wall portion **201** of cylinder or can **200** mounts a spring retainer **202** for power spring **204.** The inward end **205** of can **200** is inwardly formed to provide an inner wall **206.** Spring retainer **202** is fixed at a plurality of points to outer wall **201** by screws or bolts **207.** Centrally of the inner wall **206** is provided opening **208** receiving therewithin a shaft sealing plug **209** having shaft seals **210** and **211** in grooves **212** and **213** thereof. Bolts **214** and **215** serve to attach the entire housing assembly to an automotive frame, axle or the like. The same is true of the unnumbered studs (bolts welded in) in FIG. **3** at the inward side of service chamber **23''**.

A piston generally designated **216** has an outer greater diameter wall portion **217** containing grooves **218** and **219** with sealing rings or the like. The central hub **222** of the piston has a shelf or ledge **223** formed thereon whereby to receive the lower end of service brake chamber diaphragm return spring **35'''**. The inner central portion of the piston engages a push rod bushing **224** which also is fixed to the outer end of hollow piston rod **225.** Push rod **36'''** extends centrally down through push rod bushing **224** in slidable sealing fashion, within hollow piston rod **225.** At the lower end of (inward end of) rod **36'''** there is a threaded portion **226** upon which a washer **227** is threadably received, same locked thereon by nuts **228** and **229** which adjust the position of washer **227** on rod **36'''**. The outer diameter of washer **227** is greater than the outer diameter of tube **225.**

There is additionally provided an air input passage **230** in the inner wall **206** which passes air into the cavity **231** between piston **216** and inner wall **206.**

In the operation of the device seen in FIG. **4,** air pressure through passage **230** into chamber **231** normally retains piston **216** in the precise position shown in the view, namely, with extensions **220** rammed against wall member **201,** thus totally compressing power spring **204.** This assures the maximum action of diaphragm return spring **35'''**. In the meantime, as air is normally input into fitting **18'''** through holes **21'''** in service operation of the brake, inward diaphragm **26'''** acts upon plate **23'''** and push rod **36'''** to actuate and release the brake to greater or lesser degree. Tube **225** does not move during this normal operation.

In case of an emergency actuation of the brake or in case the inward diaphragm **26'''** perforates, air is input into opening **14'''** thus forcing plate **30'''** off shelf **31'''** and with its diaphragm **25'''** downwardly in the view, inwardly toward the brake, actuating the brake. As previously mentioned, in the event of normal service operation of the service brake via diaphragm **26'''**, and in case of perforation of outer diaphragm **35'''**, the plate **30'''** remains sealed thus permitting the normal operation until repairs can be made.

In the case of loss of pressure into passage **14'''** and hose **21'''**, diaphragm return spring returns the diaphragms to the position shown. Air pressure, however, is lost through passage **230** from chamber **231,** thus permitting power spring **204** to drive piston **216** down until the lower portion of piston wall **217** abuts wall **206** thus applying the brake via tube **225** abutting washer **227** and picking up rod **36'''**. This occurs also in a parking situation when pressure goes out of chamber **231.**

Thus, it is seen that the operation of the brakes of FIGS. **3** and **4** are the same, but utilizing different mechanisms due to the fact that, in one, FIG. **3,** the power spring chamber is outboard of the service chamber and, in FIG. **4,** the other, the opposite is true.

With respect to the lines and circuitry employed for air pressure to the forms of brake of the figures, it is noted that the springs on the locks of FIGS. **1** and **2** (**52** and **91**) are, in a sense, miniature power springs analogous to springs **118** and **204.** Thus, the air circuitry and valving may be the same between the various figures with the air sources backing off and releasing pistons **47** and **86** analogous those sources backing off and releasing pistons **109** and **216.**

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In a service air brake chamber, in combination,
- a pair of members defining said service air brake chamber therebetween and having continuous, opposed, circumferential flanges thereon,
- a pair of diaphragms together peripherally engaged by one another and said service chamber defining member flanges,
- a first pressurized fluid input between a first one of said diaphragms and a first one of said chamber defining members next thereto, and
- a second pressurized fluid input between said two diaphragms through an opening in the central portion of said first diaphragm,
- and resilient conduict means within said service brake chamber communicating between an opening in said first chamber defining member and the central opening in the first diaphragm and comprising said second pressurized fluid input.

2. A chamber as in claim **1** wherein the second pressurized fluid input through the first diaphragm includes a resilient hose movable with the perforated first diaphragm to and fro within the chamber and communicating inside of said chamber through the first defining member next to the perforated first diaphragm.

3. In a service air brake chamber, in combination,
- a pair of members defining said service air brake chamber therebetween and having continuous, opposed, circumferential flanges thereon,
- a pair of diaphragms peripherally engaged by said service chamber defining member flanges,
- a first pressurized fluid input between one of said diaphragms and the one of said chamber defining members next thereto, and

a second pressurized fluid input between said two diaphragms through an opening in the central portion of one of said diaphragms,

the pressurized fluid input through the diaphragm including a resilient hose movable with the perforated diaphragm to and fro within the chamber and communicating outside of said chamber through the defining member next to the perforated diaphragm,

the defining member next the perforated diaphragm recessed to receive the hose, a circumferential shelf provided in said member and a sealing plate connected to said perforated diaphragm adapted to rest against said shelf to seal the recess containing the hose.

4. In a service air brake chamber wherein a diaphragm is peripherally engaged by opposed flanges of paired members defining said service chamber therebetween,

with a pressurized fluid input between the diaphragm and the outboard one of said chamber defining members,

the flanges of the chamber defining members with the periphery of the diaphragm engaged therebetween removably and substantially circumferentially gripped by a clamp band,

a push rod operably connected with said diaphragm on the side opposite that pressurized by said fluid input extending out of the other one of said defining members and moving in and out corresponding to the action of the diaphragm and a diaphragm return spring within the non-pressurized segment of the service chamber,

the improvement which comprises:

a length of said push rod having teeth formed therein where said push rod moves in and out of said service chamber,

a movable wall normally driven by resilient means toward the push rod and carrying a toothed member adapted to engage said teeth on the push rod,

and means for moving said movable wall to a position radially away from said push rod,

means for pivotally mounting said toothed member on the movable wall and including a spring to bias the member to one extremity of its pivotal movement.

5. In a service air brake chamber wherein a diaphragm is peripherally engaged by opposed flanges of paired members defining said service chamber therebetween,

with a pressurized fluid input between the diaphragm and the outboard one of said chamber defining members,

the flanges of the chamber defining members with the periphery of the diaphragm engaged therebetween removably and substantially circumferentially gripped by a clamp band,

a push rod operably connected with said diaphragm on the side opposite that pressurized by said fluid input extending out of the other one of said defining members and moving in and out corresponding to the action of the diaphragm and a diaphragm return spring within the non-pressurized segment of the service chamber,

the improvement which comprises:

a length of said push rod having teeth formed therein where said push rod moves in and out of said service chamber,

a movable wall normally driven by resilient means toward the push rod and carrying a toothed member for engaging said teeth on the push rod,

and means for moving said movable wall to a position radially away from said push rod,

the push rod being hollow,

a rod connected received within the hollow center of said push rod and having an enlarged head thereon,

whereby to be picked up by means of the hollow push rod when the latter moves outwardly and into the service chamber, and

resilient means provided within the hollow push rod acting between the connection of the push rod to the diaphragm and the rod within the push rod to provide a resilient connection under return forces transmitted inwardly of the service chamber toward the diaphragm.

6. A brake actuating device having spring emergency and parking functions and operable connection with the braking mechanism of a vehicle, comprising,

a closed housing divided into inner and outer compartments,

a pair of flexible diaphragms together peripherally secured by one another and a pair of opposed circumferential flanges in the outer compartment,

a first pressurized fluid input between the outboard one of said diaphragms and the outboard end of the outer compartment,

a second pressurized fluid input between said two diaphragms through the central portion of the outboard one of said diaphragms,

conduit means within the outer compartment communicating between an opening in the outer comparment outer compartment and the central opening in the outboard diaphragm and comprising said second pressurized fluid input,

a brake operating rod surmounted by a diaphragm abutment plate extending axially through the inner and outer compartments and having attachment to the braking mechanism,

a movable wall mounted within the inner compartment equipped with a tubular axial extension surrounding and having abutting engagement at its inner end with said rod,

an annular member forming the partition between the inner and outer compartments,

a power compression spring unit between the said annular member and movable wall,

a rod return compression spring between the diaphragm abutment plate and one of said annular member and movable wall, and

an air inlet for introducing compressed air to the inner compartment between the movable wall and the inner end of the housing.

7. In combination,

a housing,

said housing having inner and outer ends with respect to a vehicle brake mechanism,

one end of the housing closed by an inner wall member having a central opening therethrough,

the other end of said housing closed by an outer wall member,

a movable wall within said housing with the outer face thereof next the outer wall member of said housing,

a rod connected at one end thereof centrally of said movable wall, extending inwardly of the latter and having a sliding fit through the inner wall member central opening,

an air inlet into said housing between the inner wall member and the inner face of the movable wall, whereby to permit pressurization of a movable wall pressurization chamber defined between said movable wall and the inner wall member,

a service air brake chamber inboard of said housing with the inner wall member of the housing constituting at least in a part one of a pair of members defining said service air brake chamber therebetween and having continuous, opposed, circumferential flanges thereon,

a pair of diaphragms together peripherally engaged by one another and said service chamber defining member flanges,

a first pressurized fluid input into the space between the outboard one of said diaphragm and the outer service air brake chamber defining member,

a second pressurized fluid input between the two diaphragms through the central portion of the outboard one of said diaphragms, and

resilient conduit means within the outer compartment communicating between an opening in the outer one of said service chamber defining members and the central opening in the outboard diaphragm and comprising said second pressurized fluid input.

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