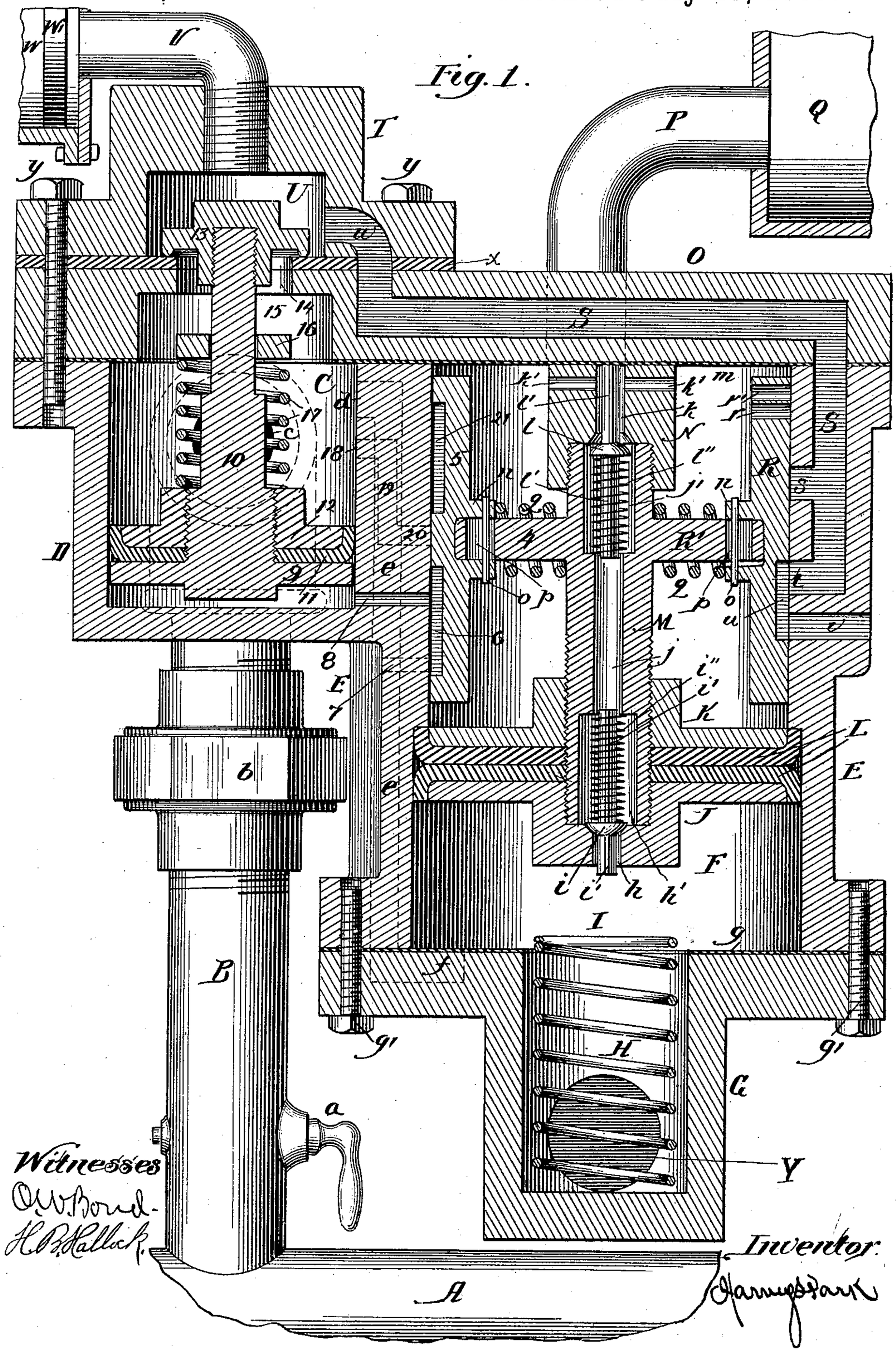
(No Model.) 3 Sheets—Sheet 1.

H. S. PARK.

AIR BRAKE.

No. 407,445. Patented July 23, 1889.

Fig. 1.



(No Model.) 3 Sheets—Sheet 2.

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No. 407,445. Patented July 23, 1889.

Fig. 2.

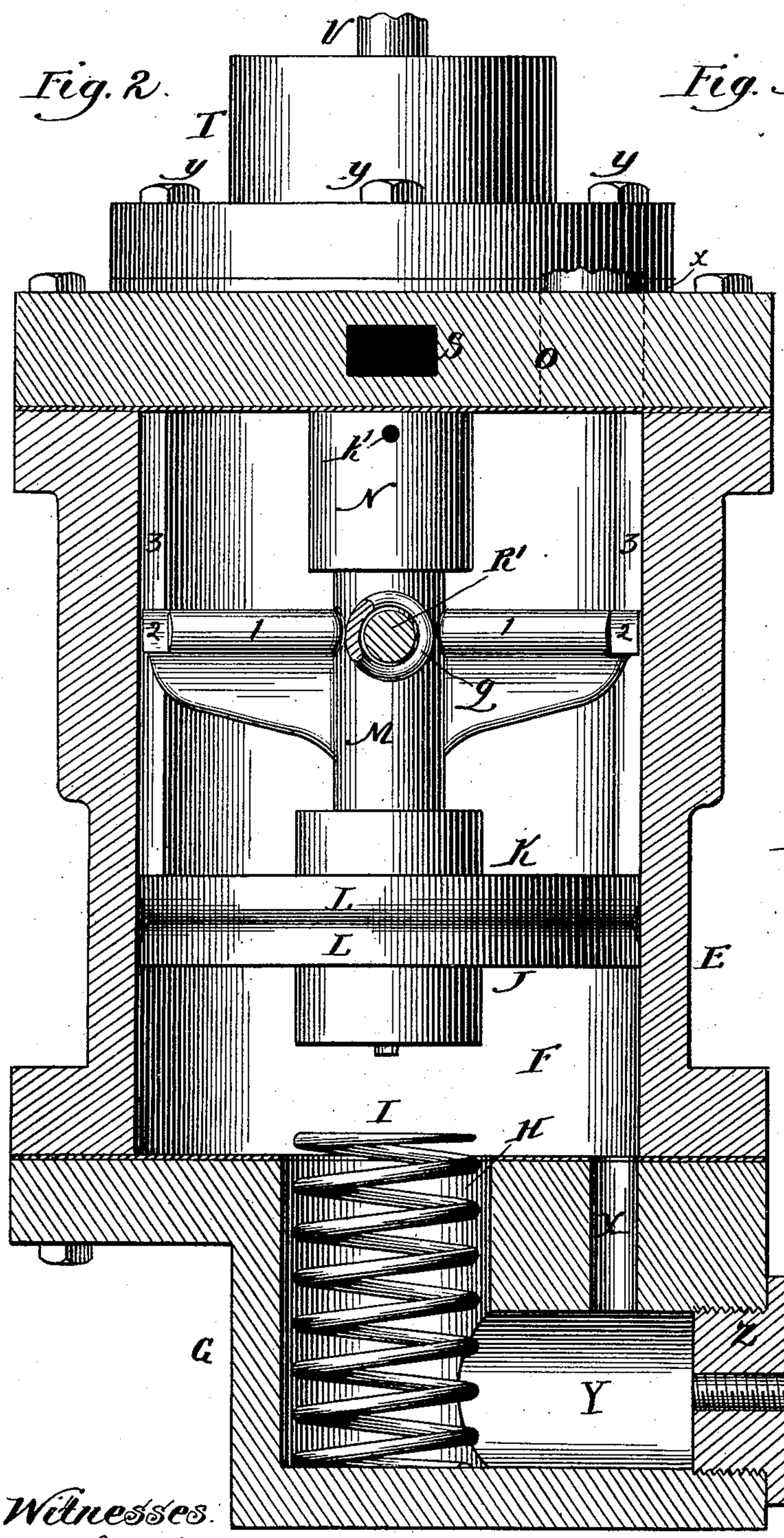


Fig. 3.

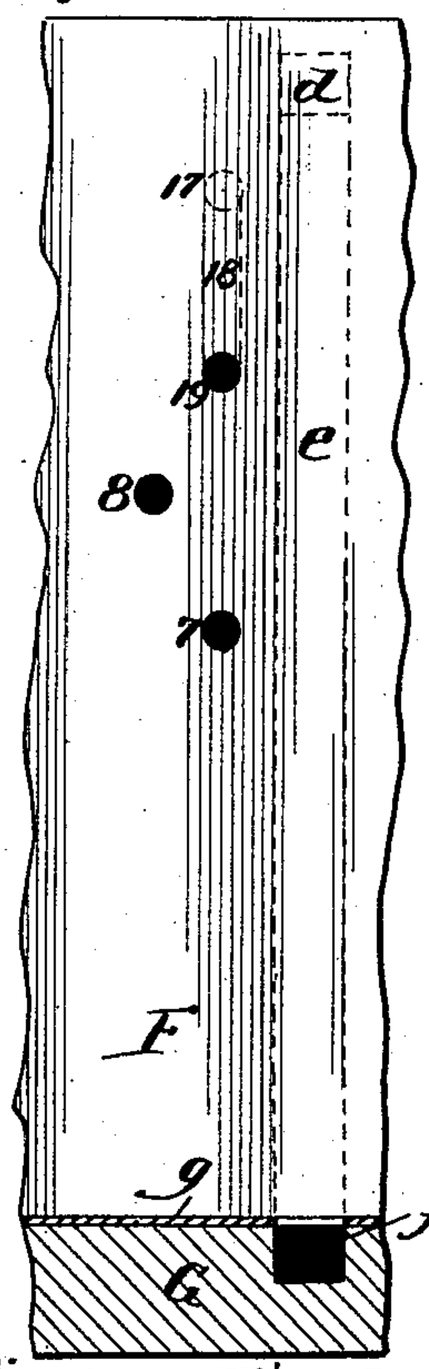


Fig. 4.

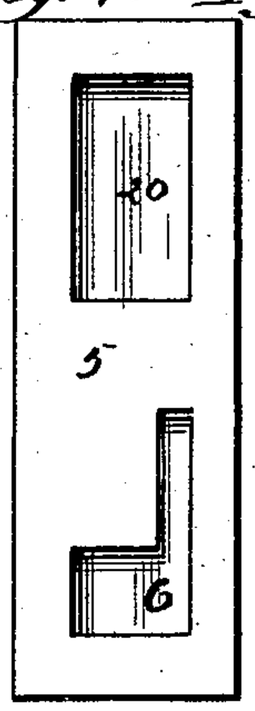
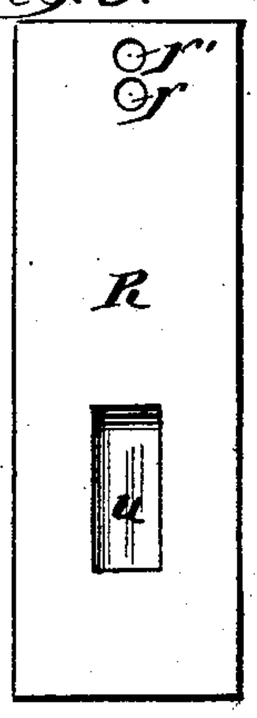


Fig. 5.



Witnesses.
C. W. Bond.
H. B. Hallock.

Inventor:
H. Harvey Park

(No Model.) 3 Sheets—Sheet 3.

H. S. PARK.

AIR BRAKE.

No. 407,445. Patented July 23, 1889.

Fig. 6.

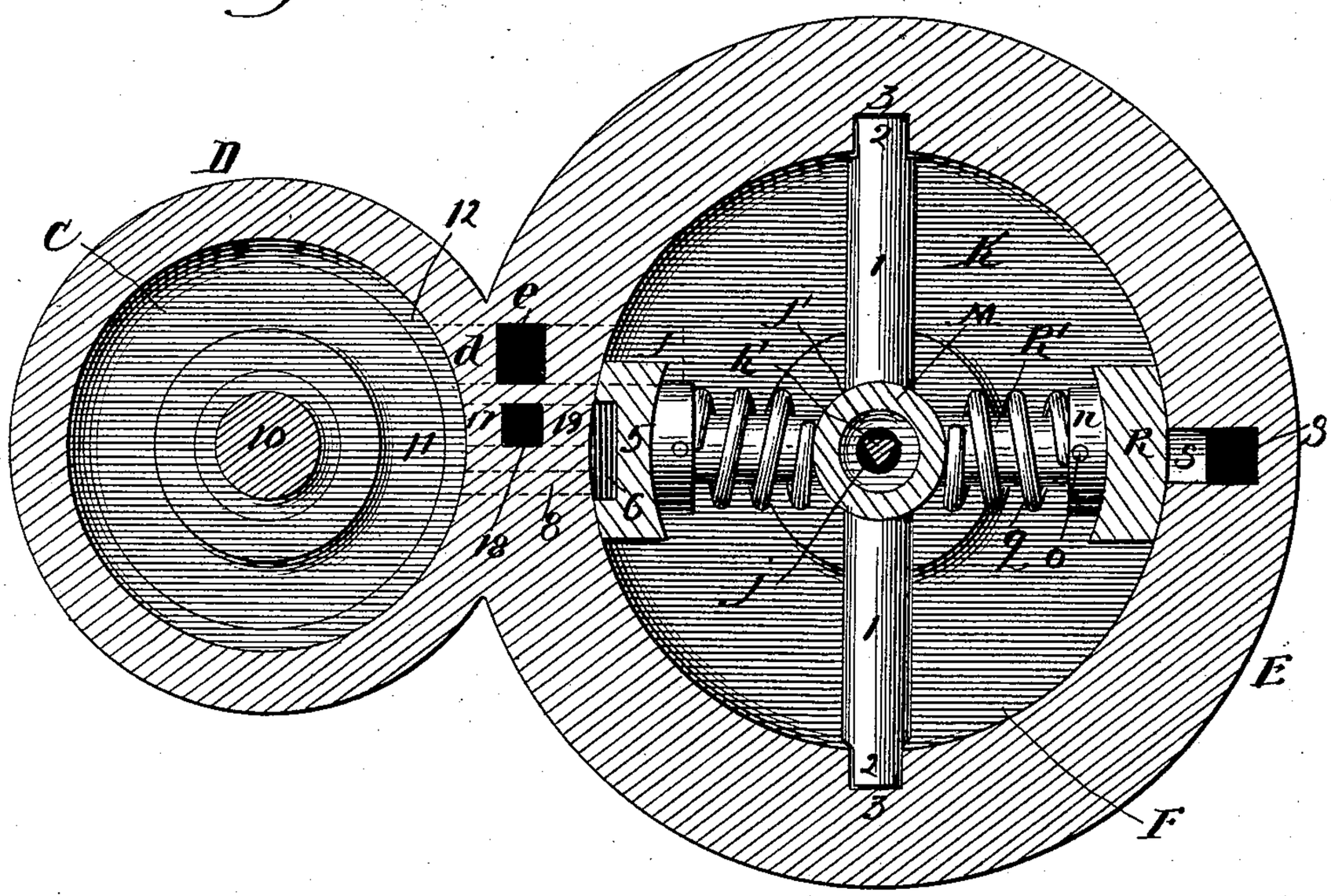


Fig. 7

Witnesses:
C. W. Bond.
H. B. Hallock.

Inventor:
H. Harvey Park

UNITED STATES PATENT OFFICE.

HARVEY S. PARK, OF CHICAGO, ILLINOIS.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 407,445, dated July 23, 1889.

Application filed December 3, 1888. Serial No. 292,471. (No model.)

To all whom it may concern:

Be it known that I, HARVEY S. PARK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Brakes; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, forming a part hereof, in which—

Figure 1 is a longitudinal section showing the main valve and its piston, the valve controlling the passage of direct train-pipe pressure to the brake-cylinder and its piston, the train-pipe, the brake-cylinder, and the car-reservoir; Fig. 2, a vertical longitudinal section through the main valve; Fig. 3, a detail showing the arrangement of passages and ports in the casing for supplying air from the train-pipe through the main valve to the car-reservoir, and for operating the piston of the valve controlling the passage of air from the train-pipe direct to the brake-cylinder; Fig. 4, a detail, being a face view of the valve for controlling the piston of the valve for the direct passage of air from the train-pipe to the brake-cylinder; Fig. 5, a face view of the valve controlling the passage of air from the car-reservoir to the brake-cylinder; Fig. 6, a cross-section through the valve; Fig. 7, a longitudinal section showing the valve controlling the passage of air from the train-pipe direct to the brake-cylinder.

This invention relates to air-brakes in which a valve operated by a piston controlled by train-pipe pressure is employed for admitting air from an auxiliary reservoir on the car to a brake-cylinder for applying the brake and for venting the brake-cylinder to release the brakes, and a second valve operated by train-pipe pressure to open direct communication between the train-pipe and the brake-cylinder for applying the brake by direct action of the train-pipe pressure is employed.

The object of the invention is to improve the construction and operation of the means employed for admitting train-pipe pressure to the car-reservoir and for operating the valve which controls the direct communication between the train-pipe and the brake-cylinder; to improve the construction and operation of the main valve and its actuating-piston; to improve the construction and operation of the valve controlling the direct communication between the train-pipe and the brake-cylinder; to improve the construction of the valve in regard to drainage, and to improve, generally, the construction of the valve as a whole.

In the drawings, A represents the train-pipe.

B is a pipe leading from the train-pipe to the valve, and this pipe B is provided with a shut-off cock *a*, by means of which the brake apparatus of any one car can be cut out in case of a failure of the valve to perform its work, or for other cause; and the pipe B is provided with a union *b*, by means of which the valve can be taken down or removed from the car without taking down the train-pipe, to do which all that is required is to disconnect the pipe B by unscrewing the union, thereby disconnecting the valve from the train-pipe.

C is a chamber into which the pipe B leads through a port *c*, and, as shown, the connection between the pipe B and the port or passage *c* is had by an elbow-coupling B′ and a pipe *b*′, which screw-threads into the elbow-coupling B′ and the port or passage *c*.

D is a shell or casing surrounding the chamber C, and through the wall of which the port or passage *c* is made, so that when the valve is in place on the car the port or passage *c* will be at the bottom or under side of the shell or casing, bringing the connecting-pipe B on the under side of the chamber C.

E is the shell or casing for the main valve, formed with which is the shell or casing D.

F is the chamber inclosed by the shell or casing E, and in which is located the main valve and its piston. The chamber C has a port *d* leading into a passage *e* of the wall or casing E, which passage, through a passage *f*, communicates with the chamber F, so that a communication is had between the chambers C and E and through the pipe B with the train-pipe A, by which air from the train-pipe passes through the pipe D into the chamber C, and thence through the passages *d*, *e*, and *f* into the chamber F.

G is a cap or cover for closing the end of the chamber F, which cap has a flange, through

which and a flange on the end of the wall or casing E bolts g' pass for securing the cap G in place, and the joint between the wall or casing E and the cap or cover G is made air-tight by a suitable packing g.

H is a chamber in the cap or cover G.

I is a resisting-spring located in the chamber H, and against which the main piston abuts when the main valve is lowered to the limit of its initial movement for a grading pressure, and the further lowering of the main valve depresses the spring I for its reaction to assist in returning the piston on the restoration of the train-pipe pressure.

J is a circular disk or plate having a central hub projecting beyond the face of the plate, which hub engages the spring I.

K is a circular plate or disk corresponding to J, and having a central hub, through which is a screw-threaded hole coinciding with a screw-threaded hole in the plate or disk J.

L represents cup-leathers forming a packing and secured between the disks or plates J and K, and these parts J, K, and L form the piston for the main valve.

M is a stem onto which the disks or plates J and K are screwed to compress the cup-leathers L between them, as shown in Fig. 1.

N is a head screw-threaded onto the end of the stem M, as shown in Fig. 1. The hub or center of the plate or disk J has a passage h leading into a chamber h' in the end of the stem M, which passage is controlled by a valve i on a stem i', and is held to its seat by a spring i'' around the stem i' in the chamber h', and leading from the chamber h' in the stem M is a passage j, which leads into a chamber j' in the end of the stem M, and from this chamber j' a passage k leads through the head N, with which passage k side passages k' communicate, and the passage k is controlled by a valve l on a stem l', and is held seated when the main valve is lowered by a spring l'' around the stem l' in the chamber j, and the valve l is opened when the main valve is in its normal position by the engagement of the stem l' with the cap or cover of the shell or casing E, as shown in Fig. 1.

The valve i seats in the direction of the cap or cover G and against train-pipe pressure, and the valve l seats in the opposite direction to the valve i, and in use, after the main valve has been returned by an increase of train-pipe pressure below its piston, such pressure being greater than the pressure in the chamber h' on the back of the valve i, such valve will be opened, allowing the train-pipe pressure to pass through the opening h in the chamber h', and thence through the passage j in the chamber j', and as the valve l is opened by the contact of its stem l' with the end wall of the chamber F the pressure will pass into the chamber F from the chamber j' through the passages k and k', and from the chamber F the air will pass to the car-reservoir through a suitable pipe, recharging such reservoir, and when the pressure in the car-reservoir and train-pipe is equalized a corresponding pressure will exist in the chamber j', passage j, and chamber h', by which the valve i will be seated, and such valve will be held seated by the action of the spring i''. The valve l is seated and held seated, when the main valve and its piston are lowered, by the action of the spring l'', and when the valve and piston are lowered the valves i and l are both closed, closing the passage-way through the stem M against the admission of train-pipe pressure.

O is a cap or cover for closing the end of the chamber F and the chamber C, and between which cap or cover and the end of the shell or case D E is a suitable packing m to make an air-tight joint. As shown, the shell or case D E has a flange for attaching the cap or cover O by means of suitable bolts or otherwise.

P is a pipe leading from the chamber F to the car-reservoir. This pipe passes through or enters an opening therefor in the cap or cover O, so that the pipe P leads from the chamber F at the bottom line of such chamber, as shown by the dotted line in Fig. 2.

Q is the car-reservoir, of the usual construction, and secured to the car in the usual manner.

R is a slide-valve controlling the admission of air from the car-reservoir Q through the pipe P and chamber F to the brake-cylinder, and this valve also controls the venting of the air from the brake-cylinder to the atmosphere. The valve R is connected to the piston-stem M by an arm R', the end of which enters an opening n' in the boss or hub n on the inside of the valve R, through which boss or hub a pin o passes, which pin passes through a slot p in the end of the arm R', and around the arm R' is a spring q, one end of which abuts against the stem M and the other against the boss or hub n, by means of which spring the acting face of the valve R is held to its seat against the face of the shell or case E. The slot p permits of a movement of the valve R facewise for the spring q to hold it properly seated, and the opening n' is slightly longer than the width of the end of the arm R', so as to permit a slight movement of the piston before acting to move the valve R.

S is a passage in the wall or shell E and continued in the cap or cover O. This passage S communicates with the chamber F by a port s, and the valve R has a port $r\ r'$, by means of which, when the valve is lowered, communication is established between the chamber F and the passage S when the ports $r\ r'$ and port s are in line, admitting car-reservoir pressure into the passage S to enter the brake-cylinder and apply the brakes with a grading pressure. The passage S communicates with the atmosphere when the valve R is at its normal position by means of a port t, which communicates with a passage u, which passage communicates with a port v, passing through the wall or shell E, as shown in Fig.

1. The valve R, with its ports *r r'* and passage *u*, is shown in Fig. 5. The ports *r r'* are in such relation to the port *s* that when in communication therewith the passage *u* will have passed the port *t*, closing the passage of the air to the atmosphere for the car-reservoir pressure to apply the brake.

T is a cap or cover attached to the cap or cover O in line with the chamber C by bolts *y*, which bolts can also pass through the cap or cover O, for attaching such cap or cover to the end of the cylinder or shell D E.

U is a chamber in the cap or cover T and communicating with the passage S by a passage *w*.

V is a pipe screw-threaded into the cap or cover G to communicate with the chamber U and leading from the chamber U to the brake-cylinder.

W is the brake-cylinder, having therein a piston W' for operating the brakes as usual.

X is a passage in the cap or cover G, communicating with the chamber F back of the piston in such chamber.

Y is a chamber or passage in the cap or cover G, standing at right angles to the chamber H and communicating with such chamber, and with which passage or chamber Y the passage X communicates.

Z is a screw-threaded plug for closing the outer end of the passage or chamber Y, and this plug Z has therein a blow-off cock *z*, as shown in Fig. 2. The passage X is in line with the bottom of the chamber F, and the passage or chamber Y stands downward when the valve is in place on the car. The passage X allows the drip from condensation to pass from the chamber F back of the piston, thereby preventing any accumulation of the condensation in the chamber F at this point, and consequently preventing any sticking of the piston from the freezing of the condensation, and in case the chamber or passage Y becomes filled with the condensation the blow-up cock is opened and the chamber blown out and cleared, and if the condensation should be frozen in the passage or chamber Y, closing such chamber and the passage X, the plug Z can be removed and the ice in the passage or chamber Y removed by chiseling or otherwise to clear the chamber or passage Y and open the passage X, and when the ice is removed the plug Z can be screwed again into place.

1 1 are arms running out from the stem M on opposite sides in line one with the other, and at right angles to the arm R'. Each arm 1, at its outer end 2, is squared on opposite sides, and these square ends enter grooves 3 in the inner face of the wall or casing E, and that portion of the chamber F in which the valve R is located and in which the grooves 3 are formed is of a less diameter than that portion of such chamber in which the piston operates, as shown in Figs. 1 and 2. The arms 1, with their square ends 2 and the grooves 3, form guides by which the piston is held in a direct line of travel, maintaining the valve R in its line of travel for its ports and the ports which coact therewith to align properly one with the other.

4 is an arm projecting out from the stem M on the opposite side to and in line with the arm R'.

5 is a slide-valve attached to the arm 4 by a boss or hub *n*, having an opening *n'* to receive the end of the arm 4, in which is a slot *p* for the passage of a pin *o* in the manner similar to the attachment of the valve R to its stem R', except that the opening *n'* is not enlarged, and the valve 5 is held to its seat by a spring *q* in a similar manner to the valve R. The acting face of the valve 5 has therein a passage 6, which communicates when the valve 5 is in its normal position with a port 7, leading through the wall or case E to the atmosphere, and also communicating with a port 8, leading into the chamber C back of a piston in such chamber, as shown in Fig. 1. The piston in the chamber C is formed of a disk 9, having a stem 10, between which disk 9 and a disk 12, screw-threaded onto the stem 10, is a cup-leather 11, which forms the packing for the piston. The stem 10, at its outer end, has secured thereto a valve 13, the acting face of which has a flange or rib to seat on a gasket *x* between the caps or covers O and P, and through this gasket *x* and the cover O is a passage 14, which is closed by the valve 13, and by which communication is had between the chamber U and the chamber 15 in the cap or cover O, which opens into the chamber C, and across the chamber 15 is a bar 16, through which the stem 10 passes, and by which the stem 10 is guided in a direct line of travel. A spring 17 is located between the bar 16 and the disk 12 for returning the piston and holding the valve to its seat, as shown in Fig. 1. A port 18 leads from the chamber C into a passage 19, and from this passage 19 a port 20 leads to the chamber F, but does not communicate with such chamber by reason of the valve 5. The valve 5 has in its acting face the passage 21, by means of which, when the valve 5 is lowered, communication is established between the ports 8 and 20 for air to pass from the chamber C in front of the piston through the port 18, passage 19, and ports 20 and 8 into the chamber C back of the piston, thereby equalizing the pressure on both sides for the train-pipe pressure to open the valve 13 and allow air to pass direct from the train-pipe to the brake-cylinder.

The connecting-pipe B enters the chamber C on the under side of such chamber, so that all water of condensation forming in the chamber C will flow into the pipe B, thus avoiding ice in cold weather and preventing the accumulation of water in the chamber C in damp weather. The chamber F is kept clear of the water of condensation by the passage X, through which the condensation can escape into the chamber or passage Y to be blown

off by the cock *z*, thus preventing the accumulation of the water of condensation in the chamber F back of the piston, and such accumulation in the chamber F in front of the piston is prevented by locating the car-reservoir supply-pipe P at the bottom line of the chamber F and in line with one of the grooves 3, so that the water of condensation will enter the groove 3 and flow into the pipe P to pass to the car-reservoir. It will thus be seen that the valve is kept entirely free and clear from water of condensation, thereby avoiding any freezing of the valve in cold weather and preventing the accumulation of the water of condensation in damp weather.

The cap G, attached to the end of the wall or casing E by bolts, permits the removal of the cap or cover G for access to be had to the chamber F to take out the main piston and its valve for the purpose of repairs or for any other purpose, and by locating the valve to work on the sides of the chamber F, with the water of condensation free to escape, the sticking of the valve in cold weather is avoided, as ice cannot form around and under the valve. The chamber F, formed with a larger bore at its piston end, leaves a surface at the valve end for reseating the valves R and 5 without changing the bore of the piston end of the chamber, thereby enabling the valves to be reseated without trouble and with but little expense.

The cap or cover T, with its chamber U, and the cap or cover O, with its passage 14 and chamber 15, furnish a communication between the chamber C and brake-cylinder, which is controlled by the valve 13, and also permits of the proper location of the valve 13, and the gasket *x*, held in place between the covers T and O, makes an air-tight joint for preventing the escape of air at this point, and also furnishes a seat for the valve 13, by which the escape of air around the valve is wholly prevented, thereby stopping leakage around the valve 13, and by providing the bar 16 a guide is had for the stem 10 of the piston and a means provided for placing the spring 17 around the stem 10, so as to act properly, and the locating of the spring 17 around the stem 10 is had without any inconvenience, as all that is required is to place the spring around the stem and pass the stem through the bar 16 and screw onto its end the valve 13.

The valve 5 may be called a "balance-valve," as the pressure on both of its faces is approximately equal when the valve is in its normal position; but with the valve R it is different, as when the valve is at its normal position no pressure will be on its front or acting face, while car-reservoir pressure is on its back face, tending to hold the acting face of the valve closely to its seat, and in case the piston should stick from any cause the valve R, hugging its seat closely, might prevent the quick action of the piston, and to overcome this objection the slot *n'* is longer than the width of the end of the arm R', allowing a slight movement of the piston without affecting the valve, by which movement the sticking of the piston alone is all that is required to be overcome, so that a quick start of the piston can be had.

The operation is as follows: The train-pipe and car-reservoir, when the car-reservoir is fully charged, will be at an equal pressure, and the corresponding pressure is in the chamber C in front of the piston, while the pressure back of the piston is that of the atmosphere, by reason of the communication had through the passage 6 and ports 7 and 8. A reduction of the train-pipe pressure will produce a corresponding reduction in the chamber F back of the piston, as with the reduction of the train-pipe pressure the pressure in the chamber F will pass out through the opening *f*, passage *e*, and opening *d* into the chamber C, thence out at the train-pipe through the pipe B, a few pounds of reduction in the train-pipe pressure producing a corresponding decrease of the pressure on the back of the piston in the chamber F, by which the car-reservoir pressure will act on the front of the piston and force it down for the disk J to abut the spring I, at which time the port *r r'* lines with the port *s*, for the reservoir-pressure to pass from the chamber F into the passage S, thence through the passage *w* into the chamber U, out through the pipe V into the brake-cylinder W, applying the brakes with a grading pressure. The restoration of the train-pipe pressure returns the piston to its normal position by the pressure passing from the train-pipe through the pipe B, chamber C, opening *d*, passage *e*, and opening *f*, into the chamber F back of the piston in such chamber, and such restoring of the train-pipe pressure by the return of the piston carries the valve R back to its normal position, closing the port *s*, and, through the passage *u*, bringing the ports *t* and *v* into communication for the brake-cylinder to vent to the atmosphere by the pressure passing from the brake-cylinder into the chamber U by the pipe V, thence into the passage S by the passage *w*, and thence to the atmosphere through the port *t*, passage *u*, and port *v*. This setting of the brakes to a grading pressure has no effect on the valve 13, which controls direct communication between the train-pipe and brake-cylinder, as for a grading pressure. The piston in the chamber F in applying a grading pressure is not lowered sufficient for the passage 21 to connect the ports 20 and 8 to equalize the pressure on both sides of the piston in the chamber C, so that for ordinary grading the valve 13 does not come into operation. The valve 13 is actuated by reducing the train-pipe pressure to bring the passage 21 into communication with the ports 20 and 8, for the pressure in the chamber C in front of the piston in such chamber, to pass back of the piston through the port 18, passage 19, ports 20 and 8 into the chamber C, equalizing the pressure in the chamber C on both sides

of the piston, for the train-pipe pressure to act against the valve 13 and open said valve for the train-pipe pressure to pass through the pipe B into the chamber C, and out through the chamber 15 and passage 14 into the chamber U to enter the brake-cylinder W by the pipe V. This venting of the train-pipe pressure direct to the brake-cylinder is only sufficient to reduce the pressure in the chamber F for the car-reservoir pressure to act on the piston in the chamber F and lower such piston to bring the valve R below the port *s*, when the car-reservoir pressure, entering the passage S to pass to the brake-cylinder, as before described, entering the chamber U, will act on the valve 13, and, with the spring 17, will seat such valve against the train-pipe pressure, closing the direct communication between the train-pipe and the brake cylinder. It will thus be seen that the train-pipe pressure is vented to the brake-cylinder direct until the pressure in the chamber F has been reduced to lower the valve R below the port *s*, when the car-reservoir pressure is admitted to the passage S to continue applying the brakes for an emergency-stop, and the admission of this car-reservoir pressure also closes down the valve 13, shutting off the direct passage of pressure from the train-pipe to the brake-cylinder.

The restoration of the train-pipe pressure to return the piston in the chamber F charges the car-reservoir anew, as on the return of the piston the stem *l'* engages the cap or cover O and opens the valve *l*, and the valve *i* is opened by the train-pipe pressure, so that air can pass from back of the piston into the chamber F in front of the piston, and thence to the car-reservoir, until the pressure in the car-reservoir and train-pipe is equalized, when the spring *i''* seats the valve *i* to stop the flow of air.

The lowering of the piston in the chamber F sufficient to set the brakes for an ordinary stop should be effected by a reduction of two or three pounds of pressure in the train-pipe, at which point the piston will abut against the spring I for the ports *r*, *r'*, and *s* to be in communication, and for this operation the valve 5 performs no work, and after applying the brakes for an ordinary stop the train-pipe pressure is restored, returning the piston and venting the brake-cylinder to release the brakes, as already described. The venting of the train-pipe pressure direct to the brake-cylinder for an emergency-stop, and then closing the valve controlling the direct train-pipe pressure by the action of the car-reservoir pressure, causes a reduction in the train-pipe pressure only sufficient to lower the piston in the chamber F to the extent required for the operation of the valve R, so that the train-pipe pressure is only reduced to this extent, and by thus venting the train-pipe pressure direct for each valve the valves on the preceding car become in effect an engineer's relief-valve for the succeeding cars, thereby venting the train-pipe pressure on all the cars almost simultaneously, thereby dispensing with the flow of pressure through the train-pipe to the engineer's valve for a reduction, as has heretofore been required in the use of ordinary air-brakes. This result of making each valve an engineer's valve, so that each car will vent its succeeding car, is had by venting the train-pipe pressure direct to the brake-cylinder only sufficient to lower the valve R for the car-reservoir pressure to pass to the brake cylinder and equalize the brake-cylinder, car-reservoir, and train-pipe pressure, thereby closing the valve 13. It will be seen that by the use of this valve a perfect grading system is had without bringing into use the emergency-ports proper, and when the emergency-ports are brought into use the valve 13 controls the reduction in the train-pipe pressure to produce the best results by only venting sufficient train-pipe pressure to bring into action the emergency-ports, and a simultaneous action is had for all of the valves on the train by making each valve 13 perform the office of an engineer's valve in effect for the succeeding valve, and by preventing accumulation of the water of condensation and avoiding freezing the liability of sticking is overcome.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a brake mechanism, the combination of a train-pipe, an interposed chamber between the train-pipe, brake-cylinder, and main-valve chamber, a pipe leading from the train-pipe to the interposed chamber, a passage leading from the interposed chamber to the main-valve chamber outside of the main-valve piston, a passage leading from the interposed chamber to the brake-cylinder, and a valve controlling the passage from the interposed chamber to the brake-cylinder and operated by train-pipe pressure, substantially as and for the purposes specified.

2. In a brake mechanism, the combination of a train-pipe, an interposed chamber between the train-pipe, brake-cylinder, and main-valve chamber, a pipe leading from the train-pipe to the interposed chamber, a passage leading from the interposed chamber to the main-valve chamber outside of the main-valve piston, a passage leading from the interposed chamber to the brake-cylinder, a valve controlling the passage from the interposed chamber to the brake-cylinder, a piston in the interposed chamber for operating the valve of the passage to the brake-cylinder, ports and passages leading from the interposed chamber to both sides of the piston therein, and a valve controlling said ports and passages, substantially as and for the purposes specified.

3. In a brake mechanism, the combination of a train-pipe, an interposed chamber between the train-pipe, brake-cylinder, and main-valve chamber, a pipe leading from the interposed chamber to the train-pipe, a passage leading from the interposed chamber to

the main-valve chamber outside of the main-valve piston, a passage leading from the interposed chamber to the brake-cylinder, a valve controlling the passage from the interposed chamber to the brake-cylinder, a piston in the interposed chamber for operating the valve for the brake-cylinder passage, ports and passages leading from the interposed chamber on both sides of the piston, a valve controlling such ports and passages, and a piston in the main-valve chamber, operating the valve for the ports and passages, substantially as and for the purpose specified.

4. In a brake mechanism, the combination of a main-valve chamber lying horizontal, a cap or cover for the end of the main-valve chamber, a vertical discharge-passage in the cap or cover, and a horizontal passage leading from the main-valve chamber in line with the bottom thereof to the vertical discharge-passage in the cap or cover for draining the main-valve chamber, substantially as specified.

5. In a brake mechanism, the combination of a main-valve chamber lying horizontal, a cap or cover for the end of the main-valve chamber, a vertical discharge-passage in the lower side of the cap or cover, a horizontal passage leading from the main-valve chamber in line with the bottom thereof to the discharge-passage in the cap or cover, and a plug for closing the discharge-passage in the cap or cover and provided with a blow-off cock, substantially as and for the purposes specified.

6. In a brake mechanism, the combination of a main-valve chamber, a pipe leading from the under side of the main-valve chamber to a car-reservoir, and a passage in the wall of the main-valve chamber for preventing water of condensation from accumulating in the main-valve chamber in front of the piston therein, substantially as specified.

7. The train-pipe A, pipe B, and interposed chamber C, in combination with the passage *d e f* and chamber F, substantially as and for the purpose specified.

8. The train-pipe A, pipe B, union *b*, and chamber C, in combination with the passage *d e f* and chamber F, substantially as and for the purpose specified.

9. The train-pipe A, connecting-pipe B, interposed chamber C, passage *d e f*, and chamber F, in combination with a piston in the chamber C, piston-stem 10, valve 13, passage 14, and chamber 15, substantially as and for the purpose specified.

10. The chamber C, stem 10, a piston on the stem 10, valve 13, and gasket *x*, in combination with the passage 14, chamber 15, bar 16, and spring 17, substantially as and for the purposes specified.

11. The chamber C, stem 10, and piston on stem 10, valve 13, and passage 14, in combination with the chamber U, chamber 15, gasket *x*, and bar 16, substantially as and for the purposes specified.

12. The chamber F, lying horizontal, and end cap or cover G, having the vertical discharge-passage Y, in combination with the horizontal passage X in line with the bottom of the chamber F, and the plug Z, closing the passage Y, substantially as and for the purposes specified.

13. The chamber F and groove 3, in combination with a pipe P, leading from the chamber F at the under side thereof, for drainage purposes, substantially as specified.

14. The wall or casing E and chamber F, in combination with a piston traveling in the chamber F, and having a piston-stem M, the arm R′ and valve R, the arm 4 and valve 5, and the arm 1, having the ends 2 traveling in the grooves 3, for maintaining the travel of the valve and piston in a straight line, substantially as and for the purposes specified.

15. In a brake mechanism, the combination of a main-valve chamber, a piston in said chamber, a piston-stem, an arm projecting from the piston-stem, and a valve controlling the passage of air from the car-reservoir to the brake-cylinder, and having a slot larger than the width of the stem-arm entering thereinto for enabling the piston to move slightly without moving the valve, to overcome any sticking of the piston, substantially as specified.

HARVEY S. PARK.

Witnesses:
O. W. BOND,
H. B. HALLOCK.