No. 798,517. PATENTED AUG. 29, 1905.

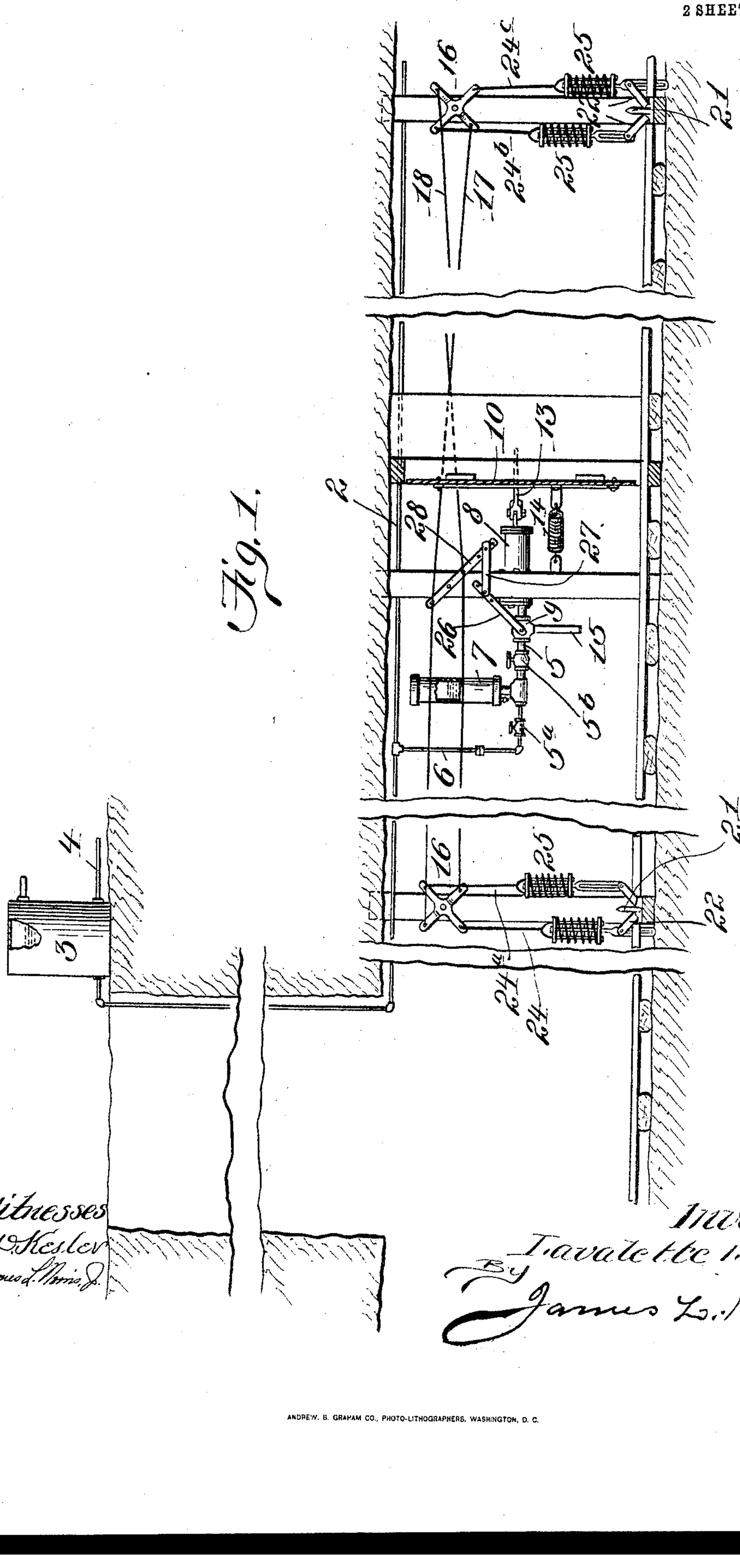
L. L. LOGAN.

MINE DOOR.

APPLICATION FILED DEC. 15, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

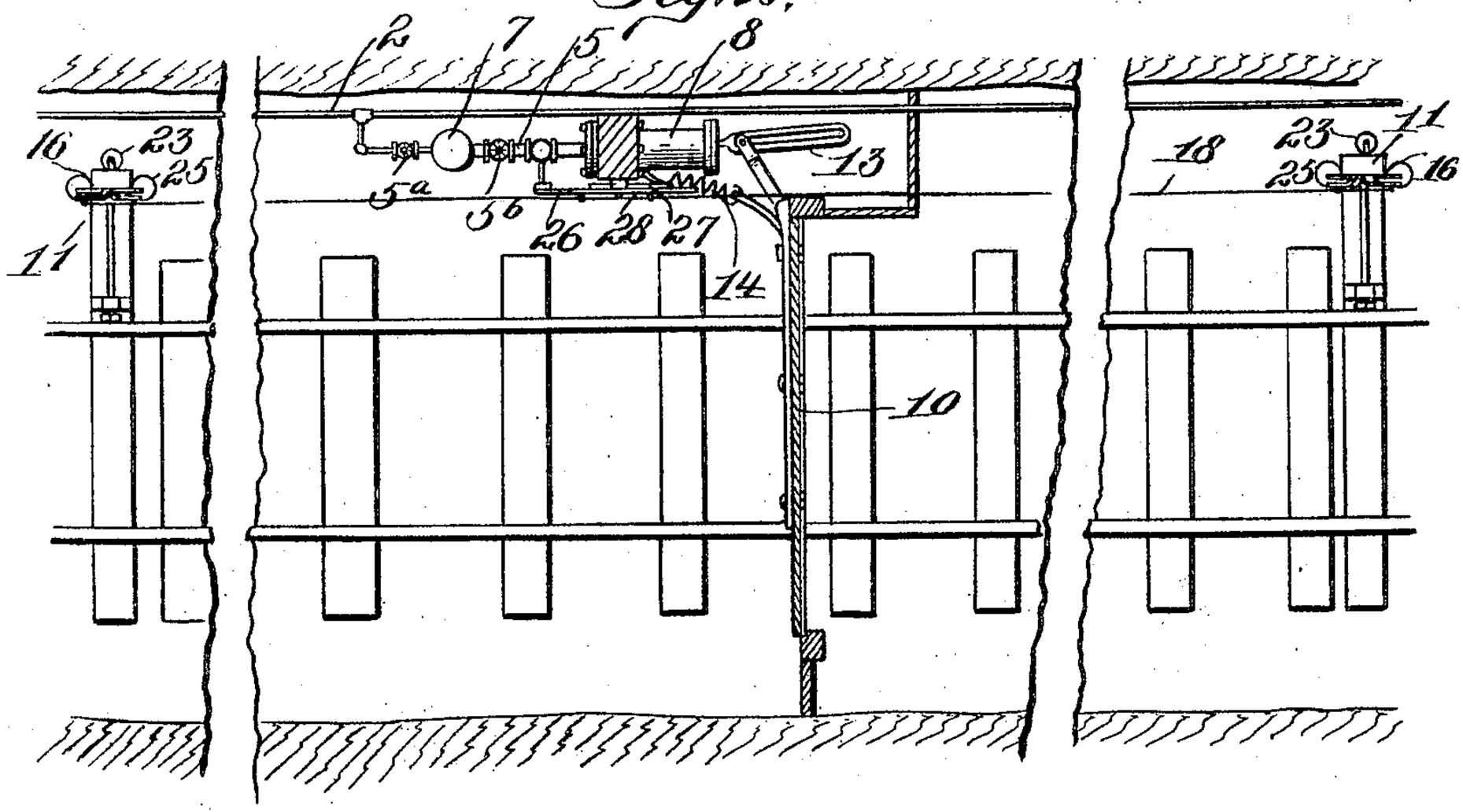


Fig. 3.

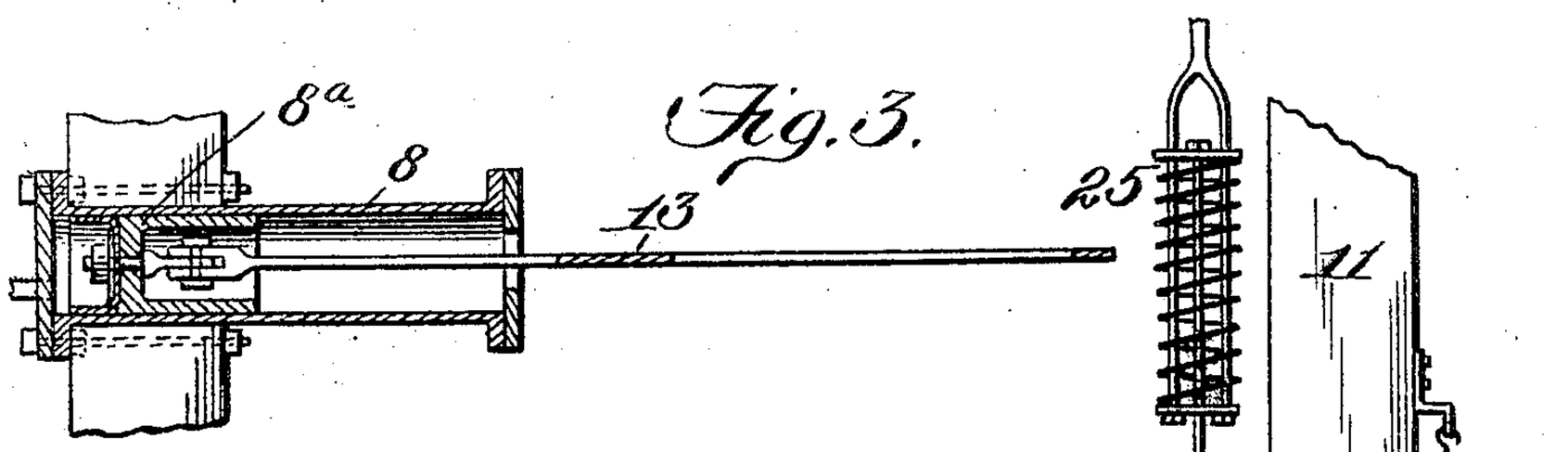


Fig. 4.

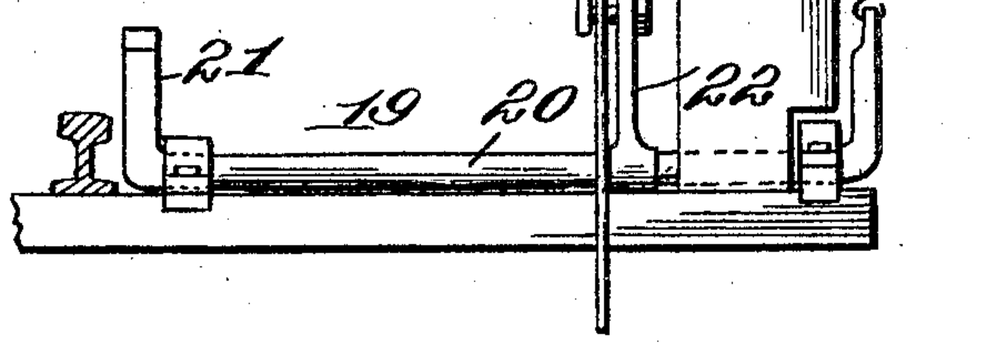


Fig. 5.

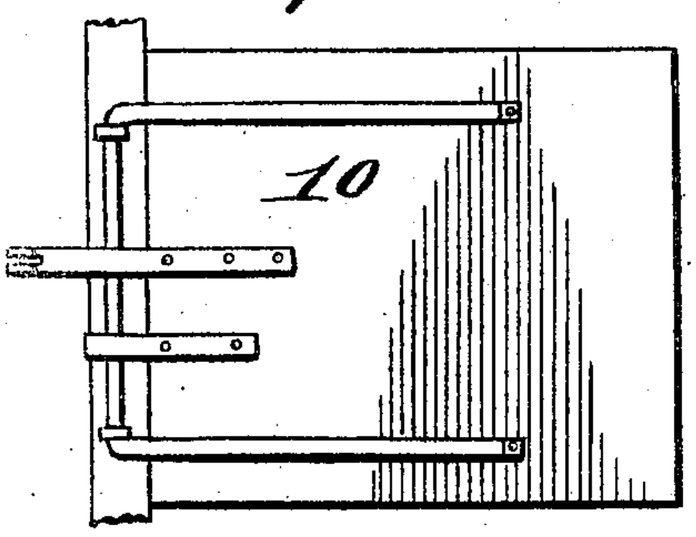
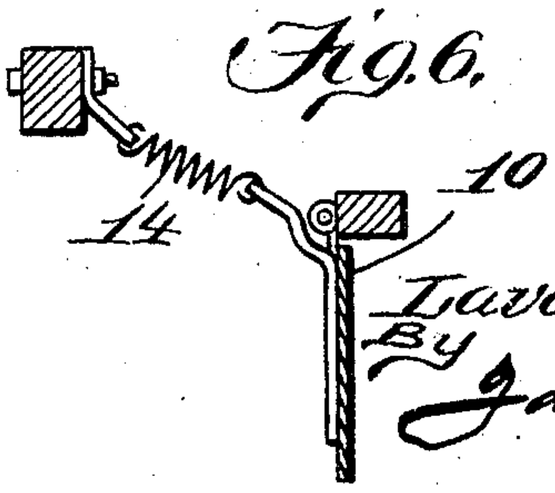


Fig. 6.



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UNITED STATES PATENT OFFICE.

LAVALETTE L. LOGAN, OF ROBERTSDALE, PENNSYLVANIA.

MINE-DOOR.

No. 798,517. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed December 15, 1904. Serial No. 237,043.

To all whom it may concern:

Be it known that I, LAVALETTE L. LOGAN, a citizen of the United States, residing at Robertsdale, in the county of Huntingdon and State of Pennsylvania, have invented new and useful Improvements in Mine-Doors, of which the following is a specification.

This invention relates to what I shall for convenience term a "mine-door."

The invention resides particularly in the means for operating the door, such means in the present instance being of a hydraulic character and of such construction that a door can be operated with rapidity and preferably by a moving vehicle approaching the door from either side thereof.

The invention, as will be understood, can be employed with equal advantage in conjunction with other types of doors, and it is not necessary to employ all the parts of that particular adaptation of the invention which for convenience I have selected for illustration in the accompanying drawings, forming part of this specification, in one system.

The principal benefit derived from my invention is in the saving of piping, for, as will hereinafter appear, I employ a line of piping of varying internal capacity, the piping of less internal capacity constituting the main or supply piping for feeding the piping of greater proportionate internal capacity. This particular feature of the case will be fully set forth in the following description, as will other features and their advantages.

Referring to the drawings, Figure 1 is a side elevation of a door and operating mechanism therefor involving my invention in a mine, the latter being in cross-section. Fig. 2 is a plan view of the parts represented in Fig. 1. Fig. 3 is a sectional elevation of a door-actuating means. Fig. 4 is an elevation of a trip device and certain associated parts. Fig. 5 is a face view of the door represented in Figs. 1 and 2. Fig. 6 is a plan view of the same.

Like characters refer to like parts throughout the different views.

As will be inferred from my initial statements, the invention is applicable to various uses, one of which, as will be indicated by the title thereof which I have selected, is in combination with a mine-door, and I have shown the shaft and heading or gangway leading from said shaft of a mine and in the latter a door.

The operating means includes in its organization a main, as 2, which is carried through the chambers of the mine and which receives water under a suitable pressure from the supply-tank, as 3, located at a convenient place. The pipe for delivering water to the tank is designated by 4, while the said tank is provided with an overflow near its top, and the water will be so supplied to the tank that the latter will contain a uniform quantity of water, so as to maintain a constant pressure or head in the main 2, which, as will hereinafter appear, supplies one or a plurality of auxiliary pipes of greater proportionate internal capacity than the main pipe 2. The auxiliary pipes in the present instance are shown as being of greater internal diameter than the main pipe, and I provide, as will hereinafter appear, automatic means for applying to the water flowing through the pipe of greater diameter and received from the pipe of lesser diameter a pressure approximately equal to that developed in the latter pipe, so that I am enabled to secure all the advantages that would arise from using a main of large diameter, at the same time doing away with the disadvantages that would follow the use of such a large main pipe.

There is one auxiliary pipe, as 5, for each door. I have only shown one door, and consequently one auxiliary pipe. As a matter of fact, these may under some circumstances be all that will be necessary. In the case of a mine, however, a large number of these doors and a corresponding number of auxiliary pipes should be installed. The doors serve their customary functions.

From the main pipes and constituting, in effect, a part of the same are extended branches, as 6, connected directly with the auxiliary pipes 5, so as to supply water from the main to the auxiliary pipes, only one of which, however, as has been previously indicated, is illustrated. Communicating with the auxiliary pipe 5 is represented a casing 7 in the form of a cylinder, which, as will hereinafter appear, is in the nature of an accumulator. The auxiliary pipe is adapted to deliver the water received from the main pipe 2 to hydraulic door-actuating means, involving in the present case a cylinder 8 and its piston, the flow of water, however, from the auxiliary pipe to the cylinder 8 being controlled by a valve 9 of some ordinary three-way kind. In the present instance, as will hereinafter appear, this valve is adapted to be set in motion either to cause the supply of water to

the cylinder 8 from the pipe 5 or to cut off these parts by a means operated by a moving vehicle, which may be a car, a motor, or something of such character. The cylinder 7 is a combined hydrostatic and pneumatic cylinder.

It will be assumed that the valve 9 is closed, which is its normal relation, the door 10 being also normally closed. By stating that the valve 9 is closed I mean that it cuts off communication between the pipe 5 and cylinder 8. Upon the flow of water through the pipe 2 under a predetermined or desired pressure such water will pass from the main uninterruptedly into the pipe 5 and from thence into the cylinder 7 and will rise in said cylinder until it compresses the air above it to a pressure equal to the head or pressure of the water, at which point the further flow of water into the cylinder or chamber 7 will be arrested.

When the valve 9 is opened, the compressed air in the chamber or cylinder 7 will force the water from said chamber or cylinder in a relatively large quantity into the cylinder 8 by way of the pipe 5 to operate the piston or plunger 8^a in said cylinder 8. The initial pressure of the air on the water is equal to that in the main 2; but as the piston or plunger 8^a moves out and some water leaves the chamber 7 the pressure drops. This drop in air-pressure, however, does not affect the operation of the door, for as soon as a mine-door starts to open the pressure of the air in the mine, which acts against the door when closed, is released to permit the ready opening of the door. In other words, the greatest work of opening a mine-door is at the start of such opening. With the accumulator described I can get initial or main pressure to start the door, and after the door commences to open the lessened pressure will force the desired quantity of water into the cylinder 8 to open the door fully as quickly as may be desired.

By the construction described I secure the advantage of a stream of large volume under high pressure without the necessity of employing a main pipe of large size to secure such volume.

I do not of course limit myself to the particular means shown for securing the results in question, for means of a different form might be employed instead of those illustrated and described.

When the door 10 is open, the piston 8^a is against the outer head or flange of its cylinder, so that the forces are self-contained. The door 10 is represented as hinged; but this is an immaterial point, for it may be otherwise mounted.

The different working parts of the system are shown as mounted upon posts, each designated by 11, which may be upheld in any desirable way. The door is shown as carried by the intermediate post 11 to the right in Fig. 1. Fastened to the door 10 between its top and bottom and laterally projecting from the same is a strap, which presents, in effect, a lever and which is operatively connected with the rod or stem 13 of the piston in the cylinder 8 by a slip-joint, which in the present case consists of a pin carried by the strap or lever and fitting in a longitudinal slot in the outer end of the stem or rod 13, by virtue of which construction the door 10 can be swung directly open without disturbing the piston and its rod or stem. When the parts are in their normal relations, the pin on the strap or lever is against the inner wall of the slot in the rod 13, so that when the piston in the cylinder 8 is forced outward by water-pressure thereagainst the door will be swung open and will be held open until automatically released, at which point it will be closed by the coil-spring 14, associated with the door and with the adjacent post 11. The spring 14 is tensioned when the door is opened, whereby when said door is released the spring by reaction can promptly close said door.

Connected with the casing of the valve 9 is a vent or relief pipe 15, illustrated as depending from said casing and which when the valve is in its normal position or that it assumes for cutting off the pipe 5 from the cylinder 8 will be in communication with said cylinder. This is what might be considered the closed position of the valve, and when the valve is closed, as will hereinafter appear, to effect the release of the door 10, whereby it can be swung shut, the vent or relief pipe 15 is put into communication with the cylinder 8, so that the piston can be returned to its original position by the power of the spring 14, and during the return motion of the piston the water in the cylinder 8 is expelled backward out of the same and caused to flow into and then out of the vent or relief pipe 15. The valve 9 is automatically opened by a car, motor, or train of vehicles traveling in either direction toward the door when such car, motor, or train of vehicles reaches a certain distance from the door, whereby the latter, as will be apparent, can be opened to permit the passage of the vehicle or vehicles thereby. When the vehicle or vehicles have reached a point beyond the open door, the latter will be automatically released by them, so that it can in the manner set forth be promptly closed. I will set forth in detail the means illustrated for securing the results named.

Cruciform rocking members, as 16, are shown as mounted upon the posts 11, and connecting members, as 17 and 18, are united at their ends with diametrically opposite arms of said cruciform members, the members 17 and 18 being illustrated as crossed between the door 10 and the member 16 to the right in Fig. 1 and being of wire, so that a car approaching the door from either side of it will

cause the lever 26 to swing to the left and open the valve 9, and so that a car passing through the door either way will cause the lever to swing to the right.

Mounted for operation by the vehicles traveling through the heading or gangway of the mine are trip devices 19, two in the present instance coöperating with each door and being located, respectively, at opposite sides thereof. Each trip device includes an intermediate or shaft portion 20, a single arm 21 rising from the inner end thereof, and a pair of arms 22 extending at angles to each other from near the outer end of said shaft portion, the latter being supported in some suitable way for rocking movement. The arms 21 are in such position relatively to the rails running through the heading or gangway that they may be operated or swung down from their vertical positions at proper times by the action of the tread of a leading wheel of a vehicle. When the arms 21 are freed, they will be promptly returned to their original positions by means of springs 23, connected with normally vertical projections on the outer ends of the shaft portions 20 and also with the adjacent posts 11.

Connected with the arms 22 by slip-joints, which may be of the pin and longitudinal form, are parallel links or rods 24, 24^a, 24^b, and 24^c, each link being provided with a push-spring 25. The upper ends of the respective links are jointed to the respective cruciform rocking members 16—that is to say, to two arms of each rocking member are connected the ends of the wires 17 and 18, while to the other arms are connected the links 24 and 24^a or 24^b and 24^c, respectively. By virtue of the longitudinal yieldable means in the several links, which consist in the present instance of springs, it will be apparent that should vehicles traveling in the same direction simultaneously strike the two trip devices 19 no derangement of the system can result. The springs 25 have another advantage, as will hereinafter appear.

To the stem of the valve 9 is connected a rod 26, a link 27 connecting said valve-actuating rod and the lever 28, which in turn is connected in some suitable way with the wires or equivalent connections 17 and 18, the lever being fulcrumed upon one of the posts 11 intermediate its connection with said wires. The connections between the opposite ends of the link 27 and the rod and lever are in practice made adjustable.

It will be assumed that a vehicle is traveling toward the closed door 10—say from the left toward the right in Fig. 1. When the tread of the head-wheel nearest the arm 21 of the trip device 19 on the left in said figure strikes said arm the same will be swung downward from its vertical position, thereby moving the arm 22 on the right in a corresponding direction and necessarily drawing the rod or link 24^a downward, so as to rock the cruciform part 16 and draw the wire 18 to the left, thereby through the intermediate parts opening the valve 9 and permitting water to flow from the casing or cylinder 7 into the cylinder 8 to operate the piston in said latter cylinder in the manner hereinbefore described to open the door 10. As the rod 24^a was drawn downward in the manner just set forth the coöperating rod 24 was elevated, while the wire 18 was moved toward the left a corresponding distance, so as to turn the rocking part 16 on the right a similar extent, whereby the rod 24^c will be elevated, while the rod 24^b will be thrust downward. This will result in bringing the lower wall of the slot of the rod 24^c against the pin of the coöperating arm 22, while the upper wall of the slot in the rod 24^b will be thrown against the pin of the coöperating arm 22. The door 10 being open, the vehicle or vehicles can pass by the same, and when said vehicle or vehicles reach a certain point beyond the open door the tread of the head-wheel, which operated the arm 21 on the left, will strike the arm 21 on the right and swing the same downward, so as to draw the rod 24^c downward or bring it to the position shown in Fig. 1, the rods 24, 24^a, and 24^b being also simultaneously returned to the position shown in said figure. When the rod 24^c was drawn down under the primary action of a vehicle, the arm 26 through the intermediate parts was operated in a direction to turn the valve 9 to cut the cylinder or chamber 8 out of communication with the pipe 5, so that, as hereinbefore set forth, the water in said cylinder or chamber is free to back out of the same and into the vent or relief pipe 15, which action is brought about, as will be apparent, by the door-closing spring 14. It will be understood that the trip devices may be operated from either direction.

It will be apparent that the valve 9 can be opened from either or both sides of the door by hand by lever means connected to the valve in the same way that the wires 17 and 18 connect the cruciform members 16.

I have hereinbefore set forth one of the functions of the springs 25—that is, they prevent injury to any of the parts should two vehicles traveling in the same direction simultaneously strike the two trip devices. Another advantage follows these springs. They are arranged so that they will compress solid about one-half the displacement of their coöperating rods or the rods of which, in effect, they form a part. It therefore follows that in case the valve 9 is hard to start a spring forming a part of the rod utilized in bringing about the motion of the valve is not depended on to apply an initial motion to the valve, (the spring being compressed during such initial motion;) but this is brought about independently of the spring. After the valve has started, assuming that it should stick, the

remainder of the motion will be brought about by a spring.

It will be understood that a vehicle or vehicles initially cause, through the intermediate hydraulic and hydrostatic means, the opening of a door and subsequently cause the closure by the same means of said door through suitable intervening devices, and such effects can be secured no matter in which direction the vehicle or vehicles are traveling toward the door.

At a convenient point in the pipe 5 is arranged a stop-cock 5^a, which when closed shuts off communication between the main 2 and the water and air containing chamber 7, so that said chamber 7 can be drained of its water by way of a petcock in its bottom, after which said chamber can be refilled with air, as it will be understood that the air in the chamber will in time be absorbed by the water. The air supplied to the chamber is in the present case at atmospheric pressure.

In the case of a deep shaft the water-pressure in the main will be very great, and as the valve is always completely opened when operated the door will be opened too quickly in the case of such high pressure. To control the pressure, I provide the valve 5^b, located in the pipe 5 between the accumulator-cylinder 7 and the valve 9, to control the amount of water flowing into the cylinder 8. At a door in some cases in a mine the valve 5^b will be wide open, while in other cases it will be partially closed.

The organization hereinbefore described is simple and effective and involves several advantageous features. It insures, without the necessity of employing a large main pipe, an initial pressure to a mine-door sufficient to insure the initial opening movement thereof. The means whereby this result may be obtained involves a main supplied from a tank or water-supply agent at the surface of the mine, which supplies several accumulators. Instead of using the car itself as the means for opening a door I use, as will be evident, relatively light mechanism to operate the valve that controls the action of such door, so that no shock or jar will be present when the door is opened, as is invariably the case with existing apparatus with which I am familiar.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to the said door-actuating means, a valve for controlling the flow of water to said door-actuating means, and automatic means for applying to the water flowing into the pipe of greater capacity from the one of less capacity, a pressure approximately equal to that developed in the latter.

2. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to the said door-actuating means, a valve for controlling the flow of water to said door-actuating means, automatic means for applying to the water flowing into the pipe of greater capacity from the one of less capacity, a pressure approximately equal to that developed in the latter, and means, arranged for operation by a vehicle, for effecting the operation of said valve.

3. The combination of a door, hydraulic door-opening means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the latter serving to deliver water to the door-opening means, a valve for controlling the flow of water to the door-opening means, automatic means for applying to the water flowing into the pipe of greater capacity from the one of less capacity, a pressure approximately equal to that developed in the latter, and means for actuating the door in opposition to the opening means.

4. The combination of a door, hydraulic door-opening means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the latter serving to deliver water to the door-opening means, a valve for controlling the flow of water to the door-opening means, automatic means for applying to the water flowing into the pipe of greater capacity from the one of less capacity, a pressure approximately equal to that developed in the latter, and a spring for operating the door in opposition to the opening means.

5. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to the said door-actuating means, a valve for controlling the flow of water to the door-actuating means, and a water-receiving and air-containing chamber adapted to receive the water-pressure from the pipe of less capacity, and, when the valve is opened, to transfer said pressure into the pipe of greater capacity.

6. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver

the water to the door-actuating means, a valve for controlling the flow of water to said door-actuating means, and means for operating the valve to effect the action of the door from opposite sides of the latter.

7. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to the door-actuating means, a valve for controlling the flow of water to said door-actuating means, and means adapted to be operated by a vehicle when traveling in either direction toward the door, for opening the valve to permit the flow of water toward the door-actuating means.

8. The combination of a door, a piston and its cylinder, a rod connected with the piston and serving to transfer the force thereof to and in a direction for opening the door, a main pipe, an auxiliary pipe, the main pipe being adapted to supply water under pressure to the auxiliary pipe, and the latter being adapted to supply the water to said cylinder, a valve for controlling the flow of water through the auxiliary pipe, automatic means for applying to the water flowing through said auxiliary pipe a pressure substantially equal to that developed in the main pipe, and mechanism arranged for operation by a vehicle for operating the valve in a direction to permit the water to flow from the auxiliary pipe to said cylinder.

9. The combination of a door, a piston and its cylinder, the piston serving to act against the door to open the same, communicating pipes of different internal diameters, the one of greater internal diameter serving to deliver water into said cylinder, and the other to convey water under pressure toward the companion pipe, a valve to control the flow of water from the pipe of larger internal diameter to the cylinder, where it can act upon said piston, automatic means for applying to the water flowing through the pipe of greater internal diameter a pressure substantially equal to that developed in the other pipe, and a spring associated with the door to close the same and to return the piston to its original position.

10. The combination of a door, a piston and its cylinder, the piston serving to act against the door to open the same, communicating pipes of different internal diameters, the one of greater internal diameter serving to deliver water into said cylinder, and the other to convey water under pressure toward the companion pipe, a three-way valve to control the flow of water from the pipe of larger internal diameter to the cylinder, where it can act on the piston, automatic means for applying to the water flowing through the pipe of greater internal diameter a pressure approximately equal to that developed in the other pipe, and a venting means associated with the three-way valve and adapted to be put into operative association with the cylinder on the motion of said valve, to thereby permit the escape of water previously supplied to the cylinder by the said pipe of greater internal diameter.

11. The combination of a door, hydraulic door-actuating means for said door, means for supplying a hydraulic agent to said hydraulic door-actuating means, a valve for controlling the flow of water to said door-actuating means, cross-wires, a lever connected to the cross-wires and operatively connected with said valve, rocking members to which the opposite ends of the wires are connected at opposite sides of said door and at diametrically opposite points, rods depending from the respective rocking members and connected thereto at diametrically opposite points, each rod having in its make-up a compression-spring, and trip devices at opposite sides of the door, having arms connected by slip-joints with the respective rods, and each having an arm located for operation by the tread of the wheel of the moving vehicle.

12. The combination of a door, hydraulic door-actuating means for said door, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to said door-actuating means, automatic means for applying to the water flowing into the pipe of greater capacity from the one of less capacity a pressure approximately equal to that developed in the latter, a valve for controlling the flow of water to the hydraulic door-actuating means, mechanism arranged for operation by moving a vehicle to operate the valve in a direction to permit the action by the water of the hydraulic door-actuating means, and a tank for supplying water to the pipe of lesser capacity.

13. The combination of a door, a main water-pipe, an auxiliary water-pipe, means for opening the door, arranged for operation by water flowing from the auxiliary pipe, and means independent of the main pipe for automatically applying a pressure to the water flowing through the auxiliary pipe.

14. The combination of a door, a main water-pipe, an auxiliary water-pipe, means for opening the door, arranged for operation by water flowing from the auxiliary pipe, a valve for controlling the flow of water through the auxiliary pipe, means independent of the main pipe for applying pressure to the water flowing through the auxiliary pipe, and mechanism for opening said valve to permit the flow of water from the auxiliary pipe to the door-opening means.

15. The combination of a door, a main water-pipe, an auxiliary water-pipe, a water-receiving and air-containing chamber adapted

to receive the water-pressure from the main pipe, a valve controlling the flow of water through the auxiliary pipe, said chamber, with the water and compressed air therein, serving to transfer a pressure to the water in the auxiliary pipe when said valve is opened, means for opening the valve, and hydraulic door-operating means arranged for action by water passing from the auxiliary pipe.

16. The combination of a door, hydraulic door-actuating means, pipes of different proportionate capacities, the pipe of lesser capacity being adapted to deliver water under pressure to the other pipe, and the pipe of greater capacity being adapted to deliver the water to the said door-actuating means, a valve for controlling the flow of water to said door-actuating means, automatic means for applying to the water flowing into the pipe of greater capacity from the one of lesser capacity a pressure approximately equal to that developed in the latter, and means for operating the valve to permit the flow of water in a direction to cause the operation of said hydraulic door-actuating means.

17. The combination of a door, a cylinder, containing a piston, operatively connected with said door, a main water-pipe, an auxiliary water-pipe, a valve for controlling the flow of water through the auxiliary pipe, and an air-containing and water-receiving chamber in communication with the auxiliary pipe and adapted to receive water from the main pipe, the said chamber, with its contained water and air, serving to apply a pressure to the water in the auxiliary pipe when said valve is opened, to cause the water in the auxiliary pipe to act against the piston in a direction to open the door.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LAVALETTE L. LOGAN.

Witnesses:

P. D. BROWNING,

W. O. FIELDS.