(No Model.)

2 Sheets—Sheet 1.

J. W. BOWERS.

FLUID PRESSURE BRAKE.

No. 450,610. Patented Apr. 21, 1891.

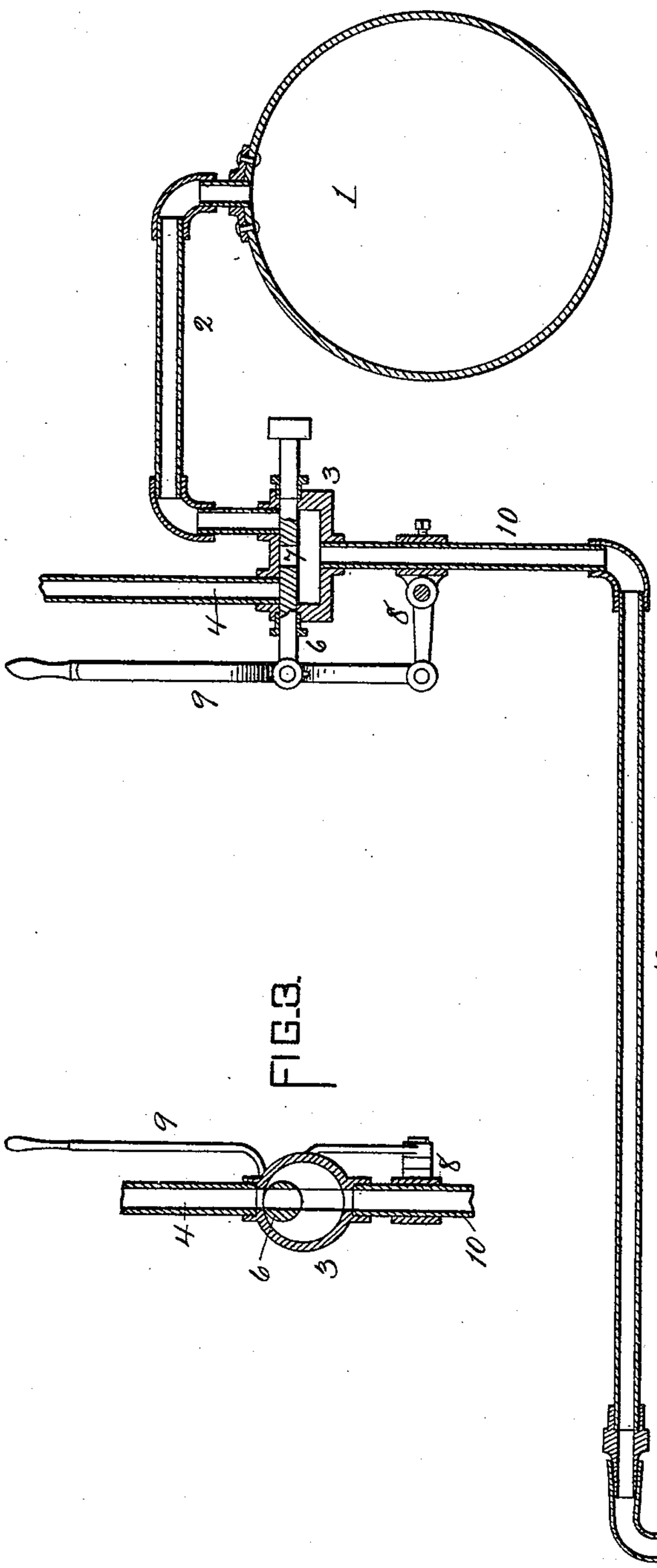
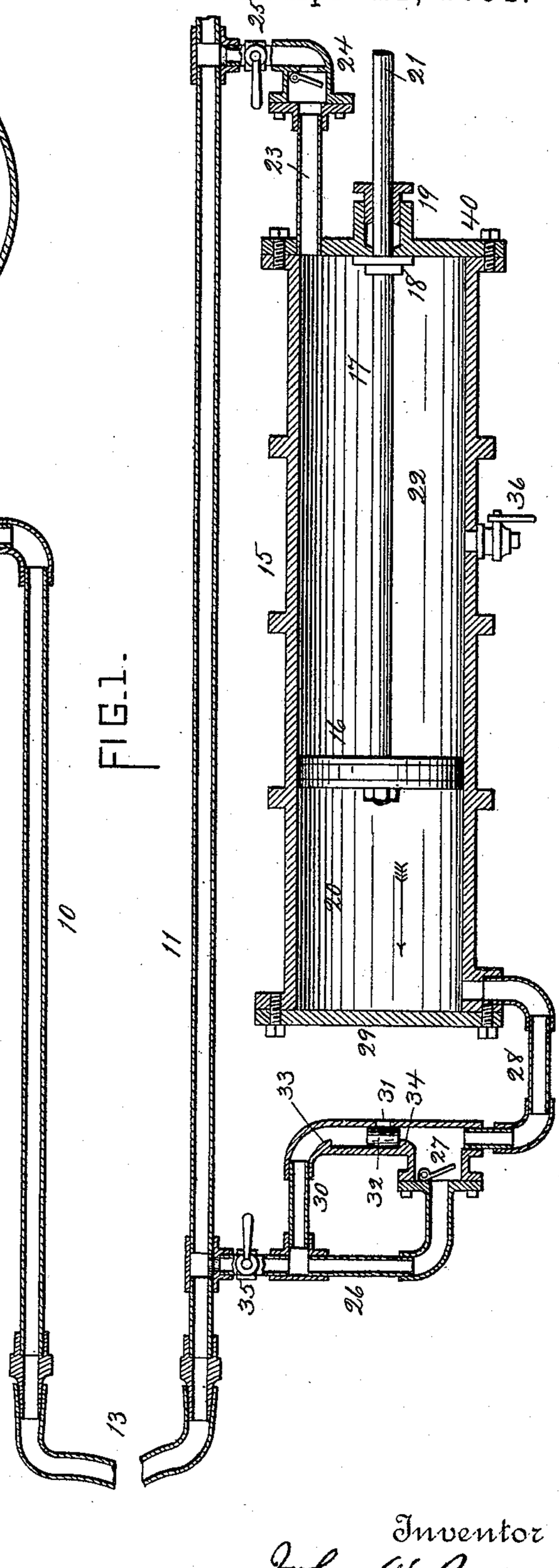


FIG. 1.

FIG. 3.



Witnesses
J. G. Lepper.
T. W. Johnson.

Inventor
John W. Bowers
By his Attorney
W. A. Barrett

(No Model.)

2 Sheets—Sheet 2.

J. W. BOWERS.

FLUID PRESSURE BRAKE.

No. 450,610. Patented Apr. 21, 1891.

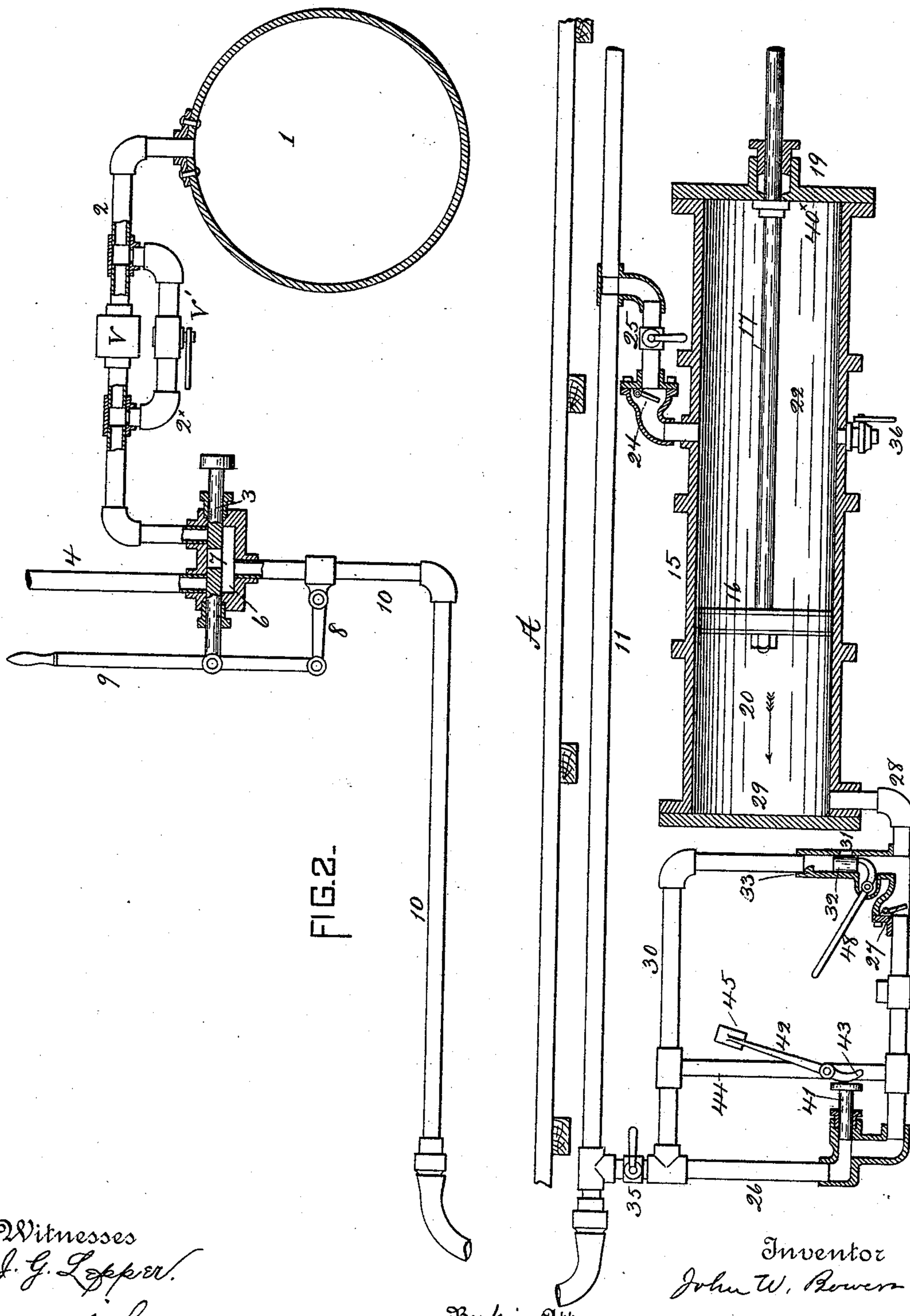


FIG 2.

Witnesses
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UNITED STATES PATENT OFFICE.

JOHN W. BOWERS, OF SACO, MAINE.

FLUID-PRESSURE BRAKE.

SPECIFICATION forming part of Letters Patent No. 450,610, dated April 21, 1891.

Application filed June 14, 1890. Serial No. 355,442. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BOWERS, residing at Saco, in the county of York and State of Maine, have invented certain new and useful Improvements in Fluid-Pressure Brakes and Operating Same, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to the form of fluid-pressure brakes known as "automatic" and a method of operating the same.

The object of the invention is to produce an apparatus by which the engineer will be able to grade the pressure applied to the brake, and yet the brake will be operated automatically if any air-pipe connection be broken; also to produce a convenient arrangement of valves by which the brake may be controlled and to avoid the necessity of the commonly-used auxiliary reservoir; also to operate a distant valve from the locomotive by means of a special application of fluid-pressure.

Figure 1 is a diagram indicating a longitudinal central section of the brake apparatus as it may be employed. Fig. 2 is a similar view of a modified construction, the floor of the car being shown. Fig. 3 is a rear elevation of the engineer's valve and lever connection.

The numeral 1, Fig. 1, indicates the air-storage reservoir, in which air is stored under pressure, and this may be supplied with a reducing-valve of any known construction. The reservoir is preferably at the engine, and is supplied with compressed air from a pump or compressor in usual manner. A pipe, as 2, leads from reservoir 1 to the casing 3 of a slide-valve. The casing 3 has an opening or outlet 4, communicating with the outer air, and an inlet from the reservoir referred to. A slide-valve 6 works in the casing 3 and has an opening 7, which may be brought opposite the inlet to admit compressed air to the casing 3, or by a reverse movement can be brought opposite the escape 4 to permit the escape of confined air from the casing 3. The slide 6 is operated by means of a hand-lever 9, which is arranged in proximity to the casing 3, being pivoted to the bracket 8 or in other suitable position. The hand-lever is offset at one side of casing 3 and escape-pipe 4, so that the lever may be conveniently manipulated without striking escape-pipe 4. The valve-casing 3 communicates with the single line of train-service pipe 10, which occupies any usual position, as under the floor of the car, and, as at 11, under each car of the train, suitable and usual couplings being indicated at 13.

Under each car and in suitable position for connection to the usual brake mechanism there is an air-cylinder 15. The piston 16 works air-tight in cylinder 15. Piston-rod 17 extends through a stuffing-box 19 in the end of the cylinder and has a stop 18 to limit the piston movement in one direction. The chamber 20 thus becomes the working or exhaust chamber of the cylinder, and the piston fits air-tight therein. As shown, the piston can only move in the direction indicated by the arrow, Fig. 1.

The piston-rod 21, which is an extension of rod 17, is connected to the car-brakes of any usual construction and in any usual manner, so that a movement of the piston in the direction indicated by the arrow will apply the brakes.

The chamber 22 of the cylinder receives compressed air from the train-pipe 11 through branch pipe 23, which branch contains a check-valve 24, opening toward the cylinder. The valve is of any usual or convenient form, but preferably of such construction that it will close by gravity when pressure is equal on both sides.

The air-chamber 20 of cylinder 15 receives its air-supply through branch pipe 26, leading from the train-pipe 11 to a check-valve 27, which opens toward the cylinder, and so on by a pipe 28, which preferably enters the side of chamber 20. This side opening into the cylinder permits the removal of the cylinder-head 29 for repacking the piston without changing the pipe-connection. The branch pipe 26 and 28 should be of slightly-greater diameter than the branch pipe 23.

The branch pipe 26 28 is provided with a by-passage 30, which leads around the check-valve 27 and has a vent or air-escape 31, which is normally closed by a plug or piston 32, which drops by gravity on stop 34 and covers said opening. An excess of pressure backward from chamber 20 in by-passage 30 will tend

to lift plug 32 toward stop 34, thus opening vent or escape-passage 31.

The cocks 25 and 35 may be used to cut out the branch pipes in case any part of the brake is disabled. The train-pipe 11 in such case will be intact to pass an air-supply from car to car.

36 is a vent or drain cock.

It will be understood that in many particulars the illustration merely outlines a construction which may be adopted, but that the construction may be varied within wide limits.

Assuming the connections made as described and no air-pressure in cylinder 15, if lever 7 be pressed toward the right in Fig. 1, compressed air from reservoir 1 will pass through the valve-opening 7 to the train-pipe 10 11. From pipe 11 air passes through branch pipes 26 28 to chamber 2 , and by branch pipe 23 to chamber 22. As the surface of piston acted on by air in chamber 20 is somewhat greater than the surface toward chamber 22, (owing to the piston-rod,) the piston and its rod will be forced to the right until stop 18 strikes piston-head 40. This throws off the brakes. The piston movement may be assisted by a spring in usual manner, but the spring is not essential. As soon as the pressure in both chambers 20 and 22 equals that in the train-pipe 11, the check-valves 24 and 27 will close by gravity and all the parts will remain locked. The lever 9 is then placed at a midway position, closing both passages 4 and 2.

To apply the brakes, the operator pulls lever 9 backward or to the left, Fig. 1, so as to open a passage from pipe 10 through valve-opening 7 to air-escape 4. This permits an immediate reduction of pressure in train-pipe 10 11. The reduction may be made very slight by a small movement of lever 9, and after a little air has escaped from the train-pipe the lever may be returned to midway position. The pressure in pipe 11 being thus reduced, the air-pressure in chamber 22 will tightly close check-valve 24. Air in chamber 20 will close valve 27, but in trying to equalize pressure will lift plug 32 and escape by opening 31 until the pressure is about equal on both sides of plug or valve 32, when said valve will fall and close opening 31. The pressure in chamber 20 will of course be reduced to that in the train-pipe 11. There will thus be a greater pressure in chamber 22 than in chamber 20, and piston 16 will be moved by this excess in the direction indicated by the arrow, pulling on rod 17 21 and applying the brake. Of course the greater the reduction in pipe 11 the greater will be the difference of pressure on the two sides of the piston and the greater the force applied to the brakes. To remove the brake-pressure, push lever 9 to the right again, restore pressure in the tube 11, which then again charges chamber 20 and throws off the brakes by reason of the excess of pressure in chamber 20, due to the reduction of sectional area in chamber 22 by the presence of the piston-rod. The air, once admitted to the chamber 22, remains there and acts as an elastic motor to move piston 16 and apply the brakes. The pressure in chamber 22 will always be the highest ever applied in pipe 11, except as changes are caused by leakage. The air in chamber 20 is allowed to escape in whole or in part every time the brakes are applied; but the air does not escape by way of the train-pipe, but by passage and opening 31. Thus the power applied to the brakes can be graduated, and any amount of pressure, up to the extent of pressure in chamber 22, be applied to set the brakes, and this without increase, but with diminution of pressure in train-pipes and connections.

As has been explained, an excess of pressure in the train-pipes throws the brakes off. Thus there is no likelihood of the engineer throwing an excess of pressure on the connections in a moment of emergency, and by bursting a connection crippling the entire brake system. The direction of movement of the lever—forward to throw off the brakes and permit the train to move forward, and backward to apply the brakes—is natural and advantageous and likely to prevent accidents.

It will be seen that the pressure applied to the brakes may be very small. The maximum pressure is not applied at the first movement of the engineer's valve. Thus the necessity of applying the brakes with such a high pressure as has been usually necessary with automatic brakes is obviated. The engineer easily grades the pressure on the brakes, either applying or releasing them. The advantage of what is known as "straight air" brake is attained without the danger of disabling the apparatus inherent in the use of straight air or a direct air-supply. If a reducing-valve is used, the lever 9 should be pushed forward so as to open communication from the reservoir to the train-pipe while the train is runniug. The air-pressure in the train-pipe and cylinders will thus remain constant, as any leakage will be supplied from the reservoir. It is impossible to change this brake apparatus into a non-automatic brake by any turning of cocks.

The modification outlined in Fig. 3 adds to the construction hereinbefore described two new elements—to wit, a reducing-valve V, having a by-passage $2^{\times}$, and a supplementary valve 41 in the branch 26, leading from train-pipe to the exhaust-chamber of the cylinder.

It has been impracticable to pack a piston so tightly as to prevent leakage. Leakage from the cylinder will allow the brakes to slacken up and release themselves in going down a long grade. To obviate this, I introduce into the brakes of cars which run over roads with long grades a valve 41 in pipe 26. The valve 41 is pressed open and held open by a small pressure in the train-pipe, but will be closed by a weighted lever 42, having a short arm 43, which bears against said valve.

The lever 42 is pivoted to a suitable support or standard 44. The valve 41 I call the "straight air" valve. As long as there is minimum air-pressure in the train-pipe valve 41 remains open being held by that pressure. On ordinary grades the engineer always maintains some air in the train-pipe; but on approaching a very long downgrade, where the brakes must be applied for a long time, the engineer lets out all the air in the train-pipe. When the pressure falls below the fixed minimum—say five pounds—the weight 45 pulls down lever 42 and closes the valve 41, cutting off air to chamber 20 through passage 28. The engineer now opens passage 7 by pushing forward lever 9, and air will constantly enter the train-pipe through pipe 2 and reducing-valve V, and will enter chamber 22 and maintain the pressure therein. As the passage to chamber 20 is closed, that chamber will oppose no resistance. The engineer's valve is then left in the forward position as long as the train is moving downgrade, and the brakes will be held by direct air-pressure in chamber 22. At the same time the brake remains automatic or operative by any accident to the train-pipe. A by-passage $2^{\times}$ leads round the reducing-valve V, and this by-passage is normally closed by cock V′. When the engineer desires to open valve 41, he opens cock V′, and an excess of pressure above the normal maximum forces open valve 41, lifting weight 45. As the air in branch 30 would tend to close valve 32 when valve 41 is closed, said valve 32 is held open by a bell-crank lever 48, which is struck by weight 45 as said weight falls and operates to hold open the valve 32. The lever 48 is light, and valve 32 will be operative by air-pressure in one direction and by gravity in the other, as hereinbefore described. The lever 42 is so weighted that when it is down the normal pressure allowed by the reducing-valve cannot raise it; but a pressure slightly above that allowed by the reducing-valve (which may be had through the by-passage) will force open the valve 41 and raise the lever.

What I claim is—

1. In an air-brake apparatus, a brake-cylinder, a piston therein connected to the brakes, an air-chamber on the operating or pressure side of the piston communicating with the train-pipe by a passage which is automatically closed to retain the air at maximum pressure in said chamber, and a chamber at the reverse side of the piston having an escape-opening governed by a valve which is controlled by the pressure in the train-pipe, all in combination, substantially as described.

2. The combination, with the operating-cylinder having a piston therein, of the train-pipe, a branch pipe 26 28, connecting the train-pipe and the cylinder and governed by a check-valve closing toward the train-pipe, and an exhaust-passage connecting the train-pipe and cylinder, having an opening controlled by a valve which is opened by back-pressure from the cylinder, substantially as described.

3. The combination, with the train-pipe, of the operating-cylinder having a piston therein connected to the brakes, a branch pipe connecting the train-pipe to the pressure end of the cylinder and having a check-valve closing toward the train-pipe, a branch pipe leading from the train-pipe to the exhaust end of the cylinder, having a check-valve closing toward the train-pipe and an exhaust-pipe between the train-pipe and cylinder, having an opening, and a valve which closes said opening when the pressure in the train-pipe overcomes that in the cylinder, substantially as described.

4. The combination, with the train-pipe, of a cylinder, as 15, having a practically uniform bore, a piston in the cylinder connected to the brake apparatus, branch pipe connecting the pressure end of the cylinder to the train-pipe and having a check-valve, as described, and a branch pipe and exhaust-pipe connecting the exhaust end of the piston to the train-pipe, said branch pipes having operating-valves, substantially as described.

5. The combination of the cylinder 15 of practically even bore, but with one end only finished for the reception of a piston, the piston 16 in said cylinder having rod 17 and a stop 18 thereon, and the branch pipe 23, connecting the pressure end of said cylinder to the train-pipe, substantially as described.

6. The combination of the cylinder 15, having piston 16 and a rod connected to the brakes, the train-pipe 11, the branch pipe 26, controlled by valve 27 and connecting the train-pipe and cylinder, and the exhaust or by-passage 30, having aperture 31 and valve 32 controlling said exhaust, substantially as described.

7. The combination, with the train-pipe, of an air-supply reservoir, a slide-valve interposed between the two, and a sliding plunger in said valve which moves forward to admit pressure to release brakes and rearward to reduce pressure to set the brakes, substantially as described.

8. The combination of the air-reservoir 1, the slide-valve having offset-lever connected thereto, the escape 4, controlled by said slide-valve to reduce pressure in the train-pipe, and an escape-passage from the casing of said slide-valve, all substantially as described.

9. The combination of the reservoir 1, the train-pipe, and a valve between the reservoir and train-pipe in position to open an escape and reduce pressure in the train-pipe or to admit pressure thereto, a cylinder connected to the train-pipe at each end by a branch pipe controlled by a check-valve opening toward the cylinder, a piston in the cylinder and connected to the brake, and an exhaust-passage between one end of the cylinder and the train-pipe having an opening therein, and a valve governed by pressure in the train-pipe, substantially as described.

10. The combination, with the cylinder having chambers, as described, of the train-pipe, the branch pipe having a valve, as 41, normally held open by gas-pressure in the pipe, and a weighted lever by which said valve is closed when the pressure is below a fixed minimum, substantially as described.

11. The combination, with the cylinder-chamber 20, of the branch pipes 26 28 30, the straight air-valve 41, which is closed by a weight on reduction of air-pressure, and the escape-valve 32, which is opened by the same weight, substantially as described.

12. The method of operating valve 41, which consists in allowing the air in train-pipe to escape, thus reducing pressure below a normal minimum and causing a gravity device to close the lever, and opening the lever by admitting a pressure to the train-pipe above the normal maximum, thus lifting the gravity device, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. BOWERS.

Witnesses:
W. H. BARNES,
C. W. JOHNSON.