No. 643,812.

M. CORRINGTON.

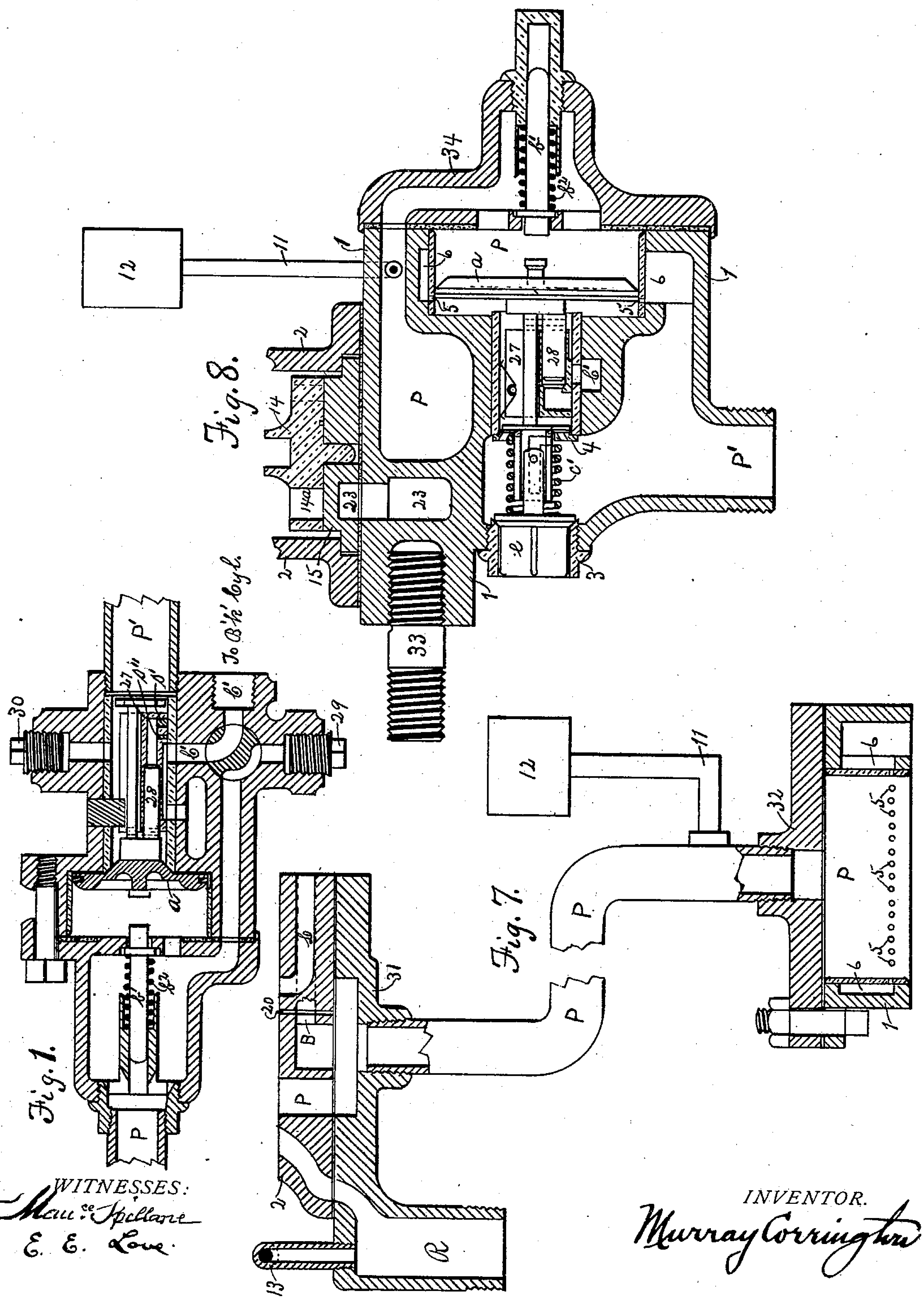
Patented Feb. 20, 1900.

AIR BRAKE.

(Application filed Oct. 31, 1899.)

(No Model.)

2 Sheets—Sheet 1.



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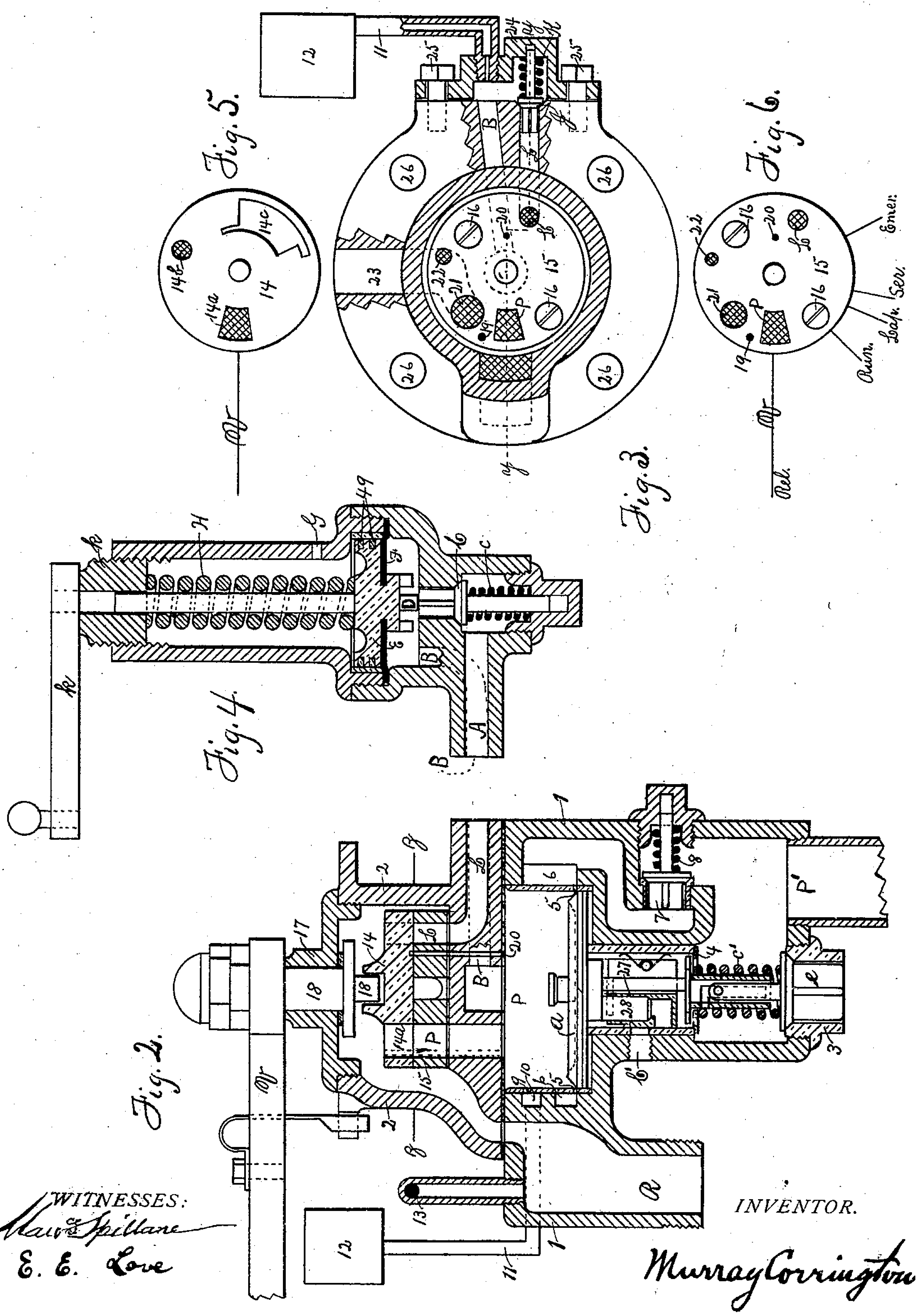

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UNITED STATES PATENT OFFICE.

MURRAY CORRINGTON, OF NEW YORK, N. Y.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 643,812, dated February 20, 1900.

Application filed October 31, 1899. Serial No. 735,364. (No model.)

To all whom it may concern:

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

My invention relates to improvements in automatic air-brake apparatus, and may be defined as a valve device adapted to be located at some point between the engineer's valve and the portion of the train-pipe in the rear of the train for controlling the pressure in the train-pipe. More specifically, it may be defined as a cut-off and relief valve device located between two sections of a train-pipe and adapted to control the admission of air from one section to the other in the rear and the exhaust of air from the latter. In this connection it is to be understood that the term "train-pipe" is meant to include all that space or passage which is filled by the compressed air after it flows from the main reservoir or air-pump past the engineer's valve on its way to the triple valves on the cars.

In its narrowest sense my invention may be defined as the employment of the usual moving parts of a triple-valve device adapted to operate as a cut-off and relief valve device in a train-pipe as an improvement upon the devices described and illustrated in the expired patent to Westinghouse, No. 245,110, dated August 2, 1881.

By the term "triple valve" as last above employed I mean the usual moving parts of a triple valve, including the piston, main valve, and graduating-valve, without intending to include those special or particular ports which a triple valve in its common use ordinarily controls.

Referring to the drawings, Figure 1 is a vertical section of a modification of a triple valve adapted to operate as a cut-off and relief valve and showing the prior art. Fig. 2 is a vertical section of my improved mechanism on the dotted line y y of Fig. 3, showing, so far as possible in a single figure, the relationship of all the working parts. Fig. 3 is a section of the casing 2 on the line z z of Fig. 2 looking downward, with certain additional parts not shown in Fig. 2. Fig. 4 is a vertical section of a well-known device adapted to control the admission of fluid under pressure between a main reservoir and a train-pipe. Fig. 5 is a view of the bearing-surface of an engineer's rotary valve. Fig. 6 is a plan of the seat on which the engineer's rotary valve rests and operates, and Fig. 7 is a view illustrating a modification for locating the cut-off and relief valve at a greater distance from the engineer's valve. Fig. 8 illustrates a modification hereinafter fully explained.

In order that I may comply with the Rules of Practice in that behalf, I have shown in Fig. 1 a device which illustrates so much of the prior art as will enable my improvements to be more readily understood, as well as their relationship to the prior art. Said Fig. 1 is the triple-valve device of the expired patent to Westinghouse, No. 220,556, dated October 14, 1879, modified slightly, so as to make it perform the cut-off and relief functions between two sections of a train-pipe, as fully set forth at page 3, line 29 of said expired patent, No. 245,110, as follows: "Various modifications may be made in the appliance described, such as may be suggested by or copied from various triple-valve patents heretofore granted to George Westinghouse, Jr., and, in fact, the device in question has many of the features of construction and operation of a triple valve, the principal distinctive features being in the addition of the spring c' and in the arrangement of the charging and exit ports P P' in line with each other on opposite sides of the diaphragm instead of at right angles, as has heretofore been usual in triple valves." The reference-letters are as far as possible taken from said Patent No. 245,110 and applied to those parts of Fig. 1 which correspond in function with the parts of said patent. The forward and rear sections of the train-pipe P P' are connected at the opposite ends of the valve-casing. The train-pipe air in charging the system goes from P, past the piston a, through the charging-port at the under side of the piston to the slide-valve chamber, and thence through the pipe P' to the rear cars of the train. It will be noticed that the ports s' and s^2 in the slide-valve 27 are plugged. When the engineer reduces the pressure moderately in P, the pressure in P' moves the piston back to its stop, which is held in place by spring b^2, and there will be no reduction of pressure in P′; but when in case of emergency or danger or when for any reason more than the usual or a moderate braking power is desired the engineer opens his cock so as to lower the pressure in the brake-pipe P more than the supposed ten or fifteen pounds commonly not exceeded in ordinary braking. As a consequence of this the pressure on the left of piston a being so much reduced the back air-pressure on the right of said piston will then become effective in compressing the spring b^2, and consequently the piston a, carrying the valve 27, will be shifted to the left a greater or less distance, according to the amount of the supposed reduction, and the movement of the valve 27 opens the escape from the rear brake-pipe P′ through the port C′. It will therefore perform identically the functions described in said Patent No. 245,110, so that at one degree of reduction of pressure the cut-off function will be brought into play and at another degree of reduction of pressure an escape-port will be opened to the external air.

I have marked port C′ "To B'k Cyl." because it is the port C in Patent No. 220,556 which is connected by a pipe with the cylinder. By simply omitting the pipe the port opens to the atmosphere.

It will be seen that the plugs 29 and 30 are employed to stop the ports marked P and R, respectively, in Patent No. 220,556. It is evident that the pipes P P′ might be connected to the casing, the former at the under and the latter at the upper of said ports, and the ends of the valve-casing closed as in said patent. The device would then operate as described, and the pipes P P′ would still be in line with each other, though not in line with the movement of piston a.

Going now to Fig. 2, my improvements will be readily understood. I arrange according to convenience a main valve-casing 1 and a second section 2. In the main casing 1 is a chamber P for a piston a and a chamber for a slide-valve 27, having a graduating-valve 28 operating therein and controlling a port C′, leading from its chamber. The arrangement of piston a and valves 27 and 28 will be readily recognized as essentially that of the corresponding parts of a triple valve. The casing 1 also has two nozzles or connections—R, for attachment to the main reservoir or air-pump, and P′, which leads to or becomes the train-pipe running to the rear of the train. It will be understood that I use the reference-letters P and P′ throughout not so much to indicate parts of the mechanism as to indicate the character of air-pressure which the designated parts contain. All the parts to which both letters are applied are filled with air which has passed by the engineer's valve and which I therefore designate "train-pipe pressure." A ported valve-seat 3 is fixed in the casing 1, on which rests the valve e, held to its seat by the spring c' of any desired tension, whose upper end bears against the ported rest or plate 4. The valve e is coupled to the stem of the piston a, as shown, and said piston has a considerable movement independent of the movement of said valve. A series of ports 5 5 are made through the bushing of the chamber P into a groove or passage 6 around said bushing, which finally leads to chamber or passage P′, past the check-valve 7, which is normally closed by the spring 8. This series of ports may extend completely around the said chamber, as will presently be fully described in connection with Fig. 7. One or two small ports 9 may also be made through the bushing of said chamber into a small cavity 10, from which a pipe 11 may lead to the small reservoir 12, whose office will be presently fully described. The pipe 13 offers a convenient means for attaching a pressure-gage. The upper casing 2 serves as a cap to the chamber of piston a in Fig. 2. Said casing likewise incloses the engineer's rotary valve 14, resting and revolving upon the valve-seat 15, which is preferably made separate from the casing 2, so that it may be readily removed for grinding its surface without removing casing 2. The seat 15 may be held in a fixed position by the two screws 16 16. (Seen in Fig. 3.) The top of the casing 2 is closed by a cap 17, through which projects the shaft 18, to which is fixed the engineer's valve-handle V. The lower end of the shaft 18 fits a slot in the upper side of the rotary valve 14, so that with each movement of the handle V the valve 14 will be rotated in the same direction.

The rotary valve 14, Fig. 5, has the two ports 14^a and 14^b through it and the cavity 14^c on its under side. This latter cavity serves the same purpose as the ordinary D-cavity in an ordinary slide-valve. The seat 15, on which the rotary valve operates, has the large port or passage P, leading to and really being part of chamber P, the small ports 19 and 20, also leading to chamber P, the port or passage L, and the exhaust-ports 21 and 22, leading to the atmosphere by passage 23. The passage L leads out of the casing, and a corresponding passage B (seen in Figs. 2 and 3) likewise runs from the chamber P to the outside of the casing. In Fig. 3 these passages are closed and connected by the cap or plate 24, held in place by bolts 25. The passage L is controlled by the valve J, held to its seat by the spring K, gaged to a definite tension for reasons presently to be described. In Fig. 3 the pipe 11, leading to the small reservoir or tank 12, is fixed to the cap 24, and it will be noticed that the opening from passage B into said pipe may be very small, if desired. Parts 1 and 2 of the casing may be held together by bolts through holes 26.

Fig. 6 illustrates the same view of the rotary-valve seat seen in Fig. 3. Let us suppose that Fig. 5 is placed upside down upon Fig. 6, so that the lines V of the two figures or the position of the valve-handle shall correspond. This is the position shown in Fig. 2. There are five positions to which the rotary valve (or handle) may be turned. In the first or normal or running "Run," Fig. 6, the port 14^b in valve 14 will meet port L in the valve-seat and admit pressure from reservoir R through L and B into chamber P and thence to P'. All other ports will be closed. The second position of the handle V is marked "Ser.," or the position for service application. In this position a portion of cavity 14^c of the rotary valve connects port 19 with exhaust-port 21, thus venting air gradually from P, while all the other ports are closed. In the third position of V, marked "Lap," all ports are closed. In the fourth position, marked "Emer.," or that for emergency action, the cavity 14^c connects the large ports P and 21, thus venting the pressure in P instantly to the atmosphere. In the fifth or release position of V, marked "Rel.," the large port 14^a opens into P, while a portion of cavity 14^c connects ports 20 and 22, as shown in Fig. 2. This admits pressure rapidly from R to P and exhausts very slowly from P to 23.

From the above description the operation of the apparatus will be readily understood. Figs. 4, 7, and 8 will presently be described. Let us suppose that the brakes are to be operated with about seventy pounds pressure in the train-pipe and auxiliary reservoirs and about eighty-five pounds pressure in the main reservoir, according to the general custom. We will turn the engineer's valve to the first or running position, in which the port 14^b registers with port L. Air then goes from R through 14^b and L, and thence by passage B into P, and thence by ports and passages 5 and 6 into P', and to the cars in the rear. In passing from L into B, Fig. 3, the air must lift valve J against spring K, which we assume is adjusted to balance a pressure of about fifteen pounds per square inch on the opposite side of the valve. The valve J and spring K will therefore take the pressure in L or main-reservoir pressure at eighty-five pounds and admit it into B up to seventy pounds, and then keep the passage closed. In the performance of this function the valve device J K is called a "pressure-reducing" valve when spoken of with reference to the lower pressure of seventy pounds in the train-pipe, which it automatically regulates from the higher main-reservoir pressure of eighty-five pounds, or it is called an "excess-pressure" valve when described with reference to the higher main-reservoir pressure which it maintains over the lower train-pipe pressure. The brake system being thus charged, to set the brakes moderately the engineer moves his valve to the second or "service" position. All ports between R and P are closed, while cavity 14^c connects ports 19 and 21, gradually reducing the pressure in P and tank 12 about six or eight pounds. The valve is then turned to third or "lap" position, closing all ports. The pressure in P' thereupon moves piston *a* upward, first crossing ports 5 and unseating valve 28 and then drawing the valve 27 so that the port controlled by valve 28 registers with C'. The hollow stem of piston *a* slides over the stem of valve *e*, and the valve *e* remains seated by the spring *c'*, which limits the upward movement of the piston *a* to about three-fourths of its chamber. Air thereupon flows out of P' until the pressure above piston *a* moves it down and closes valve 28. Further moderate reductions of pressure in P will further graduate reductions in P'. These reductions in P' operate all triple valves for service applications. Again, supposing the system charged and an emergency application desired, the engineer's valve is moved to fourth instead of second position. The cavity 14^c then connects large ports P and 21 and instantly exhausts the pressure in P, causing the piston *a* to move through the full traverse of its chamber and open the valve *e*. The slide 27 will also pass across and open port C'. This causes a rapid exhaust of pressure from P' and the consequent operation of the quick-action emergency-valves on the adjoining cars. To release the brakes, the engineer's valve is turned to the fifth position, Fig. 2, admitting air rapidly from R to P, which forces the piston *a* back to normal position and opens the ports 5. The brakes may sometimes be released after being set by turning the engineer's valve to running instead of release position. In either event the action on the piston *a* is the same. In the one case the air from R goes through passage P and in the other through passages L and B into chamber P and forces the piston *a* and slide 27 into the position shown in Fig. 2 before it opens ports 5 and admits the pressure into P'. I prefer that the ports 5 shall be so located that the piston *a* shall move slide 27 to close port C' before opening the ports 5 and also that said piston shall pass above said ports in its independent movement of opening valve 28 and before moving valve 27. It will be seen, therefore, in Fig. 2 that as quickly as piston *a* passes across the ports 5 and so long as it is performing its functions of releasing pressure from P' the check-valve 7 is entirely cut out of operation, for should any air in P' leak past the check-valve it would pass to the under side of piston *a*, already open to the train-pipe P', through the chamber of valve 27.

In Fig. 3 the tank 12 is always open to the upper side of piston *a*, and hence the pressure in said tank is exhausted in the emergency action through ports P and 21 and cavity 14^c. In Fig. 2 the tank 12 opens into the piston-chamber through port 9, so located that in the emergency action piston *a* passes above it and connects the tank 12 with the chamber on the under side of the piston, so that the air in the tank will be exhausted past the valve *e* or through port C'. Both these tanks may be employed, but one is sufficient. Throughout all the drawings it will be understood that the only purpose of tank 12 is to afford a convenient means of enlarging the spaces filled with train-pipe pressure, (designated by the letter P.)

I have spoken of the device J K in Fig. 3 as a "pressure-reducing-valve" device. In Fig. 4 I illustrate another well-known form of pressure-reducing valve for admitting the air at a high pressure from a main reservoir or air-pump into the train-pipe at a lower pressure and automatically regulating the difference between these pressures. This device is copied from the device shown in expired patent to Westinghouse, No. 251,980, dated January 3, 1882, excepting that the passages A and B enter the casing from the same side instead of opposite sides and that the valve D and handle K M are omitted. It is evident that the device of said patent is made by boring a hole through the piston E and then fitting the valve D therein. In the device of Fig. 4 the same piston E is left solid, but the stem D performs exactly the same function in opening the valve C as the stem of D in said patent. The same reference-letters are used as in said patent to denote the same parts, and I have added the numeral 49 to the friction device on the piston E, which bears against the walls of the chamber and regulates the movement of the diaphragm of said device, consisting of one or more packing-rings.

It is intended that Fig. 4 may be moved to the left and fastened to Fig. 2, passage A meeting passage L, and the passages B in the two figures also meeting and there being flanges on the sides to accommodate bolts 25, just as in Fig. 3. Air then goes through passages L and A, past valve C, then through passages B B into P, until train-pipe pressure on the under side of diaphragm F and piston E overcomes the spring H and moves the piston upward, permitting spring *c* to close valve C. As the pressure in P and B declines below the force of spring H the said spring moves the piston E downward, and the stem D opens valve C against spring *c*. Thus the automatic regulation of the pressure in B and P—that is, in the train-pipe—is effected. The force of spring H is governed by the nut *k*, which may have a handle, as shown. Fig. 4 assumes that the passage B and train-pipe are normally charged.

Referring to details of construction, two peculiarities are noticed in Fig. 4. First, there is the combination, with the movable diaphragm F, adapted to be operated by fluid-pressure, of a piston E, connected thereto and fitting in a chamber, and a friction device 49 on the piston E, which bears against the wall of the chamber and regulates the movement of the diaphragm F, or, speaking still more broadly, the construction shows a combination, with a movable diaphragm F, adapted to be operated by fluid-pressure, of means 49 for effecting frictional resistance for the purpose of regulating the movements of the diaphragm F, which is independent of or additional to the usual incidental or unavoidable resistance of the part or parts which may be operated by the movement of the diaphragm. Again, it will be noticed that the piston E is moved upward by fluid-pressure in B and P above a certain maximum and downward by the spring H. The piston E in its downward movement opens the valve C by the stem D coming in contact therewith; but the piston E in its upward movement does not close the valve C, but merely permits its closure by the spring *c* as the stem D moves out of the way. These parts therefore represent a combination of a train-pipe, a passage from an engineer's valve to the train-pipe, a regulating-valve in the passage, and a piston or diaphragm which is independent of the regulating-valve and is moved by the pressure of the spring H to effect the opening of the valve when the train-pipe pressure is below a determined maximum and is moved by fluid-pressure to permit the closure of the valve C when the train-pipe pressure is above the determined maximum.

In Fig. 7, instead of connecting casings 1 and 2 directly, I have fastened a cap 31 to casing 2, to which the nozzle R and pipe 13 may also be connected. Another cap 32 closes the piston-chamber of casing 1, and the caps 31 and 32 are connected by a pipe P. The pipe 11 and tank 12 may be connected to the latter, as shown. If this connecting-pipe between 31 and 32 is made large enough, the tank 12 may evidently be dispensed with. As previously explained, I employ the letter P to indicate that all parts to which it is applied are filled with the same kind of pressure. The piston *a* being removed from its chamber, the row of ports 5 5 is shown. If sixty-four of these ports be made one-sixteenth of an inch in diameter, their aggregate capacity will be equivalent to one port one-half inch in diameter, and if they be three-thirty-seconds of an inch in diameter their aggregate capacity will be equivalent to a port three-fourths of an inch in diameter. Either size will be ample for admitting pressure into the train-pipe. Moreover, there will be no danger of the chamber becoming clogged with grease, since it will be blown through said ports into pipe P′.

Fig. 8 illustrates a modification the principal purposes of which are to provide for operating the piston *a* and the valves 27 and 28 horizontally instead of vertically, as in Fig. 2, and to avoid the use of the check-valve 7 between the ports 5 and P′. The casing 1 is arranged as shown, having suitable chambers for piston *a* and valve 27 to operate horizontally. The valve-seat 15 rests on top of casing 1, the valve 14 operates on the upper side of the seat 15, and both are inclosed by the casing 2 as in Fig. 2. A cap 34 closes the chamber of piston *a* and may hold the stop b' and spring b^2, which will be recognized as the equivalent of the parts similarly lettered of Fig. 1. The ports 5 are arranged substantially the same as in Fig. 2. The piston *a*, however, rests normally on the right side of said ports, being held there by the spring *c'*, which is preferably made in this instance about stout enough to easily move the piston *a* when the pressures on its opposite sides are nearly equal. The bolt 33 offers a convenient means of attaching the casing to a support.

It is understood that the ports and passages in valve 14 and seat 15 and the mode of operating valve 14 are exactly the same in Fig. 8 as in the other figures. The view is practically that of a central section of Fig. 2 looking to the right. The valve 14 is, however, revolved farther around, as though port 14^a in the valve 14 stood about opposite 23 in Fig. 3. The valve is turned to this position simply to enable the observer to readily understand that it is identical with valve 14 in Figs. 2 and 3 and operates to control identically the same ports in the seat 15. It is sufficient to say that when the valve 14 is revolved to either of the positions designated above as "running" or "release" air is admitted from R into P, whence it flows against the piston *a*, moves it to the left across the ports 5, through which the air flows into passage 6, and thence to P' and to the train-pipe in the rear. It will be noticed that the end of the piston-stem bears against the rest 4. As the piston moves to the left it carries the rest 4 also to the left, compressing the spring *c'*. The ports 5 being uncovered, the air flows from P into P' until the pressures are about equalized, when the spring *c'* moves the rest 4 back to its normal position and the piston *a* to the right across the ports 5, as shown. When the air is vented from P for the service action, there can be no return flow from P' to P, as the piston itself cuts it off. The piston will therefore move back against the stop *b* and vent the air from P'. The hollow end of the piston-stem slides over the stem of valve *e*, as in Fig. 2. In this arrangement valve 28 is normally unseated, but valve 27 closes port C'. In the emergency action when the air is quickly exhausted from P the piston moves through its full traverse to the right and pulls the valve *e* off its seat, quickly venting the air from P'. It will be noticed that the piston *a* is limited in its movement to the proper position for service action in Fig. 8 by the springs *c'* and b^2 and also by the air-pressure upon the valve *e*. I designate either or all of these means by the general term of "a yielding force," meaning a force capable of limiting the movement of the piston in service actions and also of yielding to permit the further movement of the piston for emergency. If the spring *c'* is nicely adjusted, it will answer the purpose, aided by the air-pressure on valve *e*; but the use of the spring b^2 is a convenient way of providing additional means.

Speaking generally of the mechanism illustrated and described, it is to be understood that I do not claim any invention in connection with the rotary valve, such as 14, since such a rotary valve is shown in expired patent to Westinghouse, No. 214,602, dated April 22, 1879, as valve C therein, and in this connection it may be remarked that I consider the valve 14 as the equivalent merely of any five-way cock adapted to occupy five positions—one for opening a comparatively large and a second for opening a comparatively small passage from main reservoir to train-pipe, a third for opening a comparatively large and a fourth for opening a comparatively small vent from the train-pipe, and a fifth position for closing all ports. Neither do I claim any invention in connection with the pressure-reducing device J K and passage L of Fig. 3 or the arrangement of the "warning" ports 20 and 22, since all these things are described in said last-mentioned patent, and I have employed the letters J K L of said patent to indicate the corresponding parts herein. If it is not desired to give the "warning" that the engineer's valve is in release position, the ports 20 and 22 may be omitted. Neither do I claim any invention in connection with Fig. 4, since, as we have seen, it is taken from said expired patent, No. 251,980. I merely describe all these various devices as capable of operating in connection with those elements of mechanism which constitute my invention, as pointed out in the claims below.

I claim—

1. In an automatic air-brake cut-off and relief valve device, including the usual moving parts of a triple-valve device the combination, with a piston-chamber and a piston controlling the release of train-pipe air working therein, of a row of ports through the bushing of the chamber for admitting train-pipe air from said chamber into the train-pipe in the rear and located so that said piston travels across them in one direction before air is charged past the piston into the rear train-pipe, and in the other direction before a train-pipe release-port is opened, a graduating-valve for gradually reducing the train-pipe pressure in a service application, an emergency-valve for quickly releasing the train-pipe pressure in an emergency application, and a yielding means for holding said emergency-valve closed, and for limiting the traverse of said piston to the proper position for a service application and permitting it to move to the position for an emergency application.

2. In an automatic brake system, including the usual moving parts of a triple-valve device operating in a train-pipe as a cut-off and relief valve device, the combination, with a piston in a chamber controlling the release of train-pipe air, of a graduating-valve for venting the train-pipe air in a service application, an emergency-valve for venting the train-pipe air in an emergency application and a row of ports opening from said cham-

ber into a passage for admitting air past said piston into the rear train-pipe, located so as to be crossed by said piston in alternate directions before admitting air through said ports, and before opening the service-vent from the train-pipe, respectively, and a yielding means for limiting the movement of said piston for service action, but permitting it a further movement for emergency action.

3. In an automatic brake system, including the usual moving parts of a triple-valve device operating as a cut-off and relief valve device in a train-pipe, the combination, with a piston in a chamber controlling the release of train-pipe air, of a graduating-valve for venting the train-pipe air in a service action, an emergency-valve for venting the train-pipe air in an emergency action, an engineer's valve, a tank charged with air from the piston-chamber, and a port through the wall of the chamber to the tank located so that the piston shall stand on one side of said port during the service action and on the other side thereof during the emergency action.

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