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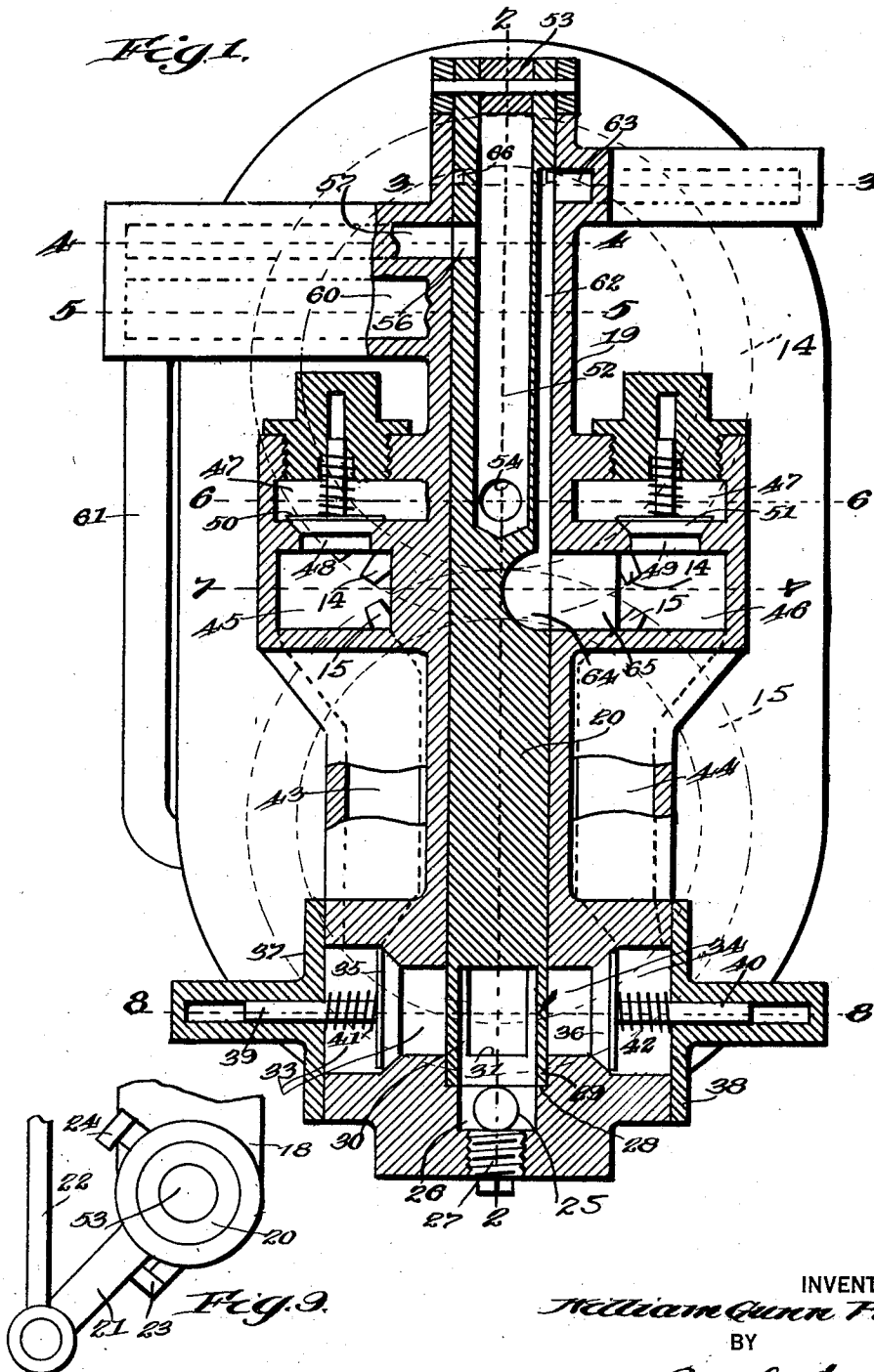
W. G. PRICE

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HYDRAULIC BRAKE

Filed Oct. 2, 1926

4 Sheets-Sheet 1



Jan. 6, 1931.

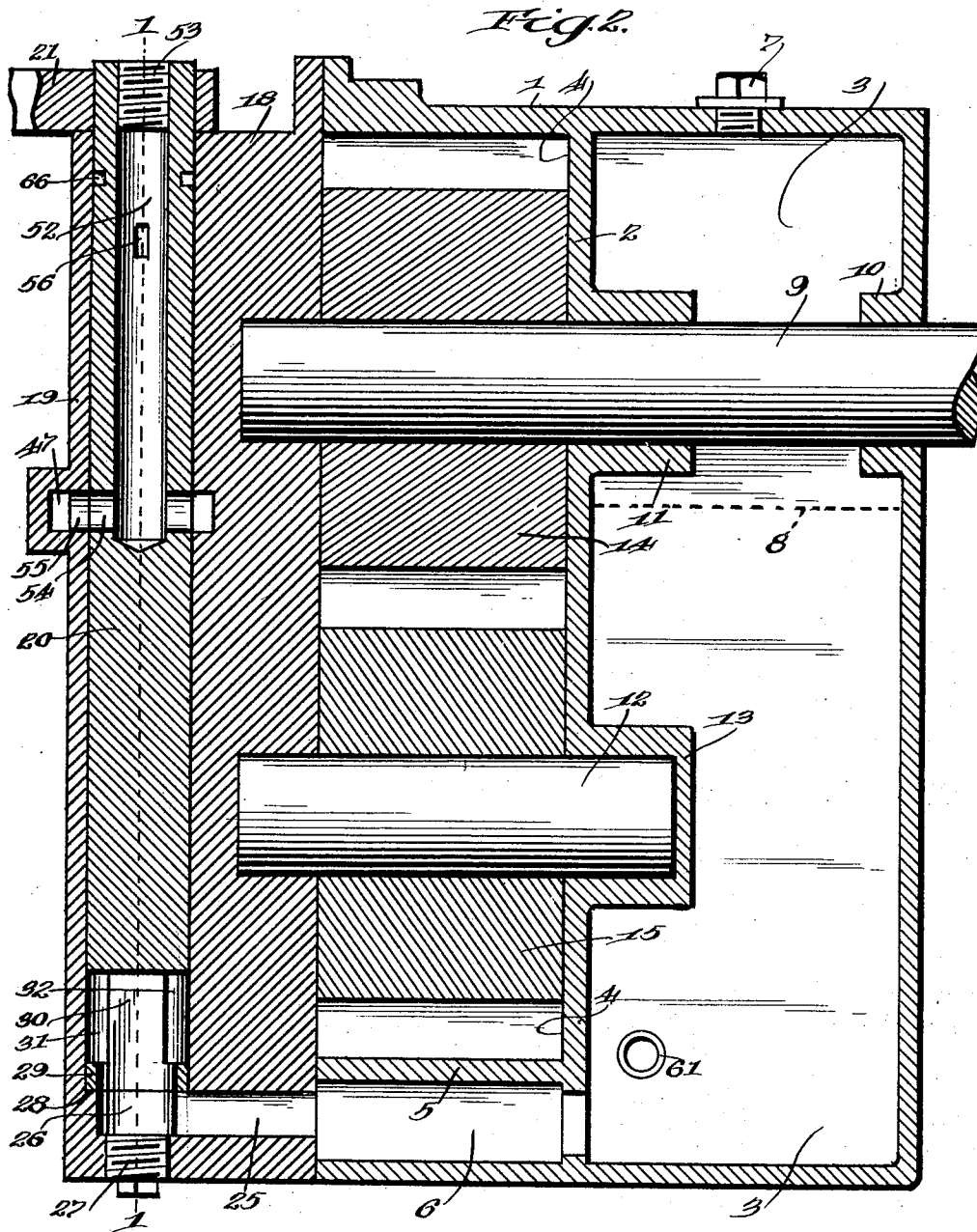
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HYDRAULIC BRAKE

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4 Sheets-Sheet 2



INVENTOR

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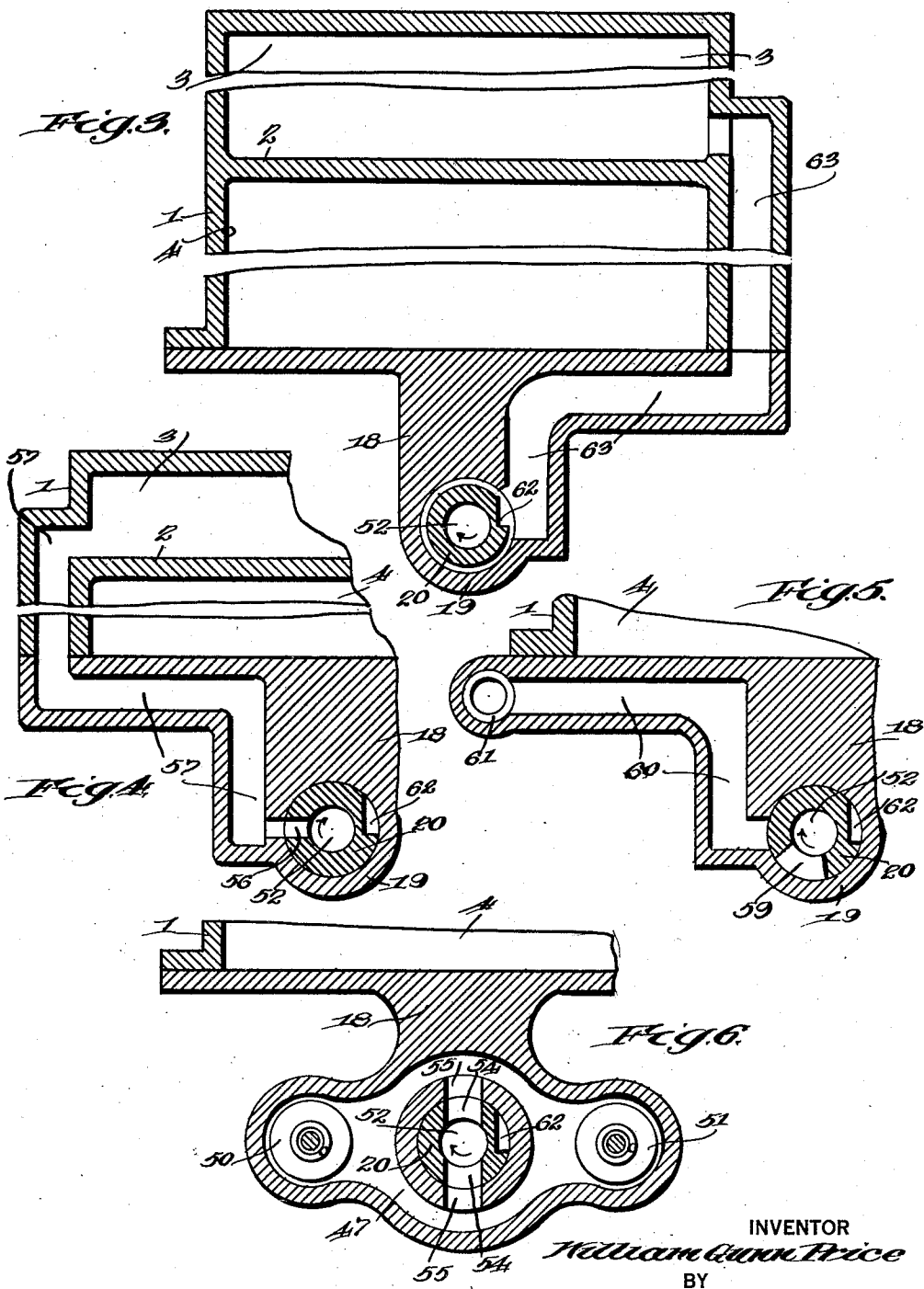
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HYDRAULIC BRAKE

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4 Sheets-Sheet 3



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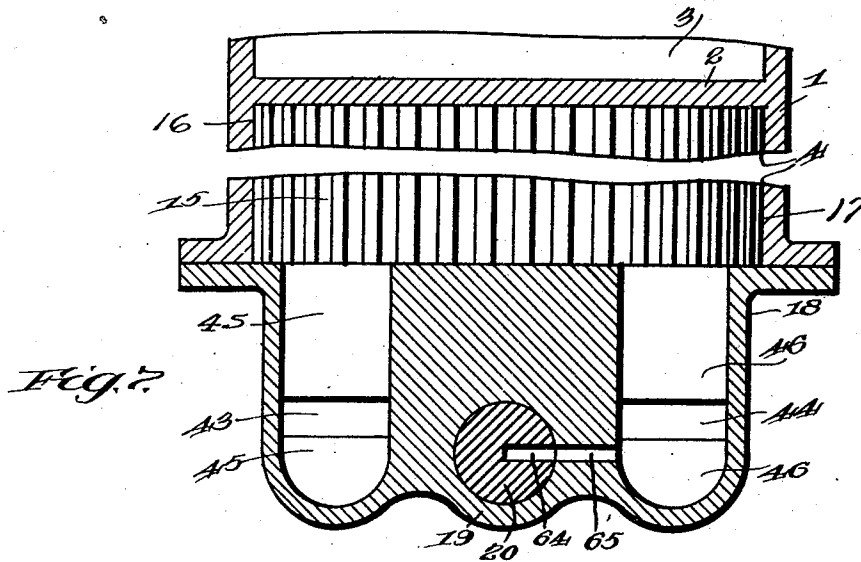
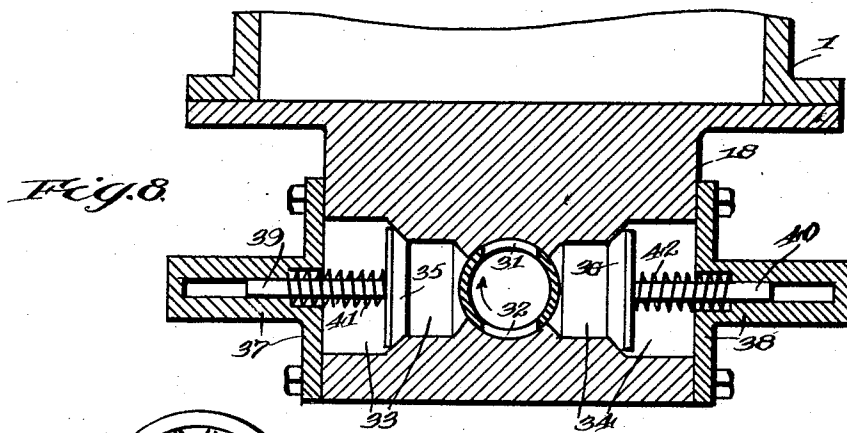
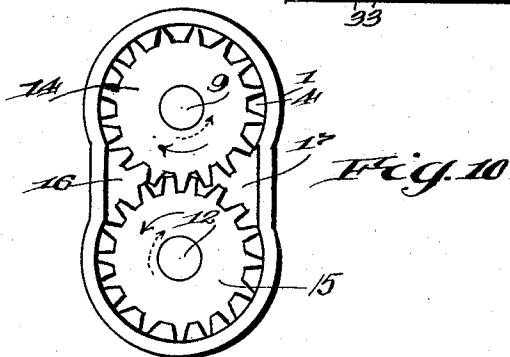
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HYDRAULIC BRAKE

Filed Oct. 2, 1926

4 Sheets-Sheet 4



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HYDRAULIC BRAKE

Application filed October 2, 1926. Serial No. 139,105.

This invention relates to improvements in vehicular hydraulic brake mechanism.

The invention has to do with a type of hydraulic brake in which pressure or gear chambers are employed into either of which liquid or oil is compressed by vehicle driven members such as gears, the reaction causing an application of brakage. In this type of mechanism, a reservoir is employed to supply a body of oil for operation of the mechanism, and therein, when the brake is operating, an endless flow of oil going to and from said chambers, or one thereof.

It has been found that if the oil is discharged to the reservoir below the lever therein, that the air which enters the gear or pressure chambers just prior to the application of brakage, will cause the oil body to foam, and if the oil is discharged to the reservoir above the level therein, a sufficient noise results that might be objectionable in some types of cars, especially passenger cars.

Further, it has been found that after a brakage application has been applied, a certain residue of oil remains in the chambers or chamber, and this oil residue idles as the vehicle is running in the absence of brakage stress. This idling oil, causes a slight drag, and also generates heat.

Now it is one of the objects of this invention to release the air from the gear chambers, preferably to the reservoir, above the liquid level therein, and to provide for the return of used oil to the reservoir below the level therein, thereby gaining all the advantages of oil delivery below the oil level and avoiding the objectionable foaming of the oil body.

A further feature of the invention is to provide means for expressing from the gear or pressure chambers any and all idling oil that heretofore has remained therein subsequent to the application of brakage and when the vehicle driven members are operating idly.

My improved mechanism and method involves many other features and advantages which will be more fully described in connection with the accompanying drawings

and which will be more particularly pointed out in and by the appended claims.

In the drawings:

Fig. 1, is a sectional view on line 1—1 of Fig. 2.

Fig. 2, is a sectional view on line 2—2 of Fig. 1.

Fig. 3, is a horizontal sectional view on line 3—3 of Fig. 1.

Fig. 4, is a similar view on line 4—4 of Fig. 1.

Fig. 5, is a similar view on line 5—5 of Fig. 1.

Fig. 6, is a similar view on line 6—6 of Fig. 1.

Fig. 7, is a similar view on line 7—7 of Fig. 1.

Fig. 8, is a similar view on line 8—8 of Fig. 1.

Fig. 9, is a top plan view showing the extent of movement of the operating lever for the controlling valve.

Fig. 10, is a face view of the casing and gears.

Like characters of reference designate similar parts throughout the different figures of the drawings.

As more clearly shown in Fig. 2, the device includes what I will term an operating section 1, which is divided by a partition 2, into a reservoir 3 and a gear chamber 4, the left hand side being open. A partition 5 divides off the gear chamber 4 to form an oil supply passage 6, leading from the bottom of the reservoir toward the open side of the casing. A suitable filling opening is shown closed by a screw plug 7, and I have indicated the oil level at 8. A vehicle driven shaft is indicated at 9, and is journaled at 10 and 11, and extends into the gear chamber 4. A second shaft 12, is journaled at its right hand end in a bearing 13. What I will call a first gear 14, is suitably secured to shaft 9, and is disposed in the upper portion of the gear chamber 4. Meshing with first gear 14, is a second gear 15, which is suitably secured to shaft 12, and is disposed in the lower portion of the gear chamber 4. As will be seen by reference to Fig. 10, the gear chamber 4 is shaped to closely fit the peripheries of gears 14 and 15, and

at points on opposite sides of the area of mesh engagement, the casing is shaped to form pressure chambers 16 and 17. When the vehicle is backing, the gears 14 and 15 rotate in the direction of the full line arrows shown in Fig. 10, and when the vehicle is advancing, the gears will of course be rotated in a direction opposite to the full line arrows, as indicated by the dotted line arrows.

The casing 1, is closed on its open left hand side by what I will term a valve section or casing 18, the juncture being suitably made leak proof in a well known manner. Section 18, is provided with a vertically disposed controlling valve casing 19, in which a controlling valve 20 is mounted for rotative adjustment, which adjustment, in the present case, is oscillatory. An operating arm 21, is suitably secured to the valve 20 and is connected by a rod 22, to be oscillated between stops 23 and 24, from a non-braking to a full-braking adjustment, respectively.

I will first describe the manner in which oil is admitted to the controlling valve 20, and will successively describe thereafter, the manner in which the oil performs its various functions in association with various parts of the structure.

Section 18, is provided with an admission passage 25 which connects with passage 6 and opens to a valve inlet chamber 26, which is shown suitably closed by a plug 27. Said chamber 26, is shouldered at 28 and the lower end 29, of the valve 20, seats on said shoulder. Said lower end is hollow, as shown at 30, and is provided with ports 31 and 32. Extending laterally in opposite directions from the lower end of valve 20, are valve controlled passages 33 and 34, the latter being equipped with non-return valves 35 and 36, respectively. Caps 37 and 38, form bearings for stems 39 and 40, respectively, with which said valves are provided and springs 41 and 42, normally act to seat said valves. Oil suction passages 43 and 44, lead, respectively, from the outer sides of valves 35 and 36, upwardly to passage chambers 45 and 46; the latter delivering to pressure chambers 16 and 17, respectively, as will be clearly seen from Figs. 1 and 7. It will be clear that no oil can pass the non-return valves 35 and 36, in descending said passages 43 and 44.

By reference to Fig. 10, it will be clear that if the vehicle is advancing, the gear wheels 14 and 15 will suck oil up passage 44 to chamber 17, and deliver the oil to chamber 16, when braking is applied, as will later be more fully described. Assuming that braking had been applied, in this manner, the valve section is provided with an outlet chamber 47, see Figs. 1 and 6, which has openings 48 and 49, communicating with passage chambers 45 and 46, respectively. Non-return valves 50 and 51, control said openings 48 and 49, respectively, to prevent return of oil downwardly

or backwardly to said chambers 45 and 46, and are normally held closed by springs, as shown.

I will next refer to the novel means whereby air confined in chambers 16 and 17, upon initiation of a braking application, will be released.

Viewing Figs. 1, 3, 4, 5 and 6, it will be seen that the valve 20, is provided with an axially disposed and combined air and oil discharge port or passage 52 which extends upwardly from said outlet chamber 47 to the top of said valve 20, at which point I have shown it closed by a plug 53. At its lower end, said passage communicates with chamber 47 through ports 54, in valve 20, and corresponding ports 55, in casing 19. When the controlling valve 20 is in the non-braking adjustment shown in the drawings, these ports are fully open as will be seen by reference to Fig. 6. The arrangement is such that a balance of pressure will be afforded so that there will be no resistance to rotative adjustment of valve 20, as far as lateral oil pressure is concerned. An air exhaust port 56, Fig. 4, leads from passage 52 to an air exhaust passage 57, which delivers to reservoir 3, above the oil level therein. The purpose of this air exhaust, will be more fully set forth in the description of the operation.

I will next describe the means and manner of discharging the used oil from the chambers 16 and 17, when braking pressure is being applied, this oil being discharged to the reservoir below the level therein and free from air admixture therewith.

Referring to Figs. 1 and 5, it will be seen that valve 20 is provided with an elongated port 59, opening from passage 52, to an oil discharge passage 60. It will be noted that port 56, which is relatively narrow, comes into and turns out of registry with passage 57, before the beginning of registration of port 59 with passage 60. It is the intention to permit discharge of all the air from the pressure chambers 16 and 17 before the oil comes into the same, or substantially so. Thus, at any rate and in all events, the air and oil ports 56 and 59 come into registration with their respective passages sequentially. Thus, there will be a minimum of oil in the air that discharges out through passage 57, if there is any at all, and there may be a moiety of air passing out through 60, but only at the start, and that will not in any event be sufficient to cause any foaming of oil. However, where the ports are accurately located, there will be no oil in the air passage or no air in the oil passage. I have shown passage 60, connected by a pipe 61, the lower end of the latter entering the reservoir below the oil level as shown in Fig. 2.

I will next describe the means and manner of forcing out from the pressure chambers 16 and 17, any residue or idling oil, such as may

remain after the controlling valve has been adjusted from a braking to a non-braking position.

The valve 20, is provided with an air ingress passage 62, shown more particularly in Figs. 1 and 3 to 6, and which, in the present form, extends downwardly or lengthwise of the valve 20 in parallel relation with passage 52. At its upper end, said passage 62, communicates with a passage 63, which, as will be seen in Fig. 3, opens to reservoir 3, above the oil level therein. The lower end of said passage 62, terminates at 64, see Fig. 7, in an outlet of narrow cross section adapted to register with a like narrow port 65, which opens to passage chamber 46. Near the passage 63, the valve 20, has an annular groove 66, adapted to catch oil that may rise between valve 20 and casing 19, the groove 66 being always in registration for discharge to passage 63 and the oil will be returned thereby to the reservoir. This will effectively prevent oil leakage out through the top of the device.

I will next describe the operation of my improved device.

All the views show the device in a non-braking adjustment, hence, in this adjustment, I will first describe a portion of the operation. Assuming that the vehicle is advancing, the gears 14 and 15 will, subsequent to and following the application of brakage, draw any residue oil from chamber 17 to chamber 16, thereby making the former a suction chamber. This will induce air from the top of the reservoir to flow through 63, 62, 64 and 65 into chamber 46 and thence into chamber 17. This air will be carried around by gears 14 and 15 and will crowd any residue oil from chamber 16 up into outlet chamber 47, by raising valve 50. With the parts in the non-braking adjustment, the expressed oil, if the velocity of the air was great enough, dependent upon the speed of advance of the vehicle, would be forced up passage 52 and out through passage 57 back into the reservoir. However, if the residue was only a small quantity, it might remain in a portion of chamber 47, thereby freeing the wheels 14 and 15 from any oil drag. There could be no drag as a result of air suction, as the air coming into the suction chamber 17, from the reservoir, would be sent right back to the reservoir, from chambers 16, 45, 47 and passages 52 and 57. Thus, there would be an endless circuit of air passing through the chambers 16 and 17, which could not form a drag of any appreciable nature. This is true when the vehicle is advancing and the device is in the non-braking adjustment shown but it would not be true if the vehicle were backed up while the device is in the non-braking adjustment, as will be later described. It will be understood that in the present adjustment, the ports 31 and 32, are in a position to pre-

vent oil from entering either suction passages 43 or 44.

Now assume that the vehicle was advancing and it was desired to apply brakage, the arm 21 would be turned in a clockwise direction, viewing Fig. 9, thereby opening ports 31 and 32 to passages 33 and 34. In this direction of movement of the vehicle, chamber 17 would still be a suction chamber and would suck up oil through passage 44, and as turning of valve 20 would shut off ports 54, dependent on the extent of turning movement of valve 20, egress of oil from the compression chamber 16, would be correspondingly restricted, thus, increasing congestion in said chamber. This would retard rotation of wheels 14 and 15 and would apply brakage to the vehicle. At this point it may be stated that such adjustment of valve 20, would move terminal 64, out of registry with 65, thereby cutting off ingress of air therethrough. Further, just as the oil rushed into chamber 17, and over into chamber 16, the air in said chambers would be expressed in advance of the oil, and, if in sufficient volume, would pass out through port 56, Fig. 4, into passage 57. It will be noted that port 56 is relatively narrow, hence, it would be out of registry with 57 just as soon as valve 20 had been turned into a braking adjustment of a substantial nature. For instance, it will be assumed that port 56, in a full size brake, was three eighths of an inch wide and when the ports 31 and 32 were opened three sixteenths of an inch, in a light braking application, the port 56 would still be half way open, and hence, air could first rush out through port 56 and passage 57 before the valve 20 had been turned far enough to close port 56. A three sixteenths opening of valve 20, would afford a very considerable brakage application. Of course, if a wide open adjustment of valve 20 was suddenly made, then both the air and oil would have to pass out through port 59 and passage 60. However, a driver usually, and in the great majority of instances, applies his brakes gradually, and this is especially true of a hydraulic brake where the braking action is so quickly responsive.

Now, by reference to Fig. 5, it will be seen that just as soon as air egress has been closed, then port 59 will begin to register with passage 60. Port 59 is elongated, as shown so that it will remain open when ports 31 and 32 have reached a full open position. However, port 59 will not begin to register with passage 60, until just after ports 31 and 32 have been opened slightly.

While I have stated a certain sequence of port action, such action, in actual practice, may be slightly varied, without departing from the real invention.

When the valve 20, has been returned to a non-braking position, the operations here-

tofore described will take place, and this part of the operative description need not be repeated.

Describing the action of the device in backward movement of the vehicle it will be noted that in the non-braking adjustment shown, chamber 16 would be the suction chamber and the suction set up would exercise a closing action on valve 50, in addition to the closing spring of the latter. The suction in chamber 45 and passage 43 would tend to unseat valve 35 but just as soon as suction became equalized, it would again seat. The valve 20 would of course not permit entrance of oil toward valve 35 because it would close passage 33, as shown in Fig. 1. Of course an absolute vacuum could not be established because it is not intended that gears 14 and 15 should be in absolutely air tight engagement with their respective chambers, and further, such a relatively rough mechanism as a brake, would not be made on a precision basis. It will also be understood that backing up movement is seldom effected at a rapid rate or for any considerable distance. While the vehicle is backing up, in a non-braking adjustment, it will be clear that air could egress from compression chamber 17, through port 62, as shown in Fig. 1. Such air as would be forced into chamber 17, in backing up, with non-braking adjustment, could either be forced out of opening 49, past valve 51, or could in fact be expressed out through passage 62.

I will next describe the action that would take place in applying brakage against backing up movement of the vehicle.

In applying brakage against backward movement of the vehicle, the valve 20 is turned in the same direction as it would be to apply brakage against forward vehicular movement. The chamber 16 becomes the suction chamber and chamber 17, the congestion chamber. Hence, oil is sucked upwardly through port 33, opening valve 35, and passing upwardly in passage 43 to chamber 45, from whence it enters chamber 16. The gears transfer the oil from chamber 16 to chamber 17 and as the oil cannot pass valve 36, it forces valve 51 upwardly and enters chamber 47. The ports 54 and 55 are partially closed, dependent upon the extent of braking adjustment imparted to valve 20, and thereby restrict egress passage of oil so as to cause an application of brakage. The oil egressing upwardly through port 52, passes through port 59 and passage 60 and down through pipe 61 to the reservoir.

When brakage is released against backward vehicular movement, the valve 20 will be restored to the Fig. 1 position, and if the vehicle is advanced, air will enter through port 64 to chamber 17, and be carried over by gears 14 and 15 to chamber 16 from whence it will be expressed as heretofore described.

It is believed that my invention will be

fully understood from the foregoing description and while I have shown one specific form of my invention, I do not wish to be limited thereto except for such limitations as the claims may impart.

I claim:

1. In combination, a vehicular hydraulic brake mechanism having an oil reservoir, and means for releasing and conveying confined air in said mechanism to said reservoir above the oil level therein upon initiation of brakage, and said means arresting such egress from said mechanism after brakage has been applied.

2. In combination, a vehicular hydraulic brake mechanism having an oil reservoir, means for releasing air confined in said mechanism to said reservoir above the level therein upon initiation of brakage and then closing off such egress, and means for conveying used oil from said mechanism during brakage to said reservoir below the level therein.

3. In combination, a vehicular hydraulic brake mechanism, an oil reservoir therefor in communication with said mechanism above the level in said reservoir, and means for releasing air from said reservoir above the level in the latter to said mechanism to express idling oil from said mechanism to said reservoir above the level therein when said mechanism is in a non-braking adjustment.

4. In combination, a vehicular hydraulic brake mechanism, an oil reservoir therefor having air ingress and egress passages leading to and from said mechanism above the level in said reservoir and also an oil egressing passage leading from said mechanism to said reservoir below the level in the latter, and a controlling valve for said mechanism having ports for controlling said passages.

5. In combination, a vehicular hydraulic brake mechanism, an oil reservoir therefor having air ingress and egress passages leading to and from said mechanism, respectively, above the level in said reservoir and also an oil egressing passage leading from said mechanism to said reservoir below the level in the latter, and a substantially vertically disposed rotary controlling valve for said mechanism having ports for controlling said passages dependent upon the operative adjustment of said mechanism.

In testimony that I claim the foregoing as my own, I hereby affix my signature.

WILLIAM GUNN PRICE.