(No Model.) 2 Sheets—Sheet 1.

R. SOLANO.

AUTOMATIC AIR BRAKE.

No. 406,006. Patented June 25, 1889.

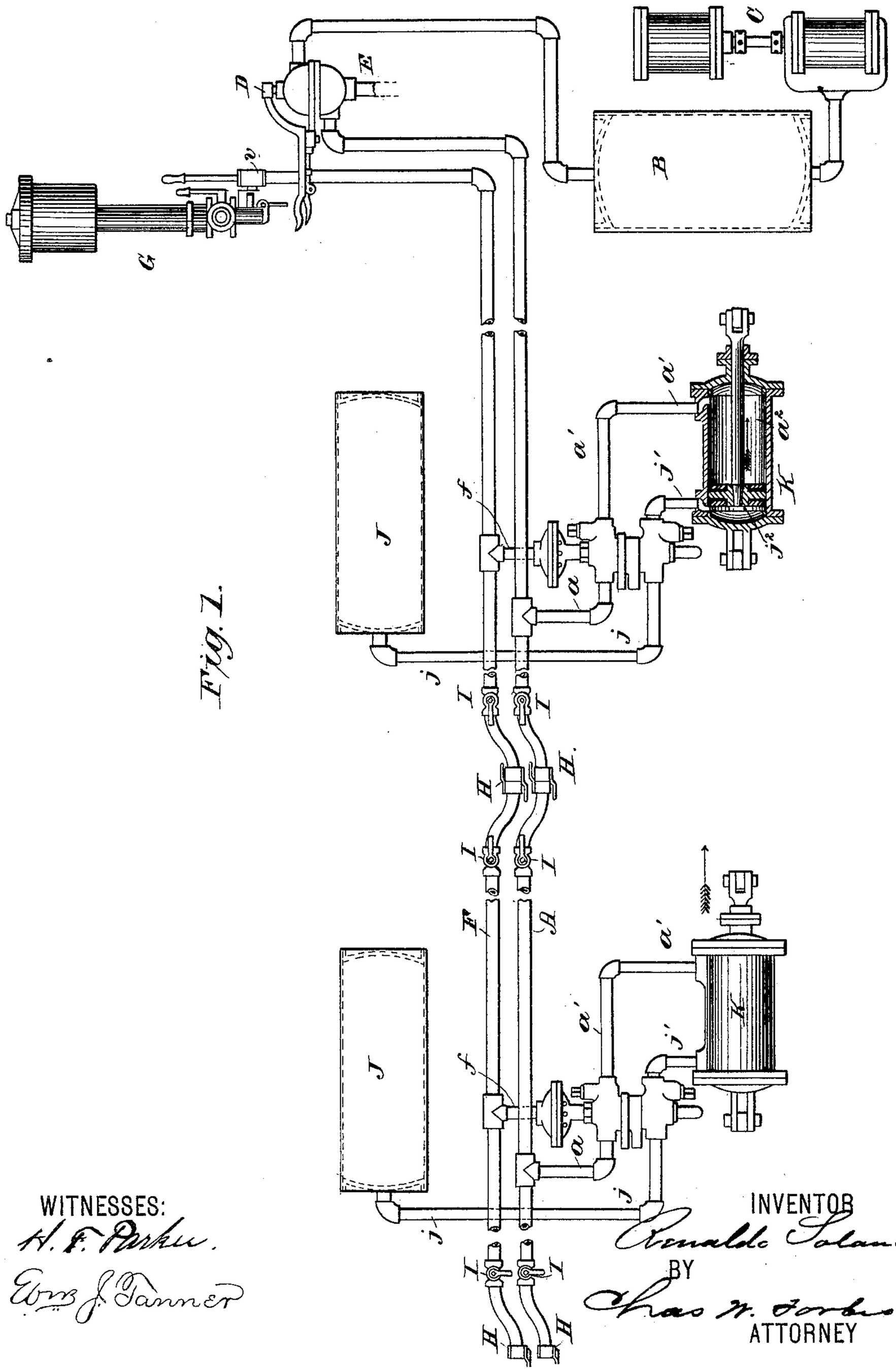

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

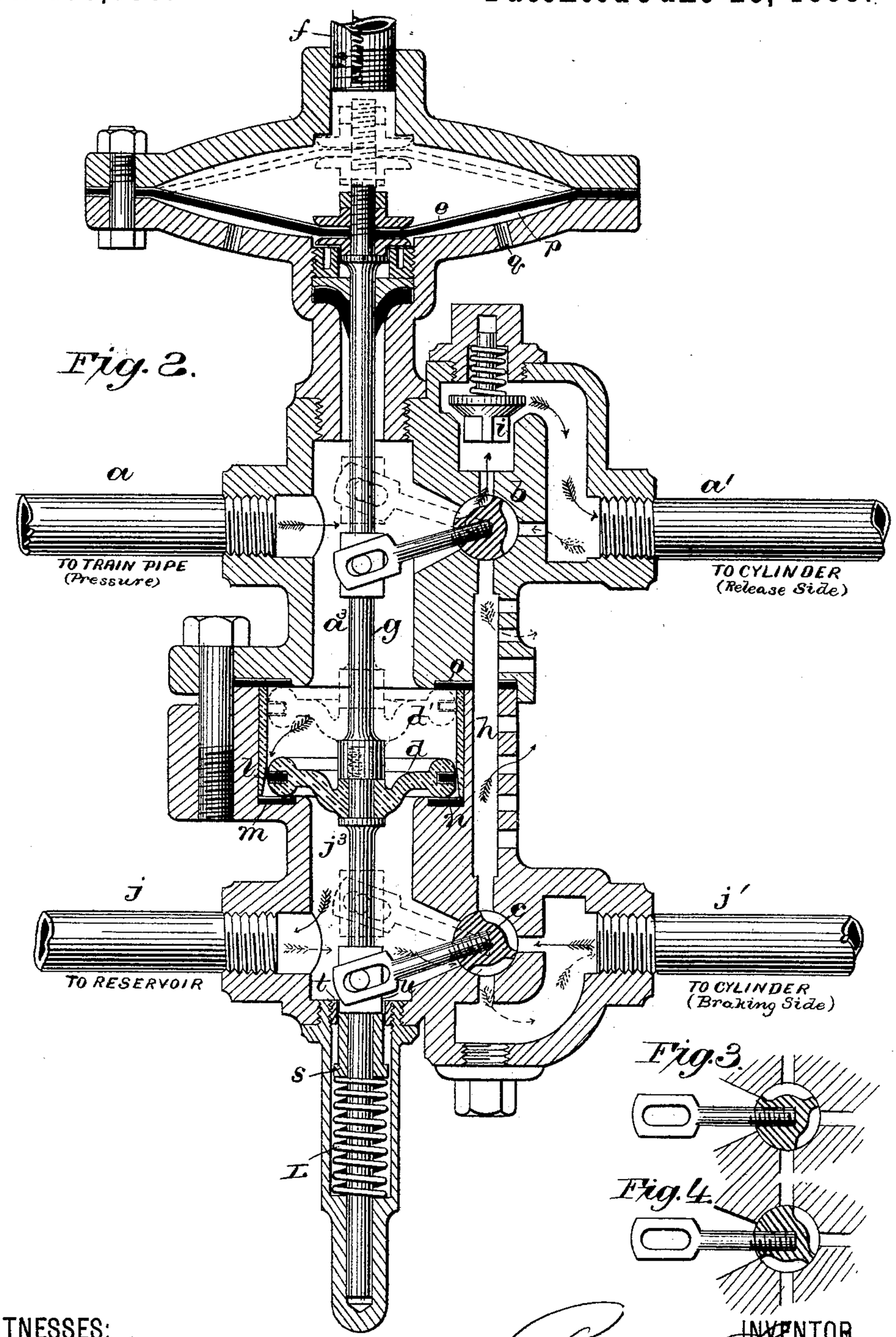

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 406,006, dated June 25, 1889.

Application filed December 6, 1887. Serial No. 257,112. (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 that will enable others skilled in the art to which my invention appertains to understand and use the same, reference being had to the accompanying drawings, in which—

Figure 1 is a plan showing diagrammatically the general organization of an apparatus embodying my invention applicable to the cars and locomotive of a train; Fig. 2, an enlarged sectional view of the automatic brake-valves; and Figs. 3 and 4 detail views, showing said valves at mid-stroke.

This invention relates to the class of fluid-brake apparatus in which stored pressure is rendered active upon the braking appliances automatically by the reduction of pressure in the train-pipe; and the said invention comprises a system of automatic mechanism for controlling the brake-cylinder valves subordinate to said reduction of train-pipe pressure, and also subordinate to an independent system of vacuum or direct exhaust below the atmospheric pressure in separate train-pipes, the method of practicing the invention being claimed in a patent granted to me January 24, 1888, No. 376,970.

By the present invention the control of the engineer is extended to a variable degree of brake application predetermined by noting the reduction of pressure indicated by the train-pipe gage, the produced effect corresponding to that described in my application for a patent filed July 5, 1887, Serial No. 243,317. The actuating mechanism for the brake-cylinder valves in the present instance is balanced between the opposing pressures—namely, the stored pressure and the train-pipe pressure—so that the reduction of either shall actuate the said valves and that a given reduction of train-pipe pressure may be employed to predetermine the extent of brake-stroke by limiting both the period of cylinder-exhaust and the period of braking-pressure application simultaneously on opposite sides of the brake-piston. In the employment of the vacuum or direct-exhaust system in conjunction herewith, the feature of controlling the extent of brake-stroke by the unbalancing of opposing pressure to a degree given at will is dispensed with, this vacuum system being combined with the pressure-reduction system for the purpose of affording an additional and independent means of controlling the brakes.

In Fig. 1, A is the pressure train-pipe receiving its charge from the main reservoir B and air-compressor C, under control of the engineer's operating-valve D, located usually upon the locomotive, the escape-pipe E affording alternate means of discharging pressure from said train-pipe A when the operating-valve D is moved for that purpose.

F is the vacuum train-pipe, from which the atmospheric pressure normally contained therein is withdrawn by means of the ejector G, the latter being of any well-known construction. The said train-pipes are provided at their junctions between the cars with the usual flexible pipe-couplings H, and are also provided at these points with cocks I, those rearmost of the train being kept closed.

J J are the auxiliary or storage reservoirs provided to each brake apparatus, located beneath the several cars, and K the brake-cylinders, the latter being of ordinary double-acting construction, as shown by the sectioned cylinder and connected to the brake-levers, so as to apply the brake when the pistons move in the direction indicated by arrows.

Referring to Fig. 2, the several pipes *a a' j j'* and the pipe *f* correspond to those similarly designated in Fig. 1, and the connections of the same will therefore be understood.

By the arrangement of valve-ports shown the train-pipe pressure (of chamber a^3) and the storage-reservoir pressure (of chamber j^3) are alternately connective to the corresponding sides of the brake-cylinder—namely, the release side a^2 and the braking side j^2, respectively—the common exhaust-port *h* relieving the disconnected side in each instance by communication to the atmosphere.

The valves *b* and *c* are cylindrical and of sufficient length to give the required area of ports, and having a small diameter oscillate by the shifting movement of the piston *d* or

diaphragm e and valve-stem g with minimum friction.

The check-valve i is provided to prevent back pressure from the cylinder-chamber a^2 from filling the train-pipe a when pressure is reduced in the latter and during the shifting movement of the valve b.

The brake-cylinder valves are here shown in the position whereby brake-release is effected and the storage-pressure recharged, the opposite or braking position being indicated by the dotted lines, the corresponding movements of the fluid-currents being indicated by the full lines and dotted arrows, respectively. The normal position of the brake-cylinder valves is that of mid-stroke, which is assumed after the equalization of pressures upon the valve-piston d, which event is incident to the termination of a predetermined braking-stroke, or to the completion of the storage-reservoir's charging operation, the action of a spring L, hereinafter described, returning the piston d in the latter instance.

The valve-piston d fits the cylinder air-tight, separating the train-pipe chamber a^3 from the reservoir-chamber j^3, excepting at the position of downstroke, at which time the enlarged portion of the cylinder at l and piston-passages m opposite the packing n permit the pressure restoration. The packings n o are designed to act as cushions to terminate the valve-piston stroke.

The diaphragm e is separated from the chamber a^3 by the packing r, provided to the valve-stem g. The chamber p beneath said diaphragm is open to atmospheric pressure through perforations q. The diaphragm is given an effective area sufficient, when actuated by the exhauster G, to move and retain the valves b c at braking position, overcoming the preponderance of the charging-pressure (the same remaining constant) above the stored pressure when the latter is reduced under the piston d by active expansion.

The retarding-spring L insures against passage of the downward valve-stroke beyond mid-position during the return movement of the piston d incident to the automatic limitation of brake-stroke. The washer s of the spring L slides loosely on the valve-stem g and abuts against the block n, except when disengaged therewith by the retention of its shoulder against the adjustable bushing t, through which its sleeve part moves. It is to be understood, however, that the spring L is not an essential feature of the apparatus, the return movement aforesaid of the valve-piston d being otherwise arrested at mid-stroke by the cessation of storage-pressure reduction through the valve c at the moment of cut-off.

The operation of the invention is as follows: The train-pipe A, pipe a, valve-chamber a^3, cylinder-pipe a', and release side a^2 of the brake-cylinder are charged to the air or other fluid working pressure of the reservoir B, through the engineer's valve D, the parts assuming the position shown by Fig. 2 until the reservoir J is charged, and subsequently the position of mid-stroke. To set the brakes with full application, the pressure is released from the train-pipe A by the engineer's valve, the valve-piston d automatically shifted to the position d' and there retained by the reservoir-pressure, permitting the latter to enter through the valve c to the braking side j^2 of the brake-cylinder, the opposite chamber a^2 thereof discharging its pressure to the atmosphere through valve b. To set the brakes with a limited application, the train-pipe (A) pressure is reduced to a degree known to correspond with the reduction of the storage-pressure by expansion when the brake-piston has reached the desired intermediate point of stroke. The valve-piston d is thereby automatically shifted to the position d' and there retained until the equalization takes place, when the continued reduction on the reservoir side j^3 causes the return movement of said valve-piston sufficient to close all port communication and lock the brake-piston between the confined pressures within the cylinder-chambers. The brake release is effected in either of the aforesaid instances by the restoration of train-pipe pressure from the main reservoir B. The brakes are also fully set when the vacuum train-pipe F is subjected to the action of the exhauster G, operating the diaphragm e and valves b c, as hereinbefore described, the release of the same being effected by subsequently opening the air-charging valve v.

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

1. In the automatic fluid-brake apparatus herein described, the combination of the double-acting brake cylinder and piston, a valve-piston, or its equivalent, permanently exposed to the train-pipe, and auxiliary storage-reservoir pressures connected with oscillating valves which turn through different degrees of a circle by means of the variations of pressure induced on opposite sides of said valve-piston, a retarding-spring to limit the return movement of said valve-piston, and a check-valve interposed between the charging-passage of the oscillating valve and brake-cylinder port, whereby a predominating train-pipe pressure will actuate the valve-piston to simultaneously admit the pressure to the release side and exhaust the pressure from the braking side of said brake-cylinder, and a predominating auxiliary storage-reservoir pressure will actuate said valve-piston to simultaneously admit pressure to the braking side and exhaust the pressure at the release side of said cylinder, and whereby said pressure, when balanced on the valve-piston in conjunction with said retarding-spring, will retain and hold the same and sever all the ports, as and for the purpose specified.

2. In an automatic brake system, the com-

bination of an oscillating valve, substantially as described, for controlling the charging and exhaust cylinder passages, and with a reciprocating piston or its equivalent connected to impart a rocking movement to said valve through different degrees of a circle by means of the variations of pressure induced on opposite sides of said piston or its equivalent, as specified.

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