No. 675,837.

Patented June 4, 1901.

J. H. NEAL.

HYDRAULIC BRAKE FOR CARS.

(No Model.)

(Application filed Jan. 4, 1901.)

4 Sheets—Sheet 1.

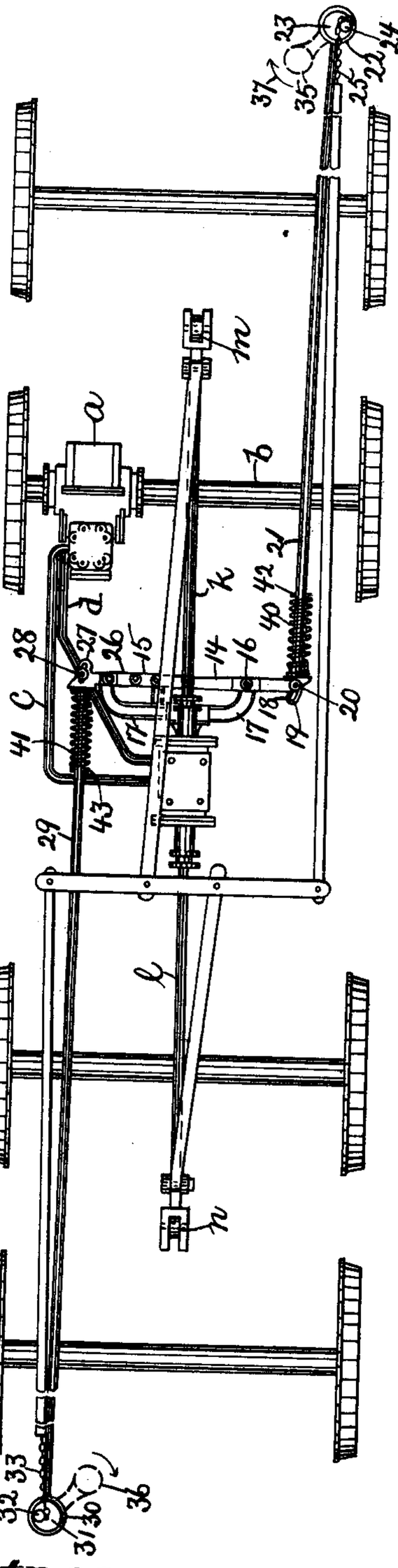

Fig. 1.

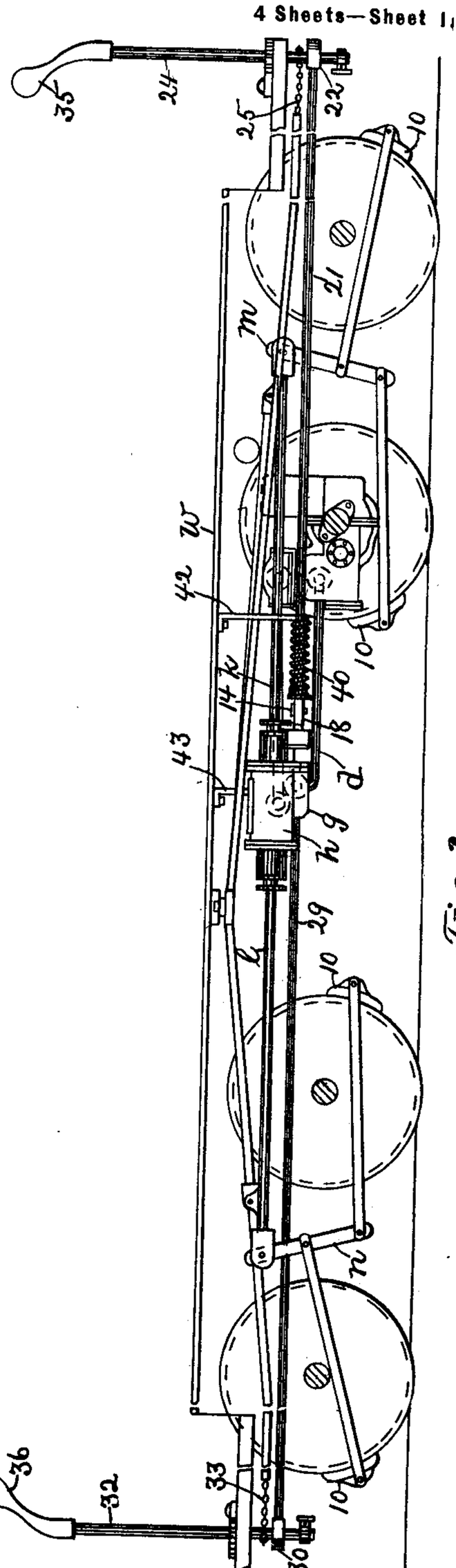

Fig. 2.

Witnesses.
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4 Sheets—Sheet 2.

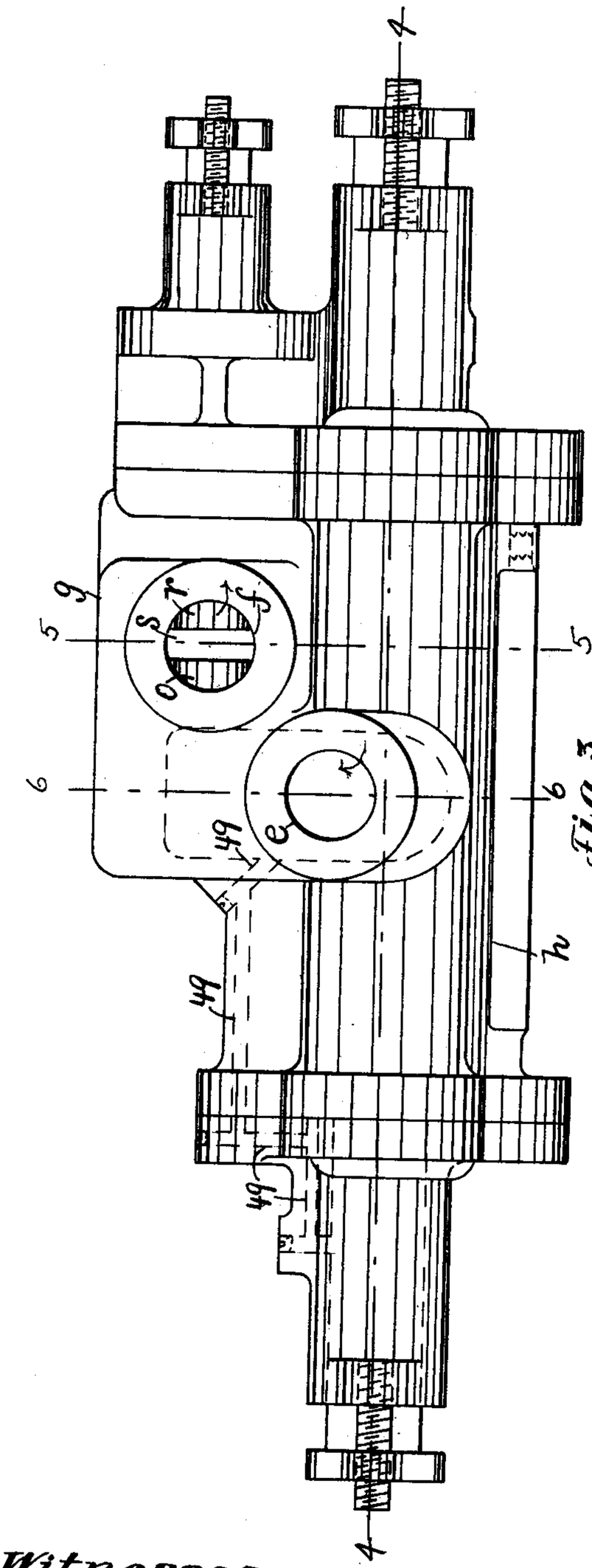

Fig. 3.

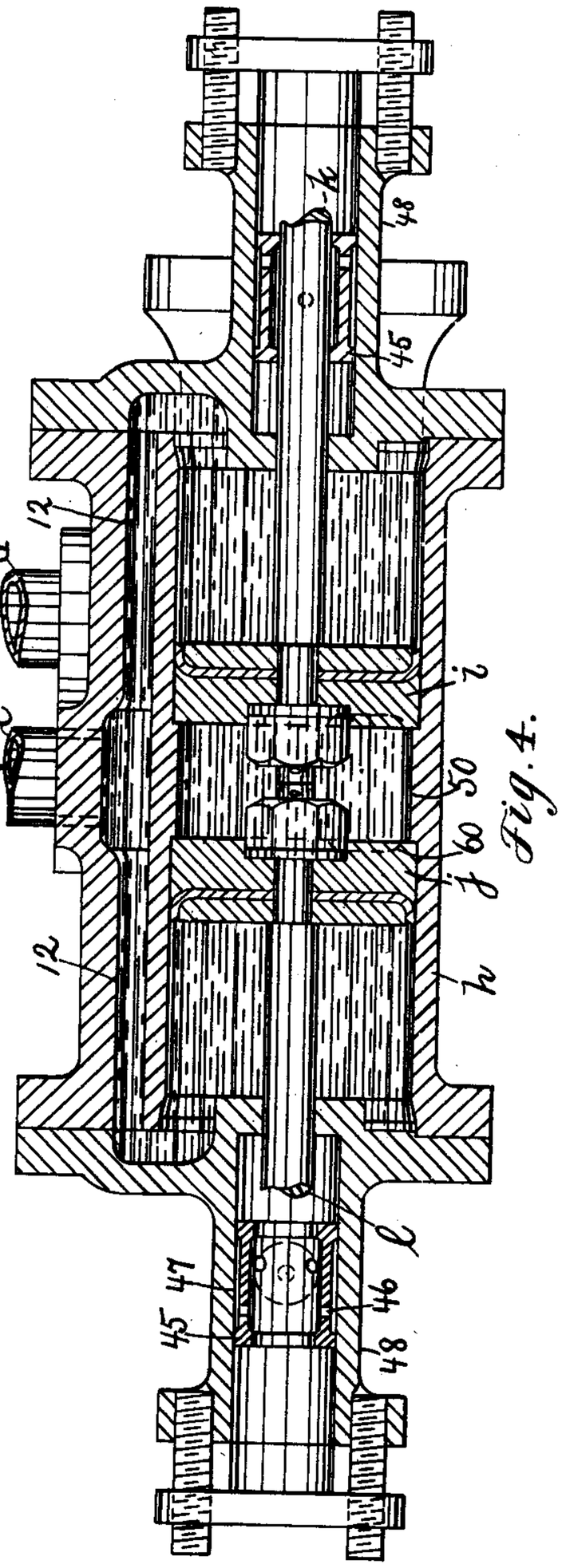

Fig. 4.

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4 Sheets—Sheet 3.

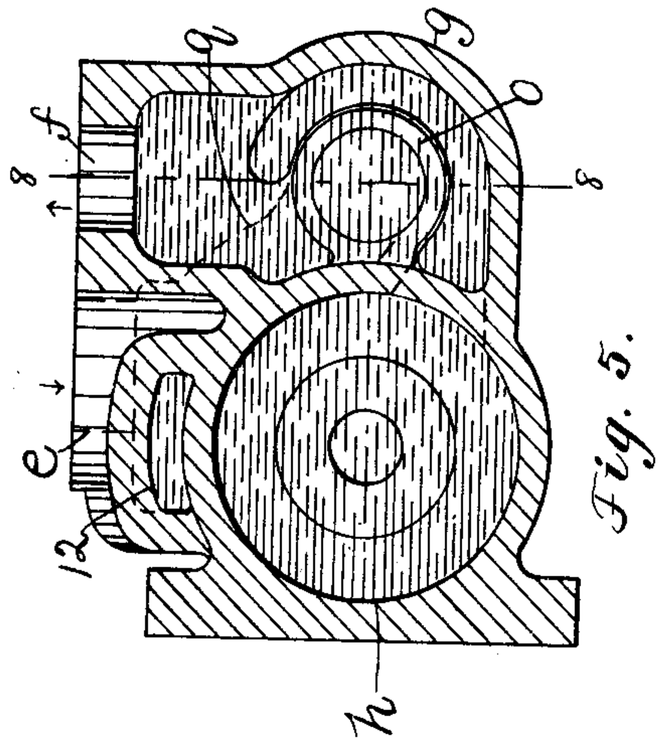

Fig. 5.

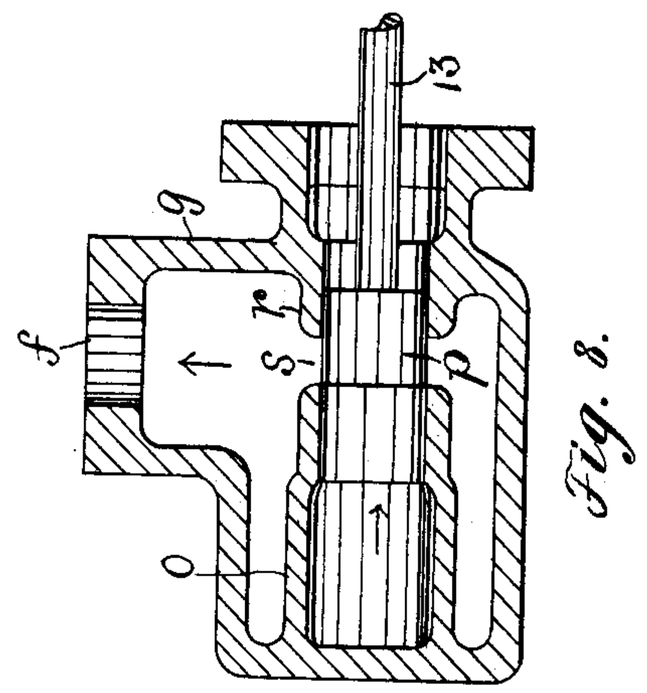

Fig. 8.

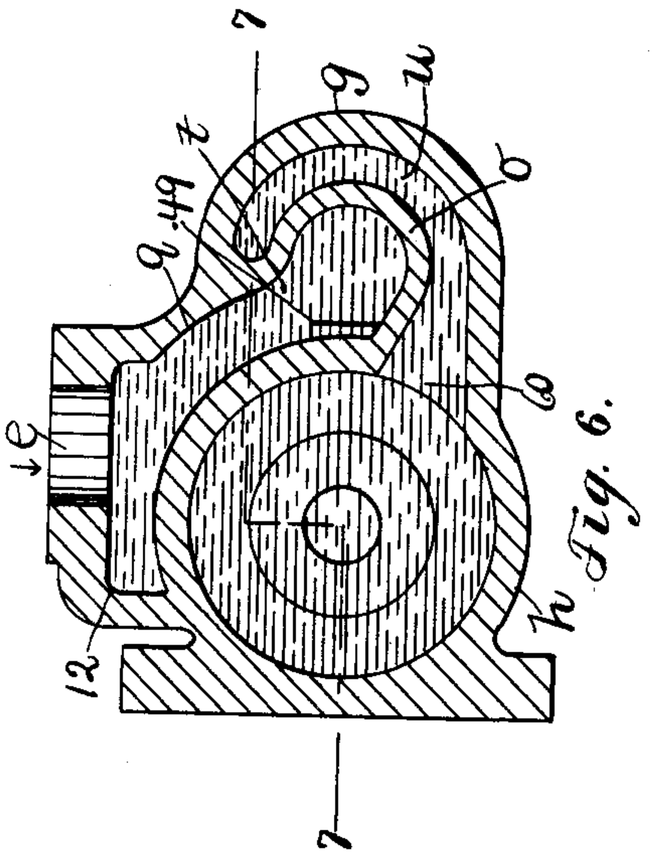

Fig. 6.

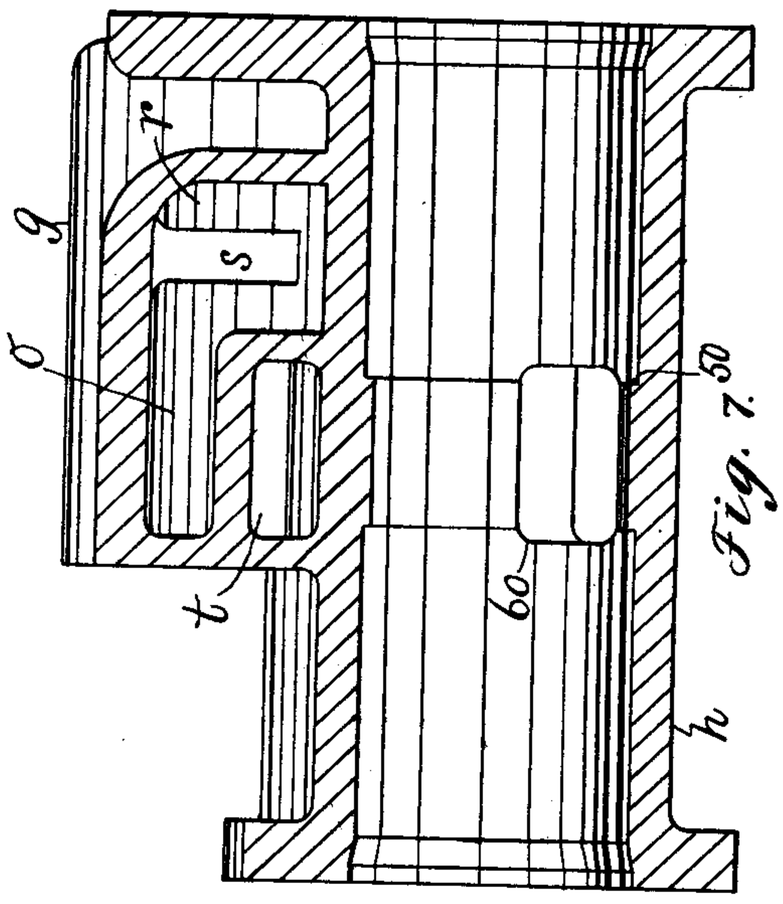

Fig. 7.

Witnesses.
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HYDRAULIC BRAKE FOR CARS.

(Application filed Jan. 4, 1901.)

(No Model.) 4 Sheets—Sheet 4.

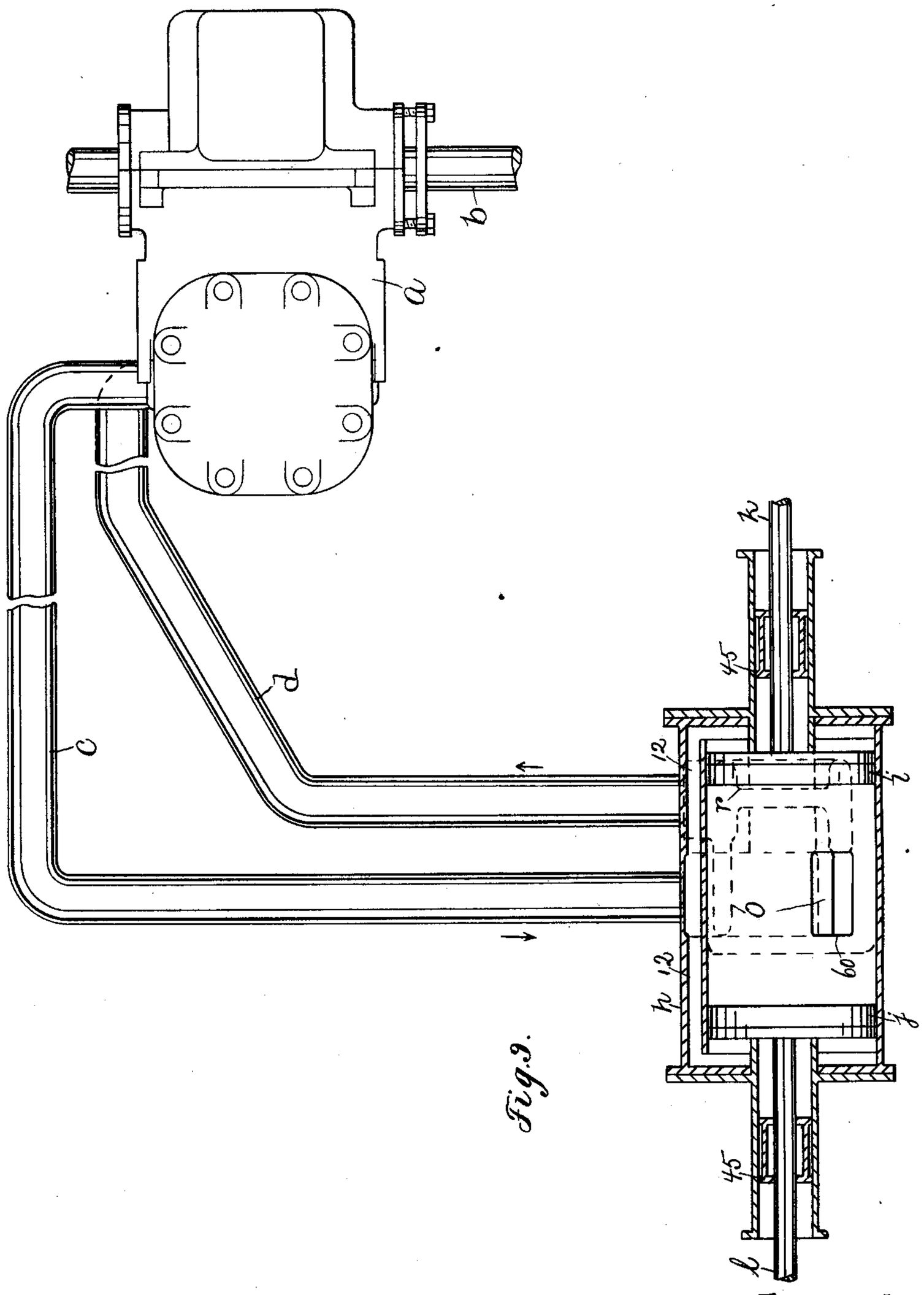

Fig. 9.

Witnesses.
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UNITED STATES PATENT OFFICE.

JAMES H. NEAL, OF BOSTON, MASSACHUSETTS.

HYDRAULIC BRAKE FOR CARS.

SPECIFICATION forming part of Letters Patent No. 675,837, dated June 4, 1901.

Application filed January 4, 1901. Serial No. 42,073. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. NEAL, a citizen of the United States, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Hydraulic Brakes for Cars, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to a brake-operating mechanism for cars, and has for its object to provide mechanism in which a body of liquid is circulated by a pump driven from the car-axle through a circuit with which a brake-cylinder is in communication, so that when the car is in motion the body of liquid in the said circuit is kept in motion without acting upon the brakes, and so that when the flow of the liquid in the circuit is interrupted the brake mechanism is operated upon by the momentum of the moving body of liquid in addition to the pressure of the pump exerted upon said body of liquid. The increased pressure due to the momentum of the moving body of liquid acts to apply the brakes more quickly and to stop the car in a minimum time, and by reason of the fact that the car-axle revolves at a slower and slower speed as the car is stopped the pressure due to the momentum of the moving body of liquid is gradually decreased until it disappears, after which the brakes are held by a pressure due to the pump. As a result the brakes are first applied with what may be termed a "maximum pressure," which is not maintained, but which gradually drops until the car is stopped, and the brakes are then held by the pressure of the pump acting on a static body of liquid, which latter pressure may be termed the "normal pressure." This decrease in pressure permits the car to be stopped without severe shock and without discomfort to the passengers, even when running at a high speed. The flow of liquid through the circuit referred to may be interrupted by a valve located outside of the brake-cylinder and actuated by a manually-operated device carried by the car and which may be the brake-staff now commonly employed to set the brakes by hand. These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is a plan view of a sufficient portion of a car provided with a brake mechanism embodying this invention to enable it to be understood; Fig. 2, a side elevation of the apparatus shown in Fig. 1; Fig. 3, an inverted plan of the brake-cylinder; Fig. 4, a section on the line 4 4, Fig. 3; Fig. 5, a cross-section on the line 5 5, Fig. 3; Fig. 6, a cross-section on the line 6 6, Fig. 3; Fig. 7, a longitudinal section on the line 7 7, Fig. 6; Fig. 8, a longitudinal section on the line 8 8, Fig. 5; and Fig. 9, a diagrammatic view to illustrate the circuit for the body of liquid.

Referring to Fig. 1, *a* represents a hydraulic pump, which may be of any suitable construction, adapted to be driven by the rotation of a car-axle *b* and which is connected by the pipes *c d* to the inlet and outlet ports *e f* of a valve-casing *g*, attached to and communicating with a brake-cylinder *h*, which is provided in the present instance with two pistons *i j*, having piston-rods *k l* connected to the levers *m n* of the brake mechanism now commonly employed on railway-cars. The valve-casing *g* contains within it a cylinder *o*, adapted to receive a piston-valve *p*, the said cylinder constituting the valve-chamber proper, which is normally open at one end and communicates with the valve-casing *g*, and which also communicates with the inlet-port *e* by a passage *q*. (See full lines, Fig. 6, and dotted lines, Fig. 5.) The piston-valve *p* may be supported by a cylindrical guide *r*, (see Fig. 8,) which is extended from one wall of the valve-casing *g* toward the valve-cylinder *o*, but is separated from the open end of said valve-cylinder by a space or passage *s*, which is bridged over by the valve when it is desired to operate the brakes. The valve-cylinder *o* is provided with a port or opening *t*, (see Fig. 7,) with which the passage *q* is connected.

From the above description it will be seen that a complete circuit for the flow of liquid, which may and preferably will be oil, (indicated by broken lines *u*,) is provided when the valve *p* is withdrawn from its cylinder *o*

and the latter is in open communication with the valve-casing g through the passage s. The circuit is indicated in diagram in Fig. 9 and may be traced as follows, viz: from the outlet-port of the pump a through the pipe c to the inlet-port e, thence by the passage q, port or opening t into the valve-cylinder o, thence out therefrom through the passage s into the casing g, and thence through the outlet-port f and pipe d back to the inlet-port of the pump. The valve p is open when the car (represented by w in Fig. 2) is in motion under normal conditions, and the body of liquid is moved through said circuit without operating the brake-shoes 10. When, however, it is desired to apply the brake-shoes to the car-wheels, the valve p is moved into its cylinder o to close its open end, and thereby interrupt the flow of the circulating body of liquid, which is forced by its own momentum and by the pump into the brake-cylinder h through the passage 12, which extends longitudinally of the cylinder and communicates, as herein shown, with both ends of the cylinder. (See Fig. 4.) The passage 12 also communicates with the inlet-port e and with the passage q, leading to the valve-cylinder o, as shown in Fig. 6. When the valve p is closed, the liquid acts immediately upon the pistons i j with an increased pressure due to the momentum of the moving body of liquid, which renders the brake mechanism very sensitive and effective, as the brakes are applied with a maximum pressure, which gradually diminishes as the car is stopped, so that when the car-axle has ceased to revolve the brakes are held by the normal pressure of the pump. The decrease in pressure from the maximum to the normal serves to prevent the car being stopped too suddenly, and consequently avoiding shocks and injury to the passengers.

The valve p may be operated from either end of the car, and this may be accomplished by mechanism as will now be described.

The valve is provided with a stem or rod 13, to which is pivotally connected the ends of levers 14 15, (see Fig. 1,) the lever 14 being pivoted at 16 to a suitable support 17, which may be attached to the brake-cylinder. The lever 14 is provided at its opposite end with an ear 18, having a curved slot 19, through which is extended a stud or pin 20 on the end of a rod 21, attached at its opposite end to the strap 22 of an eccentric disk 23, fast on a staff or rod 24, which may be the usual brake-staff and is herein shown as such, the said staff having fastened to it the brake-chain 25, which is usually employed. The lever 15 is pivoted to the support 17 and is pivotally connected to a second lever 26, also pivoted to the said support and provided with a slotted ear 27, through which extends a pin or stud 28 on a rod 29, attached at its opposite end to the strap 30 of an eccentric 31, fast on the brake-staff 32, to which the brake-chain 33 is secured. The brake-staffs 24 32 may be provided with the usual handles 35 36.

As represented in Fig. 1, the handle 35 has been turned sufficiently to move the valve p into the position shown in Fig. 8, and further movement of the handle in the direction indicated by arrow 37 will move the valve farther into its cylinder. The slots in the ears 18 27 of the levers 14 26 effect a loose connection between the said levers and their eccentric-rods, so that the valves may be operated from either end of the car. As represented in Fig. 1, the lever 14 is being positively moved by its eccentric-rod 21, while the lever 26 is being moved independent of its eccentric-rod. The levers 14 26 and the valve p are restored to their normal or starting position by the springs 40 41 on the eccentric-rods 21 29, which springs are compressed by the levers 14 26 when the valve is closed, said springs being interposed between the said levers and bars 42 43, which straddle the eccentric-rods and are fastened to the car-body, as represented in Fig. 2.

In order to avoid waste of oil in case any should leak by the piston-rods, I have provided a stuffing-box 45 for each piston-rod, (see Fig. 4,) which is provided with one or more holes 46 through it, which communicate with an annular chamber 47 between the said stuffing-box and the wall of the cylindrical extension 48 of the cylinder-head. The chamber 47 is connected by the irregular passage 49 (formed in the extension 48, cylinder-head, and the cylinder-body h) with the valve-cylinder o, so that any oil which may leak by the piston into the stuffing-box may return to the circuit from which it started.

The inward movement of the pistons within the brake-cylinder may be limited by suitable stops, shown in Fig. 4 as the opposite sides of an annular flange 50 on the inner circumference of the cylinder. The stops referred to serve to limit the movement of the pistons in the direction to apply the brakes and also insure both pistons being moved the same distance, for if one of said pistons for any reason should be moved faster than the other, and thus reach its stop before the other, the pressure would then be exerted against the other piston and would move it to the end of its stroke, thus insuring all the brakes being applied with substantially the same pressure.

In order to provide an outlet from the cylinder h for any oil which may leak by the piston into the space between the two pistons i j, the wall of the cylinder h is provided with a port or opening 60, which communicates with the valve-casing g, and thereby with the suction side of the pump.

When the pistons are in their normal position at the opposite ends of the cylinder, the space between said pistons is filled with oil; but as the said space is connected with the

suction side of the pump the oil exerts practically no pressure on the rear side of the pistons, and consequently when the valve *p* is closed the pressure of the oil is effective on one side only of the piston.

I claim—

1. In a hydraulic brake mechanism for cars, the combination of a circuit containing a body of liquid, means for imparting momentum to said body of liquid in said circuit, a brake-cylinder, a piston therein connected to the brakes, a body of liquid in said cylinder communicating with said moving liquid body and normally exercising no pressure on said piston, and means for interrupting the flow of said moving liquid body at a point beyond said cylinder, whereby the momentum of said moving liquid body is thrown against the piston with a force greater than the pressure exerted by the means for imparting the momentum to said liquid body.

2. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with a piston connected to the car-brakes, a valve-chamber in communication with said cylinder, a pump driven by rotation of a car-axle, pipe connections between said valve-chamber and said pump to form a circuit, a body of liquid in said circuit, and a valve to interrupt the flow of the liquid body through said circuit and cause it to act on the said piston with an increased pressure due to the momentum of the moving body of liquid and then with a lower pressure due to the pump, substantially as described.

3. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with a piston connected to the car-brakes, a liquid-pump operated from the car-axle, means for connecting said brake-cylinder with said pump to form a circuit, a liquid body movable in said circuit by the said pump when the car is in motion under normal conditions, and normally inactive upon the said piston, and a valve to interrupt the flow of the circulating body of liquid and render it active upon the said piston to apply the brakes, substantially as described.

4. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with a piston operatively connected to the car-brakes, of a liquid-pump operated from the car-axle, means for connecting the said cylinder with said pump to form a circuit, a liquid body movable in said circuit by said pump and normally inactive upon said piston, and a valve to interrupt the flow of the circulating body of liquid and render it effective on the piston to apply the brakes, substantially as described.

5. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with a piston operatively connected to the car-brakes, of a liquid-pump operated from the car-axle, a valve-casing in communication with said cylinder and with said pump and forming with the pump a circuit independent of said cylinder, a body of liquid movable in said circuit, and a valve in said casing to interrupt the flow of the circulating body of liquid and render it effective on said piston, substantially as described.

6. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with oppositely-movable pistons connected with the car-brakes, a liquid-pump operated from the car-axle, a valve-casing outside of the brake-cylinder and communicating therewith, pipe connections between said valve-casing and said pump to form a circuit, a body of liquid movable in said circuit and normally ineffective upon said pistons, and a valve in said casing to interrupt the flow of liquid therethrough and cause it to flow into said cylinder to operate said pistons to set the brakes, substantially as described.

7. In a hydraulic brake mechanism for cars, the combination with a brake-cylinder provided with a piston connected to the car-brakes, of a pump actuated from the car-axle, a valve-casing provided with an inlet and an outlet port, pipe connections between said ports and the said pump to form a circuit, a body of liquid movable in said circuit, means for effecting communication between said brake-cylinder and said circuit, and a valve in said casing to interrupt the flow of liquid through said casing and cause it to act on said piston to set the brakes, substantially as described.

8. In a hydraulic brake mechanism for cars, the combination of a circuit containing a liquid, a pump actuated by the car-axle to drive said liquid in said circuit, a brake-cylinder, a piston therein connected to the said brakes, a communication between said circuit and said cylinder, a valve to interrupt the flow of the liquid through said circuit and render it effective on said piston to set the brakes, an eccentric, and means for connecting said eccentric with said valve, and means to rotate said eccentric, substantially as described.

9. The combination with a railway-car, of a power-brake-operating mechanism comprising a pump actuated from an axle of the car, a brake-cylinder provided with a piston connected to the car-brakes, pipe connections between said pump and cylinder to form a circuit, a valve to interrupt said circuit, manually-operated devices located at opposite ends of the car, and intermediate mechanical connections between said devices and the said valve and having provision for permitting the valve to be operated by either device, without moving the other of said devices.

10. In a hydraulic brake mechanism for cars, the combination with a circuit containing a body of liquid, means for moving said body of liquid in said circuit, a brake-cylinder outside of said circuit but in open communication therewith, a piston in said brake-

cylinder operatively connected to the car-brakes, and a valve to close said circuit and divert the flow of liquid from its normal course in said circuit into the brake-cylinder to apply the brakes, substantially as described.

11. A hydraulic brake mechanism for cars having in combination with the brake mechanism a body of liquid maintained in continuous motion by the movement of the car and adapted to be impinged against said brake mechanism to set the brakes.

12. A hydraulic brake mechanism having in combination, a brake-cylinder and piston, a pump, a body of liquid driven by said pump between said pump and said brake-cylinder and having sufficient volume to act effectively on the brake-piston by its momentum, and means for controlling the effective action of said moving body of liquid on said piston.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES H. NEAL.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.