S. G. NEAL.

DISTRIBUTING VALVE FOR AIR BRAKES.

APPLICATION FILED JUNE 7, 1910.

1,012,693.

Patented Dec. 26, 1911.

2 SHEETS—SHEET 1.

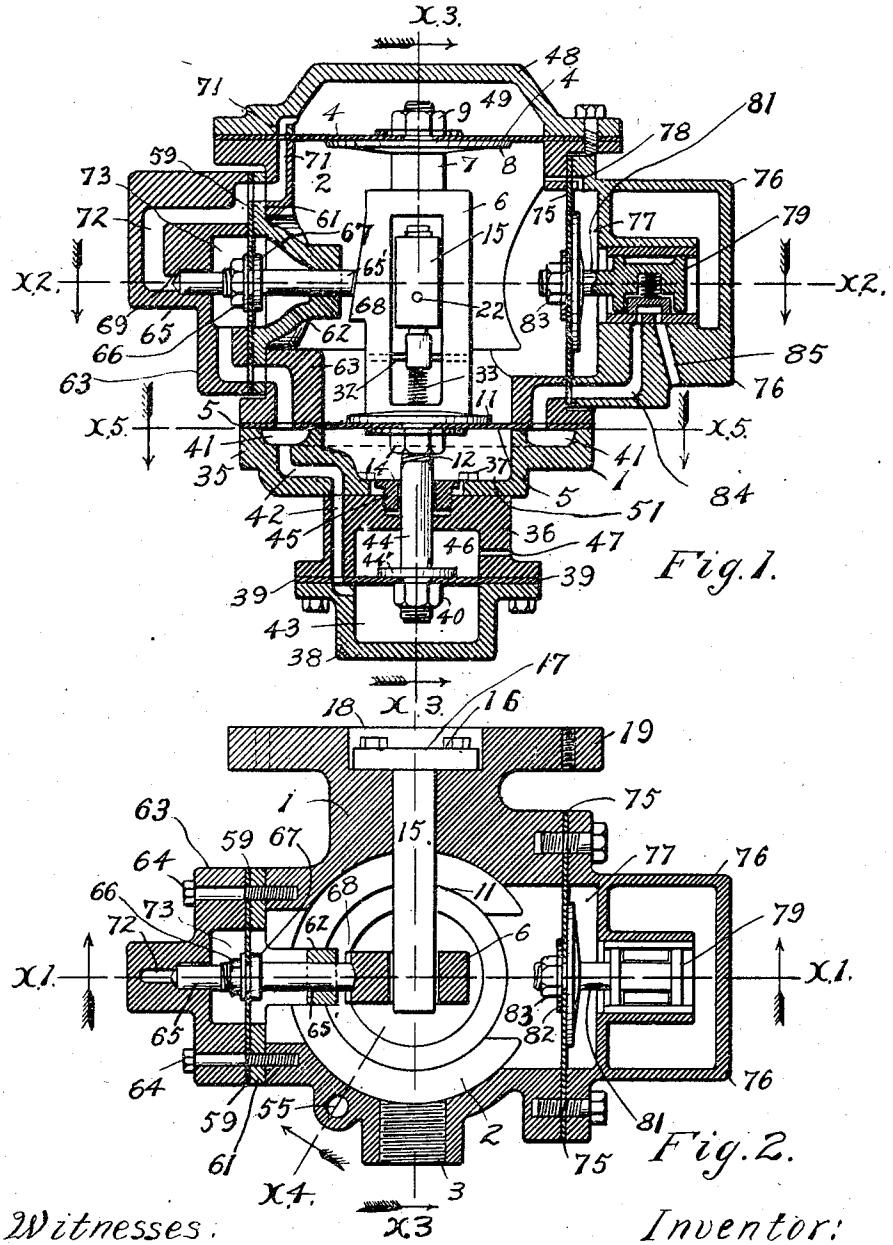

Fig. 1.

Fig. 2.

Witnesses:
H. H. Hunt.
L. D. Loomis

Inventor:
Spencer G. Neal
By Albert H. Merrill
Atty.

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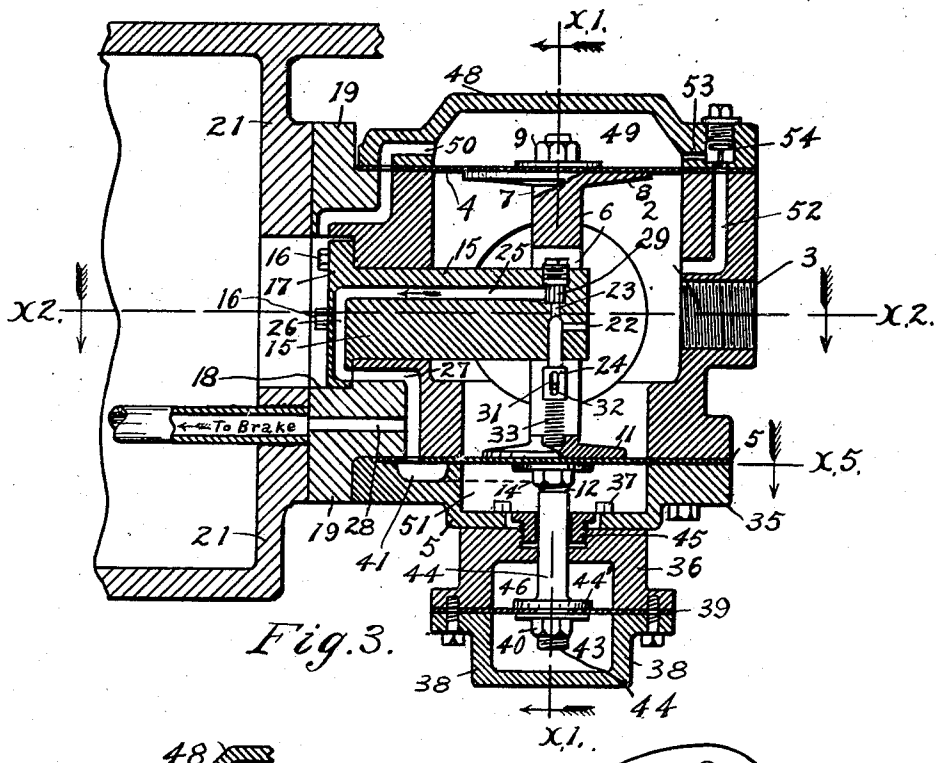

Fig. 3.

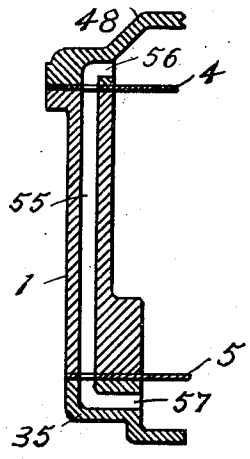

Fig. 4.

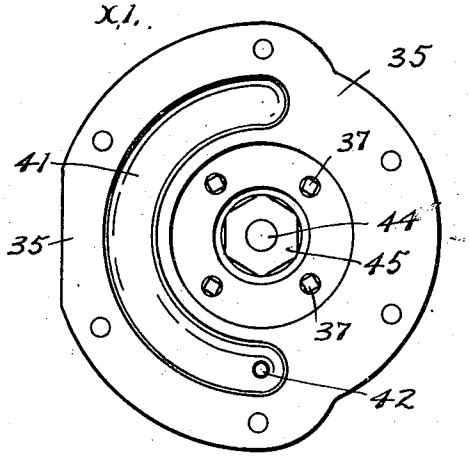

Fig. 5.

Witnesses:
H. H. Hunt.
L. D. Loomis

Inventor:
Spencer G. Neal
By Albert H. Merrill
Atty.

UNITED STATES PATENT OFFICE.

SPENCER G. NEAL, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO CALIFORNIA VALVE AND AIR BRAKE COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

DISTRIBUTING-VALVE FOR AIR-BRAKES.

1,012,693. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed June 7, 1910. Serial No. 565,616.

To all whom it may concern:

Be it known that I, SPENCER G. NEAL, a citizen of the United States, residing at Los Angeles, California, have invented a new and useful Distributing-Valve for Air-Brakes, of which the following is a specification.

The object of this invention is to improve upon the air braking apparatus described and claimed in Patent No. 961,320, issued jointly to William H. Sheasby and myself June 14, 1910. The valve controlling means of the present invention is adapted to perform nearly all the functions of the apparatus set forth in said patent, and is an improvement thereover in respect to responding more readily to small variations of air pressure, and in being therefore more positive in operation. It is also exceedingly simple in construction and very inexpensive to manufacture.

Referring to the accompanying drawings which illustrate the invention,—Figure 1 is a vertical section on line X^1 of Figs. 2 and 3. Fig. 2 is a transverse section on line X^2 of Figs. 1 and 3. Fig. 3 is a vertical section on line X^3 of Figs. 1 and 2. Fig. 4 is a sectional detail on line X^4 of Fig. 2. Fig. 5 is a plan view of the lower cap shown in Figs. 1 and 3.

Referring in detail to the drawings, within the main casing 1 is an air chamber 2 which will be termed the "train pipe chamber" because it is in constant communication with the train pipe port 3. Across the top of said chamber 2 extends a movable abutment desirably consisting of the diaphragm 4. Across the lower side of said chamber extends a movable abutment 5 consisting of a diaphragm of a smaller area than said upper diaphragm 4. Between said abutments 4 and 5 is a valve operating device consisting, in the embodiment of the invention illustrated in the drawings, of a yoke 6 having an upward extension 7 which projects through diaphragm 4 and is provided with a disk 8 in contact with the lower side of said diaphragm. Said extension 7 is screw-threaded above the diaphragm and is provided with a nut 9 to clamp the diaphragm 4 against the disk 8 thereby to make an air-tight connection. At the lower end said yoke 6 is provided with a disk 11, threaded stem 12 and a nut 14 to make an air tight connection with the lower diaphragm 5. Referring now to the means operated by said yoke 6 for supplying air to the brake cylinders during service application of the brakes, one side of the case 1 is provided with a rectangular opening within which is fitted an arm 15, said arm being desirably held in place by cap screws 16 extending through a flange 17 at the outer end of said arm, the casing being preferably provided with a counterbore 18 to allow said flange to seat below the surface of the wall of that side of the case, said side of the case being provided with flanged portions 19 for bolting the same to the auxiliary reservoir 21 a portion of which is shown. Arm 15 is provided with a passage 22 which communicates with another passage 23, communication between said passages 22 and 23 being controlled by graduating valve 24. Passage 23 leads to a passage 25 which extends through the arm 15 to a point near the outer end thereof thence downwardly by means of a passage 26 which opens out through the inner side of the flange 17 and is continued by means of passages 27 and 28 to the brake cylinder. Between passages 23 and 25 is a check valve 29 which permits air to flow only toward the brake cylinder as indicated by the arrow in Fig. 3.

Graduating valve 24 is provided with a longitudinal slot 31 through which extends a pin 32 the ends of which are made fast in each side of yoke 6. When the yoke descends pin 32 engages the lower end of slot 31 and thereby moves valve 24 downward thus admitting air from the train pipe chamber 2 through passages 22, 23, 25, 26, 27, and 28 to the brake cylinder. A spring 33 is provided to compensate for inaccuracies of adjustment between the emergency valve and the graduating valve. It will be seen that if the graduating valve 24 was rigidly united with the yoke 6, the result would be that both valves would have to be so adjusted as to be closed at the same time in order to avoid one of the valves being left open more or less on account of the other valve closing first. As soon as pin 32 leaves the bottom of slot 31 spring 33 holds

the valve to its seat. To the lower side of cap 35 is secured an inverted cup 36 desirably by means of cap screws 37. To the lower side of said cup is secured a cap 38, a diaphragm 39 being interposed between said cup and cap.

The passage 27 communicates with a passage or groove 41 formed in cap 35 and extending about half way around said cap. Said groove 41 communicates with a downwardly extending equalizing passage 42 which leads through diaphragm 39 and communicates with an equalizing chamber 43 within cap 38. To diaphragm 39 is secured an upright stem 44 which extends upwardly through base of cup 36 and normally abuts against the lower end of stem 12. Said stem is provided with a flange 44′ against which diaphragm 39 is clamped by a nut 40. Within the base of cup 36 is a stuffing box 45 through which the stem 44 extends to form an air tight fitting but to permit said stem to slide up and down through the bottom of said cup. Stem 44 could be formed in one piece with the stem 12 of the yoke; but for convenience in assembling said stems are preferably made separate, as shown. Above diaphragm 39 is an air space 46 which has free communication with the outer atmosphere through a vent 47. The upper diaphragm 4 is held in place by cap 48 beneath which is an upper diaphragm chamber 49 which communicates with the auxiliary reservoir 21 through passage 50. The lower cap 35 likewise forms a lower diaphragm chamber 51, the latter being of smaller diameter than the diaphragm chamber 49. Communication is established between the train pipe chamber 2 and the upper diaphragm chamber 49 by means of a passage 52 (see Fig. 3) which leads up through diaphragm 4 and thence to the diaphragm chamber 49 through a passage 53 in the base portion of the cap 48. A check valve 54 prevents air from flowing from the upper diaphragm chamber 49 to the train pipe chamber 2. The diaphragm chambers 49 and 51 are kept in free communication with each other by means of a passage 55 (see Figs. 2 and 4) which communicates with the upper diaphragm chamber through a port 56 and with the lower diaphragm chamber through a port 57.

Referring more particularly to Fig. 1, 59 is an emergency diaphragm which is clamped between the flanged base 61 of yoke 62 and the inner side of a cap 63, said cap, yoke and diaphragm being secured to the main case desirably by means of cap screws 64 as seen in Fig. 2. To diaphragm 59 is secured a horizontally extending stem 65 desirably by a nut 66, said nut clamping the diaphragm against a disk 67 formed around said stem 65. The inner portion 65′ of said stem projects through the front end of yoke 62 and is slidably supported thereby. Said inner end 65′ extends in proximity to a beveled rise 68 formed on the side of yoke 6. When said yoke is in the upper position said rise 68 forces the stem 65 to the left against a valve seat 69. The auxiliary reservoir pressure which is at all times in diaphragm chambers 49 and 51 may pass from the diaphragm chamber 49 through downwardly extending passages 71 and 72 so that when the valve 69 is not seated said auxiliary reservoir pressure may enter a chamber 73 outside of the emergency diaphragm 59.

The means will now be described for bringing the brake cylinder to full release. For this purpose a release diaphragm 75 is clamped beneath a cap 76, said diaphragm 75 being exposed on its inner side to the train pipe pressure in the main chamber 2 and on its outer side to the pressure in a chamber 77 beneath said cap 76. A small leakage passage 78 provides for gradually admitting the train pipe pressure to said chamber 77. Said diaphragm 75 is operatively connected with a slide valve 79 by means of a stem 81 having a disk 82 affixed thereto against which the diaphragm is clamped by means of a nut 83 on the inner side thereof. Said slide valve 79 establishes and cuts off communication between passages 84 and 85, the former passage leading to the groove 41 which is in communication with the brake cylinder, and the latter passage leading directly to the outer atmosphere.

The operation is as follows: Assuming the parts to be in full release position as shown in Fig. 1, there being no pressure in the train pipe chamber 2 and the auxiliary reservoirs being empty, the train line pressure is raised thus increasing the pressure in the chamber 2 thereby forcing air through the charging passage 52 past the check valve 54 through passage 53 into the upper diaphragm chamber 49 and charging the auxiliary reservoir through passage 50. At the same time the air escapes from the upper diaphragm chamber out through port 56 by way of passage 55 and out port 57 into the lower diaphragm chamber 51. Air may thus be admitted to the train pipe chamber 2, the diaphragm chambers 49 and 51, and the auxiliary reservoir, until the pressure has been raised in all of said chambers to, say one hundred pounds per square inch. At the same time air will escape from the train pipe chamber through leakage passage 78 to chamber 77 back of the diaphragm 75 so that an equal pressure will be built up on both sides of said diaphragm. Assuming the pressure to have thus been built up, it will be seen that the pressures above and below both the upper diaphragm 4 and the lower diaphragm 5 will balance

each other in the case of each diaphragm separately considered. The yoke 6 is so adjusted that when the pressures are as just stated it will occupy a sufficiently elevated position to permit the valve 24 to be closed by the pressure of its spring 33, thus preventing the train pipe pressure from entering the brake cylinder. To make a service application of the brakes under these conditions, a reduction may be made in the train pipe pressure as in present systems of, for instance, ten pounds per square inch with the result that, owing to the upper diaphragm 4 being of greater area than the lower diaphragm 5, the reduced air pressure in central chamber 2 will permit the pressure above the large upper diaphragm 4 to predominate over or overcome that beneath the lower diaphragm 5 with the result that the yoke 6 will be moved down and by means of pin 32 engaging the bottom of slot 31 will depress the valve 24 and admit air through the inlet 22, arm 15 and passages 27 and 28 to the brake cylinder, thus making a service application of the brakes. The air thus admitted to the brake cylinder, being in communication with the equalizing chamber 43, will build up a pressure in said chamber beneath the equalizing diaphragm 39, the area of said lower diaphragm 39 being proportioned so as to enable the same to lift the stem 44 and close the graduating valve 24 when the desired amount of air has been admitted to the brake cylinder from the train pipe. Further reduction of the train pipe pressure will cause a repetition of the operation just described, it being possible to thus continue to increase the brake cylinder pressure until the pressure per square inch in the brake cylinders becomes equal to the pressure per square inch in the train pipe. After equalization between the train pipe and the brake cylinder has thus been secured, a further reduction of the train pipe pressure will cause the brake cylinder pressure chamber 73 outside of the emergency diaphragm 59 to move said diaphragm inwardly, (the yoke 6 being at such time depressed bringing the rise 68 out of the way of the stem 65′) and thereby will unseat the valve stem 65 and admit auxiliary reservoir pressure to the groove 41 thence to the brake cylinder by way of passages 27 and 28. It will be understood that this latter operation will be resorted to by the engineer for the emergency application of the brakes, and will also occur in case the train pipe becomes broken by reason of the train parting or other accident.

If the engineer desires to make a moderate application of the auxiliary reservoir pressure to the brake cylinders he can do so by reducing the train pipe pressure only a few pounds below the brake cylinder pressure, and in such an event the auxiliary reservoir pressure will increase the pressure in the equalization chamber 43 and will raise stem 44 and yoke 6 thus bringing the beveled rise 68 against the end of stem 65′ and cutting off the auxiliary reservoir pressure from the brake cylinder causing the brake cylinder pressure to be built up in inverse proportion to the train pipe pressure. The check valve 29 (see Fig. 3) will prevent the air from escaping from the brake cylinder through passage 25 during the time the train pipe pressure is below the brake cylinder pressure. During the first reduction of train pipe pressure the pressure on the outer side of diaphragm 75 will force said diaphragm inwardly before the leakage passage has time to cause an equalization of pressure on opposite sides of said diaphragm, thus bringing the slide valve 79 to a position in which said valve closes escape to the outer atmosphere through the discharge passage 85. In order to fully release the brakes at any time after a service application has been made, the pressure in the train pipe is increased with sufficient suddenness to cause the diaphragm 75 to be moved outwardly and open the passage 85 before the air has time to leak through the passage 78 and build up a pressure on the outer side of the diaphragm 75 equal to the train pipe pressure. When the engineer reduces the train pipe pressure sufficiently to cause release of air from the train pipe to the brake cylinders, the immediate effect of such release will be to further reduce the train pipe pressure by causing each distributing valve to aid in making a reduction of the train pipe pressure, thus making a quicker and more uniform application of the brakes and causing a greater portion of the air which escapes from the train pipe to be put to useful work. If, at a time when there was no air pressure in the brake cylinder, and therefore none in the chamber 73, the train pipe should suddenly break thus exhausting the air from the central chamber 2, the auxiliary reservoir pressure upon the end of stem 65 would unseat the emergency valve and admit air from the auxiliary reservoir to make an emergency application of the brakes. It will therefore be seen that the opening of the emergency valve is not dependent upon the presence of any brake cylinder pressure. The amount of reduction of train pipe pressure necessary to make an application of the brakes can be predetermined by properly proportioning the diaphragms 4, 5 and 39 with relation to each other. If the diaphragm 39 is enlarged in proportion to the diaphragms 4 and 5 the appliance will more quickly bring the valve to the lap position after a service application of the brakes.

The foregoing description of the operation will enable those skilled in the art to understand the invention; but a fuller and more elaborate statement of the operations of a device which performs the same functions may be had by reference to the patent hereinbefore referred to, issued jointly to William H. Sheasby and myself. In this invention, and also in the device described in said patent, the train pipe pressure, the auxiliary reservoir pressure, and brake cylinder pressure are made to coöperate to control the operations of the valve in service applications of the brakes.

I claim:

1. In braking apparatus, two movable abutments of differential areas, said abutments each being exposed on one side to train pipe pressure and on the other side to auxiliary reservoir pressure and means operated by said abutments to admit train pipe air to the brake cylinder to make a service application of the brakes, said means being operated by brake cylinder pressure to cut off the air thus admitted to the brake cylinder.

2. In braking apparatus, a valve, two movable abutments of differential areas, a valve operating device operatively connected with said abutments to control admission of air from the train pipe to the brakes, said abutments bounding an area of train pipe pressure, and being exposed to auxiliary reservoir pressure on the sides opposite said train pipe pressure, and means to actuate said valve-operating device to lap said valve at predetermined brake cylinder pressure.

3. In braking apparatus, a casing containing a chamber in communication with the train pipe, two movable abutments of differential areas each exposed on one side to the pressure in said chamber, valve-operating means extending from one to the other of said abutments and movable with the same, the outer sides of said abutments being exposed to auxiliary reservoir pressure, a valve operated by said valve-operating means to admit train pipe air to the brake cylinder, and means to restore said valve to the lap position.

4. In braking apparatus, a casing containing a chamber in communication with the train pipe and two chambers in communication with the auxiliary reservoir, a movable abutment separating each of said chambers, which communicate with the auxiliary reservoir from the chamber which communicates with the train pipe, a member uniting said movable abutments, a valve operated by said member to admit train pipe pressure to the brake cylinder to make service applications of the brakes, and another abutment exposed to brake cylinder pressure to lap said valve.

5. In braking apparatus, a casing containing a train pipe chamber, two auxiliary reservoir chambers on opposite sides of said train pipe chamber, movable abutments of differential areas separating said auxiliary reservoir chambers from said train pipe chamber, an emergency chamber, an emergency abutment separating said emergency chamber from said train pipe chamber, a valve to admit air to the brakes to make service applications, means operatively connecting said oppositely disposed abutments to said valve, means operated by brake cylinder pressure to augment the opposition of the auxiliary reservoir pressure upon the smaller of said oppositely disposed abutments to cut off train pipe air from the brakes, and means operated by said emergency abutment to make emergency application of the brakes.

6. In braking apparatus, two movable abutments of differential areas, said abutments each being exposed on one side to train pipe pressure and on the other side to auxiliary reservoir pressure, a valve to admit air to the brakes for service applications, means operatively connecting said valve with said abutments and coupling said abutments together to move as one part, the auxiliary reservoir pressure on the smaller of said abutments tending to close said valve, and means operated by brake cylinder pressure to coöperate with the auxiliary reservoir pressure upon said smaller abutment to close said valve after a service application of the brakes.

7. In braking apparatus, two movable abutments of differential areas, a casing inclosing a chamber in communication with the train pipe, said chamber being bounded on opposite sides by said abutments, said abutments being exposed on their outer sides to auxiliary reservoir pressure, a valve to admit train pipe pressure to the brake cylinder, means operatively connecting said abutments with said valve and with each other, and means operated by brake cylinder pressure to assist the auxiliary reservoir pressure and train pipe pressure to bring said valve to the closed position.

8. In braking apparatus, two movable abutments of differential areas, said abutments each being exposed on one side to train pipe pressure and on the other side to auxiliary reservoir pressure, means operated by said abutments to admit train pipe air to the brake cylinder to make service applications of the brakes by reduction of train pipe pressure while the train pipe pressure exceeds the brake cylinder pressure, an emergency valve, means adapted for operation by reductions of train pipe pressure below brake cylinder pressure to actuate said emergency valve to admit aux-

iliary reservoir pressure to the brakes, and means to cut off admission of air to the brake cylinder.

9. In braking apparatus, two movable abutments of differential areas, said abutments each being exposed on one side to train pipe pressure and on the other side to auxiliary reservoir pressure, an emergency abutment exposed on one side to train pipe pressure, a valve-operating device operated by said emergency abutment to admit air to the brakes from the auxiliary reservoir, and means to actuate said valve-operating device to cut off communication between the auxiliary reservoir and brake cylinder, said last named means operatively connecting said movable abutments to move as one part.

10. In braking apparatus, two movable abutments of differential areas, said abutments bounding an area of train pipe pressure and being exposed to auxiliary reservoir pressure on the sides opposite said train pipe pressure, connecting means joining said abutments to move as one part, a valve operated by said connecting means to admit air to the brakes from the train pipe, an emergency abutment exposed on one side to train pipe pressure and on the other side to brake cylinder pressure, an emergency valve, means for bringing said connecting means and emergency abutment into operative relation to said emergency valve, and an abutment exposed to brake cylinder pressure to coöperate with the auxiliary reservoir pressure upon the smaller of said differential abutments to close both of said valves.

11. In braking apparatus, a casing containing a chamber in communication with the train pipe, two movable abutments of differential areas each exposed on one side to the pressure in said chamber, valve operating means extending from one to the other of said abutments and movable with the same, the outer sides of said abutments being exposed to auxiliary reservoir pressure, a valve operated by said valve-operating means to admit train pipe air to the brakes, an emergency abutment exposed on one side to the pressure in said chamber and on the other side to brake cylinder pressure, an emergency valve operatively connected with said emergency abutment, and provided with a stem projecting into said chamber, connecting means uniting said differential abutments to move as one part, said connecting means being provided with a beveled face adapted to operate upon said stem of the emergency valve to close the same, and an abutment exposed to brake cylinder pressure to coöperate with the auxiliary reservoir pressure upon the smaller of said differential abutments to close both of said valves.

12. In braking apparatus, means exposed to auxiliary reservoir pressure opposed to itself but tending to move said means in one direction, said means being also exposed to train pipe pressure which normally holds the same inoperative and being movable by a reduction of train pipe pressure in the direction which the auxiliary reservoir pressure tends to move the same, a valve operatively connected with said means to control the admission of air to the brakes for service braking, and means operated by brake cylinder pressure to close said valve.

13. In braking apparatus, means exposed to auxiliary reservoir pressure opposed to itself but tending to move said means in one direction, said means being also exposed to train pipe pressure which normally holds the same inoperative and being movable by a reduction of train pipe pressure in the direction in which the auxiliary reservoir pressure tends to move the same, a valve operatively connected with said means to control the admission of train pipe air to the brakes for service braking while the train pipe pressure exceeds the brake cylinder pressure, an emergency valve exposed to auxiliary reservoir pressure which may open said emergency valve to supply auxiliary reservoir pressure to the brakes when the brake cylinder pressure is exhausted, and means operated by brake cylinder pressure to close said valve.

14. In braking apparatus, means exposed to auxiliary reservoir pressure opposed to itself but tending to move said means in one direction, said means being also exposed to train pipe pressure which normally holds the same inoperative and being movable by a reduction of train pipe pressure in the direction in which the auxiliary reservoir pressure tends to move the same, a valve operatively connected with said means to control the admission of train pipe air to the brakes for service braking while the train pipe pressure exceeds the brake cylinder pressure, an emergency valve, means exposed to the brake cylinder pressure which opens said emergency valve to supply auxiliary reservoir pressure to the brakes, and means operated by the brake cylinder pressure to close said valve.

15. In braking apparatus, means exposed to auxiliary reservoir pressure opposed to itself but tending to move said means in one direction, said means being also exposed to train pipe pressure which normally holds the same inoperative and being movable by a reduction of train pipe pressure in the direction in which the auxiliary reservoir pressure tends to move the same, a valve operatively connected with said means to control the admission of train pipe air to the brakes for service braking while the

train pipe pressure exceeds the brake cylinder pressure, and means moved in one direction by auxiliary reservoir pressure to open communication between the auxiliary reservoir and brake cylinder and moved in the reverse direction by brake cylinder pressure to cut off such communication.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses at Los Angeles, in the county of Los Angeles and State of California, this 31st day of May, 1910.

SPENCER G. NEAL.

Witnesses:

ALBERT H. MERRILL.

JOHN N. YORK.