(No Model.)

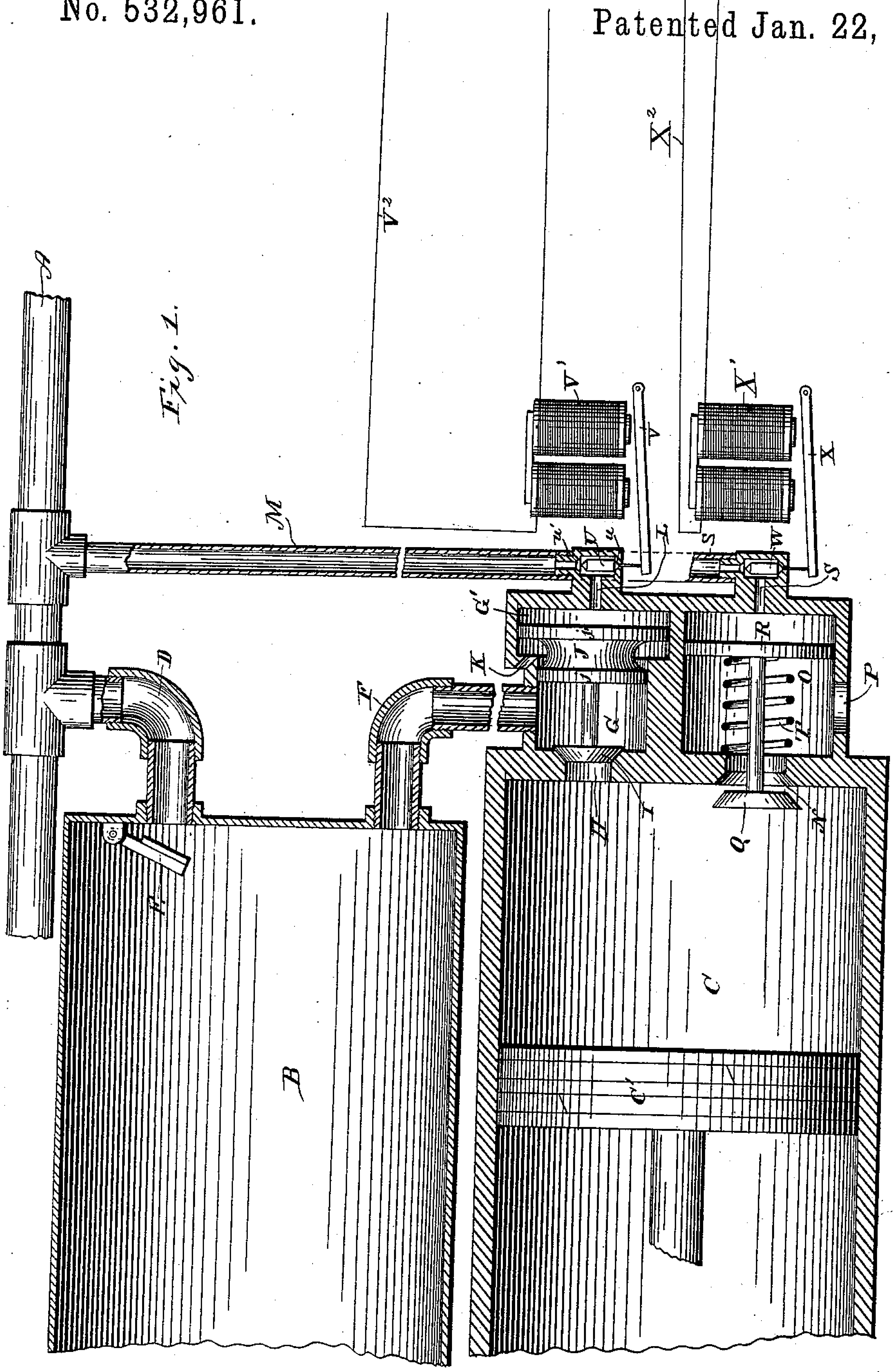
4 Sheets—Sheet 1.

H. HOLLERITH.

BRAKE FOR RAILROAD TRAINS.

No. 532,961.

Patented Jan. 22, 1895.



Witnesses.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

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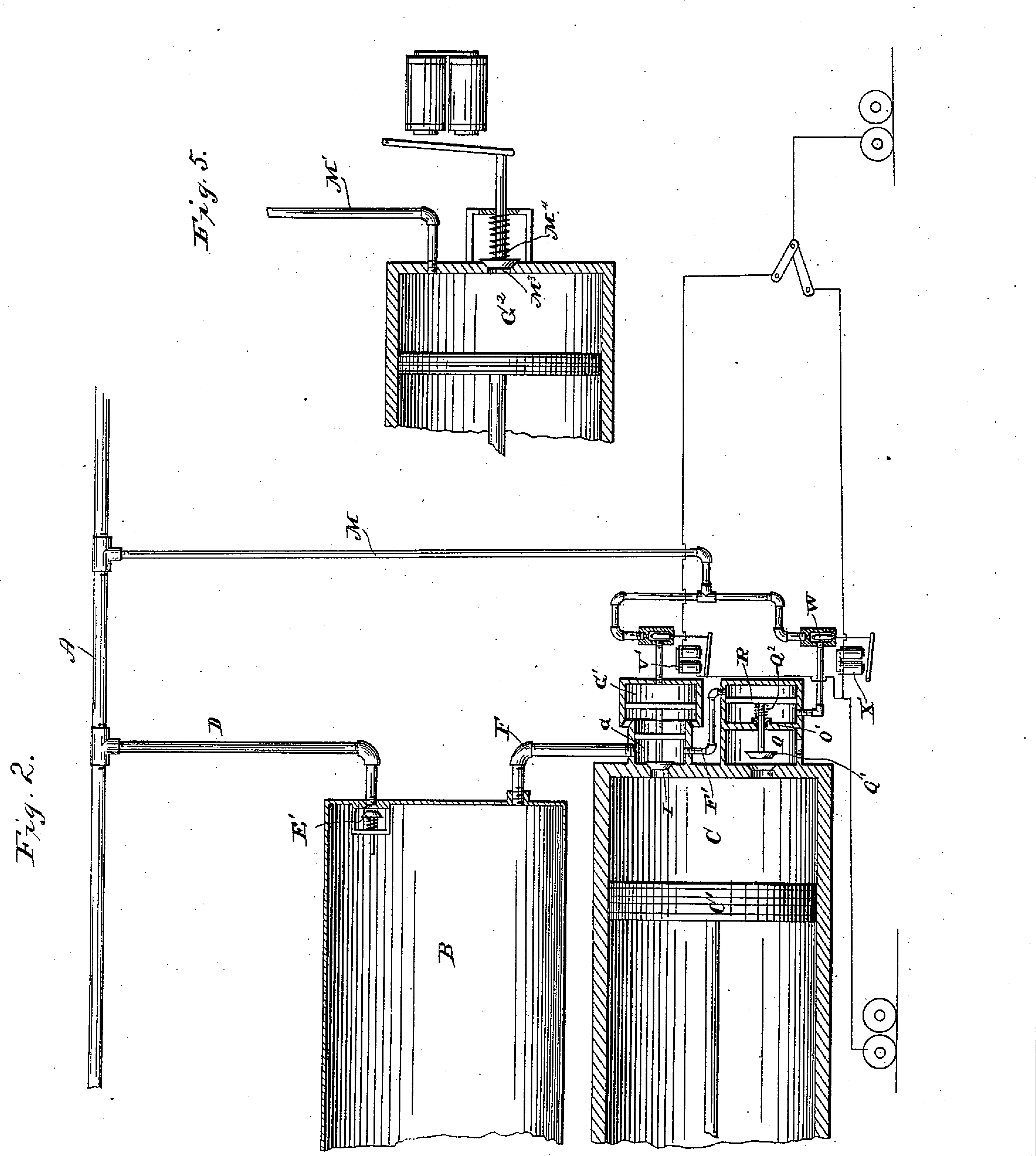

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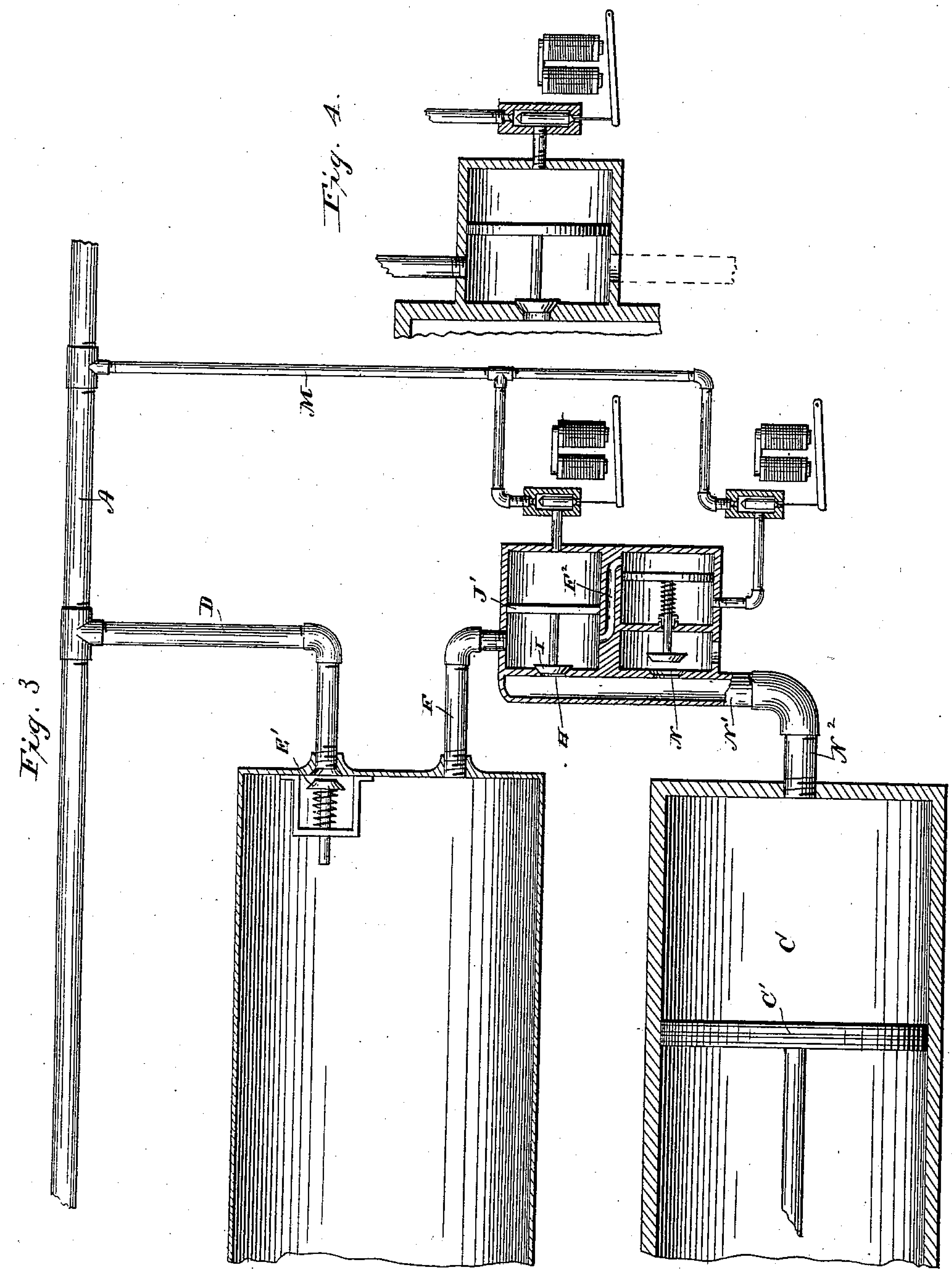

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4 Sheets—Sheet 4.

H. HOLLERITH.

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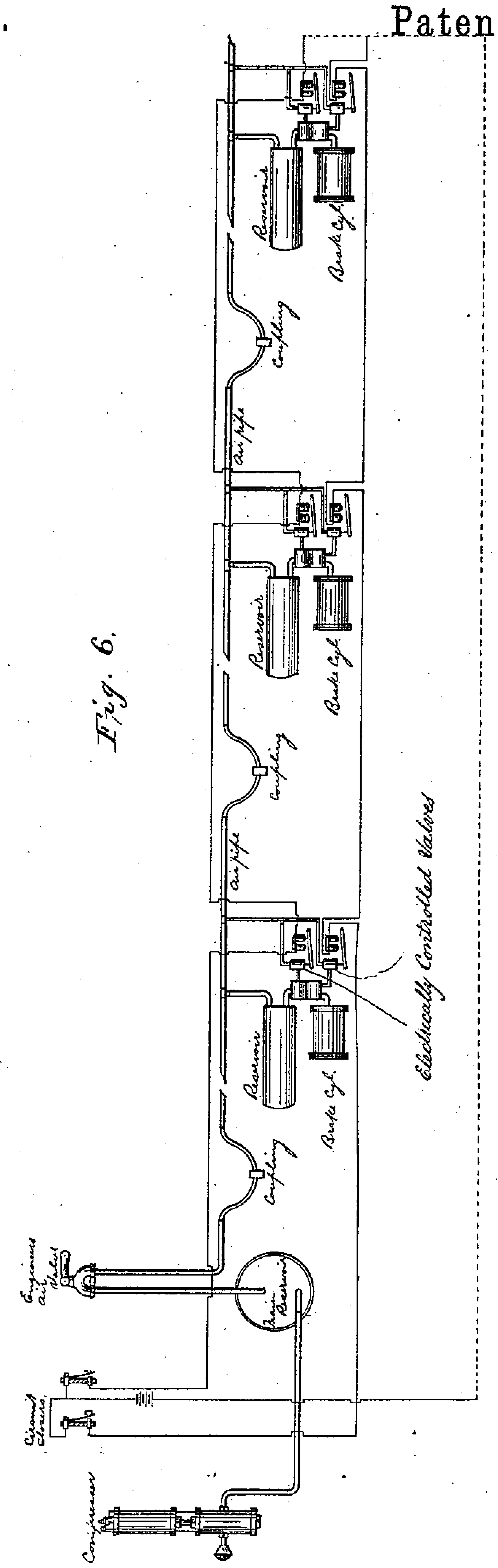
Fig. 6.



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UNITED STATES PATENT OFFICE.

HERMAN HOLLERITH, OF NEW YORK, N. Y.

BRAKE FOR RAILROAD-TRAINS.

SPECIFICATION forming part of Letters Patent No. 532,961, dated January 22, 1895.

Application filed December 16, 1887. Serial No. 258,116. (No model.)

To all whom it may concern:

Be it known that I, HERMAN HOLLERITH, of New York, county and State of New York, have invented certain new and useful Improvements in Brakes for Railroad-Trains; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

My invention relates to that class of pneumatic brakes in which the brakes of each car are adapted to be automatically applied or set by variation of pressure in the main, train pipe,—of which class the Westinghouse, Carpenter, and Eames brakes are types.

The novelty of my invention consists in certain improvements whereby the brakes are enabled to be applied or released either by variation of the pressure in the train pipe produced in the ordinary way or by the operation of electrically controlled valves, all as will be hereinafter fully described and specifically claimed.

Referring to the accompanying drawings:—Figure 1 is a sectional view showing one embodiment of my invention. Figs. 2 and 3 are similar views of modifications of the same. Fig. 4 is a detail view showing a modified construction which may be adopted for operating the valve that controls the admission of pressure to the brake cylinder. Fig. 5 is a detail view of modified means for effecting the withdrawal of pressure from the chamber containing the piston connected to the valve that controls the inlet to the brake cylinder. Fig. 6 is a diagrammatic view of the equipment of a train of cars.

I have only deemed it necessary to herein show the application of my improvements to a compressed air brake system believing that its mode of application to the vacuum and other systems now in use will be readily understood by those skilled in the art without the necessity of entering into specific details with reference thereto.

Referring particularly to Fig. 1, A represents the main pipe which extends through the train and which is normally kept filled with compressed air by means of suitable air compressing and storing apparatus located on the engine.

B is an auxiliary air reservoir and C a brake cylinder such as is preferably located on each car of the train. The reservoir B communicates through a pipe D with the main or train pipe A, a check valve E being provided for cutting off communication whenever the pressure in the train pipe falls below that in said reservoir.

The piston C′ in the brake cylinder C is connected with the ordinary brake mechanism with which the car is provided, as usual.

From the auxiliary reservoir B a pipe F leads to a chamber G which is in communication through a port H with the brake cylinder. The port H is adapted to be closed by a valve I to whose stem is connected a differential piston J, one portion *j* of which fits the chamber G and its other portion *j′* fitting a chamber G′. The chamber G′ in front of the portion *j′* of the piston J is in communication with the atmosphere through an aperture K, while behind said portion of the piston, said chamber is in communication, through a passage L with the pipe M leading from the train pipe A, as shown.

The brake cylinder C is provided with a discharge port N which leads into a chamber O that in turn opens to the atmosphere through a port P. The port N is adapted to be closed by a valve Q which opens inward and to whose stem is secured a piston R that fits the chamber O. The chamber O in rear of the piston R is in communication through a passage S with the before mentioned pipe M leading from the train pipe.

The operation of these devices is as follows: When compressed air is admitted to the train pipe it rushes thence through the branch pipe D opens the check valve E and fills the auxiliary reservoir B. It also passes through the pipe M and passages L S, respectively, into the chambers G′ and O thereby closing the inlet port H to the brake cylinder and opening the exhaust port N from the same, as shown. In this condition of the apparatus the brakes are off. When now from any cause the pressure of air in the train pipe is reduced, as for instance, by the opening of the engineer's air valve, or by the rupture of the train pipe at any point, the check valve E will be automatically closed by the pressure in the auxiliary reservoir and owing to the preponderance of pressure on the forward though smaller portion of the piston J, the valve I will be opened and pressure admitted to the brake-cylinder through the port H. At the same time, through the reduction of pressure in the chamber O behind the piston R, the spring T, operating against the front of said piston R, will be allowed to assert itself and cause the valve Q to close the discharge port N thereby retaining the pressure which flows into the brake cylinder from the auxiliary reservoir and causing the pistons C′ to be moved and the brakes to be applied.

The reduction of pressure in the train pipe necessary to operate the inlet valve is dependent upon the relative size of the pistons *j j′* and of the area of the valve seat H. The operation of the outlet or release valve is dependent upon the tension of the spring T, area of the valve seat Q and piston R and the pressure of air carried in the train pipe.

The pistons *j j′* are of such relative size that the valve I is not operated except by an appreciable reduction of the train pipe pressure, but on the other hand the difference of area is not so great as to prevent the satisfactory graduation of the application of the brake as will be presently explained. The tension of the spring T is sufficient to secure the immediate seating of the outlet valve Q upon a very slight reduction of the pressure in the train pipe. The operation of applying the brake with full force has been explained.

To apply the brakes with only part of the maximum force it is simply necessary to reduce the pressure in the train pipe slightly. This insures the immediate seating of the outlet valve Q and the opening of the inlet valve H. The inlet valve H, however, only remains open until the pressure in the chamber G and the auxiliary reservoir B is sufficiently reduced by expansion into the brake cylinder C to allow the pressure in the train pipe and chamber G′ to again seat the valve H. The brake is thus applied partially, the degree of force with which the brake is applied being directly dependent upon the amount of reduction of pressure in the train pipe. To still further apply the brake it is only necessary to further reduce the train pipe pressure when the operation is repeated.

To release the brakes it is only necessary that the pressure in the train pipe be re-established whereupon the inlet valve I will be closed by the preponderance of pressure created on the rear side of the piston J and the exhaust valve Q will be opened by the pressure on the rear of the piston R overcoming the force of the spring T as well as that of the pressure in the brake cylinder. By this arrangement of devices it is evident that the brakes can be applied or released by the engineer at will, by simply manipulating his air valve so as to exhaust or fill the train pipe, the devices on the several cars all operating automatically in the manner described.

In practice it is found that where the variation in the pressure in the train pipe due to the manipulation of the air valve on the engine is thus relied upon to effect the operation of the valves which admit pressure to and exhaust pressure from the brake cylinder on the several cars, difficulty is experienced in handling long trains, from the fact that the operation of said valves does not take place simultaneously on all the cars, that is to say, the valves on the cars nearest the engine will be operated first and the brakes on those cars applied first, the valves and brakes of the succeeding cars being operated more or less tardily according to their degree of remoteness from the engine; this result being due to the fact that it takes an appreciable time for the pressure in the main pipe to be depleted or renewed from any one point. In order therefore to provide for the simultaneous application or release of the brakes on all the cars I have devised a mode of electrically controlling the operation of the inlet and exhaust valves, leading to and from the brake cylinder, whereby I am enabled to simultaneously operate all said inlet and exhaust valves and apply and release the brakes promptly on all the cars at once. A simple mode of carrying out this part of my invention is illustrated in Fig. 1.

In the passage leading from the chamber G′ to the branch M of the train pipe is arranged a small valve U which normally remains seated over an aperture or port *u* leading to the atmosphere, but which, when raised, covers a seat *u′* and cuts off communication with pipe M. Connected to this valve U is the armature V of an electro magnet V′ which latter is included in an electric circuit V^2 that extends through the train and is adapted to be opened and closed on the engine by the engineer and also at other points if desired. A similar valve W is located in the passage leading from the chamber O to the said branch pipe M and is connected to the armature X of an electro magnet X′ in another circuit X^2 that is also adapted to be opened and closed in the same manner as V^2. The operation of these electrically controlled valves U, W is as follows:—Assuming the train pipe and auxiliary reservoirs to be filled with compressed air and the brakes to be held off, if the circuits V^2 and X^2 are simultaneously closed both valves U, W will be lifted together and the rear portions of both the pistons J and R put in communication with the atmosphere whereupon the pressure in chamber G, acting upon the smaller portion of the piston J, will open the valve I and let pressure into the brake cylinder C, while, at the same time, spring T will assert itself and close the valve Q, thus applying the brakes.

To retain the pressure in the brake cylinder and cut the latter off from communication with the air reservoir B it is only necessary to break the circuit V^2 whereupon the valve I will be closed by the re-establishment of pressure behind the piston J. Should it become necessary to renew the pressure in the brake cylinder, as for instance, in coming down long grades during which time the pressure in the brake cylinder may become diminished by leakage the circuit V^2 may be again closed, thereby raising the valve U, opening the valve I and allowing the brake cylinder to be recharged.

To release the brakes it is only necessary that the circuit X^2 be broken which will cause the valve W to drop and the pressure behind the piston R in the chamber O to be re-established thereby causing the exhaust valve Q to open. By thus operating the main valves of a brake system through small supplemental valves instead of operating the main valves directly by the electro-magnets the amount of electricity used in operating the brakes of a train is reduced to a minimum. The employment of these electrically controlled valves U, W does not in the least prevent the application or release of the brakes by the variation of pressure in the train pipe in the ordinary way.

In practice it will be found desirable, however, to ordinarily employ the electrically controlled valves for the reason that they insure the before mentioned simultaneity of action of all the brakes of a train and prevent the jars and shocks incident to the application of the brakes on the separate cars in succession, and to resort to the plan of manipulating the brakes by varying the pressure in the main train pipe by means of the engineer's valve, only when said electrically controlled valves become inoperative through a rupture of the circuit or from other cause.

In Fig. 2 I have shown a modified form of apparatus enabling the brakes to be applied by only a slight variation of the pressure in the train pipe. Referring to said figure it will be seen that the principal changes consist, first, in employing a loaded check valve E′ in the passage leading from the train pipe to the auxiliary reservoir so that the pressure in the reservoir will always be less than that in the train pipe, that is to say, with a maximum pressure in the train pipe of fifty pounds the pressure in the reservoir can never exceed forty five pounds, because of the application to the check valve of a spring of five pounds pressure; secondly, in the employment of an exhaust valve Q′ which opens outward instead of inward as in the construction shown in Fig. 1; thirdly, in dividing the chamber O by a partition O′ causing the stem of the exhaust valve to pass through a stuffing box therein and subjecting the rear of the piston R to pressure from the auxiliary reservoir through a pipe F′ and the chamber G and pipe F, and subjecting the front of said piston R to the pressure of the main train pipe as communicated through the branch pipe M.

In an apparatus thus constructed the brakes can be applied or unset by slight variations of pressure in the train pipe. When the pressure in the train pipe is reduced both the inlet valve I and the exhaust valve Q′ will be directly operated by pressure from the auxiliary reservoir, that is to say, the inlet valve will be opened and the exhaust valve closed and upon re-establishing the pressure in the main pipe both inlet and exhaust valves will be reversely operated by the direct action of the preponderating pressure from the train pipe as will be readily understood.

The electrically controlled valves in this form of apparatus are operated and operate as in the apparatus shown in Fig. 1 their manipulation causing the brakes to be simultaneously applied with more or less power or to be entirely released or unset as desired.

Instead of employing a loaded check valve to secure the preponderating pressure on the forward face of the piston R connected to the exhaust valve, a spring Q^2 shown in dotted lines, may be applied to the said piston R with the same effect.

A somewhat more simple and compact arrangement is shown in Fig. 3. Here, instead of employing two pistons of differential area in connection with the inlet valve I, a single piston J′ operating in a chamber of uniform dimensions throughout is employed and the chambers for the pistons of both the inlet and exhaust valves are formed in the same casing or casting with a channel of communication F^2 corresponding to the pipe F′ in Fig. 2, between them. Both inlet and exhaust ports H N also lead into a common passage N′ formed in said casing or casting and the latter is connected by a single pipe N^2 to the brake cylinder C.

Where it is desired the single piston connection to inlet valve shown in Fig. 4 may be substituted for the double piston arrangement shown in Fig. 2.

Instead of the form of electrically controlled valve shown in Figs. 1, 2 and 3 a direct acting valve such as shown in Fig. 5 (on an enlarged scale) may be employed. In said figure G^2 represents the chamber in which the piston connected to the inlet valve operates, as shown in Fig. 3. M′ is a pipe or port or passage of very small bore leading from the train pipe. M^3 is a port considerably larger than the bore of the pipe M′ and opening to the atmosphere. Said port is covered by a spring pressed valve M^4 which is adapted to be operated by an electro-magnet as shown.

Ordinarily the pressure within the chamber G^2 is not sufficient to open the valve M^4, but when the valve is opened by the action of the magnet the air is exhausted from the chamber G^2 through the port M^3 faster than it can be supplied through the pipe M′, the result being the required reduction of pressure in the chamber G^2.

Since brake apparatus constructed on the plan of my invention are not at all dependent upon the electrical appliances but can be operated by variation of the pressure in the train pipe, cars equipped with my apparatus can be used interchangeably with cars provided with the Westinghouse appliances and used on Westinghouse trains or on any similar trains where brakes are controlled by variation of pressure in the train or main pipe.

In Fig. 6 I have shown diagrammatically the equipment of a train of several cars.

It will of course be understood that the electric circuits extending through the train may be arranged in any of the numerous ways that have been up to this time proposed or practiced in systems of electrically controlled car brakes and electric train signaling.

It is of course apparent that diaphragms may be substituted for the various pistons connected with the inlet and outlet valves and that passages or ports drilled or cast in a suitable casing may be substituted for the different pipes I have shown connecting the different chambers.

I claim—

1. In a brake system, the combination with the main or train pipe, of a reservoir or storage chamber, a brake cylinder, inlet and exhaust valves for the brake cylinder having pistons which are controlled by differential pressure on their opposite sides, of an electrically controlled supplemental valve for controlling the pressure on one side the piston of the inlet valve and thereby regulating the position of said inlet valve substantially as described.

2. In a brake system, the combination with the main or train pipe, of a reservoir or storage chamber, a brake cylinder, inlet and exhaust valves for the brake cylinder having pistons which are controlled by differential pressure on their opposite sides, of an electrically controlled supplemental valve for controlling the pressure on one side the piston of the exhaust valve and thereby regulating the position of said exhaust valve; substantially as described.

3. In a brake system, the combination with the main or train pipe, of a reservoir or storage chamber, a brake cylinder, inlet and exhaust valves for the brake cylinder having pistons which are controlled by differential pressure on their opposite sides, of electrically controlled supplemental valves for controlling independently the pressure on one side of the piston of the said inlet and exhaust valves: substantially as described.

4. In a brake system, the combination with the main pipe extending through the train, of the following equipment on each car viz: a reservoir or storage chamber, a brake cylinder, inlet and exhaust valves for the brake cylinder having pistons which are controlled by differential pressure on their opposite sides, supplemental valves for regulating the pressure on one side of said pistons and electro magnets for operating said supplemental valves; substantially as described.

5. In a brake system, the combination with the main pipe extending through the train, of the following equipment on each car viz: a reservoir or storage chamber provided with a loaded check valve, a brake cylinder, inlet and exhaust valves for the brake cylinder having pistons which are controlled by differential pressure on their opposite sides, supplemental valves for regulating the pressure on one side of said piston and electro magnets for operating said supplemental valves; substantially as described.

6. In the herein described brake system, the combination with the main train pipe, the auxiliary reservoir having a check valve, the brake cylinder, the inlet and exhaust valves, pistons connected to said valves and the chambers within which said pistons work, with the branch of the train pipe communicating with the piston chambers on one side of the valve therein and the supplemental electrically controlled valves located and operating substantially as described.

7. In the herein described brake system, the combination with the main train pipe, the auxiliary reservoir provided with a loaded check valve, the brake cylinder, the inlet and exhaust valves and their pistons, the channel of communication between the front side of the inlet valve piston and the rear side of the exhaust valve piston and the branch of the train pipe leading to the piston chambers; substantially as described.

8. In the herein described brake system, the combination with the main train pipe, the auxiliary reservoir provided with a loaded check valve, the brake cylinder, the inlet and exhaust valves and their pistons, channel of communication between the front side of the inlet valve piston and the rear side of the exhaust valve piston, the branch of the train pipe leading to the piston chambers and the independent electrically controlled supplemental valves; substantially as described.

9. The combination with the auxiliary reservoir and brake cylinder of the casing containing the inlet and exhaust valves, the chambers or cylinders in which the pistons of said inlet and exhaust valves operate, a channel of communication between said chambers and a common passage into which open the ports of both the inlet and exhaust valves; substantially as described.

HERMAN HOLLERITH.

Witnesses:
GEO. KELLER,
C. L. WILLIAMS.