Feb. 14, 1928.

1,659,203

M. B. JACKSON

FLUID PRESSURE BRAKE

Filed Jan. 16, 1925

2 Sheets-Sheet 1

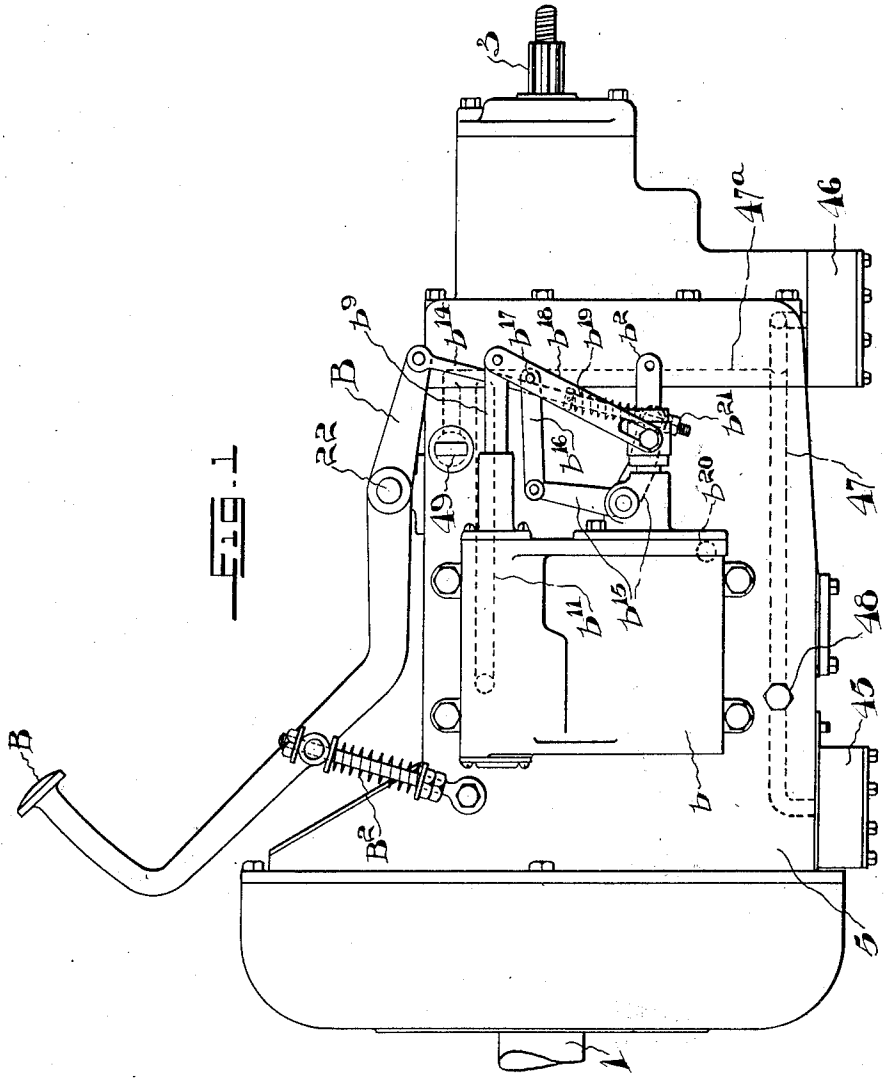


Fig. 1

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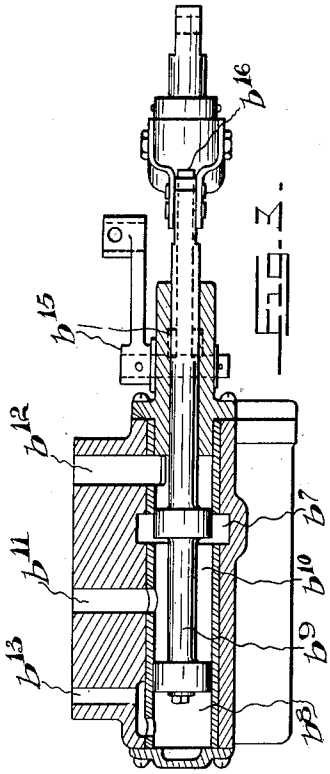


Fig. 3.

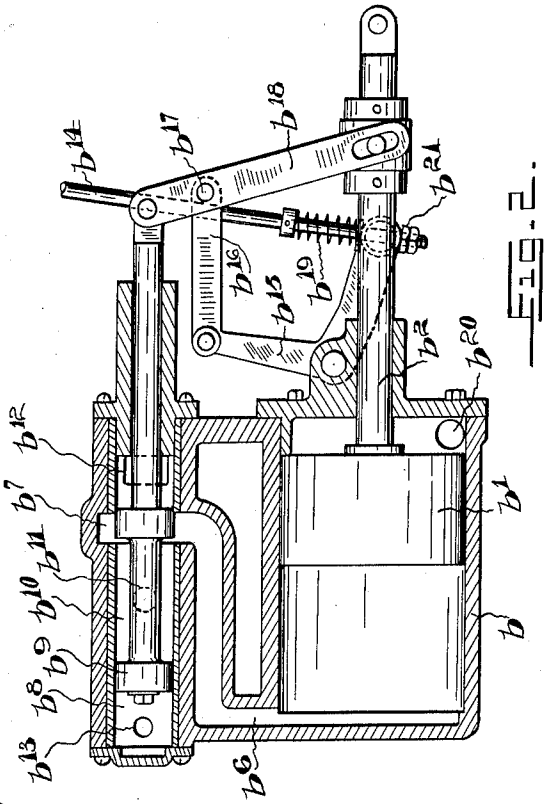


Fig. 2.

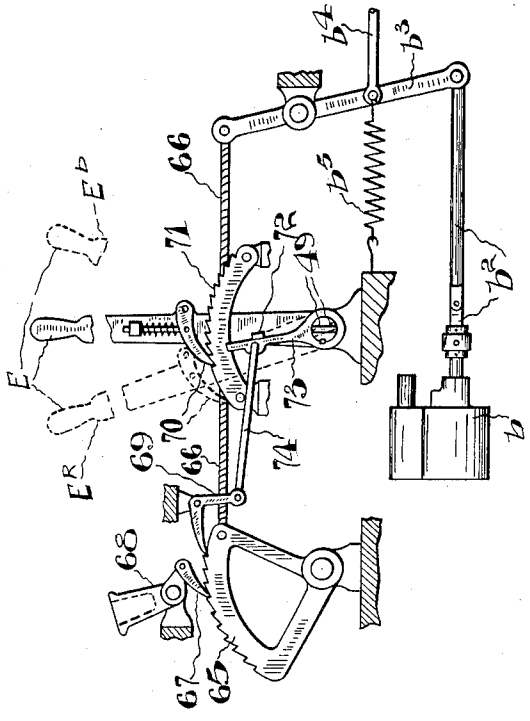


Fig. 4.

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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE BRAKE.

Original application filed November 10, 1924, Serial No. 748,992. Divided and this application filed January 16, 1925. Serial No. 2,850.

This application is a division of my copending application Serial Number 748,992, filed November 10th, 1924, and may be applied to the mechanism contained in my Patent 1,523,648, issued January 20, 1925. This invention relates to brakes and more particularly to those controlled by fluid pressure as shown in the above mentioned application and patent and my object is to provide simple apparatus of this character which may be easily operated to effectively apply the brakes. Another object of the invention is to provide means whereby the braking effect will correspond directly to the distance travelled by a control lever or foot pedal.

I attain my objects by means of the constructions hereinafter described and illustrated in the accompanying drawings in which

Fig. 1 is a side elevation of a gear box showing my brake actuating mechanism applied thereto and showing the parts of the mechanism, except the pedal lever, in the "on" position, this being the position of the parts after the brake has been fully applied and before the brake cylinder has been refilled;

Fig. 2 a longitudinal vertical section of the brake cylinder showing the parts thereof in their positions when the brake is off;

Fig. 3 a horizontal section through the valve chamber in Fig. 2; and

Fig. 4 a view showing the mechanism for holding off the brakes when it is desired to tow the vehicle.

1 is the crankshaft of an engine which is connected by any suitable change speed gearing to a transmission shaft 3, the latter being adapted to drive the wheels of a vehicle through any suitable driving connections. Oil or other fluid is carried in a sump formed in a casing 5 which may also be used for enclosing the change speed gearing. On this casing is secured two pumps 45 and 46 preferably of the rotary gear type, the former pump being driven by the engine shaft 1, the latter pump being driven by the transmission shaft 3. Any suitable driving means may be employed to operate these pumps from their respective shafts, the purpose of the two pumps is to provide a supply of liquid at all times unless the vehicle and engine are both at rest. The inlet openings of the pumps communicate with the sump in the casing 5. The outlet openings of the pumps communicate with opposite ends of a passage 47 having a safety valve 48 of common type located therein and adapted to spill the liquid into the casing when a certain pressure is reached. The passage 47 communicates with a vertical passage 47^a which leads to a manually operated valve of any suitable rotary type having a stem 49 adapted when turned to open the valve to spill the fluid from the feed passages back into the casing 5. To the valve stem is connected a lever E (see Fig. 4) adapted when set in a running position to close the spillway valve and adapted to open the latter when the lever is set in a neutral position.

To apply the brakes to the vehicle and to automatically apply them should the engine and vehicle stop or should the vehicle back down a hill with the engine stopped, I provide a brake cylinder b secured to the side of the casing 5. In the cylinder is mounted a piston b^1 provided with a piston rod b^2 connected with a lever b^3 to which is connected the brake rods b^4 which are connected to the brakes (not shown). A spring or springs b^5 connected with the lever b^3 and a suitable stationary part of the vehicle are adapted to rock the lever to apply the brakes. The brakes are normally held in their off position, when the engine is running, by means of fluid under pressure acting against the piston b^1 to rock the lever b^3 against the tension of the spring b^5. Communicating with the end of the cylinder remote from the piston rod is a duct b^6 which also communicates with an annular groove b^7 formed in a valve chamber b^8 formed on or secured at the top of the brake cylinder. In this chamber is mounted a slide valve b^9 which is turned down intermediate its ends to form an annular recess b^{10}. An inlet passage b^{11} formed in the body of the chamber forms a communication between the latter, and the feed passage 47^a and this passage communicates with the recess b^{10} so that equal pressure is applied to both ends of the valve. Referring particularly to Figs. 2 and 3 it will be noted that an exhaust opening b^{12} is formed at one end of the chamber and a relief opening b^{13} at the other end thereof. These openings and another relief opening b^{20} formed in the cylinder b communicate with the interior of the casing 5. Any leakage past the

left hand end of the valve b^9 is drained by the relief opening b^{13} which prevents any pressure from being built up in the chamber b^8. From the above description it is evident that by shifting the valve to the right that the inlet passage b^{11} will communicate with the duct b^6 and by shifting the valve to the left the duct will communicate with the exhaust opening b^{12} to thus supply fluid to the cylinder b to hold off the brakes or permit the springs b^5 to act on the plunger to force the fluid from the cylinder and thus apply the brakes.

To control the brakes I provide a pedal lever B fulcrumed on the shaft 22. To this lever is pivotally connected a link b^{14} which passes through one arm of a bell crank lever b^{15} and has adjusting nuts b^{21} threaded thereon for engagement with the bell crank. The latter is fulcrumed on the cylinder b and to its other arm is pivotally connected a link b^{16} which is pivotally connected at b^{17} to a lever b^{18}. One end of this lever is pivotally connected with the rod of the valve b^9 while the other end of the lever has a pin and slot connection with the piston rod b^2. In Fig. 2 the parts are shown in position to hold the brake off, while in Fig. 1 the parts are shown in their positions with the vehicle at rest and with the brake on since there is no liquid pressure.

A spring B^2 normally holds the pedal lever B in its inoperative position with the brakes off. A spring b^{19} disposed on the link b^{14} engages a suitable part carried thereby and also the arm of the bell crank opposite the adjusting nuts to form a resilient connection between the bell crank and the link. It will be understood that this connection, in the present invention, could be rigid or adjustable.

From the above description it is evident that, by depressing the pedal lever B, the fulcrum point b^{17} will be shifted to the left, in Fig. 2, to thus move the valve b^9 and establish a communication between the duct b^6 and exhaust port b^{12}. The springs b^5 then force the piston b^1 towards the duct which forces some of the liquid therein through the exhaust port. This movement of the piston causes the lever b^{18} to be rocked in the opposite direction, on its fulcrum, to shift the valve to its duct-closing position. If the pedal lever is only slightly depressed the automatic equalizing arrangement just described permits only a small amount of the liquid being exhausted from the brake cylinder and thus the brakes are only slightly applied. If more braking action is required the pedal lever is further depressed which causes the above described cycle of operations to be repeated. The farther the foot pedal is depressed, the longer the stroke of the valve b^9 and the greater the volume of liquid exhausted from the brake cylinder.

When the operator's foot is removed from the pedal the spring B^2 returns the pedal lever B to its normal position and rocks the bell crank to shift the fulcrum b^{17} which shifts the valve b^9 (Fig. 2) to the right and forms a communication between the inlet port b^{11} and the duct b^6 which permits fluid to flow into the brake cylinder. This fluid acts on the piston b^1 and as the cylinder is filling, the lever b^{18} is being swung, by means of its pin and slot connection with the piston rod b^2, to the right, see Fig. 1. This causes the valve to move to the left towards its position for closing the duct b^6 but the pedal is so adjusted as to leave a sufficient communication between the duct and the inlet port b^{11} to normally supply pressure and hold the brakes fully off. Any leakage past the piston is drained by the relief opening b^{20} and this leakage is automatically replaced by the valve shifting slightly to admit fluid in the duct. It is thus obvious that the operation of the pedal lever B is identical with the operation of an ordinary brake lever in which the brakes are manually operated. In other words the above described equalizing arrangement permits an easy operation of the brake without the necessity of intermittently moving the pedal to its on and off positions to avoid locking the brakes which causes the vehicle to stop so suddenly the occupants are pitched forward.

From the above description it is evident that when the engine stops and the vehicle comes to rest, both pumps will be inoperative and therefore the fluid pressure will drop. The springs b^5 acting against the fluid pressure will thus force the fluid from the cylinder b through the communication between the duct b^6 and the inlet port b^{11} and into the feed passage 47^a. Sufficient of this fluid will escape through the pumps into the casing 5 to permit the springs b^5 to apply the brakes. This is facilitated by the movement of the valve b^9 which uncovers more of the duct as the springs move the piston b^1.

From the hereinbefore described arrangement for driving the pumps 45 and 46 it will be noted that while the vehicle is traveling in a forward direction both pumps are normally pumping liquid from the liquid chamber in the casing 5 into the brake cylinder b to hold off the brakes. It is obvious that when a vehicle, in trying to climb a hill, begins to back down the latter the traction of the rear wheels revolves the transmission shaft in the reverse direction. This also reverses the direction of rotation of the rear pump 46 and causes the latter to pump the liquid from the brake cylinder, through the communication with the inlet port b^{11} and the duct b^6, into the casing 5, thus permitting the springs to apply the brakes. This eliminates the danger of the vehicle

backing down a hill due to the engine stalling or the driver changing gears near the top of the hill.

To hold off the brakes when it is desired to move or tow the vehicle, without running the engine to supply fluid to the brake cylinder, I provide a manually operated ratchet toothed sector 65 (see Fig. 4) suitably pivoted on a part of the vehicle. This sector is connected, by means of a flexible connection 66, with the end of the lever b^3 remote from the brake springs b^5 and rods b^4. A pawl 67 carried on the end of a socket 68 which is pivoted on a part of the vehicle and adapted to receive an end of a tool (not shown) is adapted to pick the sector 65 and thus rock the lever b^3 against the tension of the springs b^5. A pivoted dog 69 shaped as a bell crank is adapted to engage the teeth of the sector to releasably lock the lever in position for holding off the brakes.

The hand lever E hereinbefore described as connected with the spillway valve stem 49 is also suitably connected with the emergency brakes (not shown), the position of the lever for applying these brakes being indicated at E^B in Fig. 4. The neutral position of this lever is indicated in full lines and in this position the spillway valve is opened. The position of the lever when the vehicle is to be started and when it is in motion is also indicated at E^R and in this position the spillway valve is closed. The lever E is releasably locked in its neutral or brake applying positions by a spring actuated dog 70 carried by the lever and adapted to engage a toothed quadrant 71 carried by the vehicle.

To ensure the brakes are not held off when the lever E is moved to its "running" position the lever is provided with a projection 72 adapted to engage a pivoted arm 73 connected by means of a link 74 with the dog 69. This arrangement, when the lever E is swung to its running position, causes the dog 69 to be released from the teeth of the sector and thus causes the brake applying springs to come under the action of the brake cylinder b.

The mode of operation, assuming there is no fluid in the cylinder b, is as follows. The lever E is first set to its running position E^R and the engine started which supplies the cylinder b with fluid and causes the piston b^1 and brake rod b^2 to move to the right in Fig. 1. As these parts are moving in this direction the lever b^{18} moves the valve b^9 in the opposite direction until the duct b^6 is very nearly closed as shown in Fig. 2. When the pressure in the cylinder b exceeds a predetermined minimum the safety valve 48 opens to allow the excessive liquid to escape back into the casing. When it is desired to apply the brakes, the pedal B is depressed to permit a portion or all of the liquid to be forced out of the brake cylinder, the amount of liquid exhausted from the cylinder depending entirely on the movement of the pedal. As long as the pedal is depressed no fluid is admitted to the cylinder and no more than the predetermined amount of fluid is exhausted from the cylinder so that the pressure of the brakes will remain constant. If a slight application of the brakes is first applied, this can be increased by a further depression of the pedal. Immediately the foot pedal is released the spring B^2 returns it and thus the bell crank b^{16} to their normal positions which causes the lever b^{18} to shift the valve b^9 to permit the fluid to enter the brake cylinder to again hold off the brakes.

What I claim is:

1. The combination with a brake, of means tending to apply the brake; fluid pressure means normally holding the brake out of action; manually operable means for holding the brake applying means out of action when the fluid pressure means is inoperative; and automatic means for releasing the manually operated means when the fluid pressure means is operative.

2. The combination with a brake, of means connected with the brake including a spring tending to apply the brake; fluid pressure means including a spillway valve adapted to normally maintain the brake out of action; means including a manually operable ratchet toothed sector for holding the brake out of action when the fluid pressure means is inoperative; means for releasably locking the sector in its operative position; a lever for opening and closing the spillway valve; and means operable by the lever for actuating the locking means to release the sector when the lever is moved to close the said valve.

3. The combination with a brake, of means connected with the brake including a spring tending to apply the brake; fluid pressure means including a spillway valve adapted to normally maintain the brake out of action; means including a manually operable ratchet toothed sector for holding the brake out of action when the fluid pressure means is inoperative; a dog for releasably locking the sector in its operative position; a pivoted arm; a link pivotally connected with the dog and the arm; a lever for opening and closing the spillway valve; and a projection carried by the lever adapted to engage the arm to release the sector when the lever is moved to close the said valve.

4. The combination with a brake; means tending to apply the brake; fluid pressure means including a lever, a piston and a cylinder for controlling the operation of the brake; a valve for controlling the flow of fluid into and out of the cylinder; a piston rod connected with the said piston; a suitably fulcrumed lever connected with the

valve and the piston rod whereby a movement of the latter in one direction will cause a reverse movement of the valve; and means operable by the first mentioned lever for shifting the fulcrum of the second lever to actuate the valve.

5. The combination with a brake; means tending to apply the brake; fluid pressure means including a lever, a piston and a cylinder for controlling the operation of the brake; a valve for controlling the flow of fluid into and out of the cylinder; a piston rod connected with the said piston; a suitably fulcrumed lever connected with the valve and the piston rod whereby a movement of the latter in one direction will cause a reverse movement of the valve; and a bell crank having one arm connected with the first mentioned lever and the other arm pivotally connected with the second lever to form its fulcrum.

6. The combination with a brake; means tending to apply the brake; fluid pressure means including a lever, a piston and a cylinder for controlling the operation of the brake; a valve for controlling the flow of fluid into and out of the cylinder; a piston rod connected with the said piston; a lever pivotally connected with the valve and having a pin and slot connection with the piston rod; a bell crank; a link connecting one arm of the bell crank with the first mentioned lever; a second link pivotally connected with the other arm of the bell crank and with the second mentioned lever to form its fulcrum.

7. The combination with a brake; means tending to apply the brake; a cylinder having a piston mounted therein for controlling the operation of the brake; a valve chamber having inlet and exhaust ports therein; a fluid supply conduit connected with the inlet port; a duct communicating with the cylinder and with the chamber; a slide valve in the chamber adapted to form a communication between either one of the said ports and the duct and normally positioned relative to the duct to form a small communication between the latter and the inlet port; an operating lever; and means connected with the valve and piston for regulating the exit of fluid from the cylinder in proportion to the travel of the lever.

Signed at Toronto, Canada, this 9th day of January, 1924.

MAUNSELL B. JACKSON.