June 6, 1933. F. E. STAATS 1,912,953

HYDRAULIC BRAKE

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Fig. 1.

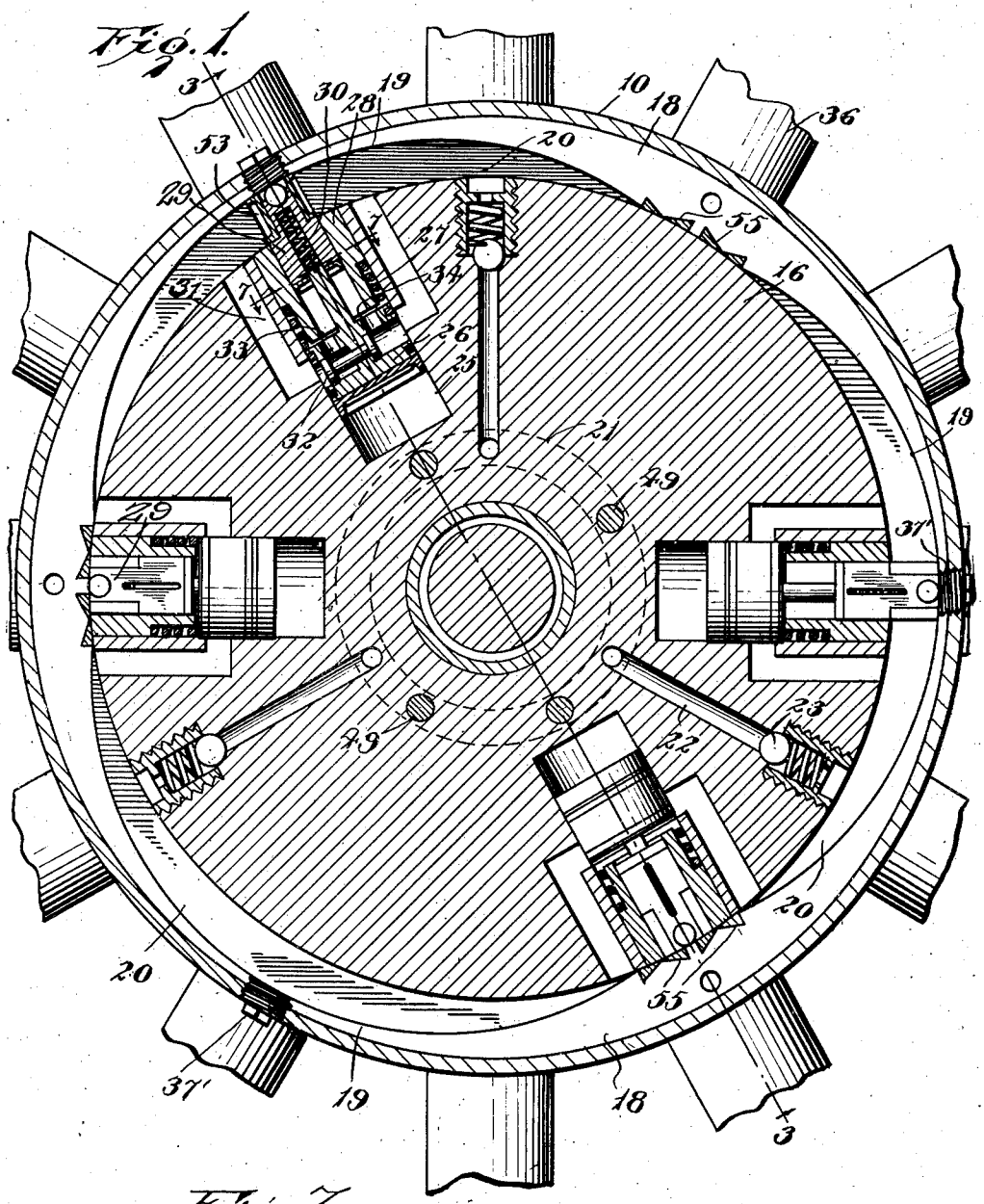
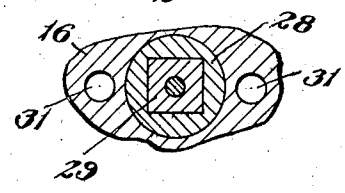


Fig. 7.



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Fig. 2.

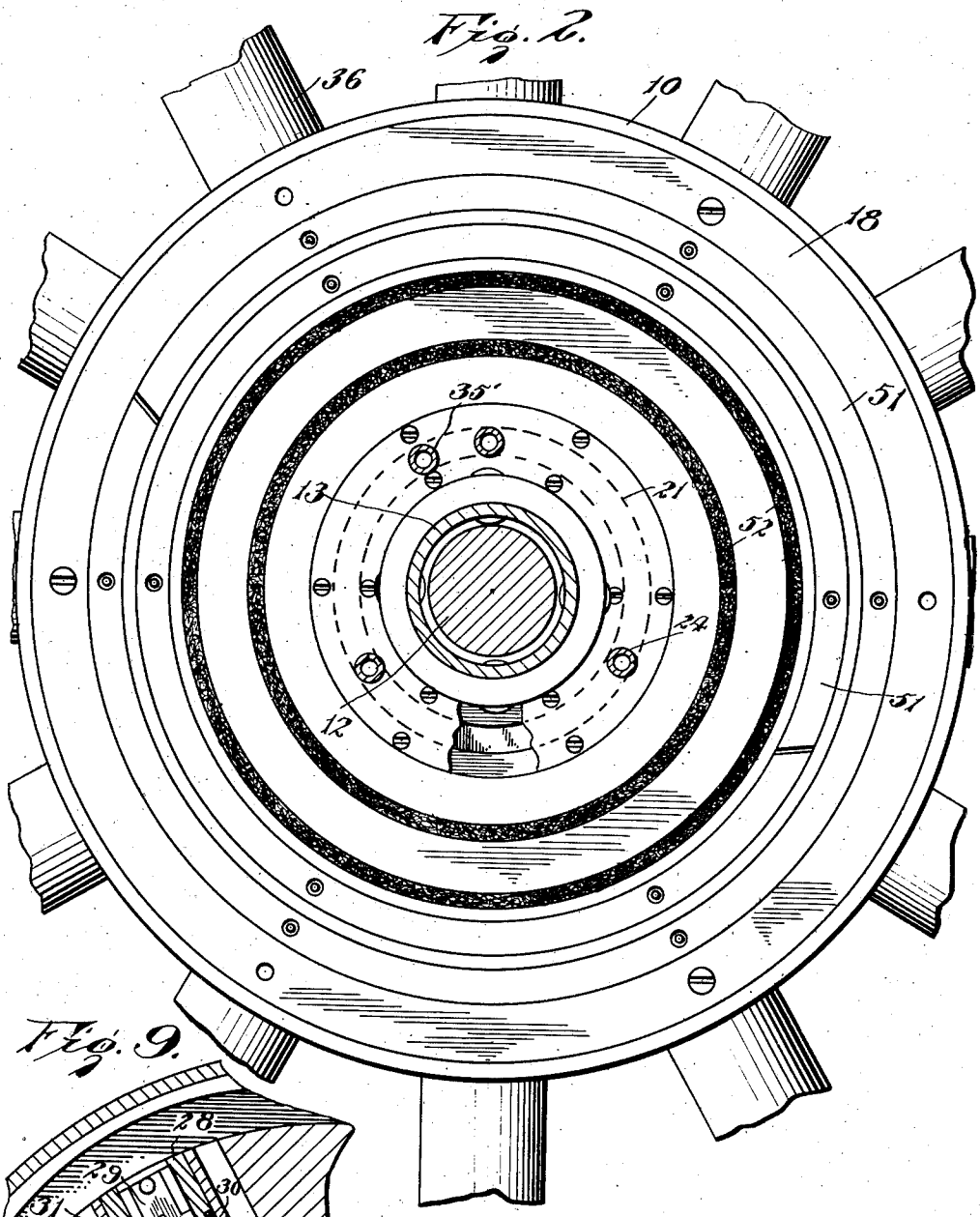
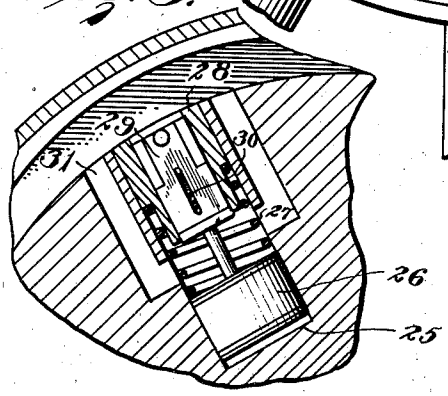


Fig. 9.



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Fig. 3.

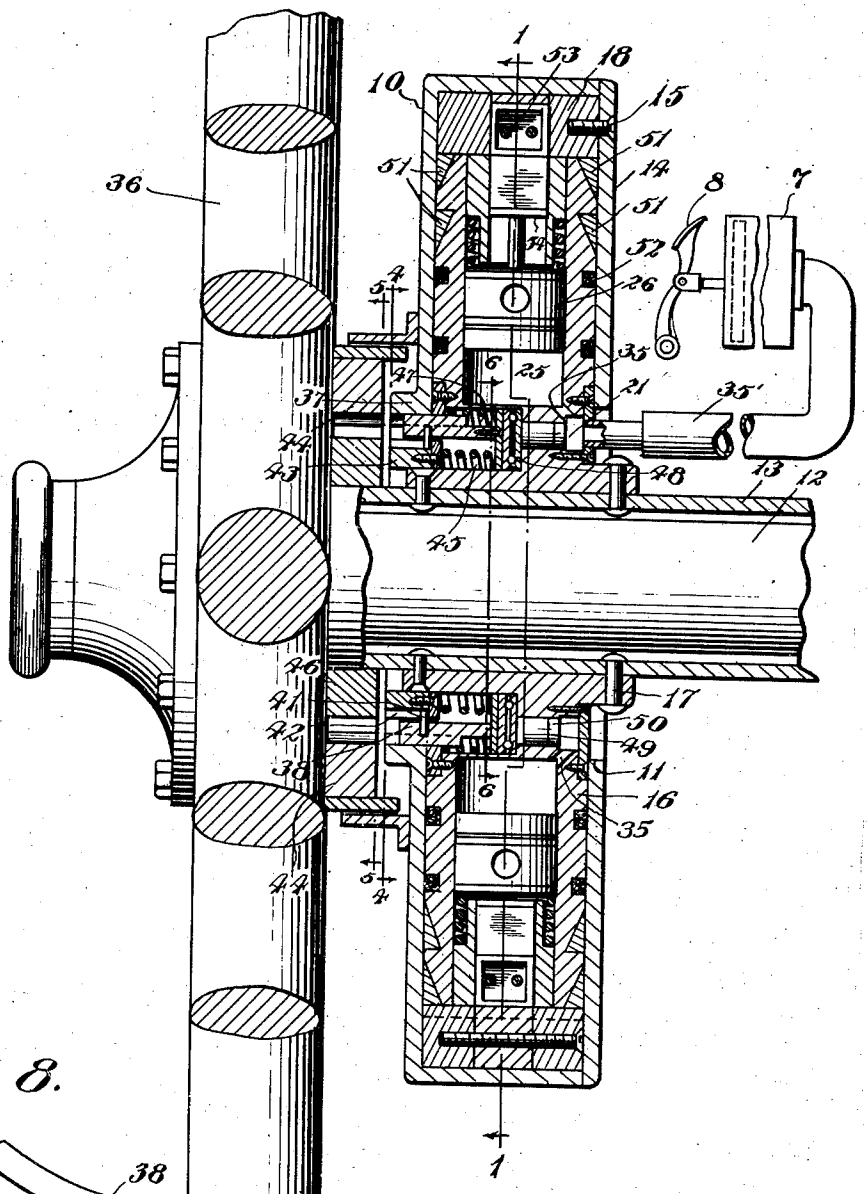
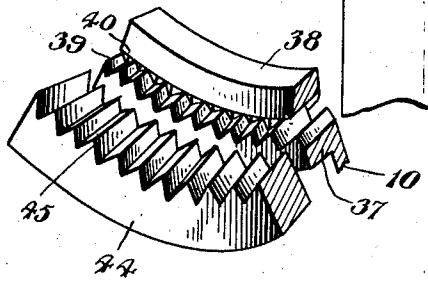


Fig. 8.



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Fig. 4.

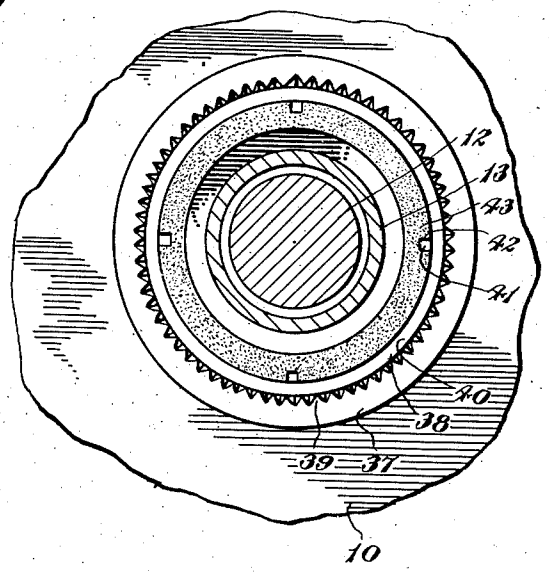


Fig. 5.

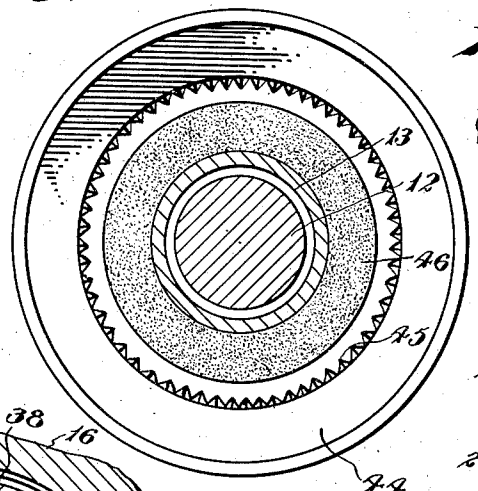


Fig. 6.

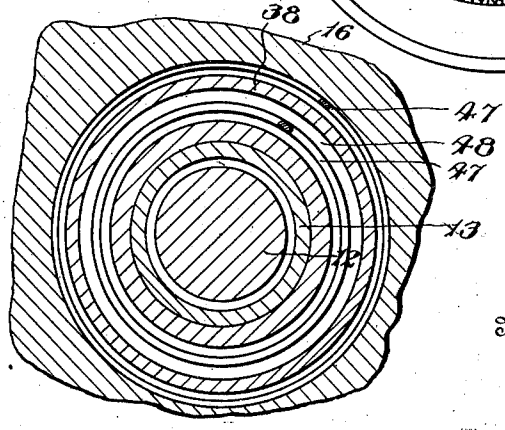
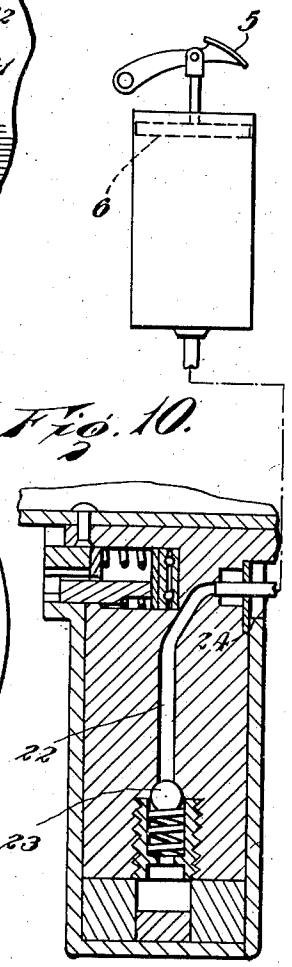


Fig. 10.



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Patented June 6, 1933

1,912,953

UNITED STATES PATENT OFFICE

FRANKLIN E. STAATS, OF PEORIA, ILLINOIS, ASSIGNOR OF ONE-HALF TO JOE SOAT

HYDRAULIC BRAKE

Application filed December 7, 1929. Serial No. 412,423.

This invention relates to hydraulic brakes of that general type in which oil under pressure is used as the braking means and has for an object to provide a brake of this type which will have its rotating parts disconnected from the vehicle wheel except when the brake is applied so that wear is reduced to a minimum and long life of the parts promoted.

Another object is to provide a brake of this type which will be positive in action and will perform its work evenly and smoothly regardless of whether applied gradually or suddenly.

A further object is to provide a brake in which the moving parts are lubricated at all times so that heating will be obviated under severe conditions of service.

With the above and other objects in view, the invention consists in certain novel details of construction and combinations of parts hereinafter fully described and claimed, it being understood that various modifications may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Referring now to the drawings in which like characters of reference designate like parts in the views shown,

Figure 1 is a vertical sectional view showing the device with the plungers in complete brakeage adjustment,

Figure 2 is a rear elevation of the device with the back plate of the drum removed,

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 1,

Figure 4 is a vertical sectional view taken on the line 4—4 of Figure 3,

Figure 5 is a sectional view taken on the line 5—5 of Figure 3,

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 3,

Figure 7 is a transverse sectional view taken on the line 7—7 of Figure 1,

Figure 8 is a fragmentary perspective view showing the toothed members for locking the idling drum to the vehicle wheel,

Figure 9 is a fragmentary sectional view showing one of the plungers in retracted position, and

Figure 10 is a detail sectional view showing the separate filling system for the oil chambers.

The brake comprises a drum 10 which is provided centrally with an orifice 11 to receive the vehicle axle 12 and housing 13 thereof in the usual manner. The back of the drum is closed by a plate 14 which is preferably secured by screws 15 to permit easy access to the parts enclosed within the drum.

Housed within the drum is a stationary disc 16 which is fixed to the housing of the vehicle axle by means of bolts 17 or otherwise, and is of slightly less diameter than the diameter of the drum as clearly shown in Figure 1. Outside of the peripheral edge of the disc and carried by the inner surface of the drum there is a cam member 18 which is cut away as shown to provide three arcuate cam surfaces 19, preferably spaced 120° apart and forming crescent shaped oil chambers 20 upon the circular peripheral edge of the disc 16. The disc is provided with passages 22, Fig. 10, which are valve controlled as shown at 23 and supply oil to fill the oil chambers 20. Supply pipes 24 are connected with the passages and are connected to a suitable source of oil supply separate from and independent of the plunger operating supply hereinafter described.

Disposed radially in the disc 16 are cylindrical orifices 25 in which are slidably fitted pistons 26 which are normally held retracted in the orifices as shown in Figure 9, by springs 27 which are held in place by bushings 28, these bushings forming stops to limit outward movement of the pistons. As shown in Figure 7, these bushings have square axial orifices therein which receive corresponding shaped plungers 29. The plungers snugly fit the contour walls of the oil chambers 20 and are slidably fitted on the stems of the pistons, being normally held retracted thereupon by light springs 30. Each oil chamber is provided with a by-pass 31 which is substantially U-shaped and extends radially within the disc, and permits free passage of oil from the oil chamber 20 over the top of the corresponding piston when

the latter is in retracted or inoperative position as shown in Figure 9.

When the piston is forced outwardly by an increase in oil pressure behind it, through the annular chamber 21 and port 35, during application of the brake as will be presently explained, the free passage of oil through the by-pass is checked by a check valve 32 which closes a port 33 formed in the piston and opens a companion port 34 therein, assuming the drum to be rotating counter clockwise, and admits the oil underneath the plunger 30. The resultant increase of oil pressure against the bottom of the plunger forces the plunger outwardly against the tension of its spring to yieldably engage the cam surface 19 of the drum. The plunger 29 follows the surface of the cam member 19 and the piston meanwhile is traveling outwardly and is cutting off the aperture of the by-pass and consequently oil pressure is being built up on the advanced face of the plunger. The check valve 32 is controlled by this oil pressure and admits oil pressure against the bottom of the plunger 29 so that the pressure of the oil in the chamber 20 will not overcome the spring 30 and permit the oil passing over the top of the plunger. As the piston continues its outward movement the by-pass is being cut off causing greater oil pressures on the face of the plunger 29 thereby causing the drum to slow down and when the piston has traveled far enough to completely cut off the by-pass the oil can no longer flow into the by-pass, it cannot pass the plunger 29, and consequently the drum and the disc are positively locked together by the pressure of the oil in the chambers 20 upon the faces of the plungers 29. It is obvious that the braking action just described will take place in either forward or reverse, that is, clockwise or counter-clockwise movement of the drum.

The orifices 25 which contain the pistons 26 are connected by ducts 35, Fig. 3, with an annular oil feed channel 21 formed in the disc and supplied by a pipe 35′ from the usual master cylinder 7 operated by the brake pedal 8 on the floor of the vehicle. It will thus be noted that when the brake pedal is depressed that oil will flow through the annular channel 21, ducts 35, and into the orifices 25 and force the pistons 26 outwardly to operative position, the pistons dropping back under the action of their springs 27 when the pedal is released and freeing the drum from engagement with the disc.

In further explanation of the braking action by oil pressure in the crescent-shaped oil chambers against the plungers, it will be seen, by referring to Fig. 9, that normally the oil passes the piston 26 through the by-pass 31 freely, the spring 27 holding the assembly of piston 26 and plunger 29 retracted. When, however, oil is forced in back of the piston through the port 35, Figure 3, the oil no longer by-passes the piston but enters the piston and closes the check valve 32 to let the oil from the oil chamber 20 act against the plunger 30 and force the plunger outwardly against the cam surface 19. The piston check valve thus prevents flow of oil through the by-pass to the opposite side of the plunger 30. Assuming the drum 10 to be rotating counter-clockwise, or toward the plunger at the top of Figure 1, the oil in the chamber and by-pass to the right of said top plunger 30, Figure 1, will be subjected to pressure by the plunger and the advancing cam surface 19, and the rigidity of the oil under such pressure, as will be understood, slows down the drum.

Since there is only enough oil used to fill the chamber 20, when the piston is only partly applied by slight oil pressure behind it and before the piston 26 completely obstructs the by-pass 31, the oil from the by-pass enters the ported piston and overcomes the light spring of the plunger, allowing the plunger to follow the cam surface 19 of the oil chamber. Then pressure is built up on the oil in the oil chamber by the plunger to force the oil through the by-pass, the supply in that end of the chamber advancing toward the plunger being depleted with consequent replenishing of the supply in that end of the plunger retreating from the plunger. Thus, the degree of oil pressure built up by the plunger on the oil in advance of the plunger determines the brake action or rate of slowing down of the drum. This brake action obviously can be made as gentle or forceful as desired, being determined by the pressure of the driver's foot on the brake pedal, which latter governs the oil pressure in the separate oil system acting against the bottom of the piston.

In order to fill the oil chambers a pedal 5 which operates a filling plunger 6 of any preferred type is now depressed several times, the oil passing from the filling plunger through the pipes 22 and supplying the chambers with oil. For draining the chambers when necessary, each chamber is equipped with a drain plug 37′ as shown in Figure 1.

The drum 10 normally idles on the disc and is connected to rotate as a unit with the vehicle wheel 36 just prior to actuation of the plungers in applying the brake, as will now be described. The drum is provided with a flange 37 within which is slidably fitted an annular member 38, interengaging teeth 39 and 40 on the flange and annular member respectively, permit of the member sliding towards and away from the wheel 36 and prohibit rotary movement of the member within the flange. The annular member is further secured by pins 41 which are mounted to slide in slots 42 formed in an annular friction member 43 that is loosely

mounted on the disc 16 and which will be presently more fully described. An annular toothed member 44 is rigidly secured to the vehicle wheel 36 and has its teeth 45 arranged to engage with corresponding teeth 40 on the sliding annular member 38 as clearly shown in Figure 8. When the annular member 38 is slid towards the vehicle wheel, its teeth engage the teeth of the drum and also the teeth of the annular member 44 and lock these parts together for rotation as a unit with the vehicle wheel.

The sliding member 38 is held in retracted position by a spring 47 as shown in Figure 3 and normally rests against a thrust bearing 48, the latter having pins 49 at spaced points which enter oil ports 50 that communicate with the annular oil feed passage 21. This retraction spring 47 is constructed much weaker than the retraction springs of the pistons so that when the pedal is depressed the oil under pressure will operate against the pins 49 and force the annular member 38 outwardly to lock the vehicle wheel and drum together before the pressure is sufficient to overcome the tension of the piston springs and move the pistons to lock the drum to the disc. Conversely, upon release of the pedal the retraction spring of the member 38 will retract this member from the member 44 and release the drum from engagement with the wheel, and prior to this the piston springs will retract the pistons and unlock the drum from the disc as the pressure continues to drop, and permit the drum to idle until the brake is next applied.

Referring now to the above mentioned friction member 43, it is found advisable to start the drum rotating to facilitate engagement of the toothed annular members 38 and 44. For this purpose, the annular friction member 43 is slidably fitted in the recessed face of the disc and is yieldably held by a spring 45 to project beyond the toothed edge of the member 38, as shown in Figure 3. An annular friction member 46 is secured to the vehicle wheel for contact with the friction member 43. When the oil pressure is first increased in the feed passage 21 the friction member 43 will be slid outwardly against the tension of its spring and engage with the friction member 46, the pins 41 transferring the rotary movement of the vehicle wheel to the drum and causing the drum to rotate on the disc for an instant before the teeth of the toothed annular locking members engage and cause positive rotation of the drum upon the disc.

In order to prevent leakage, metal rings 51 are seated in corresponding grooves on the sides of the disc and to further prevent leakage, felt or similar packing rings 52 are also arranged on the sides of the disc. It will further be noted that the sides and bottom of each plunger are equipped with leather or similar packing cups 53 and 54. Furthermore, the cam member of the drum is provided with transverse packing strips 55 as shown in Figure 1 which prevent leakage of oil from adjoining oil chambers.

In operation, assuming that the plungers are all in inoperative position as shown in Figure 9, it will be easily understood that upon depression of the pedal which controls the master oil supply cylinder usually employed in connection with brakes of this character, the oil under pressure will first operate to move the friction members into contact and start the drum rotating yieldingly and will then move the toothed annular members into engagement whereby the drum is positively locked for rotation as a unit with the vehicle wheel. As the pressure continues to rise in the feed channel and back of the pistons, the plungers will be moved outwardly against the cam surfaces of the drum and the oil pressure built up in the oil chambers against the advance faces of the plungers will retard the drum as above described.

Having thus described the invention, I claim:

1. A hydraulic brake including an idling drum, a stationary disc housed within the drum, a toothed rotary member adapted to be secured to a vehicle wheel and to rotate as a unit therewith, oil operated means for locking the idling drum and the stationary disc member together, a toothed sliding member carried by the drum adapted to be slid laterally into engagement with said toothed rotary member, and oil operated means for engaging said toothed members to lock the drum for rotation as a unit with the vehicle wheel.

2. A hydraulic brake including a drum, a disc housed within the drum, a rotary member adapted to be secured to a vehicle wheel and rotated as a unit therewith and having a toothed face, a toothed member carried by the drum and adapted to be slid into engagement with said toothed face to lock said rotary member and said drum together, means for normally holding said toothed member inoperative, oil operated means for locking said drum and said disc together, and oil operated means for locking said toothed member and said drum member together.

3. A hydraulic brake including a drum, a disc housed within the drum, the drum being provided with cam surfaces coacting with the disc and forming oil chambers, yielding plungers carried radially by said disc for engagement with said cam surfaces and adapted to be subject to oil under pressure in said chambers to lock the drum and the disc together, check valve controlled bypasses extending from the oil chambers adapted to direct the oil against and check yielding of the plungers and prevent the oil in the

chambers flowing past the plungers when the plungers are forced outwardly to engage said cam surfaces, and oil operated means for forcing the plungers outwardly to operative position.

4. A hydraulic brake including a drum, a disc housed within the drum, the drum having cam surfaces coacting with the disc in forming oil chambers, means for supplying oil to said chambers, plungers carried radially by the disc and projecting into said oil chambers for contact with said cam surfaces and adapted to be subjected to oil pressure in said chambers for locking the drum to the disc, springs normally holding the plungers retracted, means for supplying oil to actuate said plungers, and check valve controlled by-passes in said disc permitting the oil in said chambers to pass over said plungers when the plungers are in inoperative position.

5. A hydraulic brake including a drum, a disc housed within the drum, oil operated plungers carried radially by the disc for locking the drum and disc together, a toothed member adapted to be secured to the vehicle wheel, a toothed member slidably fitted to the drum adapted to engage the first named toothed member, and cause the drum to rotate positively therewith, oil operated plungers carried by said disc adapted to engage said toothed members simultaneously with the movement of the first-named oil operated plungers to operative position, and friction members extending in advance of said toothed members and operating to cause the drum to yieldably rotate prior to engagement of said toothed members whereby to facilitate engagement of said toothed members.

6. A hydraulic brake including a normally idling drum, a stationary disc within the drum, a yielding radial plunger carried by the disc, a curved cam on the drum forming a crescent-shaped oil chamber on the periphery of the disc, said plunger being adapted to be moved outwardly to project into said chamber, a by-pass in said disc connecting the ends of said chamber around said plunger, a ported piston for operating said plunger and movable radially in said disc across said by-pass, a check valve in the port of said piston for closing said by-pass, oil in said oil chamber adapted to be placed under pressure by said plunger and said cam surface when said piston is moved to actuate said plunger, and means for supplying oil to said chamber.

In testimony whereof I affix my signature.

FRANKLIN E. STAATS. [L. S.]