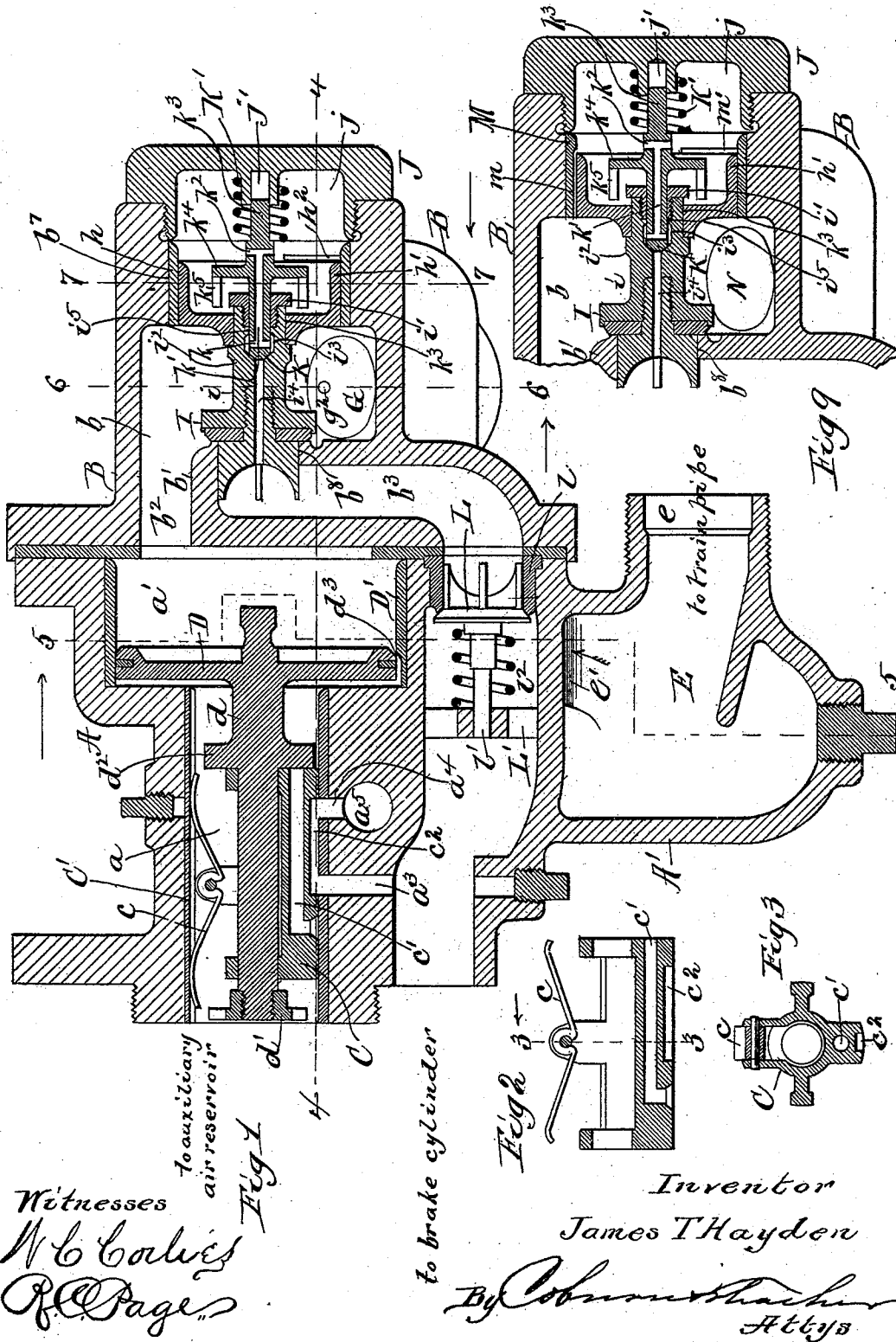


J. T. HAYDEN.

VALVE MECHANISM FOR AIR BRAKES.

No. 496,651.

Patented May 2, 1893.



Witnesses
W. C. Colvins
R. C. Page

Inventor
James T. Hayden
By Robert M. Thacher
Att'y

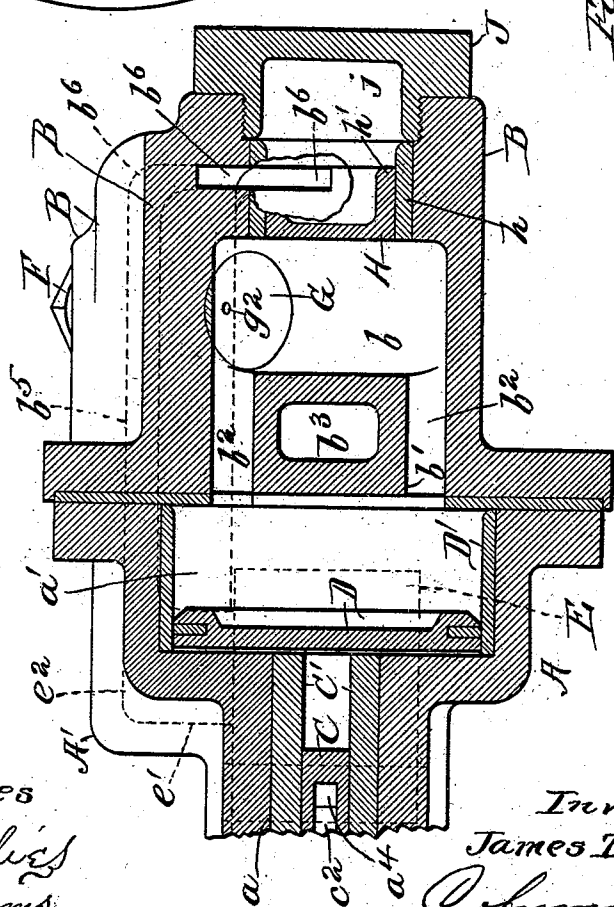
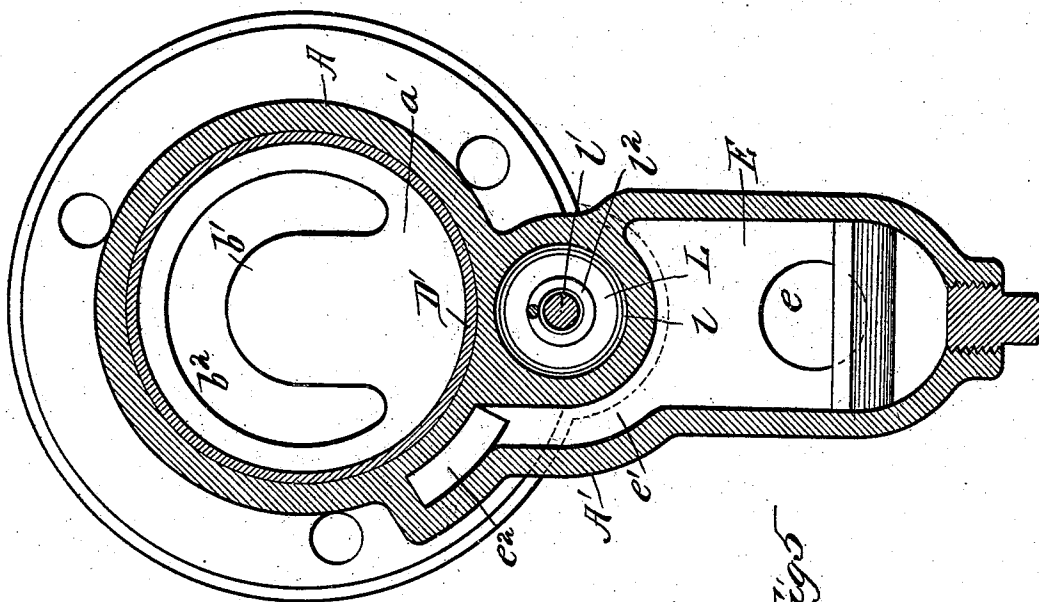
(No Model.)

3 Sheets—Sheet 2.

J. T. HAYDEN.
VALVE MECHANISM FOR AIR BRAKES.

No. 496,651.

Patented May 2, 1893.



Witnesses
W. C. Corlies
J. W. Adams

Inventor
James T. Hayden

By *Robert M. Thacher*
Attys

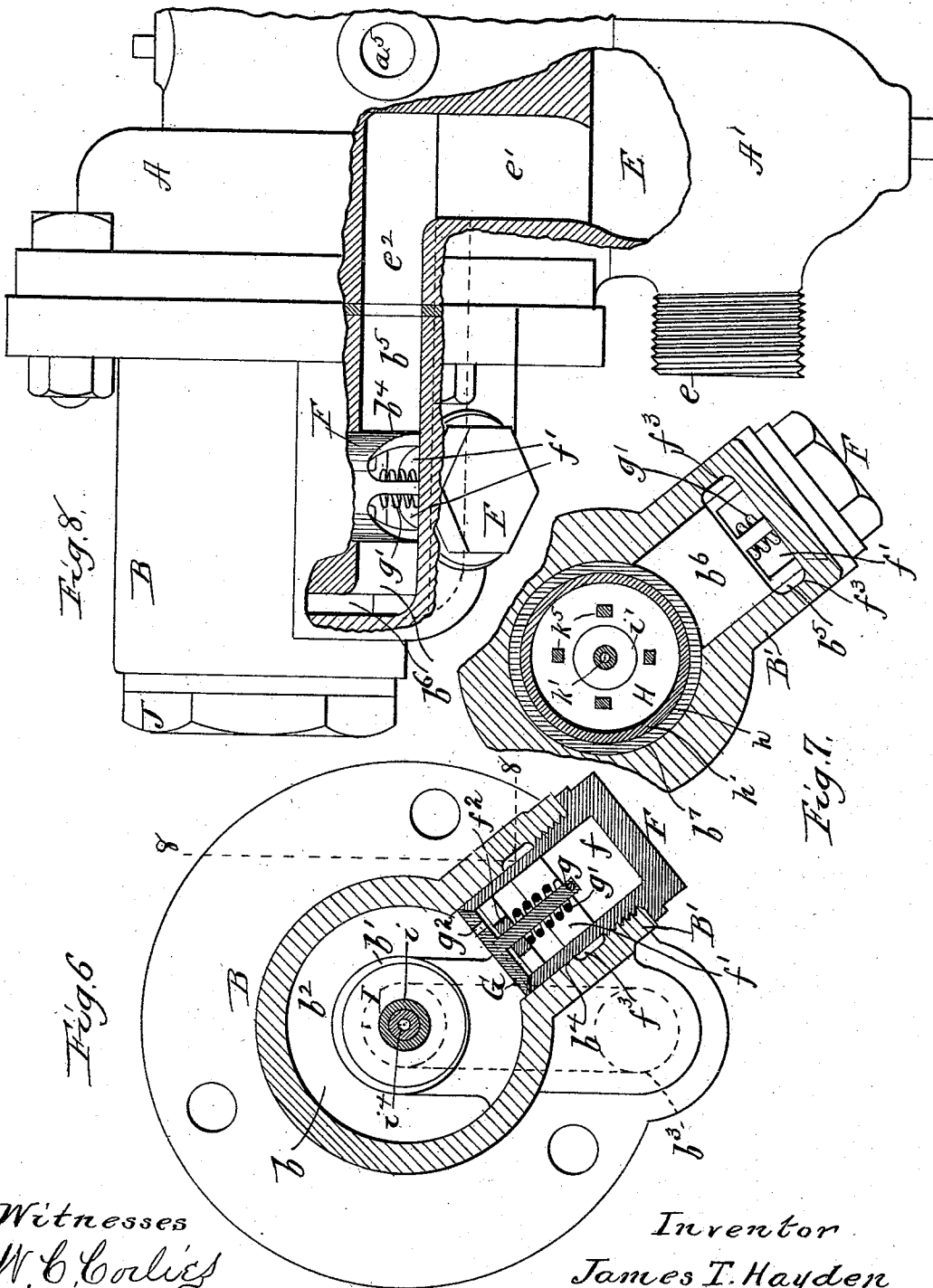
(No Model.)

3 Sheets—Sheet 3.

J. T. HAYDEN.
VALVE MECHANISM FOR AIR BRAKES.

No. 496,651.

Patented May 2, 1893.



Witnesses
W. C. Corlies
R. L. Page.

Inventor
James T. Hayden
By *Coburn & Thacher*
Attys

UNITED STATES PATENT OFFICE.

JAMES T. HAYDEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CRANE COMPANY, OF SAME PLACE.

VALVE MECHANISM FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 496,651, dated May 2, 1893.

Application filed April 9, 1892. Serial No. 428,551. (No model.)

To all whom it may concern:

Be it known that I, JAMES T. HAYDEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Valve Mechanism for Air-Brakes, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a longitudinal vertical section of a triple-valve mechanism embodying my invention; Fig. 2, a vertical section of the slide-valve, detached, and taken lengthwise thereof; Fig. 3, a cross-section, taken on the line 3—3 of Fig. 2; Fig. 4, a plan section, taken on the line 4—4, of Fig. 1, broken away at the left; Fig. 5, a cross-section, taken on the broken line 5—5, of Fig. 1; Fig. 6, a cross-section, taken on the line 6—6, of Fig. 1; Fig. 7, a similar section, taken on the line 7—7, of Fig. 1; Fig. 8, a side elevation of Fig. 6, partly in section on the broken line 8—8, of Fig. 6, and Fig. 9, a detail vertical section through the emergency valve and its actuating piston, on the same line as Fig. 1, showing a modification in construction.

The several figures of the drawings are all upon the same scale; and wherever arrows are found on the drawings, in connection with section lines, they indicate the direction in which the view is taken.

My invention relates to a valve mechanism for use in automatic air-brake apparatus, in which the device now generally known as a "triple-valve" is employed. In the usual organization this triple-valve is found in connection with an auxiliary air reservoir, a brake cylinder and a main air pipe or train pipe running from car to car, from the main air reservoir, or air pump on the engine. There is also found in connection with these devices in the later valve mechanisms what is usually known as an "emergency-valve," whereby, whenever it is desired to set the brakes with full force, communication is opened up between the train pipe and the brake cylinder, so that the full pressure of air in the train pipe may be utilized to actuate the brake-levers, in addition to the pressure from the auxiliary air reservoir by which the brakes are ordinarily operated.

The present invention relates more particularly to the emergency-valve and the means for operating the same, whereby the said valve is opened to connect the train pipe with the brake cylinder by air from the main piston cavity, when the pressure in the main air pipe is suddenly and momentarily greatly reduced.

I have shown in the drawings so much of the valve mechanism as is necessary to an understanding of my present invention, but without attempting to show all the parts of an air-brake apparatus, or, indeed, all of the parts with which the triple-valve is immediately connected, as it is to be understood that these features are to be the same as now in general use and hence well-known in construction and operation.

I will now describe in detail the construction and operation of the mechanism illustrated by the drawings, wherein I have embodied my invention in a practical way, and the special improvements which I believe to be new and wish to secure by Letters Patent will then be more clearly defined in following claims.

In the drawings, A represents the case of the triple-valve and, B, a separate case which may be called the emergency-valve case. These two cases are arranged in line with each other and are fitted to be joined together, as seen in Fig. 1 of the drawings, in which the emergency valve case is shown arranged at the right of the triple valve case.

The case A is provided with a longitudinal aperture or chamber, *a*, in which is seated the slide valve, C.

At the inner end of the case A, next to the case B, there is a chamber, *a'*, shorter than the valve chamber, but considerably larger in diameter. This is the chamber, or cylinder of the main piston D, the rod, *d*, of which passes through the chamber *a* and carries the valve C, the rod having a slight movement lengthwise independent of the valve which is a known form of construction. The outer end of the valve chamber *a* connects, as usual, with the auxiliary air reservoir and the piston rod *d* at this end of the valve chamber has the well-known small piston, *d'*. In this instance the valve C is a flat slide valve and

is held upon its seat by a spring, c , fitted to the upper portion of the valve and bearing upon the upper wall of the chamber, as seen in Figs. 1 and 2. The valve has a port or passage, c' , extending from its inner end nearly the length of the valve and then turning at right angles and passing out at the face of the valve. Below the longitudinal portion of this port there is a recess, c^2 , cut in the face of the valve. A collar, d' , on the piston rod holds the valve on the latter, but is far enough removed from the small piston on the outer end of the rod to permit the slight independent movement of the rod, mentioned above, as seen in Fig. 1. A bushing, D' , is set in the chamber a' for the piston D and at the inner portion of this bushing there is provided the usual short by-pass, d^3 , around the piston, so that when the latter is in position shown in Fig. 1 there is a small air passage from the piston chamber to the valve chamber and thence to the auxiliary reservoir.

In the triple-valve case A below the valve and piston chamber there is a passage, a^2 , extending the length of the case and connecting at the outer end of the case with the brake cylinder. A port, a^3 , extends up directly from this passage to the slide valve seat; a port, a^4 , also extends from the latter seat a short distance downward where it connects with the exhaust port, a^5 , located in the bridge portion of the case between the valve chamber and the brake cylinder passage below, as seen in Fig. 1. The brake cylinder passage a^2 is connected at its inner end with the chamber of the emergency valve case, as will be described presently.

On the under side of the case A there depends a smaller and what may be called a supplemental case, A' , within which is a chamber, E , provided with an opening, e , which connects with the train pipe. This case A' may be integral with the case A, as seen in the drawings.

Within the emergency valve case B there is a main chamber, b , in which the valve is mounted, and at the inner end thereof, or next to the case A, there rises a bridge, b' , from the bottom of the case, which, however, is not sufficiently large to close the chamber, but a wide opening, b^2 , extends around the bridge between it and the casing, except at the bottom where the two are joined together, which opening provides a free passage from the chamber b into the piston chamber a' . A passage, b^3 , in the bridge and lower part of the casing connects the chamber b with the brake cylinder passage a^2 in the lower part of the case A, as seen in Fig. 1. A passage, e' , leads out from the upper end and one side of the chamber E to a second passage, e^2 , arranged at right angles to the former and extending directly outward toward the emergency valve case, as seen in Fig. 8. These passages are made in the walls of the supplemental case A' and the valve case A, as seen in Fig. 5.

At one side of the emergency valve case B there is a small supplementary case, B' , extending out from the former at an angle to the perpendicular axis thereof, when arranged in working position, as seen in Figs. 6 and 7. Within this extension case there is a circular chamber, b^4 , running the length thereof, so that it communicates at its inner end directly with the emergency valve chamber b and at its outer end opens to the atmosphere. A short horizontal passage, b^5 , registers with the passage e^2 and connects the latter with this supplemental chamber, as seen in Fig. 8.

A hollow screw plug, F , is fitted into the extension case B' , so as to fill the circular chamber within the latter and extending nearly to the inner end thereof, as seen in Fig. 6. The interior of this plug makes a circular chamber, f , within the plug which, of course, is closed at the outer end by the cap of the plug, while at the inner end it opens into the emergency valve chamber. The body of the plug F is cut away at that portion lying in line with the passage b^5 to provide a series of quite large openings or ports, f' , extending around the plug. These openings are so large as to give a skeleton form to the plug at this point, only narrow bars being left between them, as seen in Fig. 8, so that there will always be an open communication between the horizontal passage b^5 and the interior of this plug. A puppet-valve, G , is seated on the inner end of the plug, the stem, g , of which passes down through a bridge, f^2 ; it closes the inner end of the plug and is held in place by a spring, g' , arranged between the bridge and a washer on the outer end of the stem. A small port, g^2 , is cut through the valve and is always open, thus providing a small constant communication between the chamber in the plug and the emergency valve chamber.

In the casing B' on the opposite side of the plug from the passage b^5 and directly opposite to the latter, there is a passage, b^6 , opening out from the plug chamber and extending therefrom horizontally a slight distance and then turning upward at right angles and leading into a space or chamber in the outer end of the casing B, which will be described presently.

Near the outer end of the case B there is provided a bushing, b^7 , just back or outside of the chamber b . Within this bushing is seated a valve or piston, H , a bushing, h , being first applied to this circular seat, within which the valve H is seated, as seen in Fig. 1. This valve is provided with a rim-flange, h' , so that it is cup-shaped, the cup opening being outward, and the bushing is somewhat wider than the rim of the valve to provide for movement of the latter within the former. A circumferential slot, h^2 , is cut in the bushing near the outer edge thereof, in such position that when the valve is at its innermost position, this slot will appear in the shape of a narrow slit just outside of the rim of the valve and so uncovered, as seen in Fig. 1.

The opening h^2 communicates with the passage b^6 , thereby making a connection between the hollow plug G and the space back or outside of the valve H when at its inner adjustment, seen in Fig. 1. This valve H closes the case B back of the chamber b ; but there is still some space at the outer end of the case outside of the valve and this is enlarged by a cup-shaped cap, J, which is threaded and closes the outer end of the case B, as seen in Fig. 1. There is thus provided a small chamber, j , between the valve H and the cap J, which is entirely closed, except through the slot h^2 in the bushing h , and evidently only a slight outward movement of the valve H will close this port and thus provide an entirely closed chamber.

The emergency valve, I, is arranged within the chamber b and is seated on the bridge b' to close an opening, b^8 , in the inner face thereof connecting the chamber b with the passage b^3 . The valve I is provided with a large long stem, i , which extends outward horizontally and is journaled within a central opening, h^3 , in the valve H. At the outer end of this stem there is a collar or flange, i' , and some distance within the latter, a collar, i^2 , the space between the two being somewhat wider than the bearing surface of the valve H at this point, so that provision for differential movement between the two is made; a preferable construction is to make the outer collar i' on a screw-plug which may be readily removed for the purpose of connecting and disconnecting the valve H and the stem of the valve I, as seen in Fig. 1.

Within the stem i there is provided a small chamber, i^3 , from which a small passage or port, i^4 , leads inward through the stem and the valve itself and communicates with the passage b^8 in the bridge. The diameter of this central port i^4 is very much smaller than that of the stem chamber. A small supplemental valve, K, of tubular form is inserted in the outer end of the valve stem i through a central aperture, i^5 , leading into the stem chamber, as seen in Fig. 1. This valve is seated at the inner end of the port i^4 , so as to close its opening into the stem chamber; and the latter is somewhat larger than the valve, so as to leave a free space entirely around the inner end thereof.

The valve K is provided with a small cross-port, k , at its inner end within the stem chamber, from which a central port, k' , extends outward to near the outer end of the valve, where it connects with a second cross-port, k^2 , opening into the chamber j back of the valve H. Beyond this port is the stem, k^3 , which is mounted in a socket, j' , on the inside of the cap J. A spring, K' , surrounding the socket and valve stem is arranged to normally force the valve K inward to close the port i^4 of the emergency valve. The valve K is provided at its outer end with a disk or head, k^4 , which has upon its inner face, bars or points, k^5 , projecting inward toward the

valve H, being extended, so as to almost touch the outer face of the latter when the parts are in normal position, as seen in Fig. 1; hence a very slight outward movement of the valve H will bring these two parts into contact and unseat the valve K by forcing it outward against its retaining spring; and the further movement of the valve outward will bring it into contact with the outer collar on the stem of the emergency valve and unseat the latter. The emergency valve is retained upon its seat by the retaining spring of the supplementary valve K.

A puppet valve, L, is mounted at the opening of the passage a^2 —that is, at the end of this passage connecting with the passage b^3 in the bridge b' . A bushing, l , is set in this end of the passage, which provides a seat for the valve, the stem, l' , of which extends inward and has a sliding bearing in a bridge, L' running across the passage, and a retaining spring, l^2 , is arranged between the bridge and the valve by means of which the latter is seated, but will open inwardly under sufficient pressure.

It will be noticed in Figs. 6 and 7, that the walls of the small case B' are cut out a little around the tubular plug at this point, whereby a shallow channel or passageway, f^3 , is provided around the plug, thus always insuring the entrance of air to the latter and also the passage of air into the conduit b^6 .

As a preferable construction, a bushing, C' , is set within the chamber a within which the slide-valve C is mounted and seated, ports being made through the bushing to correspond with the ports in the case intended to enter the said chamber.

In Fig. 9 of the drawings, there is shown a modification of the parts intimately related to the emergency valve. In this figure, those parts, which remain precisely the same as constructed and described above, and as shown in Fig. 1, are lettered the same as in the said figure; but those which are modified somewhat are designated by different letters. In this modification, the emergency valve and its actuating piston, H, remain unchanged, as well as the supplementary valve, K, and its actuating device. In this modification, however, the bushing, M, in which the piston, H, is seated, is constructed with a by-pass, m , commencing at the inner edge of the bushing and extending outward over and just slightly beyond the rim of the piston when standing at its inner position, as seen in the said figure. This bushing, M, is also provided with an opening, m' , which corresponds to the opening, h^2 , in Fig. 1. The valve, N, in this figure corresponds to the puppet valve, G, in Fig. 1, and is of precisely the same construction as there shown, except that the small port, g^2 , is dispensed with and the valve is made in one solid piece. In all other respects the devices shown in Fig. 9 are the same as in Fig. 1.

The operation is as follows: Upon coupling up, the devices are adjusted for working ac-

tion in the usual way by the admission of air from the train pipe to the piston chamber a' and thence past the piston, by means of the by-pass, through the triple-valve chamber to the auxiliary reservoir, this flow of air continuing until the pressure on opposite sides the piston is equalized. The course of the air in this preliminary adjustment is first from the train pipe into the chamber E; thence through the passages e' , e^2 and b^5 and openings f' into the chamber f within the screw plug F; thence, by raising the valve G, into the emergency valve chamber b , which, having free connection with the main piston chamber, permits the air to flow freely into the latter from which it passes around the piston to the slide valve chamber and thence to the auxiliary reservoir. The communication between the chamber b and the chamber a' is so open and of such area that practically they constitute but one chamber, the emergency valve chamber B being, so far as practical effects are concerned, a part of the main piston cavity. Air also flows from the cavity of the hollow plug F through the channel b^6 and port h^2 in the bushing h directly into the closed chamber back of the valve H, whereby the pressure is equalized on opposite sides of this valve, so that it will be properly seated and assist in retaining the emergency valve on its seat, this effect being also produced in part by the action of the supplemental valve and its retaining spring, as already described. It will be seen that under this adjustment there is open communication from the train pipe to the main piston cavity and also the cavity or chamber of the valve or piston H. Now when it is desired to apply the brakes for ordinary work, the pressure in the train pipe is reduced slightly in the usual way, thereby reducing the pressure on the front side of the main piston, which results, as usual, first in a slight independent movement of the piston, whereby the port c' in the valve is opened to air in valve chamber a and then a movement of the slide valve itself, which brings the inner end of this port to register with the port a^3 , and thereby air is permitted to pass directly from the auxiliary reservoir to the brake cylinder. The equilibrium of the piston H will not be disturbed by this operation, because the reduction of pressure in the train pipe will be equally felt on each side of the piston. In case an emergency arises when it is desired to apply the brakes with full force the pressure in the train pipe is suddenly greatly reduced by the momentary turning of the engineer's valve in the usual way to produce this effect. The pressure in the main piston cavity is not, however, at once lowered to the same extent, because the connection between this cavity and the train pipe is only through the small port g^2 of the valve G; but the escape of air from the chamber back of the piston H is freer and so the pressure on this piston will be quickly lessened as compared with that in front. The effect is to impart a sudden movement backward to the piston H which almost immediately brings it into contact with the bars k^5 on the supplemental valve head, thereby forcing the latter back and unseating the said valve K and at the same time closing the port h^2 thus shutting off communication between this supplemental chamber and the train pipe. The unseating of the supplemental valve K evidently produces a passage for air to escape from the closed chamber j' back of the piston H through the central port of the emergency valve into the bridge passage which leads to the brake cylinder a^2 . Almost at the same moment the piston H reaches the outer collar on the stem of the emergency valve, when, of course, its further outward movement lifts the said valve and so opens communication between the emergency valve chamber and the passage to the brake cylinder, and a free flow of air being thus provided from the emergency valve chamber, or main piston cavity, to the brake cylinder, the pressure of air in the train pipe flows rapidly into the said chamber, lifting the puppet valve G for this purpose, and thence rushes to the brake cylinder with the full force of the pressure in the train pipe to set the brakes, the puppet valve L being forced from its seat to permit this action. The action of the emergency valve is momentary, for it is quickly closed, as follows: As stated, air under full pressure enters the emergency valve chamber freely as soon as the emergency valve is opened. But the piston H is fitted in the bushing h only with what is known as a smooth sliding fit, there being no packing ring or other like device; there will be leakage, therefore, from the chamber in front of this piston through to the small chamber back of it, and the latter is so much smaller than the former that this leakage will almost instantly restore equilibrium, or at least so nearly as to enable the compressed spring K' to act, which, first, closes the supplemental valve K, and then immediately drives forward all the parts, closing the emergency valve and moving the piston H forward as far as the prongs on the head k^4 will force it. The parts are constructed relatively, so that this forward movement of the piston is sufficient to uncover or partially uncover the slot or port h^2 in the bushing, thus again establishing connection between the small rear chamber and the train pipe, whereby the piston H is maintained in equilibrium, as already described. The moment the engineer takes off pressure from the brake cylinder the main piston starts back, closing communication between the auxiliary reservoir and the brake cylinder and opening the exhaust in the well-known way, and equilibrium is restored as first described. It will be seen then that the emergency valve is actuated by the pressure of air remaining in the main piston chamber or cylinder and the emergency chamber when the pressure in the train pipe is suddenly lowered to a great degree; it will be seen that

the said two chambers constitute practically a single cavity, the communication between them being large and free; and it will be seen further that the air in this cavity is practically confined upon the sudden reduction of pressure in the train pipe, as the by-pass around the main piston is at once closed and the valve G is held upon its seat by the pressure in this cavity, so that there is no escape, except through the small port g^2 in said valve and this port is so small that the escape of air in it is not sufficiently rapid to bring down the pressure in the said cavity quickly to the reduced pressure in the train pipe. In fact a little modification in construction will provide for completely closing this cavity, so that, upon suddenly reducing the pressure in the train pipe, the first slight movement of the piston H will provide a closed chamber between the main piston and the latter. I have shown such a modification in Fig. 9 of the drawings; it is simply a by-pass m around the piston H, constructed and arranged so that at the inner adjustment of the latter this by-pass will be open, but will be closed by only a slight backward movement thereof. When this modification in construction is made I dispense with the small open port g^2 in the valve G as seen in the corresponding valve N, in said Fig. 9, and the flow of air from train pipe to auxiliary reservoir will be through the by-pass around the piston H into the chamber b , and thence on to the main valve chamber and auxiliary reservoir, as before. It will be seen that this will be the effect, because the cap chamber j is always in communication with the train pipe. Now when the pressure is suddenly reduced in the train pipe, in case of an emergency, the piston H will start back at once and immediately close the by-pass, when, obviously, there results a closed cavity in front of the piston H within which air, under greater pressure, is confined, which operates to force back the piston H and open the emergency valve, as already described, except that this pressure will be somewhat greater than in the former case with the valve G, having an open port g^2 .

So far as I am aware I am the first to operate the emergency valve which controls the passage from the train-pipe to the brake-cylinder by means of a piston loosely attached thereto, so that the valve has lost motion with relation to the piston which latter is fitted into a cavity normally connected by a port to the train-pipe and operates another valve which controls an exhaust from the cavity in which the piston works. It will therefore be understood that my invention broadly consists in the combination of these parts when so arranged that the initial movement imparted to the piston by an extreme reduction of the train-pipe pressure causes it to close the port normally connecting its cavity with the train-pipe and to open the exhaust-port controlled by the smaller valve, the further motion of the piston effected by such exhaus-

tion from the piston cavity causing the emergency-valve to open; and this is true irrespective of the location of the emergency-valve and piston, and irrespective of the particular source of the air-pressure on the outer side of the piston which effects its movement after the air has been exhausted from the piston cavity, and also irrespective of the particular location or manner of operation of the valve controlling the exhaust from the piston cavity. I therefore do not desire to limit my invention to the particular combination and arrangement of devices herein shown and described for effecting the desired result, nor to the combination or co-operation therewith of other devices herein shown and described but not forming an essential part of the mechanism which moves the emergency-valve, for obviously, numerous changes in the construction, location, arrangement and character of these devices may be made without departing from the spirit of my invention.

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

1. In an air-brake mechanism, the combination with the emergency-valve, of a piston loosely attached thereto and working in a cavity normally connected to the train-pipe, and a valve operated by said piston and controlling the exhaust from the cavity in which the piston works, substantially as described.

2. In an air-brake mechanism, the combination with the emergency-valve controlling the passage from the train-pipe to the brake-cylinder and located in a chamber having open communication with the main piston-chamber, of a piston loosely attached thereto and working in a cavity which is normally connected to the train-pipe and a valve operated by said piston and controlling the exhaust from the cavity in which the piston works, substantially as described.

3. In an air-brake mechanism, the combination with the emergency-valve, of a piston loosely attached thereto and working in a cavity which is normally connected by a port to the train-pipe, a spring for yieldingly maintaining said piston in its normal position, and a spring-seated valve connected with said piston and controlling an exhaust port from the piston cavity, substantially as described.

4. In an air-brake mechanism, the combination with an emergency-valve provided with a central port and controlling the direct passage from the train-pipe to the brake-cylinder, a piston loosely attached thereto and working in a cavity which is normally connected by a port to the train-pipe, a spring for maintaining said piston in its normal position, and a spring-seated valve connected with said piston and controlling communication between the piston cavity and the central port in the emergency-valve, substantially as described.

5. In an air-brake mechanism, the combination with an emergency-valve located in a

chamber connected by a port with the train-pipe, and means for partially or wholly closing said port on an extreme reduction of the train-pipe pressure, of a piston loosely attached to said valve and working in a cavity normally connected by a port to the train-pipe, said piston on its outer face being subject to the pressure in the valve-chamber, and a valve operated by said piston and controlling an exhaust-port from the cavity in which the piston works, substantially as described.

6. In a triple-valve air-brake mechanism, a main piston chamber and main piston mounted therein, in combination with a chamber opening freely into the former chamber, so as to form substantially a part thereof, and communicating with both train-pipe and brake cylinder, an emergency valve arranged to close the communication between said latter chamber and the brake cylinder, and mechanism for opening said valve, disconnected from the main piston and adapted to be operated directly and solely by air pressure in the main piston cavity upon sudden reduction of train-pipe pressure and without movement of the main piston, substantially as described.

7. In a triple-valve air-brake mechanism, a main piston chamber and main piston mounted therein, in combination with a chamber opening freely into the former chamber, so as to form substantially a part thereof, and communicating with both train-pipe and brake cylinder, an emergency valve arranged to close the communication between said latter chamber and the brake cylinder, a supplementary piston cavity communicating only with said emergency valve chamber and the train-pipe, and a supplementary piston mounted in said cavity, connected to the emergency valve, and subject to train-pipe pressure on one side and main piston cavity pressure on the other, whereby, when train-pipe pressure is suddenly reduced, the said supplementary piston is moved outward from the emergency valve chamber, with the expansion of air in the main piston cavity toward the train-pipe, and thereby opens the emergency valve, substantially as described.

8. In an air brake mechanism, a triple-valve case, in combination with an emergency valve case having a chamber opening freely into the cavity of the main piston and connecting with both the brake cylinder and train pipe, an emergency valve mounted in said case and arranged to control the communication between the chamber therein and the brake cylinder, a puppet or check valve opening inward to said chamber arranged to control the communication between the latter and the train pipe and provided with a small open port, and an independent piston arranged to be actuated by the pressure of air confined within the said chamber and piston cavity to open the emergency valve when the pressure in the train pipe is suddenly reduced, substantially as described.

9. In an air brake mechanism, a triple-valve device, in combination with an emergency valve case B, having chamber *b* openly communicating with the main cavity of the triple-valve main piston, and having passages connecting respectively with the brake cylinder and train pipe, a check valve controlling the passage from chamber *b* to the train pipe, an emergency valve I controlling the passage to the brake cylinder and provided with stem *i*, an independent valve or piston H mounted on the stem *i* and seated with a smooth sliding fit, and a supplemental air chamber back of said piston, substantially as described.

10. In an air brake mechanism, an emergency valve case B, having a chamber *b* openly connecting with the main piston cavity, in combination with the emergency valve I provided with central opening *i*⁴ arranged to control a passage from said chamber to the brake cylinder, a check valve G arranged to control a passage from said chamber to the train pipe and having a small open port *g*³, a supplemental air chamber *j* communicating with the train pipe, an independent valve or piston H secured to the stem *i* of the emergency valve, arranged between the chambers *b*, *j*, and having a smooth sliding fit in its seat, and a supplemental valve K controlling a passage leading out from the supplemental chamber and adapted to be actuated by the backward movement of the piston H to open the emergency valve, substantially as described.

11. In an air brake mechanism, an emergency valve I, having stem *i* provided with central port *i*² and chamber *i*³, in combination with a supplemental valve K seated within the stem *i* to close the central port and provided with ports *k*, *k'*, *k*², an independent valve or piston H mounted on the stem of the emergency valve and arranged to be actuated by pressure from the said valve chamber and main piston cavity to open the emergency valve, a supplemental air chamber *j* in rear of said piston and having a port *h*² communicating with the train pipe, whereby the backward movement of the piston H opens the valve K, closes the port *h*² and opens the emergency valve, substantially as described.

12. In an air brake mechanism, an emergency valve case B, provided with chamber *b*, having open connection with the main piston cavity, in combination with supplemental case B', having chamber *b*⁴ opening into the chamber *b* and having connection with the train pipe, and a check valve G controlling the connection between the said two chambers and provided with a small open port *g*², substantially as described.

13. In an air brake mechanism, an emergency valve case B, having a chamber *b* openly communicating with the main piston cavity, and a supplemental chamber *j* at the opposite end thereof, in combination with an emergency valve controlling a passage from said chamber *b* to the brake cylinder, an in-

dependent valve or piston H mounted on the stem of the emergency valve and arranged between the chambers *b, j*, a supplemental case B', having chamber *b*⁴ opening into the
5 chamber *b* and communicating with the train pipe and the chamber *j* by passages *b*⁵, *b*⁶, a hollow plug F set in the chamber *b*⁴ open at its inner end and provided with central open-

ings *f*' communicating, respectively, with the passages *b*⁵, *b*⁶, a check valve G seated at the inner end of said plug and provided with small open port *g*², substantially as described.

JAMES T. HAYDEN.

Witnesses:

CARRIE FEIGEL,
A. M. BEST.