

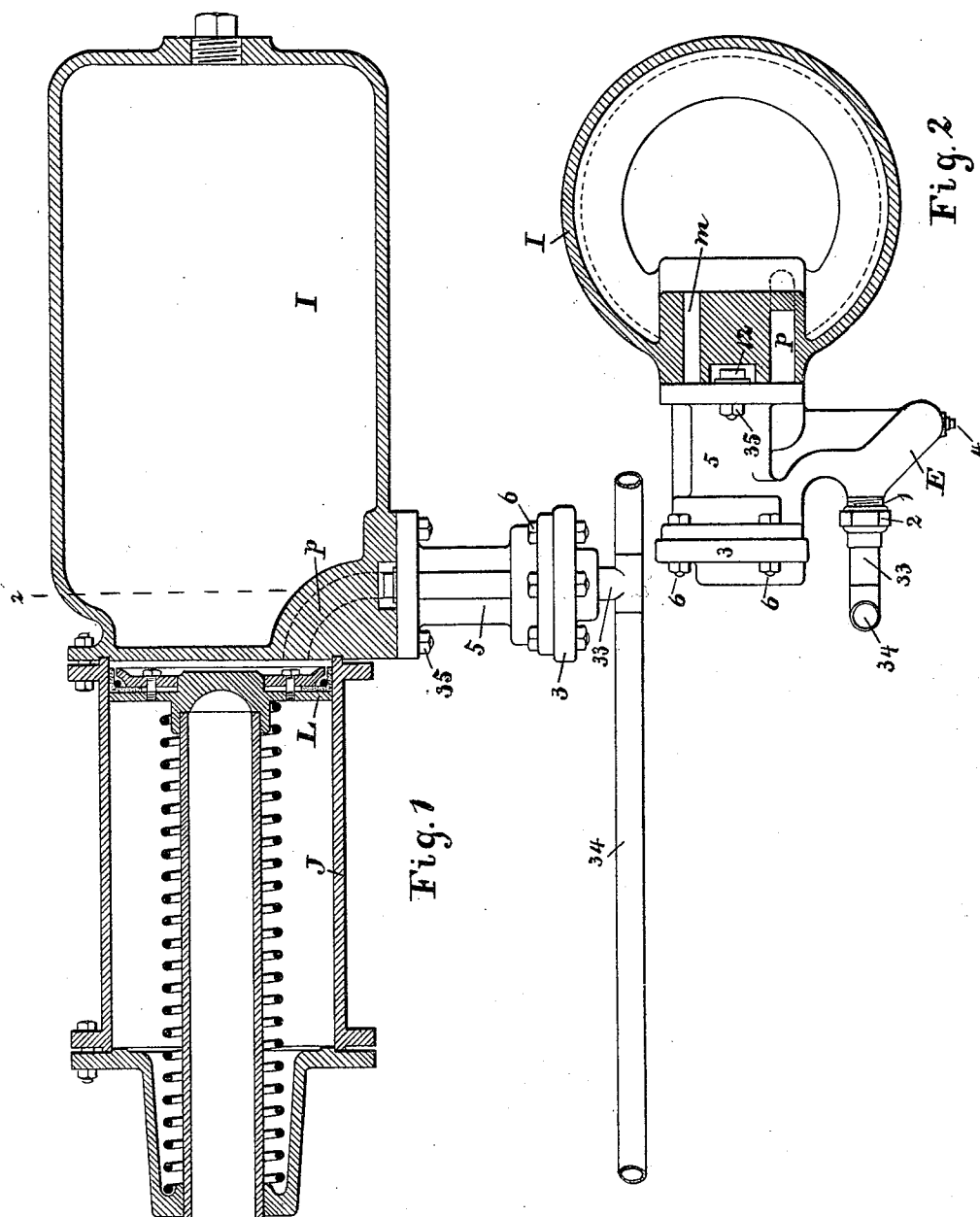
(No Model.)

2 Sheets—Sheet 1.

G. A. BOYDEN.
FLUID PRESSURE BRAKE.

No. 481,135.

Patented Aug. 16, 1892.



WITNESSES:
J. P. Davis.
Otto H. Ehlers.

INVENTOR:
Geo. A. Boyden
BY *Chas B. Mann*
ATTORNEY.

UNITED STATES PATENT OFFICE.

GEORGE A. BOYDEN, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE BOYDEN
BRAKE COMPANY OF BALTIMORE CITY, OF MARYLAND.

FLUID-PRESSURE BRAKE.

SPECIFICATION forming part of Letters Patent No. 481,135, dated August 16, 1892.

Application filed March 6, 1891. Serial No. 384,012. (No model.)

To all whom it may concern:

Be it known that I, GEORGE A. BOYDEN, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Fluid-Pressure Brakes, of which the following is a specification.

This invention relates to the construction of valves for automatic air-brakes, and has for its object to provide for admitting air-pressure to the brake-cylinder from both the train-brake pipe and the auxiliary reservoir, thereby effecting a more powerful and also a quicker application of each brake and at the same time so quickly reducing the air-pressure in the train-brake pipe adjacent to the said valves that all the brakes of a train will be applied at nearly the same time.

Referring to the drawings, Figure 1 is a section of the auxiliary reservoir and brake-cylinder, with a side view of the valve and train-pipe. Fig. 2 is a cross-section of the reservoir, with a side view of the valve attached thereto, showing the passages by which communication is established between the reservoir and the valve and brake-cylinder. Fig. 3 is a longitudinal section of the valve. Fig. 4 is a side view of the valve-piston and its attached parts.

In my patent of June 26, 1883, No. 280,285, I brought out an improved triple-valve mechanism having a check-valve passage leading from the train-pipe through or around the piston to the main-valve chamber, with a communication to the auxiliary reservoir and a communication to the brake-cylinder, the latter communication being normally covered by the main valve of the triple-valve device and uncovered by the movement thereof, thus utilizing both auxiliary-reservoir air and train-pipe air when the brakes are applied. Subsequently George Westinghouse, Jr., for the purpose of utilizing train-pipe air, in addition to auxiliary-reservoir air for applying the brakes in quick action, adopted a check-valved passage leading from the train-pipe around or past the triple valve directly to the brake-cylinder without passing through the main-valve chamber and covered said passage with a valve additional and "auxiliary" to the triple-valve mechanism, said auxiliary valve

performing none of the three ordinary functions of the latter, but adapted and used solely for producing a "quick action" of the brakes in applying for emergency. The United States Patent for the Westinghouse invention here referred to is dated March 29, 1887, and numbered 360,070.

In my present invention I use the check-valved feed-passage of my 1883 patent, leading from the train-pipe through the triple-valve piston to the main-valve chamber, and thence both to the auxiliary reservoir and the brake-cylinder for the double purpose of supplying the auxiliary reservoir, and also enabling train-pipe air to be vented directly through the main-valve chamber into the brake-cylinder to aid in applying the brakes for emergency stops, and this is done without interfering with the usual operation or functions of the "triple valve" and also without the aid of the "auxiliary valve," heretofore required for the purpose. It will be seen that the means I have thus provided for introducing train-pipe air into the brake-cylinder for "emergency stops" differs, essentially, from that shown in said Patent No. 360,070, and that said means involves a new mode of operation.

The branch pipe 33 from the train-pipe is connected to the valve by its nozzle 1 and union-nut 2, which screws thereon, the intervening joint between being made tight by a washer. The valve-case is provided with a drip-chamber E, extending below to drain the water therefrom and from which it is drawn off by removing the plug 4. The cap 3 is secured to the body 5 by suitable bolts 6 and the joint between is made tight by a washer. The body-piece 5 of the valve is provided with a cylinder D, lined with a brass bushing 8, a large passage A communicating between the auxiliary reservoir and said piston-cylinder a valve-chamber C, having at one end an opening lined with a brass bushing 9, which serves in part as a partition and separates the piston-chamber D from the valve-chamber C. A small passage B opens in the present instance between the piston-chamber D and the valve-chamber C and forms a communication through which air from the auxiliary reservoir is admitted to the valve-chamber C, and

vice versa. At the opposite end of the valve-chamber is a bushing 10, forming a port *c*, which is closed by the main valve 22. At this end of the body-piece is a passage *g*, leading
 5 to the brake-cylinder, and a bushing 11, having an exhaust-passage *G* opening to the atmosphere. It is obvious the restricted communication by which auxiliary-reservoir air flows to the valve-chamber may open directly
 10 between the auxiliary-reservoir passage *A* and the valve-chamber, as at *B'* in dotted lines. However located, this passage is much smaller than the passage *A* between the piston-cylinder *D* and the auxiliary reservoir. The
 15 piston 29 is provided with a packing-ring 30 and moves in the cylinder *D*, according to the changes in the preponderance of the pressure. Integral with the piston is the sleeve *F*, which fits and moves in the bushing 9. A cap 25 is
 20 secured to the sleeve *F* by the screw 21, which passes crosswise through the cap and also through a stem 18 and has each end resting in the piston-sleeve *F*.

A bushing 11 is fitted in an opening at the
 25 end of the body-piece 5. This bushing has a central passage *h* and an annular passage *h'*. A release-port *i* connects said two passages, and the annular passage has a connection with the exhaust-passage *G*. A cap 12 fits
 30 into the bushing, and a washer 13 makes a tight joint between the cap and bushing. The cap has a central passage, conforming in size to the central passage *h* of the bushing, and is practically a continuation thereof.
 35 The release-port *i*, before mentioned, is formed where the inner end of the cap adjoins the annular passage *h'*. In this cap is arranged an abutting piece 14, which has a limited movement by means of a slot *j* and the pin
 40 15. A spring 16 presses against the abutting piece 14 and forms a resistance in graduating to the end of the stem 18 and to the movement of the piston 29 and its attached parts. The release-valve is formed by a
 45 leather cup 17, secured to the valve-stem 18 by a screw 19, which extends into the stem, and a washer 20, that binds the said cup. The release-valve is movable like a piston in the central passage *h* of the bushing 11 and
 50 cap 12 and opens and closes the release-port *i*. The graduating-valve is formed by the valve-stem 18, having a passage *o*, with an opening *k* at one end, a port *k'* at the other, and with the main valve 22 loose on the said
 55 stem 18. The main valve 22 closes the large port *c*, which leads to the brake-cylinder, and this valve seats on the packing-rings 23 and 24. This valve 22 is loose on and is movable lengthwise of the stem 18, which wholly supports it. I term it a "floating" valve because it rides and may move freely on the stem and when unseated from the port *c* is not in contact with any other part. In the piston-sleeve *F* is arranged in a relation similar
 65 to my said 1883 patent the check-valve 26, which is held closed by the spring 27, the

seat of the check-valve being formed by the packing-ring 28. The piston-sleeve forms the train-pipe passage and has openings *o'*, which communicate with the valve-chamber *C*. The
 70 partition where the guide-bushing 9 is located isolates or separates the auxiliary-reservoir side of the piston-chamber *D* from the valve-chamber *C*, and this makes it possible when fully applying the brakes in an emer-
 75 gency for the piston 29 to be subjected on its auxiliary-reservoir side to a greater air-pressure than that contained in the valve-chamber.

As shown in Fig. 1, the auxiliary reservoir *I* is attached to the brake-cylinder *J*, in which
 80 moves the piston *L*. The valve-body 5 is attached to the side of the auxiliary reservoir by the studs and nuts 35, and the large passage *A* communicates with the auxiliary reservoir *I* through the passage *m*. Communi-
 85 cation between the valve and the brake-cylinder *J* is established through the curved passage *P*, connecting with the passage *g* in the valve.

Triple valves heretofore extensively in use, 90 like that patented to George Westinghouse, Jr., October 14, 1879, No. 220,556, have been arranged to effect two grades of brake application by auxiliary-reservoir pressure. The first grade may be called "full pressure," and 95 the second grade, which is partial pressure, is known as "graduation." For effecting these two grades of application a main valve and a graduating-valve have been employed corresponding generally, though embodied in 100 a different form, with the main and graduating valves 22 and *k'*. (Here shown.) The graduation-valve *k' o k* in the stem 18 of the present valve mechanism performs the ordinary functions of such a device and is brought 105 into useful action only in making graduation applications of the brakes. This graduation-valve does not affect the action of the release-valve or the main valve 22, which latter will allow the flow to the brake-cylinder of aux- 110 iliary-reservoir air alone, and also allow the flow of both auxiliary-reservoir air and train-pipe air. It will therefore be seen that the presence or absence of the graduation-valve is not essential to the performance by the 115 other parts of all the functions of a triple valve.

The operation of the valve is as follows: To charge the auxiliary reservoir, the air from the train-pipe passes in through the nozzle 1 120 and moves the valve-piston 29 to the position shown in Fig. 3, where the graduating-valve port *k'* and the main-valve port *c* will be closed, and thus all communication with the brake-cylinder cut off. The air then opens 125 the check-valve 26 and passes through the openings *o'* in the sleeve *F* to the valve-chamber *C*, from which it passes through the small passage *B* into the piston-cylinder *D*, and thence through the large passage *A* to the 130 auxiliary reservoir. An equalization of air-pressure will thus be brought about in the

auxiliary reservoir I, valve-chamber C, and train-pipe, and the check-valve 26 will be seated.

To apply the brakes by graduation, a slight
 5 reduction of the pressure in the train-pipe moves the piston 29 and its attached parts until the shoulder *q* on the stem 18 comes against the main valve 22, (the main valve remaining immovable on its seat, owing to the
 10 air-pressure in the valve-chamber C holding it thereon.) This movement closes the release-valve port *i* and draws the graduating-stem 18 through the main valve 22 sufficiently far to expose the graduating-port *k'* in the
 15 valve-stem to the air-pressure in the valve-chamber C. The air then passes from the auxiliary reservoir by way of the large passage A and small passage B into the valve-chamber C, and then through the graduating-
 20 port *k'*, passage *o*, and opening *k* in the valve-stem and the passage *g* to the brake-cylinder, where it effects the partial application of the brakes. This operation, which does not
 25 open the main-valve port, is due to the fact that the restricted communication B, through which the auxiliary-reservoir air enters the valve-chamber C, is larger than the graduating-port *k'*, and therefore the pressure in the valve-chamber is kept substantially equal to
 30 that in the auxiliary reservoir. This retention of the pressure in the valve-chamber when graduating holds the main valve 22 and the check-valve 26 seated on their respective ports. As the main valve 22 remains immov-
 35 able on its port at the time the brakes are being applied by the graduation-valve, it serves to arrest the movement of the piston by means of the stop-shoulder *q* on the stem coming in contact with it. The piston 29 and
 40 its attached parts will remain in the same position—to wit., with the stem-shoulder *q* in contact with the main valve 22—until the pressure has been reduced in the auxiliary reservoir below that in the train-pipe. The greater
 45 train-pipe pressure will then cause the piston 29 to move to the right till the end of the valve-stem 18 comes in contact with the spring-held abutting-piece 14, which retards the movement. When in this last position,
 50 the graduating-port *k'* in the valve-stem 18 is closed by having passed into the main valve 22, and thus prevents any further accumulation of pressure in the brake-cylinder. While in this position the cup-valve 17, which
 55 controls the release of the air, has not moved sufficiently far to uncover the release-port *i*, that leads to the atmosphere, and thereby holds the pressure in the brake-cylinder, which exerts the desired braking force. If it is desired
 60 to gradually increase the pressure in the brake-cylinder, the above operation may be repeated. To release the brakes, the engineer's valve is moved, and thereby the maximum pressure is restored in the train-pipe, which, acting on
 65 the piston 29, overcomes the resistance of the abutting spring 16 and moves the piston and its attached parts to the right to the extreme

limit of its movement, as shown in Fig. 3, which causes the release-valve 17 to uncover the release-port *i* and allow the air to pass
 70 from the brake-cylinder back through the passage *g*, then into the central passage *h*, around the stem 18, through the port *i*, and from thence to the annular passage *h'* in the bushing 11, from which it passes through the pas-
 75 sage G to the atmosphere. At the same time that the brakes are released the restoration of the pressure in the train-pipe will recharge the auxiliary reservoir for future use. The brakes may be applied fully in two ways: 80
 first, by the auxiliary-reservoir pressure alone, and, second, by the auxiliary-reservoir pressure in conjunction with the train-pipe pressure. The first mode is used when an ordi-
 85 nary gradual stop is required, such as at a station. The second mode is used when an emergency stop is required, such as upon the occurrence of an accident. To apply the
 brakes fully for an ordinary stop, a limited amount of train-pipe air is continuously dis-
 90 charged from the engineer's valve, which reduces the pressure in the train-pipe and slowly moves the piston 29 to the left and opens the main valve 22 sufficient to practi-
 95 cally maintain the same air-pressure on both sides of the said piston. The piston and the said valve will be retained in the position just mentioned, or the piston will slightly vi-
 100 brate back and forward, causing the valve 22 to repeatedly unseat and seat by the discharge of the auxiliary-reservoir air (through the valve-chamber C to the brake-cylinder) being about equal to the continuous dis-
 105 charge of air from the train-pipe at the engineer's valve. Under these conditions the pressure in the brake-cylinder, valve-chamber C, and auxiliary reservoir will equalize, and thus the ordinary function of the triple valve
 110 in applying the brakes fully by the auxiliary-reservoir pressure alone is accomplished. If the train-pipe pressure continues to lower slowly, the piston and its attached parts will be
 115 moved their full stroke to the left; but the air from the train-pipe will not pass to the brake-cylinder, because by this continuous but limited discharge of train-pipe pressure the air-
 120 pressure in the valve-chamber C will not be suddenly reduced below that in the train-pipe, as in this operation the main valve will not be opened sufficiently to discharge more air than
 125 the passage B supplies. To apply the brakes of a train quickly and with full power for an emergency stop, the engineer's valve will be
 130 moved to close communication between the storage-tank on the locomotive and train-pipe and open the latter to the atmosphere and effect a sudden reduction of pressure of from ten to twenty pounds in the train-pipe. The effect of this sudden diminution of pressure in the train-pipe is immediately mani-
 135 fested at the triple-valve mechanism on the first car, causing the valve-piston 29 to be moved by the higher pressure of auxiliary-reservoir air quickly to its full outward posi-

tion, thus moving the main valve 22 and opening the main port *c*, so that the air-pressure contained in the valve-chamber C may exhaust freely into the brake-cylinder. The supply of air from auxiliary reservoir to the valve-chamber is conducted through the restricted or small passage B. Hence when the main port *c* is fully opened and the air in valve-chamber C escapes through the larger passage thus provided, the pressure in said valve-chamber is quickly reduced below that in the piston-chamber D on the auxiliary-reservoir side, notwithstanding the fact that both the valve-chamber and the piston-chamber on said side receive air from the same source—*i. e.*, the auxiliary reservoir. The exhaustion of pressure from the valve-chamber C or the great reduction of pressure therein following the sudden opening of the main port *c* brings said air-pressure below that existing in the train-pipe, whereupon the check-valve 26 will be immediately unseated by said train-pipe pressure, and train-pipe air will then pass directly into the brake-cylinder J, thus effecting the quick application of the brakes and also further reduction of pressure in the train-pipe that will be sufficient to accelerate the action of the valve mechanism on the cars following. The piston 29 will in the meantime be held to its outward position by the relatively higher air-pressure from the auxiliary reservoir, which is delivered through the large passage A, while the transmission of auxiliary-reservoir air to the brake-cylinder is retarded by having to pass through the relatively smaller passage B. Thus a considerable volume of train-pipe air at lower pressure—say fifty to sixty pounds—will flow into the brake-cylinder, notwithstanding the admission of the auxiliary-reservoir air under a higher pressure, because the flow of auxiliary-reservoir air is so retarded by the smaller passage B that an appreciable period of time is required to raise the pressure in the brake-cylinder so that it and that in the auxiliary reservoir will be equal, and it is during this interval and before the pressure in the brake-cylinder is raised to equal that in the train-pipe that the air from the latter is free to enter the brake-cylinder. It will thus be seen that the sudden uncovering of the main port *c*, leading to the brake-cylinder, opens communication both between the train-pipe and brake-cylinder and also between the auxiliary reservoir and the brake-cylinder. As soon as the pressure above the check-valve, caused by the auxiliary-reservoir air plus the pressure of the spring 27, exceeds the pressure exerted by the train-pipe air on the other side the check-valve will close and the further ingress of train-pipe air to the brake-cylinder will be cut off, while the auxiliary-reservoir air will continue to flow, thus augmenting the pressure in the brake-cylinder. This valve mechanism belongs to the class of air-brake valves known as "triple valves," of which there are numerous examples, differing some-

what in construction and embodying variations and modifications in the form and arrangement of parts; but all of them, however specially constructed, contemplate a valve structure having suitable connections for the train-pipe, the auxiliary reservoir, and the brake-cylinder, and they are provided with passages or ports leading, first, from the train-pipe to the auxiliary reservoir; second, from the said reservoir to the brake-cylinder; and, third, from the brake-cylinder to the atmosphere. Hence the name "triple valves."

An examination of the particular embodiment of the present invention will disclose the fact that it is a triple valve *per se* without auxiliary or supplemental valve devices, and, further, that its conversion into a "quick-action" valve and its greater capacity for action over previous forms of triple valves is due to means here employed for transmitting train-pipe air direct to the brake-cylinder through the triple-valve chamber C and through the port *c* of the triple main valve, and at the same time retarding or restricting the flow of auxiliary-reservoir air to the said main port as compared with the more open or free delivery of train-pipe air to said main port. It will also be seen that a single valve 22, the main valve of the triple valve proper, here performs the office of opening a port *c* to the brake-cylinder, through which port both the train-pipe and the auxiliary-reservoir airs pass in the quick application of the brakes for emergency stops.

In my application for Letters Patent filed September 30, 1889, Serial No. 325,474, I have shown and described a valve for automatic air-brakes of the same type as that which constitutes the subject-matter of the present specification. In my said earlier application the fundamental features of the invention have been claimed. The present specification therefore relates to certain improvements in the construction of said valves.

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

1. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a main valve 22, which closes and opens said port, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, and a stem having one end suitably connected with the piston and which passes loosely through the main valve and also through the said port leading to the brake-cylinder and imparts movement to the said release-valve.

2. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a main valve 22, which closes and opens said port, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the piston and which passes loosely through the main valve and also through the said port leading to the brake-

cylinder and imparts movement to the said release-valve, and a stop-shoulder on the said stem between the main valve and release-valve.

5 3. A triple valve for automatic air-brakes, having, in combination, a port *c*, leading to the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the piston constructed to act as a graduating-valve, a main valve 22, loose on said stem and which rides or floats lengthwise thereof and is wholly supported thereby and opens and closes the said port leading to the brake-cylinder, and a stop-shoulder on the stem to come in contact with the said main valve, whereby when the brakes are being applied by the graduating-valve the main valve remains immovable and the stop-shoulder coming in contact with it arrests the movement of the said piston.

4. A triple valve for automatic air-brakes, having, in combination, a passage from the train-pipe, a passage from the auxiliary reservoir, which is smaller or more restricted than said train-pipe passage, a main port co-acting with both of said passages and communicating between them and the brake-cylinder, a piston actuated by air-pressure, a stem having one end suitably connected with the piston, and a valve loose on said stem and which rides or floats lengthwise thereof and is wholly supported thereby and opens and closes the said main port communicating to the brake-cylinder.

5. A triple valve for automatic air-brakes, having, in combination, a valve to release the air from the brake-cylinder, a piston actuated by air-pressure, a main port *c*, leading to the

brake-cylinder and located between the said release-valve and piston, a stem having one end suitably connected with the piston and which passes through said port and imparts movement to the said release-valve, and said stem provided with a passage having a lateral port for the flow of a small volume of air to apply the brakes by graduation, and a main valve 22, which is free to ride or float lengthwise on said stem and opens and closes the said lateral graduation-port and which also opens and closes the main port leading to the brake-cylinder.

6. A triple valve for automatic air-brakes, having, in combination, a port communicating with the brake-cylinder from both the auxiliary reservoir and the train-pipe, means for restricting the flow to the said port of auxiliary-reservoir air when applying the brakes for an emergency stop as compared with the flow of train-pipe air, a piston actuated by air-pressure, a stem having one end suitably connected with the piston and which is provided with a small passage for the flow of auxiliary-reservoir air to apply the brakes by graduation, and a main valve 22, which rides or floats loosely on said stem and is wholly supported thereby and opens and closes the said port communicating with the brake-cylinder and also controls the said small graduation-passage.

In testimony whereof I affix my signature in the presence of two witnesses.

GEORGE A. BOYDEN.

Witnesses:

JNO. T. MADDOX,
F. P. DAVIS.