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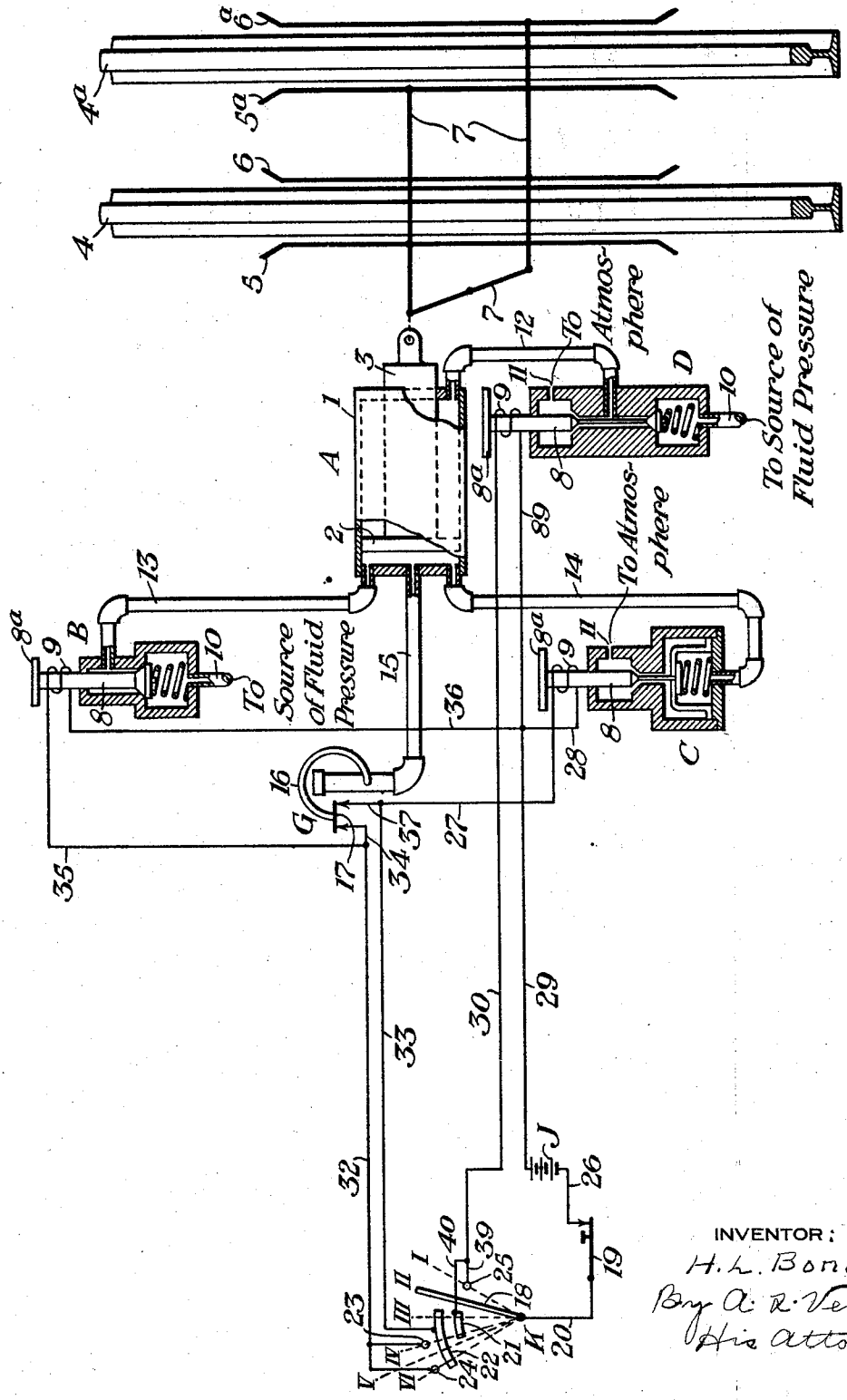

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RAILWAY BRAKING APPARATUS

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My invention relates to railway braking apparatus, and particularly to apparatus of the type comprising a braking bar located in the trackway and means for at times urging the braking bar into engagement with a part of a railway vehicle.

I will describe one form of railway braking apparatus embodying my invention, and will then point out the novel features thereof in claims.

The accompanying drawing is a view, partly diagrammatic, illustrating one form of railway braking apparatus embodying my invention.

Referring to the drawing, the reference characters 4 and 4ª designate the two track rails of a stretch of railway track provided with railway braking apparatus. In the form here shown, this apparatus comprises two braking bars 5 and 6 located on opposite sides of the rail 4 and arranged to engage the opposite sides of a wheel of a railway vehicle passing along the track. Two similar bars 5ª and 6ª are located on opposite sides of the track rail 4ª. The braking bars 5, 6, 5ª and 6ª are controlled by a fluid pressure motor device designated by the reference character A. As here shown this motor device comprises a cylinder 1 containing a reciprocable piston 2. The piston carries a plunger 3 which is operatively connected with the braking bars through suitable linkwork 7. It will be plain from the drawing that when the piston 2 is in its left-hand position, the braking bars are in their non-braking positions. When the piston is driven to its right-hand position in cylinder 1, the braking bars associated with each of the track rails are urged toward the corresponding rail, so as to engage the sides of a wheel of a railway vehicle, bars 5 and 5ª moving toward the right and bars 6 and 6ª moving toward the left. It should be pointed out that since the braking bars are urged into engagement with the car wheels by pressure tending to move the piston 2 toward the right, the total braking force exerted upon the car, depends upon the pressure which is effective to move the piston 2. It will be observed from the drawing that the plunger 3 has a comparatively large diameter, so that the piston 2 is in effect a differential piston, that is to say, the areas upon which pressures in the two ends of the cylinder 1 are effective upon the piston 2 are unequal. I propose to control the admission of fluid pressure in both ends of the cylinder 1 to provide a plurality of different total effective pressures available for urging the braking bars toward their braking positions.

The reference character B designates a magnet valve comprising a valve stem 8 provided with an armature 8ª and a winding 9. When winding 9 is energized, the left-hand end of cylinder 1 is connected with a suitable source of fluid pressure, not shown in the drawing, through pipe 10, valve B, and pipe 13. When winding 9 is de-energized, however, the valve B is closed, so that the supply of fluid pressure from pipe 10 to cylinder 1 is discontinued. A second valve C comprises a valve stem 8 which is also provided with a winding 9 and an armature 8ª, and is so arranged that when winding 9 is de-energized cylinder 1 on the left-hand side of piston 2 is connected with atmosphere through pipe 14, valve C and port 11. If, however, winding 9 of valve C is energized, valve stem 8 is drawn downwardly to blank pipe 14 and prevent the escape of fluid pressure from cylinder 1. A third valve, designated by the reference character D, controls the supply of fluid pressure to the right-hand end of cylinder 1. When winding 9 of this valve is de-energized, pipe 12 communicating with the right-hand end of cylinder 1 is connected with atmosphere through port 11. When winding 9 of valve D is energized, however, valve stem 8 is moved downwardly and pipe 12 is disconnected from port 11 and is connected with a source of fluid pressure through pipe 10.

The three valves B, C and D are controlled in part by a manually operable circuit controller designated in general by the reference character K and comprises a pivoted lever 18 which may be moved into a plurality of positions indicated in the drawing by dotted lines designated serially from I to VI. When the lever 18 occupies position I, the lever engages

a fixed contact 25, when the lever occupies position II, all of the contacts of circuit controller K are open, the lever being illustrated in this position in the drawing. The lever 18 also co-operates with certain other fixed contacts so that contact 18—21 is closed when the lever occupies positions III or IV, contact 18—22 is closed when the lever occupies positions III, IV, V, or VI, contact 18—23 is closed when the lever occupies position IV, and contact 18—24 is closed when the lever occupies position VI. Associated with the circuit controller K is a push button designated by the reference character 19. This push button is normally closed but is arranged to be opened manually.

The reference character G designates an automatic circuit controller comprising a pressure responsive unit 16, such for example, as a Bourdon tube, which is connected with the left-hand end of cylinder 1 through a pipe 15, and which controls a contact 17 so that when the pressure in the Bourdon tube 16 exceeds a predetermined value, the contact 17 will be opened.

For purposes of explanation, I will assume that pipes 10 are supplied with fluid at a pressure of 100 pounds per square inch, and that the contact 17 of circuit controller G is opened when the pressure in the left-hand end of cylinder 1 exceeds 75 pounds per square inch, and I will also assume that the diameters of piston 2 and plunger 3 are 12 inches and 8 inches, respectively.

As shown in the drawing, with lever 18 of circuit controller K in position II, all of the valves B, C and D are de-energized and the piston 2 is in its left-hand position, so that the braking bars located in the trackway are in their non-braking or ineffective position. I will first assume that the operator wishes to make a light brake application. To accomplish this result, he moves lever 18 to position III. Current then flows from a suitable source of energy such as a battery J, through wire 26, push button 19, wire 20, contact 18—22, wires 33 and 27, winding 9 of valve C, and wires 28 and 29 back to battery J. Valve C is therefore closed to blank pipe 14 and thereby prevent escape of fluid pressure from the left-hand end of cylinder 1. At the same time, current flows over the circuit just traced as far as wire 33, and thence through wire 37, contact 17 of circuit controller G, wires 34 and 35, winding 9 of valve B, and wires 36 and 29, back to battery J. When this circuit is closed, valve B opens, and fluid pressure is supplied to the left-hand end of cylinder 1. But as soon as the pressure in the left-hand end of the cylinder exceeds 75 pounds per square inch, contact 17 opens, and the pressure is thereafter maintained at 75 pounds per square inch. With lever 18 in position III, current also flows from battery J, through wire 26, push button 19, wire 20, contact 18—21 of circuit controller K, wires 40 and 30, winding 9 of valve D, and wires 89 and 29 back to battery J. Under these conditions, therefore, valve D is also open so that the full pressure existing in the pipe 10 is supplied to the right-hand end of cylinder 1. With circuit controller K in position III, therefore, pressure at 75 pounds per square inch is supplied to the left-hand end of cylinder 1 and pressure at 100 pounds per square inch is supplied to the right-hand end of the cylinder. On the assumption that piston 2 is 12 inches in diameter and the plunger 3 is 8 inches in diameter the total force effective to move the piston toward the right is therefore approximately 3500 pounds.

Should the operator wish to increase the braking force supplied to the braking bars, he moves lever 18 to position IV. The circuits already traced for valves C and D are still closed with the lever in this position, and the circuit for valve B through contact 17 of circuit controller G is also closed. In addition to this latter circuit, however, still another circuit is closed for valve B from battery J, over wire 26, push button 19, wire 20, contact 18—23 of circuit controller K, wires 32 and 35, winding 9 of valve B, and wires 36 and 29 back to battery J. When this circuit is closed, a branch is completed around contact 17 of circuit controller G so that valve B is held open to supply the full pressure of 100 pounds per square inch to the left-hand end of cylinder 1. Under these conditions, then, both ends of cylinder 1 are supplied with fluid pressure at 100 pounds per square inch, but due to the unequal areas of the opposite sides of piston 2, the total force now effective to move piston 2 to the right is approximately 6300 pounds.

Furthermore, if the lever 18 is moved to position V, contact 18—21 of circuit controller K is opened and valve D closes to connect the right-hand end of cylinder 1 with atmosphere. With the lever in position V, valve B is supplied with current over contact 17 of circuit controller G and valve C is closed. Under these conditions, no pressure is supplied to the right-hand end of cylinder 1 and the left-hand end of the cylinder is supplied with fluid pressure at 75 pounds per square inch. The force effective to move the piston to the right is therefore approximately 8500 pounds. Finally, when lever 18 occupies position VI, the closing of contact 18—24 supplies current to winding 9 from battery J independently of contact 17 of circuit controller G over a circuit similar to the circuit traced for this winding through contact 18—23. The valve D is still de-energized so that the right-hand end of cylinder 1 is connected with atmosphere and pressure of 100 pounds per square inch is supplied to the

left-hand end of the cylinder. The piston is then urged to the right by a maximum force of approximately 11300 pounds.

If the operator wishes to restore the braking bars to their ineffective positions, he may do so by moving lever 18 to position II, so that all of the circuit for the valves B, C and D are open. As an alternative, he may de-energize all of the valves by opening push button 19. In either event, the two ends of cylinder 1 are connected with atmosphere so that no pressure is exerted on the braking bars. The operator next moves lever 18 to position I, thereby closing contact 18—25, whereupon current flows from battery J, through wire 26, push button 19, wire 20, contact 18—25, wires 39 and 30, winding 9 of valve D and wires 89 and 29 back to battery J. The valve stem 8 of valve D therefore moves downwardly and fluid pressure is supplied to the right-hand end of cylinder 1. As a result, piston 2 is driven to the left, and the braking bars are moved to their non-braking positions. With the braking apparatus thus released, the operator returns lever 18 to the position shown in the drawing, thereby de-energizing valve D and restoring the apparatus to its normal condition. It will be plain from the foregoing explanation that by regulating the fluid pressure supplied to the opposite sides of a differential piston, I can control a fluid pressure motor for operating railway braking apparatus with a minimum number of line wires between the motor and the circuit controller K. It should be pointed out that although I have mentioned certain values of fluid pressure and certain diameters for the differential piston 2, these particular proportions are not essential but are only given by way of illustration. It should also be understood that although I have herein disclosed apparatus for providing only four different operating pressures, the control circuits could be modified to increase to any reasonable limit the number of steps by which the effective braking pressures are varied.

Although I have herein shown and described only one form of railway braking apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. Railway braking apparatus comprising a braking bar located in the trackway, a fluid pressure motor for actuating said bar and comprising a cylinder and a piston reciprocable in such cylinder, a manually operable circuit controller, means controlled by said circuit controller for at times supplying different pressures to the two ends of said cylinder, and means also controlled by said circuit controller for at other times supplying different pressures to one end only of said cylinder.

2. Railway braking apparatus comprising a braking bar located in the trackway, a fluid pressure motor for actuating said bar and comprising a cylinder and a piston reciprocable in such cylinder, a contact responsive to the pressure in one end of the cylinder, a manually operable circuit controller, and means controlled by said circuit controller and by said contact for at times supplying the two ends of the cylinder with fluid at different pressures.

3. Railway braking apparatus comprising a braking bar located in the trackway, a fluid pressure motor for actuating said bar and comprising a cylinder and a piston reciprocable in such cylinder, means for at times supplying fluid pressure selectively to the two ends of said cylinder, and means for at other times supplying fluid pressure simultaneously to both ends of the cylinder.

4. Railway braking apparatus comprising a braking bar located in the trackway, a cylinder, a piston reciprocable in the cylinder and carrying a plunger connected with the braking bar so that the effective areas of the two sides of the piston are unequal, means for at times supplying fluid pressure to one end only of said cylinder, and means for at other times supplying fluid pressure to both ends of the cylinder simultaneously.

5. Railway braking apparatus comprising a braking bar located in the trackway, a fluid pressure motor for actuating said bar and comprising a cylinder and a piston reciprocable in such cylinder, means for at times supplying fluid pressure to one end of the cylinder, a contact responsive to the pressure in the other end of the cylinder, and means controlled by such contact for at times supplying fluid pressure to said other end of the cylinder when pressure is being supplied to such one end of the cylinder.

6. Railway braking apparatus comprising a braking bar located in the trackway, a cylinder, a piston reciprocable in the cylinder and carrying a plunger connected with the braking bar so that the effective areas of the two sides of the piston are unequal, a manually operable circuit controller, and means for supplying the two ends of said cylinder with equal pressures or with unequal pressures depending upon the position of said circuit controller.

7. Railway braking apparatus comprising a braking bar located in the trackway, a fluid pressure motor for actuating said bar and comprising a cylinder and a piston reciprocable in such cylinder, a first winding controlling the admission of fluid pressure to one end of the cylinder, a second winding for controlling the admission of fluid pressure to the other end of the cylinder, a contact

responsive to the pressure in said one end of the cylinder, a source of energy, and manually controlled means for connecting said source with said one winding in series with said contact and for simultaneously connecting said source directly with said second winding.

In testimony whereof I affix my signature.

HERBERT L. BONE.