(No Model.) 3 Sheets—Sheet 1.

R. SOLANO.

AUTOMATIC AIR BRAKE.

No. 387,018. Patented July 31, 1888.

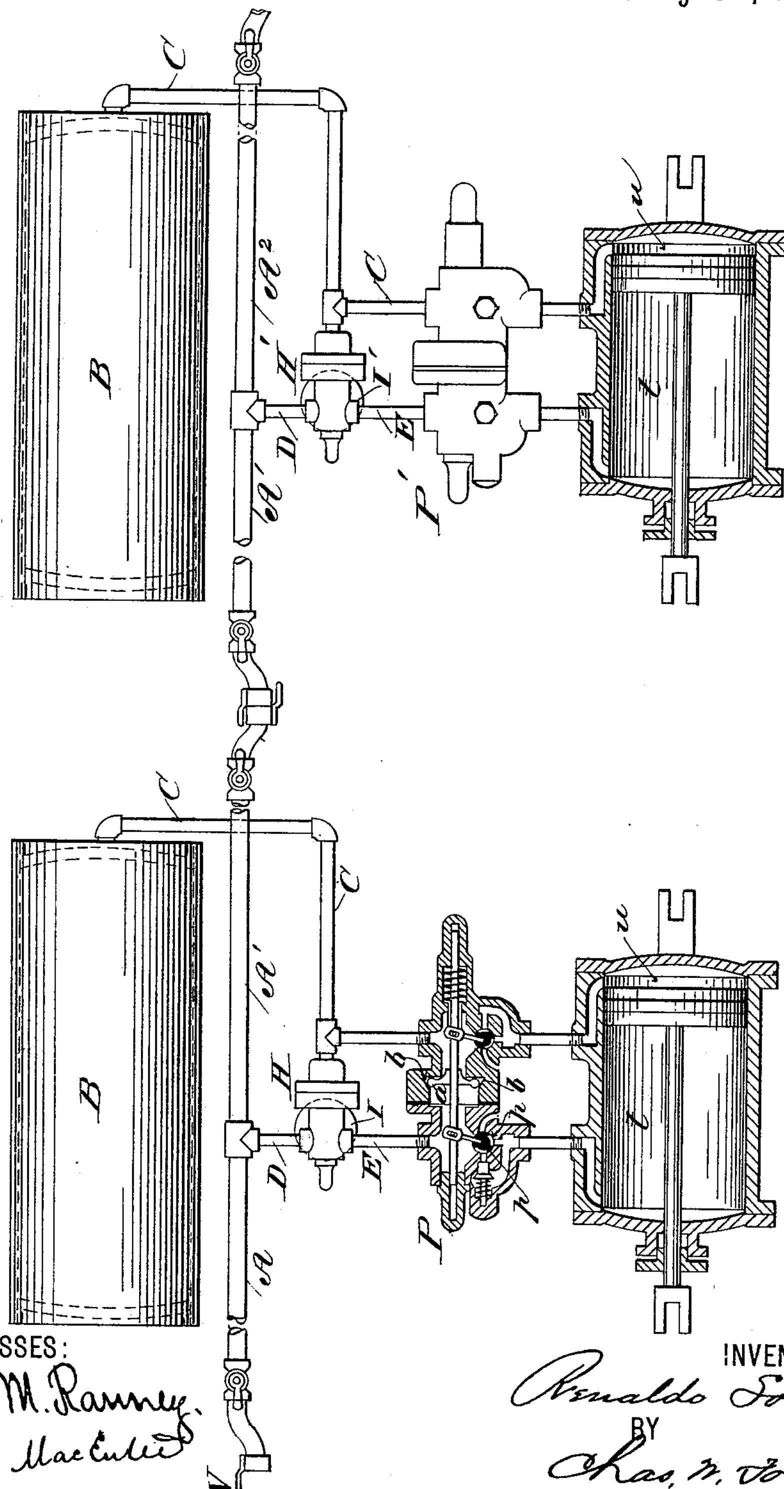

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

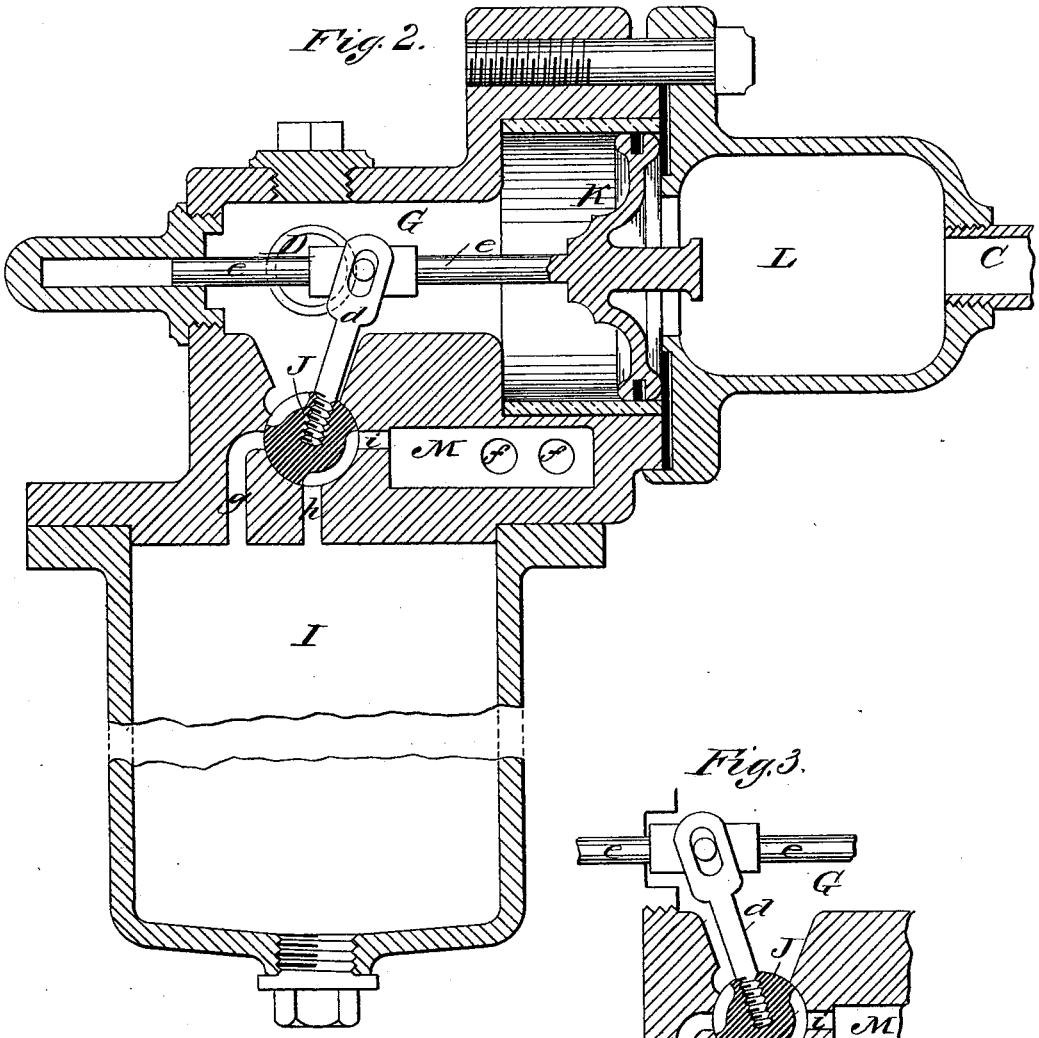
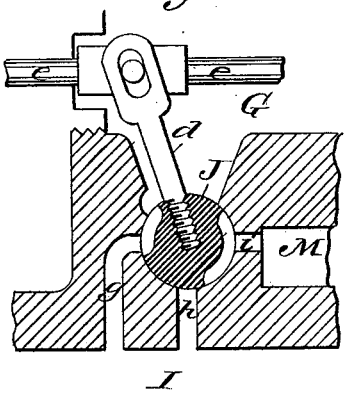


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

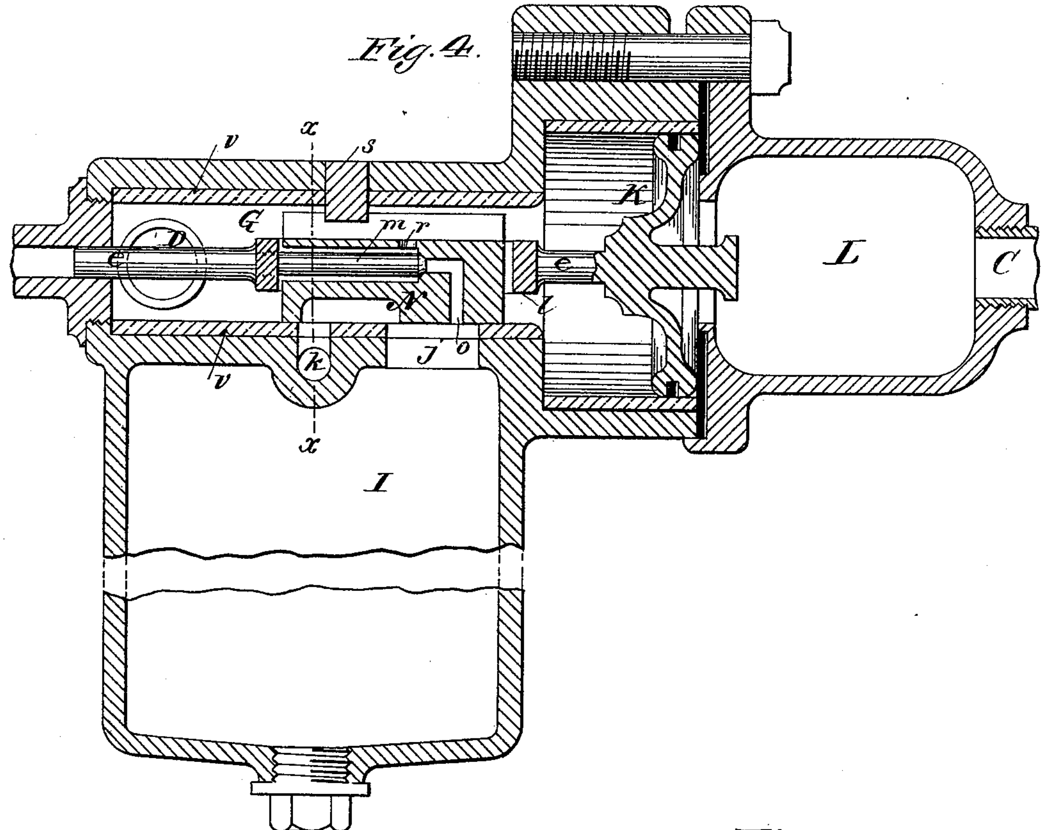


Fig. 5.

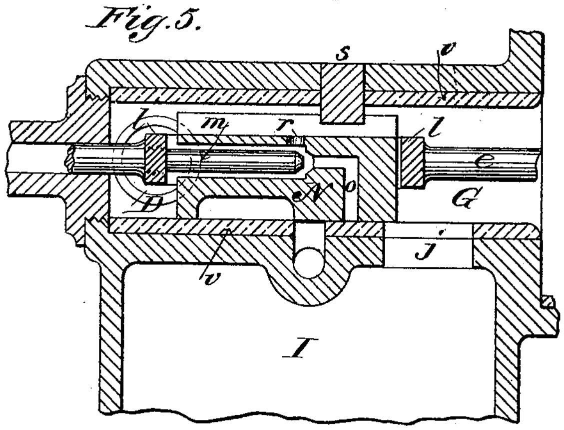
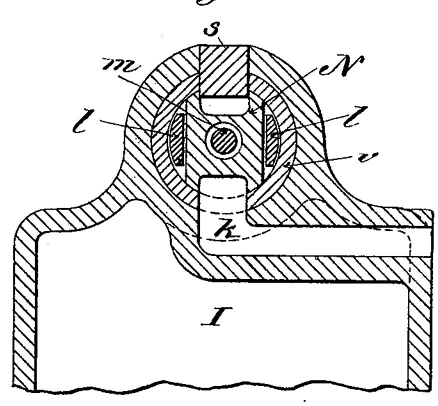


Fig. 6.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 387,018, dated July 31, 1888.

Application filed February 14, 1888. Serial No. 263,995. (No model.)

To all whom it may concern:

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

This invention relates to improvements in fluid-brake apparatus, wherein stored pressure is rendered active upon the braking appliances automatically by the reduction of pressure in the train-pipes; and the present invention consists in employing a separate automatic relief-valve and an expanding-chamber in connection with each section of train-pipe belonging to the respective cars of a train, whereby pressure is exhausted from each section independently and as nearly simultaneously as practicable without the necessity of flowing the entire exhaust-current the total length of the train during the act of reduction through the engineer's operating-valve.

In order to enable others skilled in the art to which my invention appertains to understand and use the same, I will proceed to describe its construction in detail, explain its operation, and subsequently point out in the appended claims the features herein which I believe to be novel.

Referring to the accompanying drawings, in which like reference letters indicate corresponding parts, Figure 1 is a general diagram of the essential parts of the car-brake-actuating devices pertaining to separate cars and showing the invention in connection therewith; Fig. 2, an enlarged central sectional elevation of one of the independent train-pipe relief-valves and its expanding-chamber; Fig. 3, a detail view showing the valve of the same in a reverse position; Fig. 4, a central sectional elevation of a modified construction of the train-pipe relief-valve; Fig. 5, a detail view showing the valve of the same in a reverse position, and Fig. 6 a cross section of Fig. 4 on the line *x x*.

A A′ A^2, Fig. 1, are the several sections composing the main train-pipe, coupled, as indicated, at each junction of the cars, and which is charged in the usual manner from the main reservoir on the locomotive and exhausted by the engineer's operating-valve, together with the aid of the herein-described devices.

B B are the auxiliary or car reservoirs for storage of the brake-actuating pressure, and which are charged through pipes C by communication of the latter with the main train-pipe through pipes D E, when the actuating-piston *a* of the brake-cylinder valves is at the releasing position indicated in Fig. 1, the fluid being permitted at that time to flow around the said piston through its cylinder enlargement until the reservoirs B are charged.

The form of brake-cylinder valves taken for present illustration and their connection and relation to the brake-cylinder F correspond to that more fully described by me in an application for a patent filed November 28, 1887, Serial No. 256,300, and the same will therefore not require detailed description here.

The pipes D and E, connecting from the train-pipe to the brake-cylinder valve *p*, controlling the release side of the cylinder, are intercepted by the train-pipe relief-valves H, (or H′,) shown in plan view in Fig. 1, and having expanding-chambers I, (or I′,) into which they are adapted to admit the train-pipe pressure when rendered operative.

In the details of construction of the valve H, (or H′,) shown in Figs. 2 and 3, the valve proper, J, consists of an oscillating or rocking valve automatically operated by connection of its arm *d* to the piston-rod *e* of its actuating-piston K. The plane of section of the enlarged view, Fig. 2, is taken at right angles to the position shown in Fig. 1, the expanding-chamber I therefore appearing in sectional elevation, and the connection of the pipes D and E to the chamber G are indicated at the sides, as shown at D, and at a point diametrically opposite. The chamber L permanently connects by the pipe C to the storage-reservoir B.

M is an exhaust-chamber having outlets F to the atmosphere and a port, *i*, extending to the valve J. The ports *g* and *h* extend to the valve from the expanding-chamber I at different points to each of the ports in the valve, whereby the connections are effected in the manner clearly illustrated by the two figures, exhausting the expanding-chamber through M to the atmosphere, as in Fig. 2, when pressure

in G exceeds pressure in L, and connecting the train-pipe with the expanding-chamber, as in Fig. 3, when pressure in G is slightly reduced below that stored in L.

In the modified construction of the valve H shown by Figs. 4, 5, and 6 the same consists of a slide-valve, N, automatically operated to perform similar functions to the valve J, and similarly actuated. The valve N, as shown in the cross sectional figure, is fitted to a cylindrical seat, *v*, through which the ports *j* and *k* extend and connect under the valve when the position of Fig. 4 is assumed to discharge pressure from the expanding-chamber, or the latter is connected with the train-pipe at the position of Fig. 5 through the port *j* and chamber G. The valve N is free from direct connection to its stem *e*, being reciprocated by its surrounding strap *l*, adapted to leave a space at the valve ends and permit a certain freedom of play. An auxiliary relief-valve, *m*, is thereby actuated to precede the relief action of the slide-valve during the performance of its opening stroke by instant opening from a seat, *n*, on the port *o* within the slide-valve. The valvular plunger *m* is projected rigidly from the back of the strap *l* and stem *e*, and extends through its enlarged surrounding space, through which or through the opening *r* the initial relief action takes place before the inertia of the slide-valve has been overcome sufficiently to open the main port *j*. The guide *s*, extending between the ways at the top of the slide-valve, is designed to prevent its turning out of position in its seat.

The operation of my invention is as follows: The position shown in Figs. 1, 2, and 4, being that of brake release, wherein the expanding-chambers I are severed from the train-pipe, the pressure in the latter is charged, through the brake-cylinder valve *p*, to normally maintain the brake release in chamber *t*. To apply the brakes, pressure is slightly reduced in the usual manner through the operator's valve from the forward end of the train-pipe—say at V. This effects the initial reduction of the section A of the train-pipe, actuating the brake-cylinder valves at P, through pipe D E, in the manner described in the aforesaid patent application—namely, so as to apply the stored pressure from reservoir B to set the brakes by its admission to cylinder-chamber *u*. The initial reduction in train-pipe section A also opens the train-pipe relief-valve at H, the reservoir-pressure from B being rendered operative thereon by predominance on valve-piston K. This relieves pressure from train-pipe section A′ into the expanding-chamber of the valve H, accelerating relief beyond the rate acquired by passage of the fluid through the pipe-section A and appended length of pipe extending in continuation thereof to the engineer's operating-valves. The resulting reduction at H′ relieves the succeeding pipe-section A^2 into the second expanding-chamber, I′, the repetition of the operation occurring in sequence through the length of the train.

It is to be understood that the present improvement is applicable to apparatus wherein other forms of brake-cylinder valves than those shown are employed, as that described in my patent application filed December 6, 1887, Serial No. 257,112, the form herein being exampled as a preferred one.

The expanding-chambers I are given a volume capacity proportionate to the volume of the section of train-pipe adjacent thereto, such as will reduce the pressure in the latter to a given degree, necessary to perform the brake-applying movement of the brake-cylinder valves, therefor, economizing in the volume of fluid exhausted.

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

1. In an automatic fluid-brake apparatus, wherein stored pressure is rendered active to effect the brake-stroke automatically by the reduction of train-pipe pressure, the combination, with the train-pipe, car, reservoir, and brake-cylinder, having pipe-connections and cylinder-valves adapted to operate as set forth, of the expanding-chamber and piston-actuated relief-valve located in the line of train-pipe proximate to but independent of the brake-cylinder valves, and adapted to open or close automatically by predominant reservoir or train-pipe pressure, respectively, on opposite sides of its actuating-piston, as and for the purposes specified.

2. The herein-described piston actuated oscillating relief-valve, the piston whereof is exposed on the one side to pressure in the line of train-pipe and on its opposite side to the stored pressure from the car-reservoir, and the valve adapted to connect the train-pipe with an expanding-chamber in the one position or disconnect said chamber from the train-pipe and exhaust the same to the atmosphere in the reverse position, as set forth.

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Witnesses:
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