No. 778,267. PATENTED DEC. 27, 1904.

W. B. POTTER.

MOTORMAN'S AUTOMATIC LAP VALVE.

APPLICATION FILED JUNE 6, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

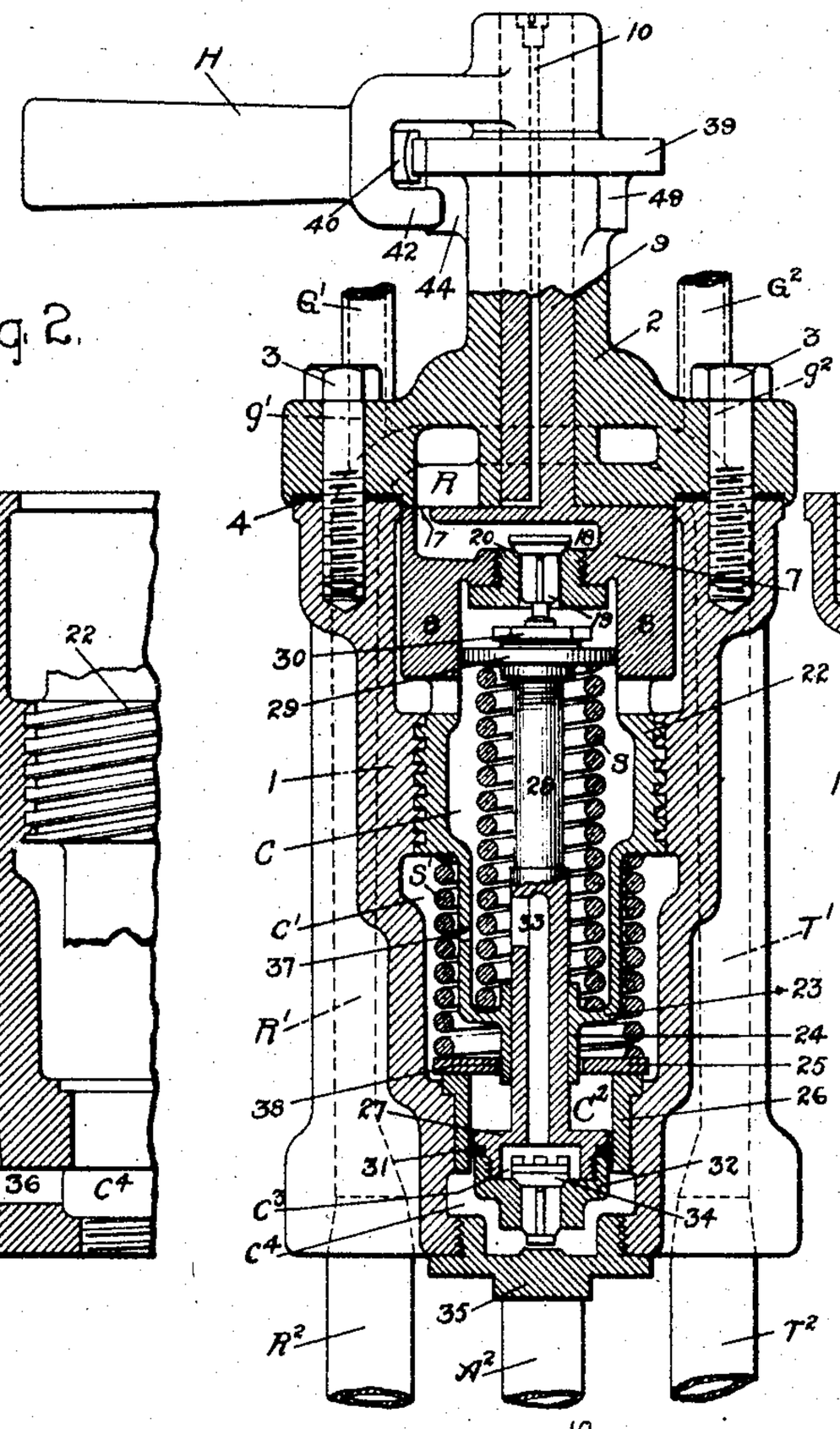


Fig. 2.

Fig. 3.

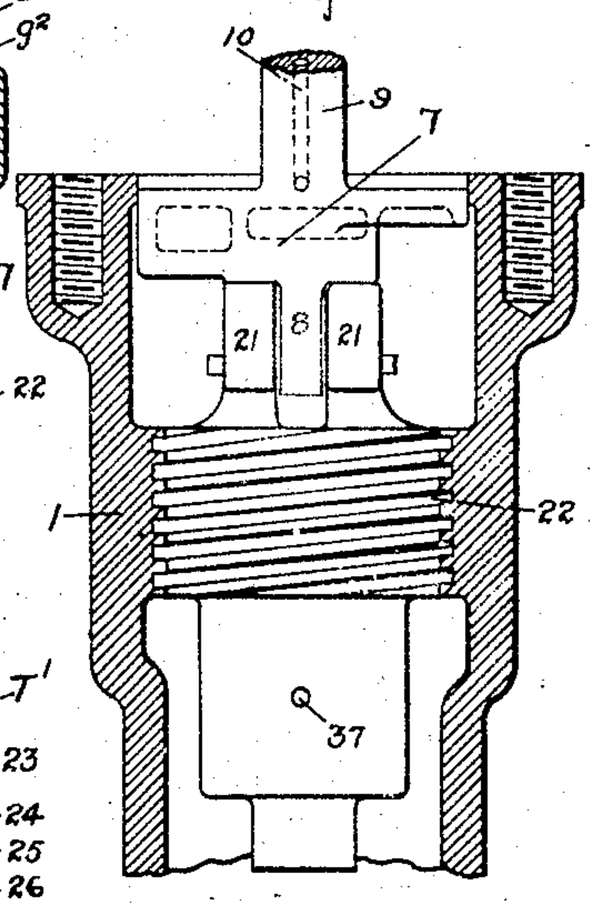
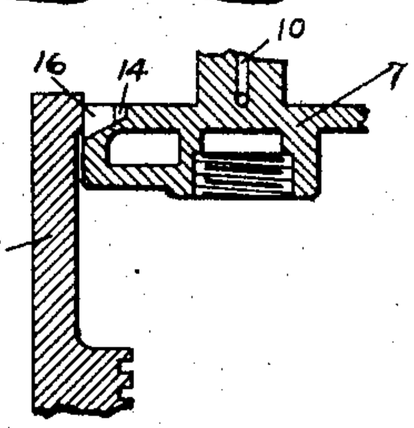


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5

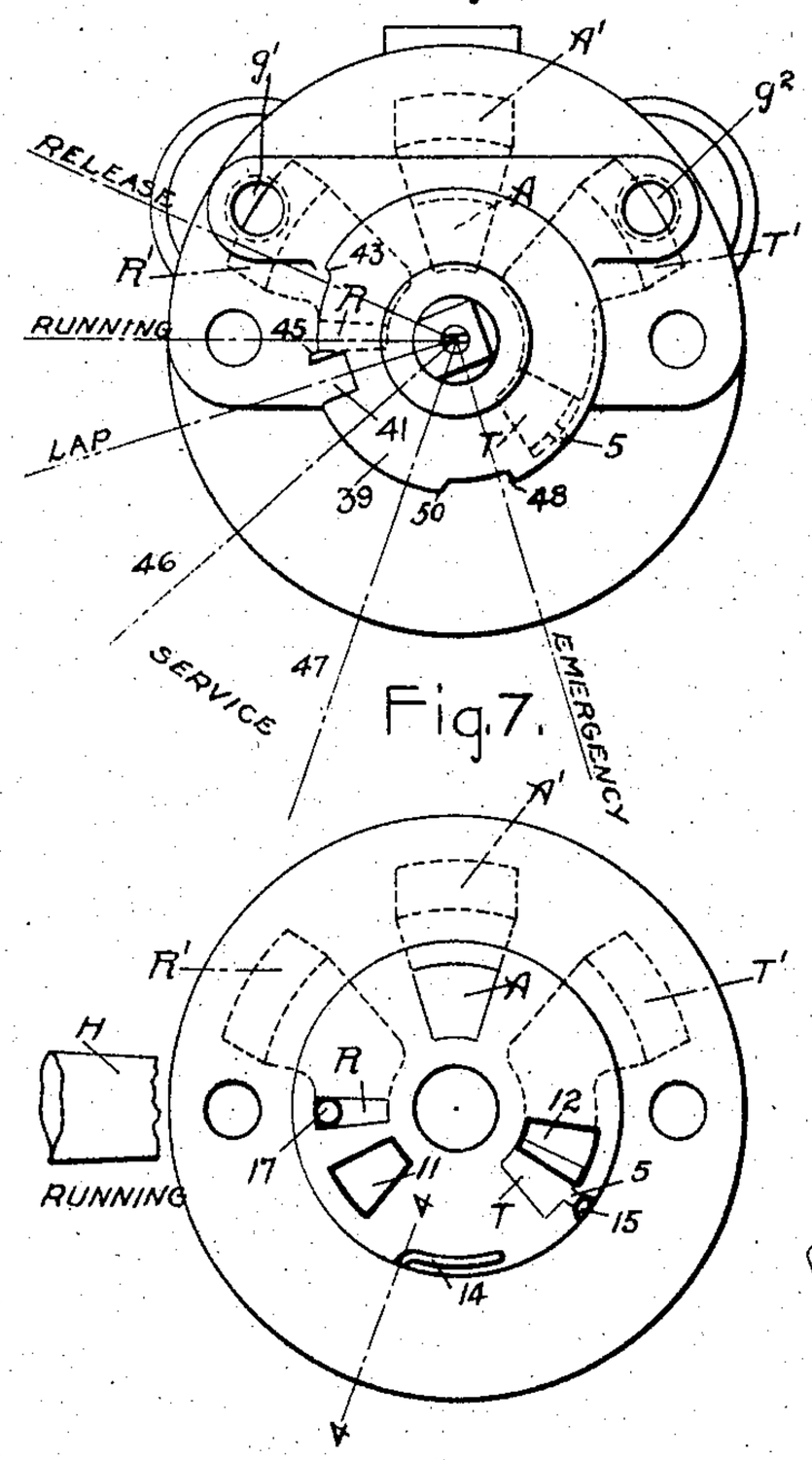


Fig. 6.

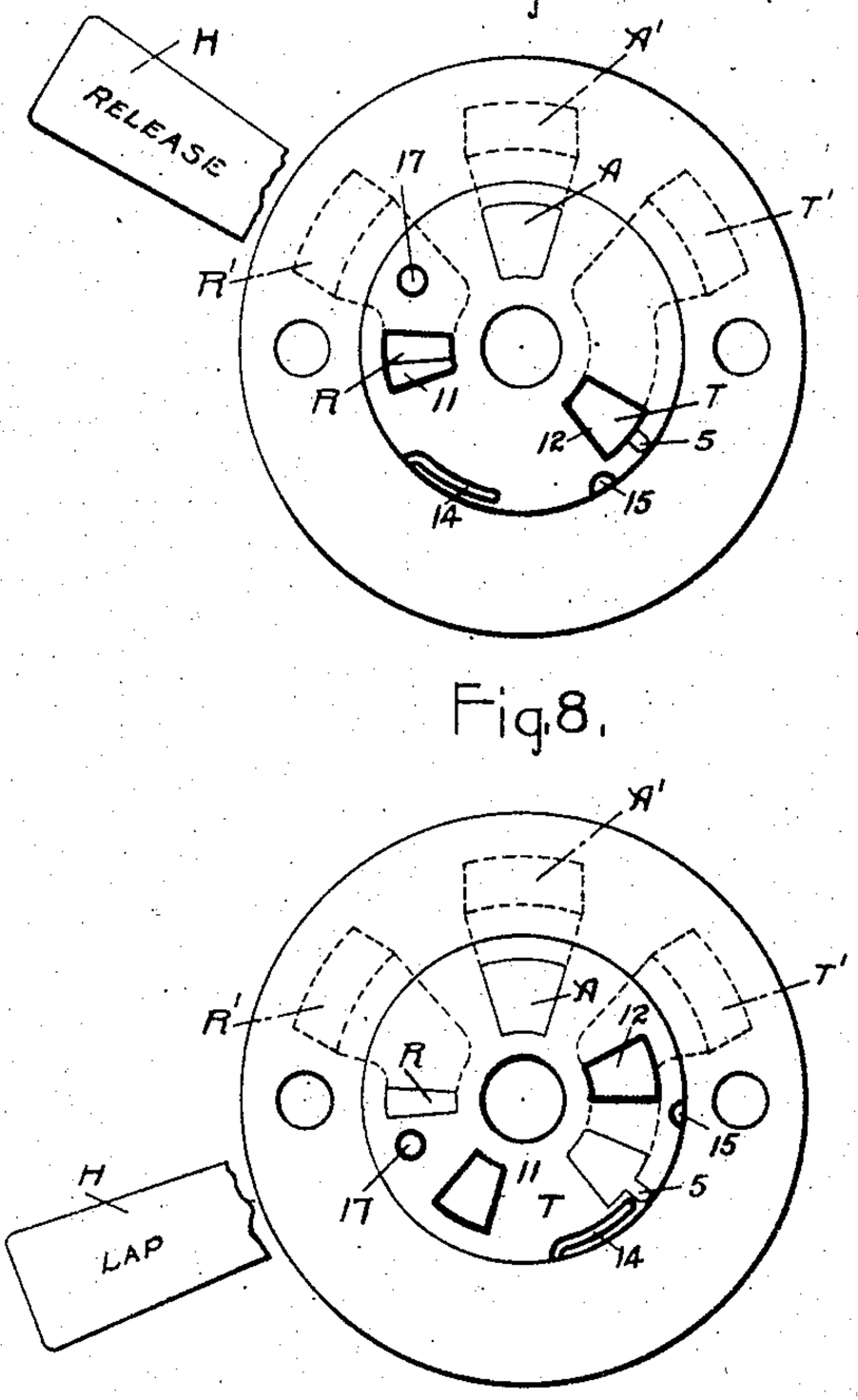


Fig. 7.

Fig. 8.

Fig. 9.

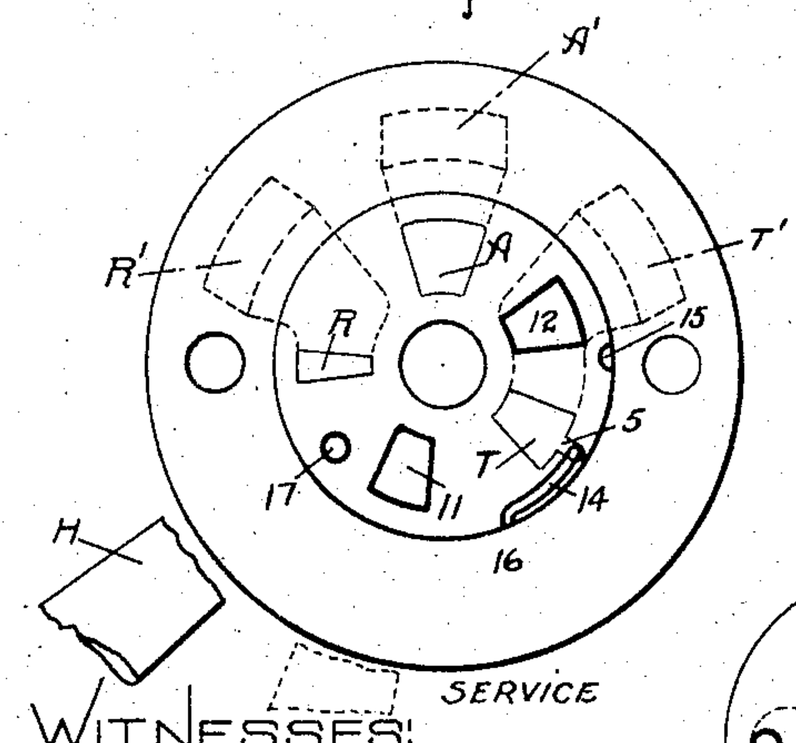


Fig. 10.

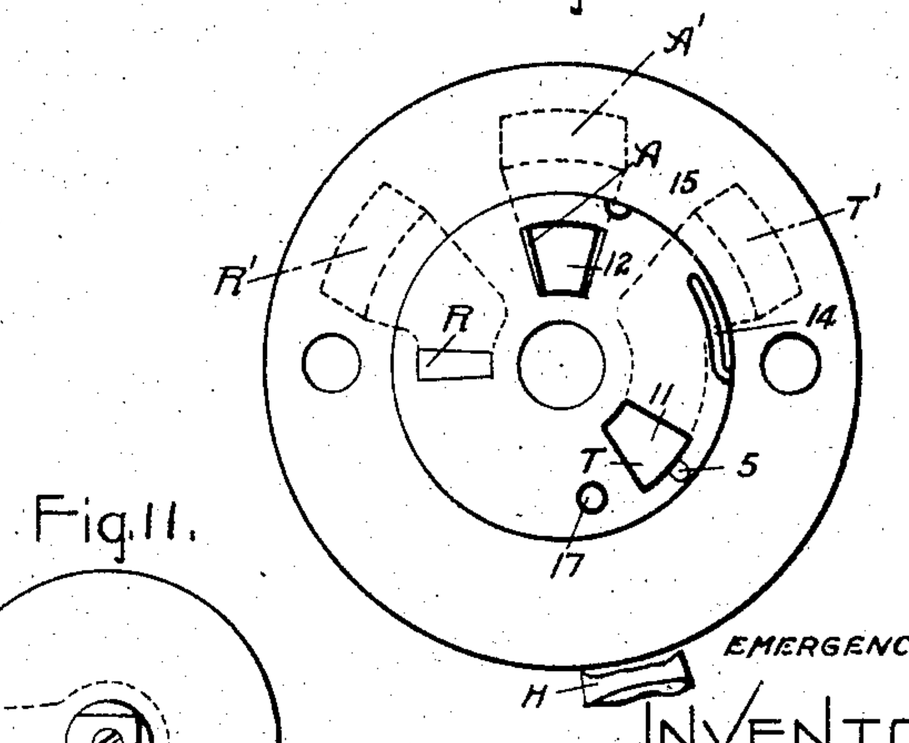
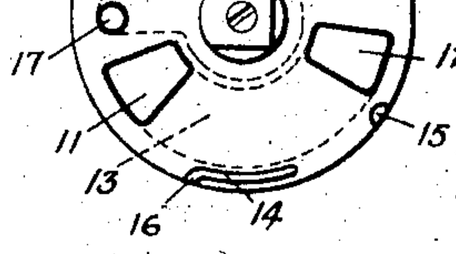


Fig. 11.



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No. 778,267. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM B. POTTER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTORMAN'S AUTOMATIC LAP-VALVE.

SPECIFICATION forming part of Letters Patent No. 778,267, dated December 27, 1904.

Application filed June 6, 1903. Serial No. 160,293.

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Motormen's Automatic Lap-Valves, of which the following is a specification.

My invention relates to valves employed by motormen or engineers to control the application of brakes in automatic air-brake systems—that is, systems in which the brakes are applied by reducing the pressure in the train-pipe and released by increasing said pressure; and it relates more particularly to that class known as "automatic lap-valves," in which a definite movement of the controlling-handle causes a definite reduction in train-pipe pressure by connecting the train-pipe to atmosphere and maintaining such connection until the fall of pressure in the train-pipe automatically causes the valve to move to lap position, thereby cutting off the exhaust connection.

One object of my invention is to provide a valve of this class which shall possess the advantages both of that type of regulating-valve in which the train-pipe may be connected through large ports directly to the main reservoir or to atmosphere, so that a quick release or application of the brakes may be obtained, and of that type an example of which is shown in the patent to Westinghouse, No. 222,803, granted December 23, 1879, in which a graduated and predetermined application of the brakes may be had through the automatic operation of the valve mechanism and without the exercise of especial care and skill on the part of the operator.

Another object is to provide a valve which shall be simple in operation and compact in structure.

I obtain these objects by the mechanism illustrated in the accompanying drawings and set forth in the following description.

Referring to the accompanying drawings, Figure 1 is a central section of a valve constructed according to my invention. Fig. 2 is a section of a portion of the valve-body, taken at right angles to that of Fig. 1, to illustrate the passage leading to atmosphere. Fig. 3 is a section similar to Fig. 1, showing the rotary valve and regulating-screw revolved ninety degrees from their position in Fig. 1. Fig. 4 is a section of portions of the rotary valve and valve-body, taken on the line 4 4 of Fig. 7, illustrating one of the valve-ports by which connection is established between the train-pipe and the chamber beneath the rotary valve. Fig. 5 is a top view of the complete valve with the operating-handle removed. Figs. 6, 7, 8, 9, and 10 are diagrams illustrating various operative positions of the rotary valve upon its seat, and Fig. 11 is a top view of the rotary valve.

In the drawings, in which like characters refer to like parts, the valve-case comprises a valve-body 1 and a bonnet 2, bolted together by bolts 3 3 passing through an interposed gasket 4. Screwed into the lower end of the valve-body are pipes R^2, A^2, and T^2, which are adapted to connect with main reservoir, atmosphere, and train-pipe, respectively. Leading from the pipes R^2, A^2, and T^2 are passages R′, A′, and T′, which extend through the valve-body 1 and the bonnet 2 and terminate in ports R, A, and T in the rotary valve-seat. The port T is provided at its outer edge with a narrow radial extension 5. The bonnet 2 is also provided with passages g' g^2, leading to the pipes G′ G^2, which are adapted to connect with the usual pressure-gage, and the body 1 has a threaded socket 6, through the agency of which it may be secured to a suitable support. Bearing against the seat on the under surface of the bonnet is the regulating-valve 7. This valve is a rotary valve provided with downwardly-projecting lugs 8 8 and an upwardly-projecting stem 9, which extends through the bonnet and terminates in a suitably-shaped end for the reception of the handle H. An oil-passage 10 extends through said stem from its upper end to the point of contact between said valve and its seat. The valve 7 is provided with a number of ports adapted to coöperate with the ports R A T of the seat-valve. Of these there are two main ports 11 12, suitably connected by a passage 13, which serve to connect the train-pipe port

T with either the main reservoir-port R or exhaust-port A, according to the position of the valve. An elongated port 14, located adjacent the periphery of the valve for certain positions of said valve, is adapted to overlap the extension 5 of the port T and connect said port with the chamber C beneath the rotary valve in the manner illustrated in Fig. 4. A small port 15, similar in shape to the outlet 16 of the port 14, is adapted to overlap the extension 5 when the rotary valve is in running position and connect said port with the chamber C. A feed-port 17 communicates with a central chamber 18 in the valve 7, separated from the chamber C by a feed-valve 19, whose seat 20 is screwed into the under side of said valve 7, as shown, and is suitably apertured for the reception of said feed-valve, which is grooved longitudinally, so that when raised above its seat communication will be had between the chambers 18 and C.

The lugs 8 on the lower side of the rotary valve engage between lugs 21, extending upward from the upper end of a regulating-screw 22, which in general outline is cup-shaped, with an opening in its bottom 23, bounded by a sleeve 24, formed integral with said screw-bottom and extending both above and below it. The upper portion of the outer surface of the regulating-screw is provided with threads, which engage corresponding threads on the inner surface of the valve-body, and the lower portion is narrowed, so as to form a shoulder just beneath the threaded portion. A spiral spring S′ is located between this shoulder and a plate 25, resting on on a bushing 26 in the lower end of the valve-body. From the above it will be seen that when the rotary valve 7 is rotated the regulating-screw is correspondingly moved either to compress said spring S′ or allow it to expand. The main purpose of this spring is to assist in the easy manipulation of the screw by reducing the friction between the threads.

A piston 97 is fitted into the cylindrical opening formed by the bushing 26, with its stem 28 extending up through the sleeve 24 in the bottom 23 of the regulating-screw 22 into proximity to the feed-valve 19. The upper end of the piston-stem 28 is threaded for the reception of an adjusting-nut 29 and a check-nut 30. Surrounding this stem and abutting at one end against the adjusting-nut 29 and at the other against the bottom 23 of the regulating-screw 22 is a spiral spring S. The piston 27 is provided with a suitable piston-ring 31, which fits snugly against the bushing 26. This ring is firmly held in place by a follower 32, screwed on the lower end of said piston 27, which is bored out on its under side, so as to form a chamber C^3 when the follower 32 is in place. The chamber C^3 communicates at all times with the chamber C through the passage 33 in the valve-stem. The follower 32, which forms a seat for an exhaust-valve 34, is provided with an aperture for the reception of said valve. This valve is longitudinally grooved, so as to open a passage between the chambers C^3 and C^4 when it is moved from its seat, and it is also provided with projections on its upper surface, so that it cannot close the passage 33 if driven against the piston 27. A closing-plug 35, screwed into the bottom of the valve-body, forces the valve 34 open upon the downward movement of the piston 27, and an upward movement of the piston and its stem 28 forces the feed-valve 19 from its seat. The chamber C^4, formed by the plug 35 and the sides of the valve-body, communicates, through the passage 36, with the atmosphere-passage A′, and therefore contains air at atmospheric pressure.

The chamber C, in which the spring S is located, communicates, through the port 37, with the chamber C′, in which the spring S′ is located, and the latter chamber communicates with the chamber C^2 directly above the piston 27 and below the plate 25 through the passage 38, which is made by cutting the opening in the plate 25 somewhat larger than the external diameter of the sleeve 24. The chamber C also communicates with the chamber C^3 through the passage 33, as previously pointed out. Thus these four chambers C, C′, C^2, and C^3, which for certain positions of the rotary valve are adapted to connect with train-pipe, are in constant communication, so that any variation of air-pressure in one will be immediately communicated to the others, and when they are in connection with train-pipe air having a pressure above that of atmosphere will act on the upper side of the piston 27 and, if unrestrained, force said piston to its lowermost position, thereby opening the exhaust-valve 34. This action, however, is opposed by the spring S, which tends to force the piston-stem 28 upward against the valve 19 to open it. It will be apparent then that for certain train-pipe pressures the spring S will balance said pressures, so as to keep the piston and its stem in an intermediate position, and thereby the valves 19 and 34 both closed. Any shifting of this position of the piston and its stem by raising or lowering the regulating-screw 22 will therefore vary the amount of train-pipe pressure necessary to hold the parts in balanced position, so that when the screw is lowered the valve 34 will be opened to atmosphere and the train-pipe pressure reduced a definite amount, depending upon the extent to which the regulating-screw 22 has been moved, and when raised the feed-valve 19 will be opened and the train-pipe pressure correspondingly increased, in each case the train-pipe pressure being varied until the balanced condition is reached. The means for moving the regulating-nut 22, as previously indicated, is the rotary valve 7. Therefore when said valve is operated not only are the

relative positions of the main ports varied, but the effective pressure of the spring S is also varied, and for each degree of angular rotation there is a definite and corresponding pressure variation. In order to indicate to the motorman the extent of the rotation of the handle H, and thereby the positions of the rotary valve 7, the bonnet 2 is provided with a suitably-notched flange 39, with which the usual spring-pressed pawl 40 of the handle is adapted to engage. In order that the handle H may be removed from the valve-stem, said flange 39 is provided with a large notch 41, through which the projection 42 on the under side of the handle is adapted to pass. This notch is so located that the handle can only be removed when the valve is in a certain position. The position chosen is the one known as the "lap" position, which is illustrated in Fig. 8 and is the one in which none of the valve-ports register with the ports in the valve-seat, and consequently the one in which the train-pipe and main reservoir are completely cut off. The purpose of the other notches in the flange 39 will appear from the description of the operation hereinafter given.

In the operation of the valve, assuming that the handle H has been put in place by passing the projection 42 down through the notch 41, while the valve 7 is in lap position, as previously indicated, and that it is desired to start the train or car, the handle is first moved to the "release" position, and as soon as the air-pressure in the train-pipe has risen sufficiently to actuate the triple valves and release the brakes the handle is returned to "running" position. Air will then continue to flow to the train-pipe through the feed-valve, so as to make up any small difference of pressure which may exist. In the release position of the valve 7, which is that indicated in Fig. 6, its ports 11 and 12 register with the ports R and T, respectively, thus connecting the train-pipe to main reservoir through a large passage. It should be noted that in this position the valve-ports 14 and 15, which are the only ports by which communication may be had between the train-pipe and the chamber below the rotary valve, do not register with the train-pipe port T or any portion of it. In this movement of the handle to the release position the pawl 40 is brought into engagement with the shoulder 43 on the flange 39 and at the same time the projection 42 on the handle H is brought into contact with the projection 44 on the valve-bonnet 2, thus limiting the movement of the handle and indicating to the motorman that the release position of the valve has been reached. In the running position of the valve 7, which is that illustrated in Fig. 7, the train-pipe is connected to main reservoir not through an unobstructed passage, as is the case when the valve is in the release position, but through a passage including the feed-valve 19.

Referring to Fig. 7, it will be seen that the valve-ports 17 and 15 register with the ports R and the extension 5 of the port T, respectively. The connection with the port R supplies air at main-reservoir pressure to the chamber 18 in the rotary valve 7 above the feed-valve 19, and the connection 15 supplies the chambers C, C′, C^2, and C^3, which are beneath the rotary valve 7 and the feed-valve 19, with air at train-pipe pressure. This train-pipe pressure in the chambers C, C′, C^2, and C^3, acting on the upper side of the piston 27, balances the pressure of the spring S so as to keep both of the valves 19 and 34 closed. If, however, for any reason, such as leakage in the system, the train-pipe pressure is reduced, the pressure of the spring S will overcome that of the air and the piston-stem 28 will be moved against the valve 19 to open it, and thus admit air at an increased pressure from the chamber 18 to the chambers C, C′, C^2, and C^3 and thence through the ports 15 and T to the train-pipe. When the pressure in the train-pipe has been sufficiently increased, the piston 27 is forced down into the aforesaid balanced position and the valve 19 is closed. Thus while the valve 7 is held in the running position the train-pipe pressure is automatically maintained at the desired point. In moving the valve from the release to the running position the pawl 40 is brought into contact with the shoulder 45 on the flange 39, thus indicating to the motorman when the running position is reached. When it is desired to make an ordinary service application of the brakes, the valve 7 is moved from the "running" position illustrated in Fig. 7 to one of several positions in which the elongated port 14 in the valve 7 overlaps the extension 5 of the train-pipe port T. This overlapping of the ports 5 and 14 establishes a connection between the train-pipe and the chambers C, C′, C^2, and C^3, and, as previously pointed out when the rotary valve 7 is rotated in this direction—that is, from left to right—the regulating-screw 22 is moved down. This action reduces the effective pressure of the spring S and allows air at train-pipe pressure which occupies the chambers C, C′, C^2, and C^3 to overbalance the effective pressure of said spring, and thereby force the piston 27 down so as to open the exhaust-valve 34 and establish communication between said chambers and atmosphere. This will allow the train-pipe pressure to fall a definite amount—namely, until it is just sufficient to balance the spring S. It is clear that if the valve be moved from the running position toward the left until the elongated port 14 begins to overlap the extension 5 of the train-pipe port T there will be a different movement of the regulating-nut 22 than if said valve be

moved to a position in which the elongated port 14 is about to pass beyond the extension 5 and there will be a corresponding difference in the effective pressure of the spring S in balancing the train-pipe pressure in the chambers C, C′, C², and C³, the effective pressure being greater in the former instance than in the latter, so that in order to produce a proper balance between said spring and the train-pipe pressure there necessarily will have to be a greater drop in train-pipe pressure and consequent stronger application of the brakes when the valve is moved to the latter position. In moving the valve 7 from the running position to that indicated by the line 46 in Fig. 5, which is the position in which the elongated port 14 first begins to overlap the extension 5 and that shown in Fig. 9, the nut 22 is lowered sufficiently to give the necessary reduction in train-pipe pressure to cause the triple valves in the system to operate to apply the brakes. In moving the handle from the position designated by the line 46 in Fig. 5 toward the position indicated by the line 47, which is the position in which the elongated port 14 is just about to pass beyond the extension 5, a graduated service of the brakes is secured, because each degree of angular movement of the handle causes a definite lowering of the nut 22 and consequent definite reduction of train-pipe pressure, as previously explained. In making service applications it will be seen that the pawl 40 on the handle rides on the smooth surface of the flange 39. If it is desired to apply the brakes suddenly, as in the case of an emergency, the handle H is thrown around to the extreme right until the pawl 40 comes into engagement with the shoulder 48 on the flange 39 and the projection 42 on the handle comes in contact with the projection 49 on the bonnet 2. In this position the train-pipe port T and the exhaust-port A register exactly with the valve-ports 11 and 12, thus forming a wide passage from the train-pipe to atmosphere. This allows a rapid exhausting of the train-pipe and consequent sudden application of the brakes. If it is desired to apply the brakes with some considerable pressure, but not with the pressure resulting from throwing the handle to the extreme right, the handle may be thrown until the pawl 40 slips over the shoulder 50 on the flange 39. This will provide a direct connection between the train-pipe and atmosphere, but through a somewhat narrower passage than in the above case, because the ports 11 and 12 of the valve 7 will only slightly overlap the ports T and A in the valve-seat. It is apparent that the degree of emergency application may be varied from the position in which the pawl 40 slips over the shoulder 50 when the valve-ports slightly overlap those of the valve-seat and the position when the pawl 40 engages the shoulder 48 when said ports exactly register. After a service or emergency application of the brakes they are released by moving the handle H to the release position and then returning it to the running position in the manner previously described.

I do not wish to be limited to the specific valve mechanism herein disclosed, but aim to cover in the appended claims all modifications and alterations which may fall within the spirit and scope of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a regulating-valve for air-brake systems, the combination of a main valve adapted to control the application and release of the brakes, a feed-valve, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said feed and exhaust valves, and a port in said main valve for supplying air under train-pipe pressure directly from the train-pipe to said means.

2. In a regulating-valve for air-brake systems, the combination of a feed-valve, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said valves, and a main valve constructed and arranged to supply air under train-pipe pressure directly from train-pipe to said means for certain positions of said main valve and to connect the train-pipe directly to atmosphere and main reservoir for other positions.

3. In a regulating-valve for air-brake systems, the combination of a feed-valve, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said valves, a main valve constructed and arranged to supply air under train-pipe pressure directly from train-pipe to said operating means, and means operated in conjunction with said main valve for adjusting said operating means.

4. In a regulating-valve for air-brake systems, the combination of a feed-valve, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said valves, a main valve constructed and arranged to supply air under train-pipe pressure directly from train-pipe to said operating means for certain positions of said valve and to connect the train-pipe directly to atmosphere and main reservoir for other positions, and means operated in conjunction with the main valve for adjusting said operating means.

5. In a regulating-valve for air-brake systems, the combination of a chambered valve-body, a reciprocating member in said chamber adapted to be moved in one direction by the pressure of air in said chamber, a spring adapted to move said member in the opposite direction, a feed-valve operable by said member in its movement in one direction, an exhaust-valve operable by said member in its movement in the opposite direction, and a main valve constructed and arranged to connect train-pipe directly to atmosphere for one position of the valve, directly to main reservoir

for another position and to said chamber for still other positions.

6. In a regulating-valve for air-brake systems, the combination of a chambered valve-body, a reciprocating member in said chamber adapted to be moved in one direction by the pressure of air in said chamber, a spring adapted to move said member in the opposite direction, a feed-valve operable by said member in its movement in one direction, an exhaust-valve operable by said member in its movement in the opposite direction, a main valve constructed and arranged to connect train-pipe directly to atmosphere for one position of the valve, directly to main reservoir for another position and to said chamber for still other positions, and means operated in conjunction with said main valve for adjusting the tension of said spring.

7. In a regulating-valve for air-brake systems, the combination of a chambered valve-body, a main valve constructed and arranged to admit air under pressure to said chamber for certain positions of said valve, a piston in said chamber adapted to be moved in one direction by the pressure of air in said chamber, means for opposing said movement and moving said piston in the opposite direction, a feed-valve carried by said main valve and operable by the movement of said piston in one direction, and an exhaust-valve carried by said piston and operable by its movement in the opposite direction.

8. In a regulating-valve for air-brake systems, the combination of a main valve adapted to control the application and release of the brakes, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said exhaust-valve, and a port in said main valve for supplying air under train-pipe pressure directly from said train-pipe to said means.

9. In a regulating-valve for air-brake systems, the combination of a main valve adapted to control the application and release of the brakes, an exhaust-valve, means coöperating with air under train-pipe pressure to operate said exhaust-valve, a port in said main valve for supplying air under train-pipe pressure directly from the train-pipe to said means, and means operated in conjunction with said main valve for adjusting said operating means.

In witness whereof I have hereunto set my hand this 26th day of May, A. D. 1903.

WILLIAM B. POTTER.

Witnesses:

HOWARD C. LEVIS,

A. D. JAMESON.