

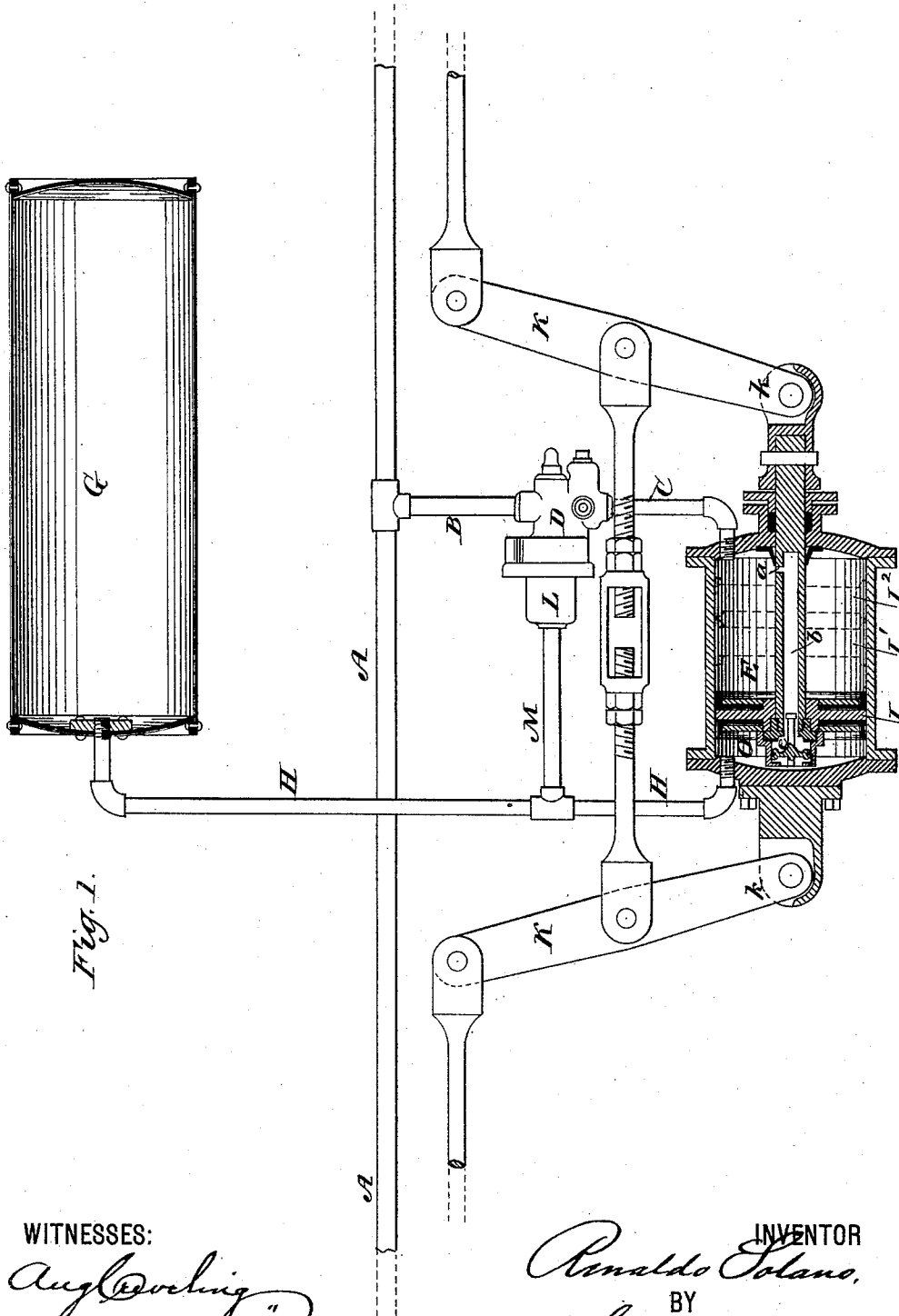
(No Model.)

3 Sheets—Sheet 1.

R. SOLANO.
AUTOMATIC AIR BRAKE.

No. 378,628.

Patented Feb. 28, 1888.



WITNESSES:
Aug. 1888
W. W. Weston

INVENTOR
Rinaldo Solano,
BY
Chas. M. Forbes,
ATTORNEY

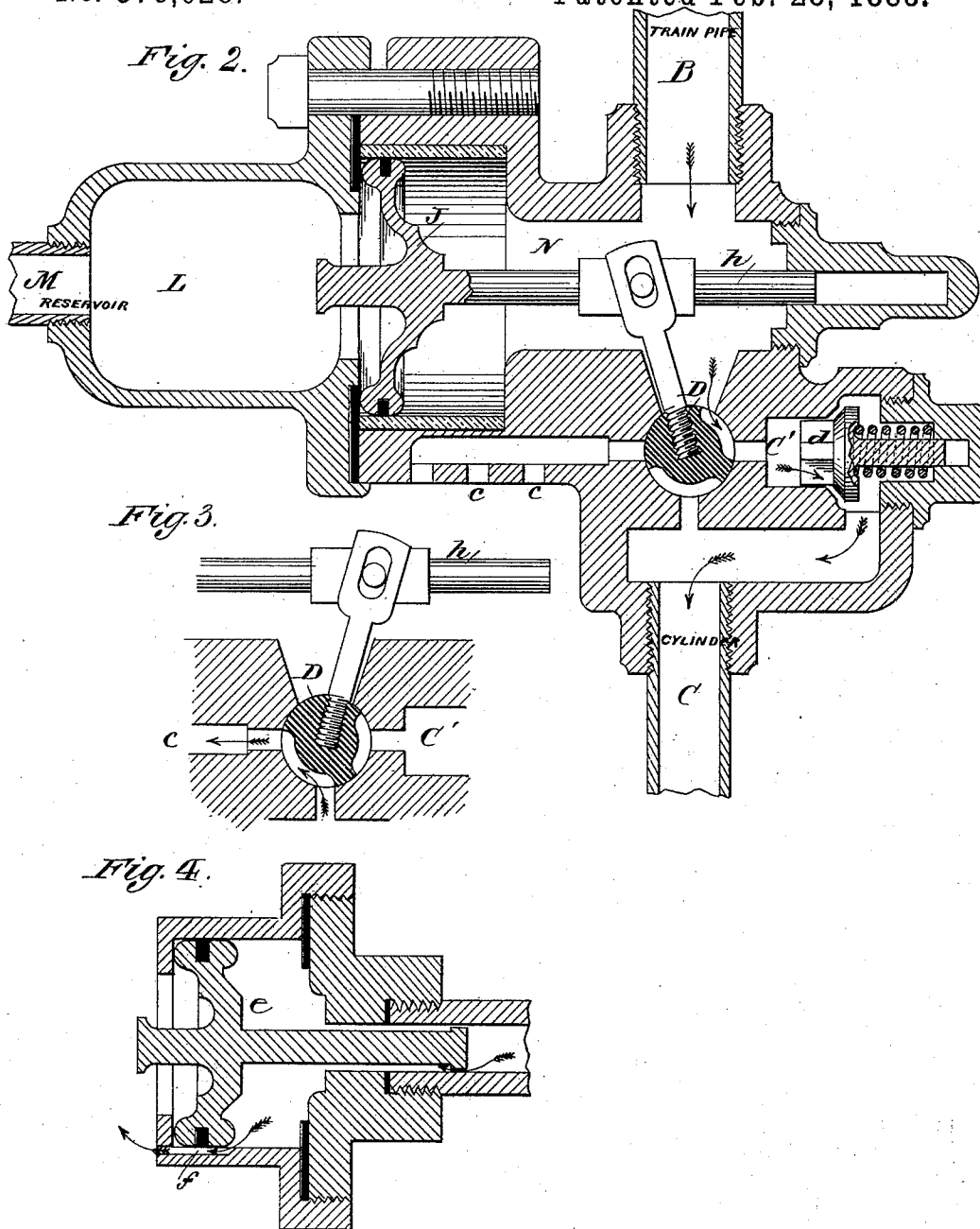
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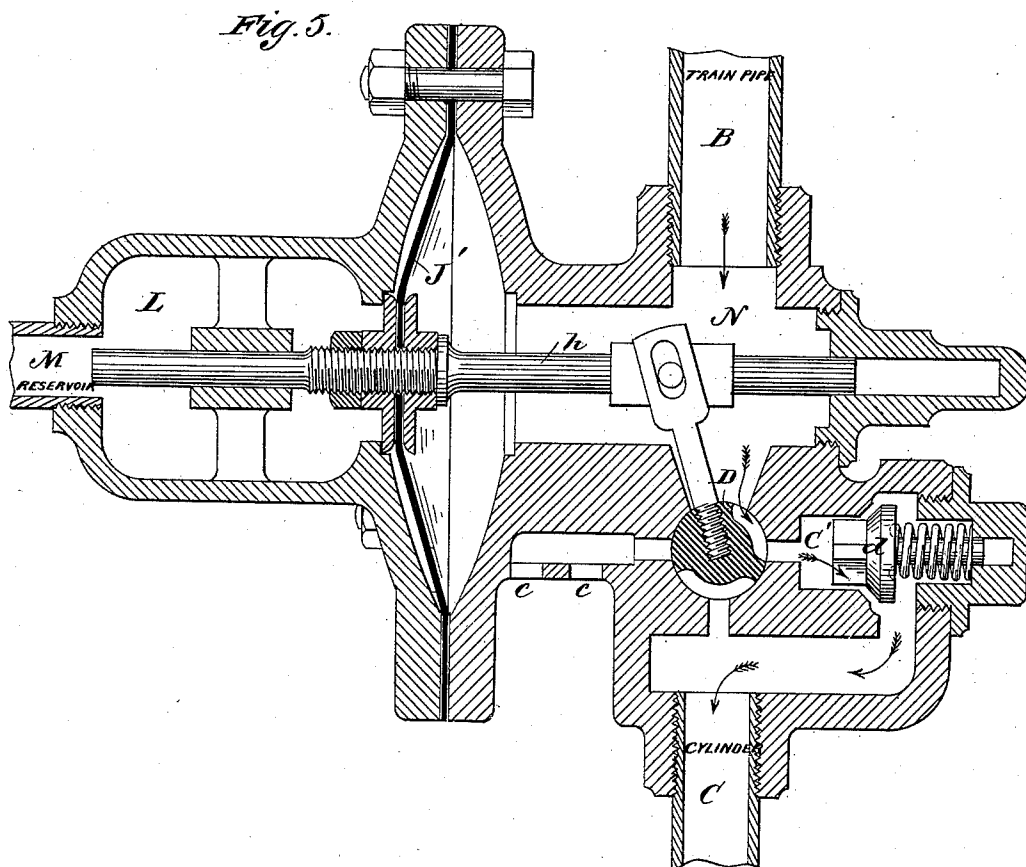
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UNITED STATES PATENT OFFICE.

RENALDO SOLANO, OF BROOKLYN, ASSIGNOR TO HOWARD & MORSE, OF NEW YORK, AND DAVID R. MORSE, OF BROOKLYN, NEW YORK.

AUTOMATIC AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 378,628, dated February 28, 1888.

Application filed July 5, 1887. Serial No. 243,317. (No model.)

To all whom it may concern:

Be it known that I, RENALDO SOLANO, a citizen of the United States, residing at the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Automatic Air-Brakes, of which the following is a specification.

The invention relates to improvements in that class of fluid-brake apparatus in which stored pressure is rendered active upon the braking appliances automatically by the reduction or exhaustion of pressure from the train-pipes.

In the class of apparatus to which this invention appertains, such as has been heretofore employed or described in various patents, the stored pressure has been rendered active either by allowing the exhaust-air from the brake-cylinder to escape through the train-pipe, by discharging the cylinder-exhaust to the atmosphere through a relief-valve actuated by said exhaust upon reduction of pressure in the train-pipe, or through a relief-valve actuated by back-pressure from the pressure side of said cylinder upon reduction of pressure in the train-pipe, each of said methods involving a considerable loss of time in effecting the necessary reduction of train-pipe pressure to actuate the relief-valve, and the latter method—namely, actuating the relief-valve from the pressure side of the cylinder—as hitherto practiced involving a limited capacity of action, sufficient only to effect a full application or a full release of the brakes.

The aim of this invention is to extend the control of the engineer to any desired degree of brake application, and to predetermine both the extent and rapidity of the brake action by noting the pressure indicated on the train-pipe gage, the variable control of the brakes thereby attained effecting a quick, a gradual, or a continuous and moderate application, as required by the grade or the momentum of the train.

The invention comprises a method of controlling the pressures upon the brake-piston by balancing the relief-valve-actuating mechanism between the opposing pressures—namely, the stored pressure and the train-pipe pressure—so that the reduction of either shall actuate the said valve, and that a given reduction of train-pipe pressure shall predetermine the period of cylinder-exhaust and con-

sequent brake-stroke and enable the brakes to be applied variably at will.

In order that others skilled in the art to which my invention appertains may be enabled to understand and use said invention, I will proceed to describe the details of construction of an apparatus embodying my method, explain its operation, and subsequently point out in the appended claim the features of said method and of the apparatus which I claim as new, having reference to the accompanying drawings, forming a part of this specification, and in which like letters of reference indicate corresponding parts in the several views.

Figure 1 is a view taken in plan, showing the arrangement of mechanism located beneath each vehicle, the brake-cylinder and reservoir being in section; Fig. 2, an enlarged sectional view of the balanced relief-valve in the position for charging the brake-cylinder corresponding to the normal or released position of the brakes; Fig. 3, a view of a portion of Fig. 2, showing the valve in its position of relief corresponding to the applied position of the brakes; Fig. 4, an enlarged sectional view of the brake-piston check-valve, and Fig. 5 a sectional view of a modification of the relief-valve-actuating device.

In Fig. 1, A is the main train-pipe, the usual couplings for the same between the cars, the main reservoir to which it connects, the air-compressor, and the engineer's operating-valve being of the ordinary construction. The pipes B C communicate from said train-pipe through the interposed relief-valve D and with the chamber E of the brake-cylinder F when the relief-valve is in the position of Fig. 2. Communication is opened thence, through the passage *a* and hollow piston-rod *b* and pipe H, to the storage-reservoir G when the piston I is in the position of full brake-release, as in Fig. 1. The relief-valve being reversed to the position of Fig. 3, the cylinder-chamber E is open to atmospheric communication through the pipe C and passages *c*, the train-pipe communication being severed and the piston I made subject to pressure from the reservoir G to set the brakes.

To prevent back-pressure from filling the train-pipe from the cylinder-chamber E when the air is reduced in the former and during the interval of the shifting movement of the relief-valve, a check-valve, *d*, is provided in

the passage C', having any suitable construction.

To prevent the escape of the stored air in the reservoir G through the piston-rod *b* at the interval of starting the stroke, a check-valve, *e*, is provided in the piston I, also having any suitable construction, but preferably that shown, in order that its closing action over the port *f* (Fig. 4 showing its open position) may be instantaneous and precede its event of seating.

The brake-levers K K and usual rods are connected so that the parting movement of the ends *k* of said levers shall set the brakes.

The storage-reservoir pressure is permanently confined, excepting the portions of air that may escape by leakage and for which provision is made, as described, for restoring during the intervals when the brakes are normal. To the reservoir-pressure the chamber L is permanently connected by pipe M, and the relief-valve piston J exposed on the one side to said chamber L and on the opposite side to the train-pipe pressure in chamber N, the piston J having the valve-connection shown, so as to operate the valve D to the positions of Figs. 2 or 3, according as the pressures in chambers L and N are unbalanced. The diaphragm J', Fig. 5, may be similarly employed as an equivalent, or likewise any suitable valve-operating device that is sensitive to slight variations of pressure.

The valve D is preferably of the construction shown, consisting of a cock or plug of sufficient length to give the required area of ports, said valve having a small diameter and being arranged to control the ports by its oscillation and with minimum friction. A sliding valve or a sliding plug attached to the stem *h* may, however, be employed to perform like functions; and I do not confine myself to the exact arrangement of valve and valve-ports shown, provided the action is the same in effect.

In the operation the train-pipe A, pipe B, valve-chamber N, pipe C, cylinder-chambers E and O, pipe H, valve-chamber L, and storage-reservoir G are charged to the normal air or other fluid working pressure. Assuming that the brakes are partly set when the piston I is at the position I' and fully set when said piston is at the position I², (shown by dotted lines,) the confined reservoir-fluid will have been reduced in pressure proportionately to these piston movements. Should the train-pipe pressure be reduced below the degree of reservoir pressure corresponding to the point I² of the piston travel, the relief-valve D will manifestly be shifted and retained at the position of Fig. 3, the cylinder-exhaust becoming complete, and the brakes be fully set in the usual manner of automatic brakes, and there retained until the release operation is effected by recharging the pipes. However, should the train-pipe reduction be limited to a degree of pressure known to correspond with that reached in the reservoir upon arri-

val of the piston I at the point I', the movement of said piston will be arrested by the return shifting movement of the relief-valve D to the position of Fig. 2, as the pressure in chamber L reaches and falls slightly below that of chamber N, (in practice, say, one-fourth pound per square inch,) and the shifting of said valve D will thereupon cause an immediate balancing of the piston I between the two pressures, the valve-piston J or diaphragm J' remaining also balanced and stationary. A positive predetermination of a variable brake-stroke is thereby obtained at the will of the engineer by his observation of the train-pipe-pressure reduction. Any return movement of the piston which would appear to take place upon arrest of the braking-stroke by the balancing of the pressures is in practice not observable nor sufficient to release the brakes in any material degree, the piston I following up the exhaust-reduction closely, and the action of the relief-valve being sufficiently prompt to obviate such return movement. Furthermore, the release brake-stroke is likewise subject to direct and positive control from the engineer's charging-valve, the relief-valve D remaining stationary upon a gradual or rapid increase of train-pipe pressure at will to the point desired, rendering the apparatus as positive and controllable one way as the other.

It will be observed that the slight reduction of train-pipe pressure required to start the brakes (say one-fourth pound per square inch) will render the action throughout a train of considerable length practically simultaneous.

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

In an automatic fluid-brake system, the method described, consisting of, first, reducing the active controllable pressure to a desired degree upon a valve piston or diaphragm, whereby a permanently-stored pressure on the opposite side of the diaphragm or valve-piston is allowed to act; second, simultaneously severing and partially exhausting the active controllable pressure from the brake-cylinder, which allows the stored air to expand to a degree below the controllable pressure; third, arresting the exhaust-pressure from the brake-cylinder and simultaneously restoring the active controllable pressure thereto, (which is effected by the reduction of the permanently-stored air-pressure on the opposite side of the valve piston or diaphragm,) which compresses the stored air-pressure in the brake-cylinder to an equal pressure to retain the brake action, and, fourth, increasing the active controllable pressure in the brake-cylinder to effect a release of the brake action.

RENALDO SOLANO.

Witnesses:

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AUGUSTUS CREVELING.