O. A. ROSS.

AUTOMATIC TRIP VALVE.

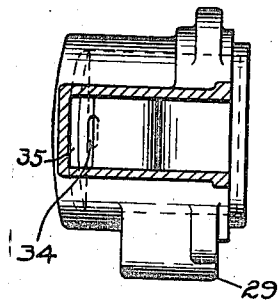
APPLICATION FILED NOV. 11, 1910.

1,167,316.

Patented Jan. 4, 1916.

4 SHEETS—SHEET 1.

FIG V



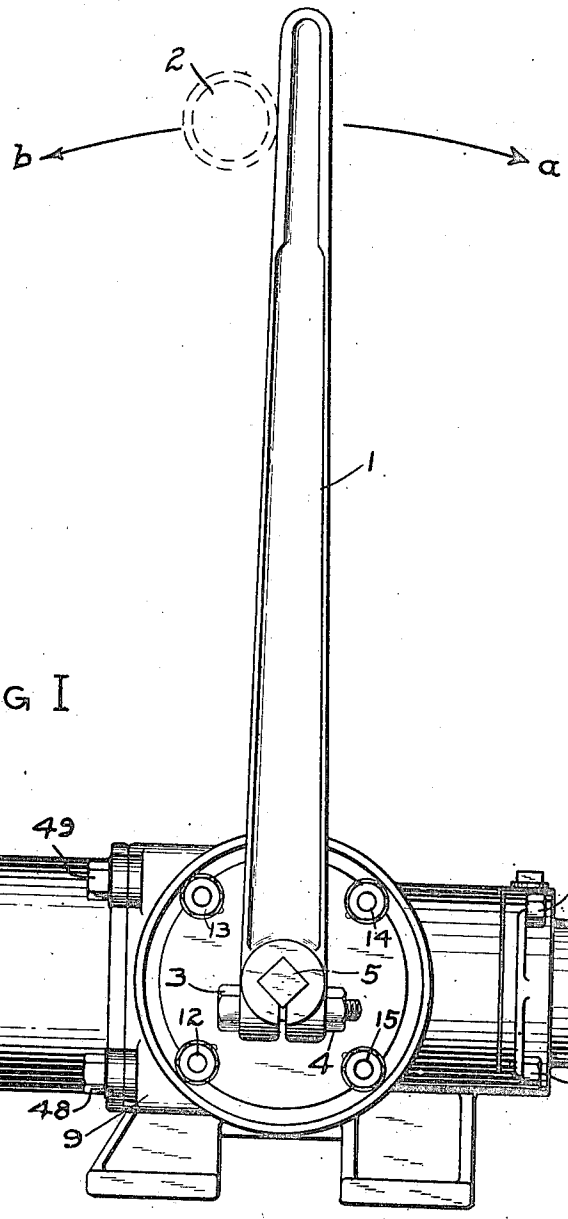


FIG I

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4 SHEETS—SHEET 2.

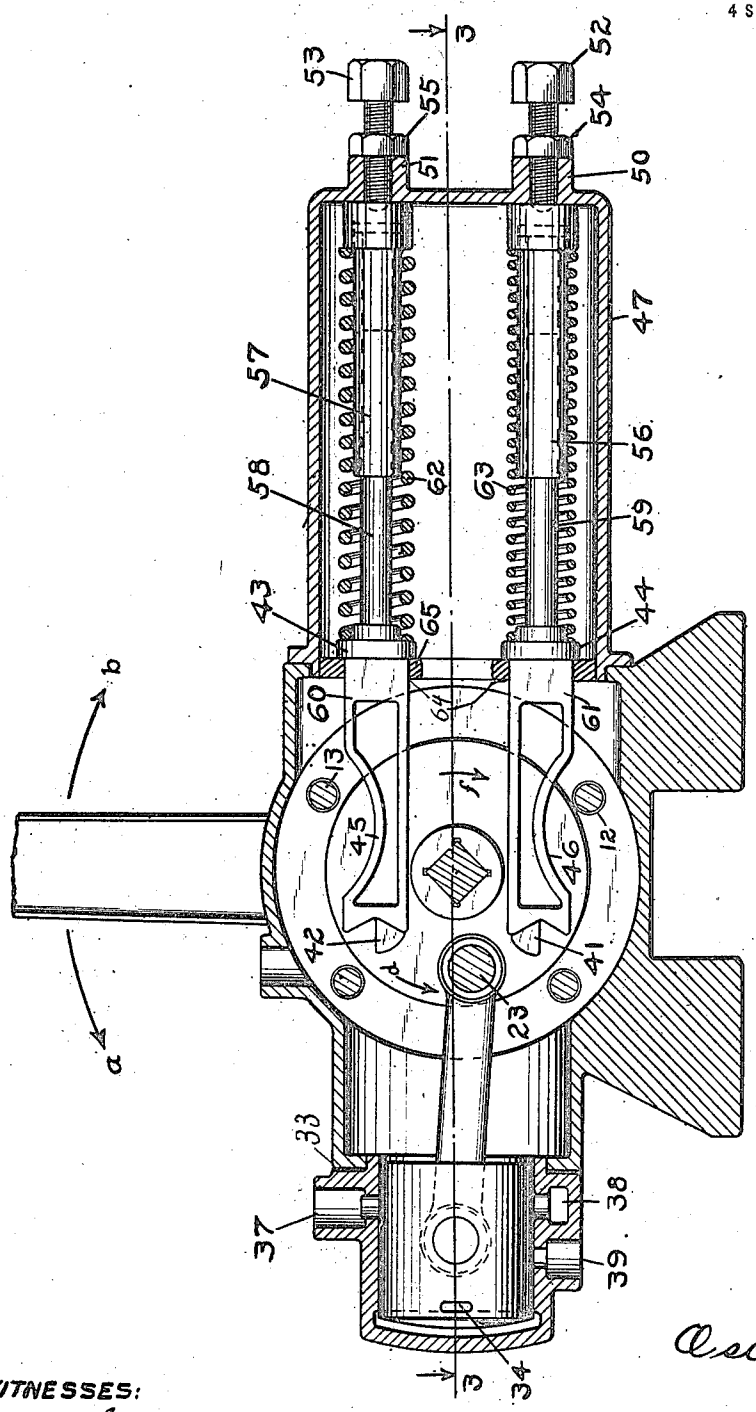

FIG. II

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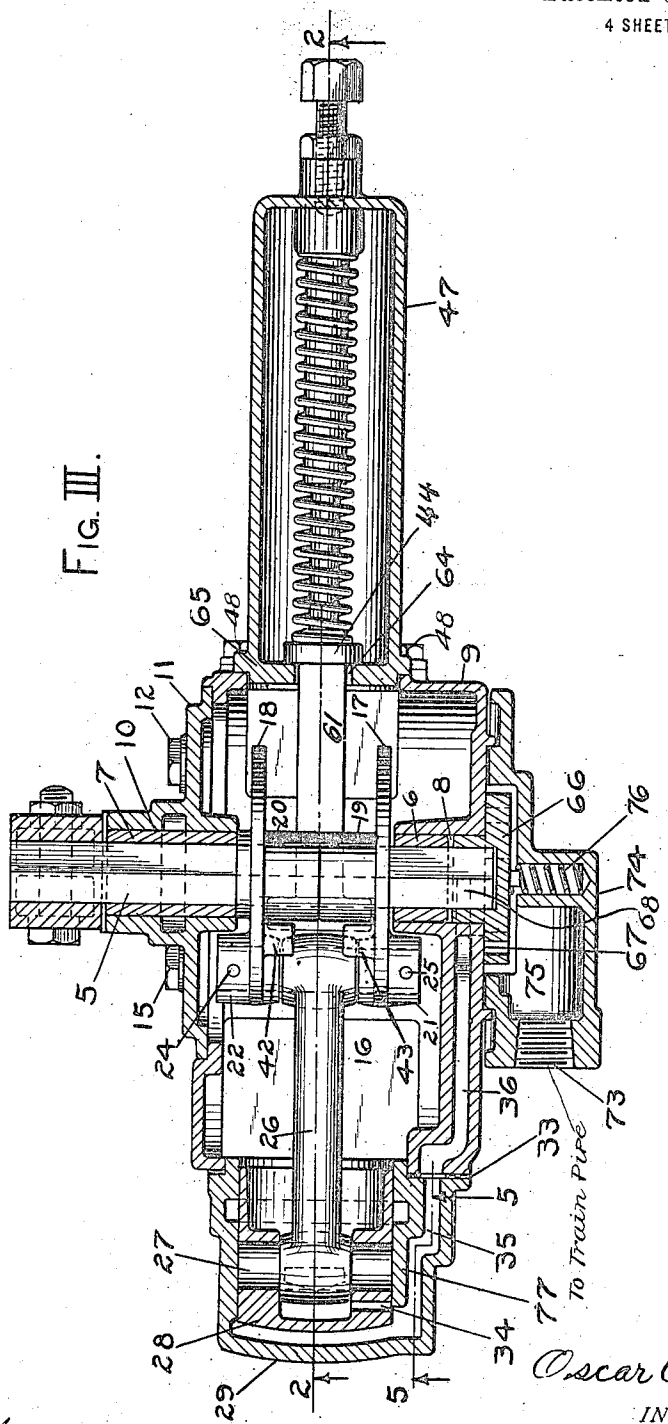
4 SHEETS—SHEET 3.

FIG. III.



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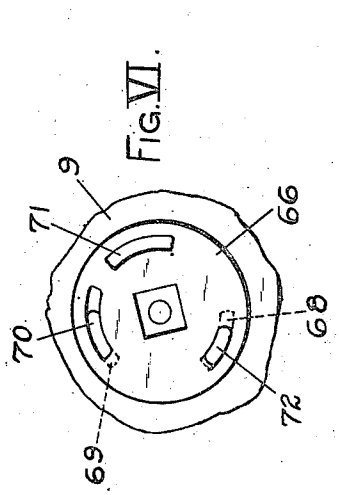

FIG. VI.

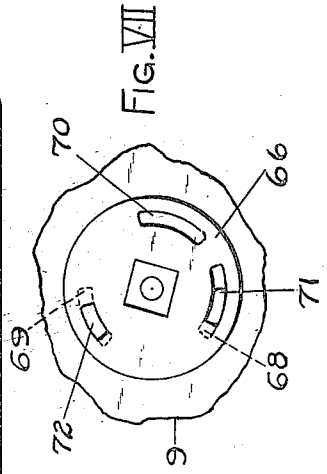

FIG. VII.

FIG. IV.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC TRIP-VALVE.

1,167,316. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed November 11, 1910. Serial No. 591,890.

To all whom it may concern:

Be it known that I, OSCAR A. ROSS, a citizen of the United States, and a resident of the city of Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Automatic Trip-Valve, of which the following is a specification.

My invention relates to valves which are adapted to be automatically tripped such as are used on railroad trains or engines for causing the train or engine to stop by venting the train line if the driver thereof attempts to pass a fixed signal in the danger position.

The primary object of the invention is to so construct an automatic trip valve that the driver of the vehicle on which it is located will be absolutely incapable of proceeding with his vehicle in a forward direction unless the trip arm of the automatic valve is in a position to be struck by the means placed along the road to contact with it when the signal is in a danger position.

A further object of the invention is the production of a device of the automatic trip valve type which will be so constructed that the trip arm will be depressed once only, when the vehicle on which it is placed travels in a backward direction, and which will not, when so depressed actuate the brakes to stop the vehicle, but which will when once depressed remain depressed until the driver stops and attempts to go forward whereupon the trip arm will immediately go to a vertical or operative position.

Another object of the invention is the production of an automatic trip valve, which when actuated by the means placed along the track to contact with the trip arm when the driver attempts to pass a signal at danger, will reduce the train line pressure of the air brake system on the train a certain predetermined amount.

A still further object is the production of an inexpensive and substantially constructed valve of the automatic trip valve type.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

The invention consists in the combinations, constructions and arrangements herein described and claimed.

In describing the invention in detail reference is had to the accompanying drawings, wherein like reference characters denote corresponding parts through the several views, and in which:

Figure 1 is a front elevation of the complete device looking at the trip lever side. Fig. 2 is a longitudinal vertical section on the plane indicated by the line 2—2, Fig. 3, looking in the direction of the arrows. Fig. 3 is a longitudinal horizontal section on the plane indicated by the line 3—3 Fig. 2, looking in the direction of the arrows, with some parts unsectioned so as to more clearly show the construction. Fig. 4 is a rear elevation in which the trip arm is shown broken away and the rear crank case cover is shown removed. Fig. 5 is a longitudinal vertical section of the cylinder on the plane indicated by the line 5—5 Fig. 3 looking in the direction of the arrow. Fig. 6 is a view of the outer face of the rotary slide valve in the position it assumes if the trip arm has been depressed upon striking an obstacle when the train or car is traveling forward. Fig. 7 is a view of the outer face of the rotary slide valve in the position it takes, when rotated by the trip arm, if depressed by striking an obstacle as it travels rearward.

Construction.—1 is a trip arm made of a very strong but light metal, which contacts with a suitable projection 2, placed at any desired point on the road, when a driver attempts to pass a signal in the danger position. If the car to which the automatic trip valve is applied, is moving forward at the time the trip arm 1 contacts the member 2, the trip arm 1 will be depressed in the direction indicated by the arrow *a*, Fig. 1; if the car is moving rearwardly the trip arm 1 will be depressed in the direction indicated by arrow *b*, Fig. 1. The trip arm 1 is rigidly connected by means of a bifurcated end and a bolt 3 and nut 4 with a square shaft 5, which carries bushings 6 and 7, said bushings being circular in cross section and forming a means for supporting the shaft in position, as they fit snugly one in a hole 8 in a casting 9 forming the main body of the automatic trip valve, and the

other fitting snugly in a hole 10 in a cover 11, which cover is bolted to the main casting 9 by means of the bolts 12, 13, 14 and 15, thereby forming an inclosed crank case space 16. On the shaft 5 and in the space 16 two disks 17 and 18 are placed each bearing a hub 19 and 20 respectively so as to space them apart, and any suitable means may be employed to prevent them from moving longitudinally of the shaft. The disks 17 and 18 bear circular projections 21 and 22 respectively near their periphery and in a straight line one with the other and at the same distance from the center of the square shaft 5. Through the projections 21 and 22 a hole is made in which is pinned a crank shaft 23 by means of the pins 24 and 25. The crank shaft passes through the end of a connecting rod 26, the other end of which bears a wrist pin 27 which fits into holes bored into the sides of the interior of a hollow piston 28 as shown in Fig. 3.

The piston 28 reciprocates in the cylinder 29 which is bolted to the main casting 9 by means of the bolts 30 and 31 and two similar bolts on the other side of the device not shown in Fig. 1, there being a gasket 33 between the two members. The piston 28 has a hole 34 therethrough leading from the surface of contact of the piston and cylinder to the crank case space 16, and the cylinder 29 has a cored passage 35 in one side which connects at one end to a similar cored passage 36 in the side of the main casting 9 and at the other end to the space between the end of the piston 28 and the inside of the head of the cylinder 29, the gasket 33 preventing any leakage of air from the joint between the cylinder 29 and the main casting 9.

37 designates an oil well at the top of the cylinder which connects with an oil groove 38 which conveys oil to lubricate the piston 28, and 39 designates an exhaust opening connecting the interior of the cylinder 29 to atmosphere, which may if thought desirable have a plug 40 screwed into it as shown in Fig. 4, through which any desired size hole may be drilled thus regulating the maximum rate of exhaust from the interior of the cylinder 29.

At points approximately just above and just below the projections 21 and 22 on the disks are formed knife edge bearing members, those on disk 18 being designated by 41 and 42, the top one on disk 17 being designated by 43 while the bottom one corresponding to 41 on disk 18 is not shown. These knife edge bearing members on the different disks are in line with each other as shown in Fig. 3 and bear against spring pressed reciprocating rods 60 and 61 having forked ends as shown in Fig. 2 and which are rectangular in cross section as far back from the forked ends as the stop shoulders 43 and 44. The reciprocating rods 60 and 61 extend into a spring case 47 which is bolted to the main casting 9 by means of the bolts 48 and 49 and two similar bolts on the other side not shown in Fig. 1, but shown in Fig. 4.

The spring case 47 carries, at its end remote from the main casting, the projections 50 and 51 through which holes are bored and in which are formed screw threads. Screwed into the projections are the adjusting screws 52 and 53 held in adjusted position by the lock nuts 54 and 55 respectively. The ends of the adjusting screws are rounded and project through the wall of the spring case 47 and into a countersunk depression in the head of stop tubes 56 and 57. The projecting cylindrical ends 58 and 59 of the reciprocating rods 60 and 61 fit slidably into the stop tubes 57 and 56, the stop tubes and reciprocating rods being separated as far as the stop 43 and 44 bearing against the wall 65 will permit by the action of the expansion springs 62 and 63. The reciprocating rods 60 and 61 are prevented from turning about their longitudinal axes by reason of the fact that the rectangular shaped ends pass through rectangular holes 64 in the end wall 65 of the spring case 47.

The square shaft 5 has as shown in Fig. 3 a rotary slide valve 66 slipped over one end, the valve having a square hole therein by reason of which this may be done and by reason of which the rotary slide valve oscillates with the trip arm. The rotary slide valve 66 seats upon a valve seat formed in the main casting at 67 through which the seat extends the ports 68 and 69 shown in Fig. 4, these ports connecting with the cored out chamber 36 leading to the cylinder 29. In the slide valve are three ports, 70, 71 and 72 which under different conditions coincide with the ports 68 and 69 in the valve seat and supply air to the cylinder 29 back of the piston 28. The air to the ports 70, 71 and 72 is supplied from the train pipe of the air brake system by means of a connection to the screw threaded opening 73 in the cover 74 which is bolted to the side of the main casting 9 by means of the bolts 12, 13, 14 and 15 shown in Fig. 1, covering the slide valve and by means of the cavity 75 supplying air directly to the valve. The cover also carries a spring 76 which presses the rotary slide valve to its seat and prevents leakage of air from the cavity 75 to the passage 36.

The automatic trip valve may be placed either underneath the car or train so as to strike an obstacle on the roadbed, or it may be placed on the top of a car or train so as to strike an overhead obstacle. In the description of the operation of the device which follows it will be assumed that the automatic trip valve is located on the top of the car.

Operation.—If the trip arm 1 strikes obstacle 2 when going forward, that is going in the normal direction of traffic, the trip arm will be depressed in the direction indicated by arrow *a*, Fig. 1. Such movement will be communicated to the square shaft 5 and through it to the rotary slide valve 66 causing it to rotate in the direction indicated by the arrow *c* in Fig. 4, and causing it to assume the position shown in Fig. 6 with the port 70 lapping the port 69 and with the port 72 lapping the port 68, thus allowing air under compression from the train pipe connected at 73 to pass into the passage 36 and so back of the piston in cylinder 29, which of course causes an outward movement of piston 28 in cylinder 29. An outward movement of piston 28 communicated to wrist pin 27, connecting rod 26 and crank pin 23 causes a rotary movement of the disks 17 and 18 in the direction of the arrow *d*, Fig. 2, thus causing a further rotation of the shaft 5 and the valve 66 in the same direction as before and so causing the ports in the rotary slide valve to extend farther over the ports in the slide valve seat, and thus causing an accumulative result which is resisted at all stages by the resistance of the spring 63 pressing against the reciprocating rod 61 and through it tending to hold the knife edge bearing in their initial position, and through the disks 17 and 18 and the shaft 5 tending to hold the rotary slide valve in initial position so that air cannot get to the cylinder 29.

The resistance of the spring 63 is so adjusted however in the preferred embodiment that the two forces will balance after air has been allowed to exhaust from opening 39 in the cylinder, due to the lapping of the port by piston 28, to such an extent as to reduce the normal train pipe pressure about 35 pounds although it may be so adjusted as to reduce it any amount at which pressure the piston 28 will just fail to open the exhaust port 39 and the trip arm will be depressed at an angle of about 60 degrees to the vertical and so be out of operative position. The time needed to effect this balance is regulated by the size of the exhaust opening 39, which may be varied in the manner previously described to thereby regulate the action of the brakes.

As after the trip arm has been depressed it will remain depressed in an inoperative position some means must be used to restore it to operative position before the driver again starts forward. In order to accomplish this result the device is so balanced that a still further manual reduction, through the ordinary engineer's valve of the brake system, of a few pounds will cause the leakage channel 34 in the piston to lap the end of the wall 77 of the passage 35 and so allow the air to exhaust from said passage into the crank cavity 16 and around the belt openings to atmosphere thus allowing the piston to return to normal position and the rotary slide valve to also return to normal position cutting off communication between the train pipe and the cylinder 29 whereupon the trip arm also returns to normal operative position ready to be again struck and operated.

It is further observed that it would be impossible for the driver to attempt to recharge the air brake system with any success without first returning the trip valve to normal position for any attempt to do so would only tend to force the piston out of the cylinder still farther and increase the size of the available exhaust to atmosphere through the exhaust port 39, thus preventing the recharging of the train line.

If the car carrying the trip valve is traveling rearwardly or against the direction of traffic, then all track trips corresponding to the obstacle 2 would be in any modern signal system employing track circuits in an operative position and thus by contacting with the trip arm cause it to be depressed, but as it is not desired to cause the setting of the brakes under such conditions the device herein illustrated is so designed that contact with a track obstacle when running against traffic will depress the trip arm 1 in a direction the reverse of that in which it would be depressed if the car or vehicle were moving with traffic. Thus, if the car was traveling against traffic and the trip arm contacted with a track obstacle the trip arm would be depressed in the direction indicated by arrow *h* in Fig. 1, and through the shaft 5, the rotary slide valve would be rotated in the direction indicated by the arrow *e* in Fig. 4, causing port 71 to lap port 68 and port 72 to lap port 69. As in the case when the car was traveling with traffic the piston 28 is forced outwardly, but the disks 17 and 18 now revolve in the direction indicated by arrow *f* in Fig. 2 for the preliminary movement of the disks 17 and 18 caused by the trip arm being depressed in the direction of the arrow *b* in Fig. 1 has caused the crank pin 23 to be raised above the center line joining the center of the shaft 5 and the center of the wrist pin 27, so that the outward movement of piston 28 in cylinder 29 causes a further rotation of disks 17 and 18 in the direction indicated by arrow *f* in Fig. 2. The rotative movement of the disks is now resisted by spring 62 which is made so much stronger than spring 63, that combined with the fact that the crank pin 23 starts from a normal position about 10 degrees below the horizontal center of shaft 5, the piston 28 does not move outwardly in the cylinder 29 sufficiently to uncover the exhaust port 39, so that when a balance is attained between air pressure and spring

action no exhaust from the train pipe takes place, but the trip arm remains depressed so that it will not contact with any obstacle it passes except the first if the car is traveling against traffic.

In order to bring the train to a stop when traveling against traffic the driver must operate the engineer's valve causing a reduction in train pipe pressure, but by so doing he restores the trip arm to operative position by the same act, because any reduction in the train line causes a corresponding reduction in the air pressure back of piston 28 and allows the spring 62 to force the piston back to such a point that the leakage port 34 in the piston laps the end wall of the passage 35 and so allows all air to escape from behind the piston and the trip arm to return to normal position closing the ports in the rotary valve seat. It has been found in practice that a very slight reduction suffices to accomplish the desired result when the spring 62 has been properly adjusted. It is to be further observed that crank pin 23 in the normal position is always the same distance below the horizontal center line of shaft 5 for the reciprocating rods 60 and 61 have the rectangular portion of a certain definite length and they extend into crank case 16 always the same amount due to the presence of the stops 43 and 44 and the fact that spring 62 is stronger than spring 63.

As there is always a liability of an air valve leaking provision has been made for such a contingency in this device by causing leakage groove 34 to lap the end wall of the passage 35, thus allowing the air entering the passage due to a gradual leak in valve 66 to pass to atmosphere and not gradually build up behind the piston and finally cause the trip arm to be depressed.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having particularly described the construction of one embodiment of my invention and explained the operation and principle thereof, what I claim as new and desire to protect by Letters Patent is:—

1. In an automatic valve, in combination, a source of compressed air, a member to be moved and means directly controlled by said member to hold the said member in the moved position by the action of the compressed air.

2. In an automatic valve, in combination, a source of compressed air, a member to be moved, a valve connected to said member and moved by the movement of said member and means directly controlled by the movement of said valve to hold the said member in the moved position by the action of the compressed air.

3. In an automatic valve, in combination a member to be moved, means acting mechanically on said member to move said member to its moved position, a valve connected to said member and moved by the movement of said member, a receiver for compressed air in communication with said valve, a cylinder, a cavity connecting the valve and the cylinder, a piston in the cylinder connected to the said member, for holding the said member in its moved position through the action of the compressed air.

4. In an automatic valve, in combination a member to be moved, a cavity connected with a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, and means for exhausting air from said train line through said cavity by the movement of said member.

5. In an automatic valve, in combination a member to be moved, a cavity connected with a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, and means controlled by the movement of said member for opening an exhaust to effect a predetermined reduction of pressure in said train line.

6. In an automatic valve, in combination a member to be moved, a cavity connected with a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, and means for making a predetermined reduction of pressure in said train line when the said member is moved, and means for restoring said movable member to initial position upon a further reduction of pressure in said train line.

7. In an automatic valve, in combination a member to be moved, a cavity connected with a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, and means for making a predetermined reduction of pressure in said train line when the said member is moved and means for restoring said movable member to initial position upon a further manual reduction of pressure in said train line.

8. In an automatic valve, in combination a member to be moved, a cavity connected with a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, and means controlled by the movement of said member for opening an exhaust to effect a predetermined reduction of pressure in said train line when the said member is moved and for preventing an increase above a predetermined pressure in said train line after said predetermined reduction is made, without restoring said member to initial position.

9. In an automatic valve in combination a

member adapted to be moved in either of two directions, a cavity connected to a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, means for exhausting air from said train line when the said member is moved in one said direction and means to prevent exhaust of air from said train line when said member is moved in the other said direction.

10. In an automatic valve in combination a member adapted to be moved in either of two directions, a cavity connected to a train line of an air brake system, the air-pressure in said cavity controlling the position of said member, means for exhausting air from said train line when the said member is moved in one direction and for thereby holding said member in the moved position and means to prevent exhaust of air from said train line when said member is moved in the other said direction and for holding the said member in the other said moved position.

11. In an automatic valve, in combination, a shaft, bearings for the shaft, disks on the shaft, a crank pin connected to the disks below the horizontal center of said shaft, bearings connected to the disks, a connecting rod connected at one end to the crank shaft, a wrist pin connected to the other end of the connecting rod, a piston connected to the wrist pin, a cylinder in which the piston reciprocates, an exhaust port in the cylinder, a leakage channel in the piston, reciprocating spring pressed rods bearing against the said bearings on the disks, a cavity connected to the train line of an air brake system, a rotary valve having ports communicating with the cavity, a valve seat on which the said rotary valve oscillates, ports in the said valve seat, a passage connecting the ports in the valve seat with the head of the said cylinder, means for adjusting the pressure on the spring pressed reciprocating rods, means for locking the adjusting means in adjusted position all arranged substantially as shown and described so that when the shaft is moved in one direction it is held substantially in the moved position and air is exhausted from the train line, whereas when the shaft is moved in the other direction it is held substantially in the moved position but air is not exhausted from the said train line.

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