No. 860,384. PATENTED JULY 16, 1907.

B. H. JEFFRIES.

FEED VALVE.

APPLICATION FILED JULY 20, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

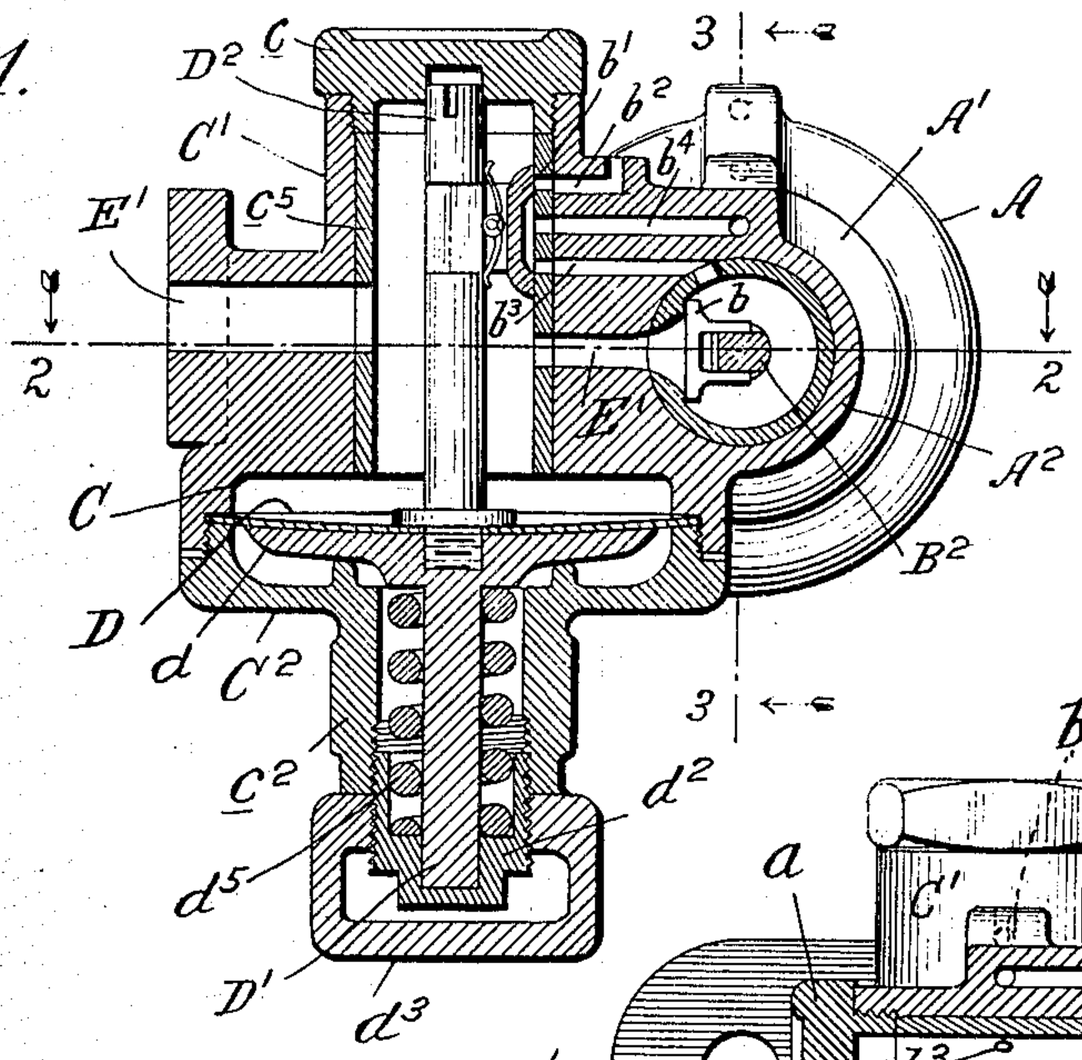


Fig. 3.

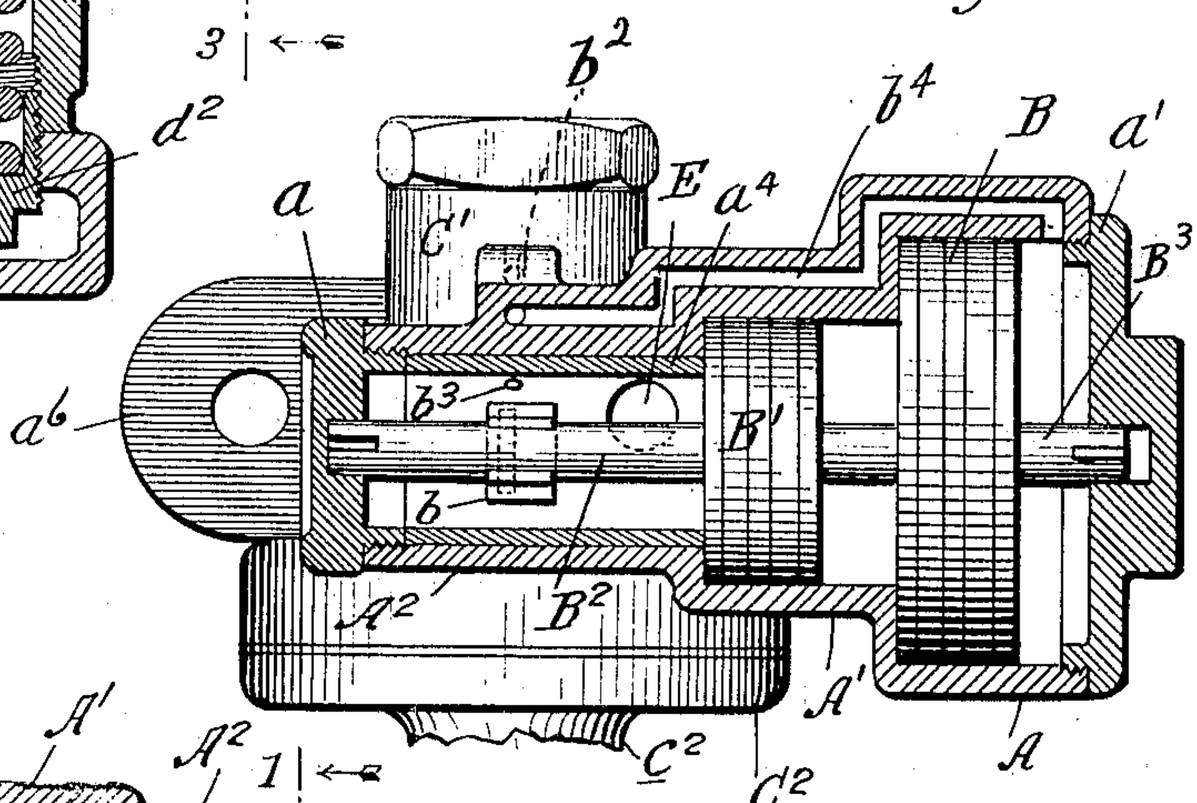
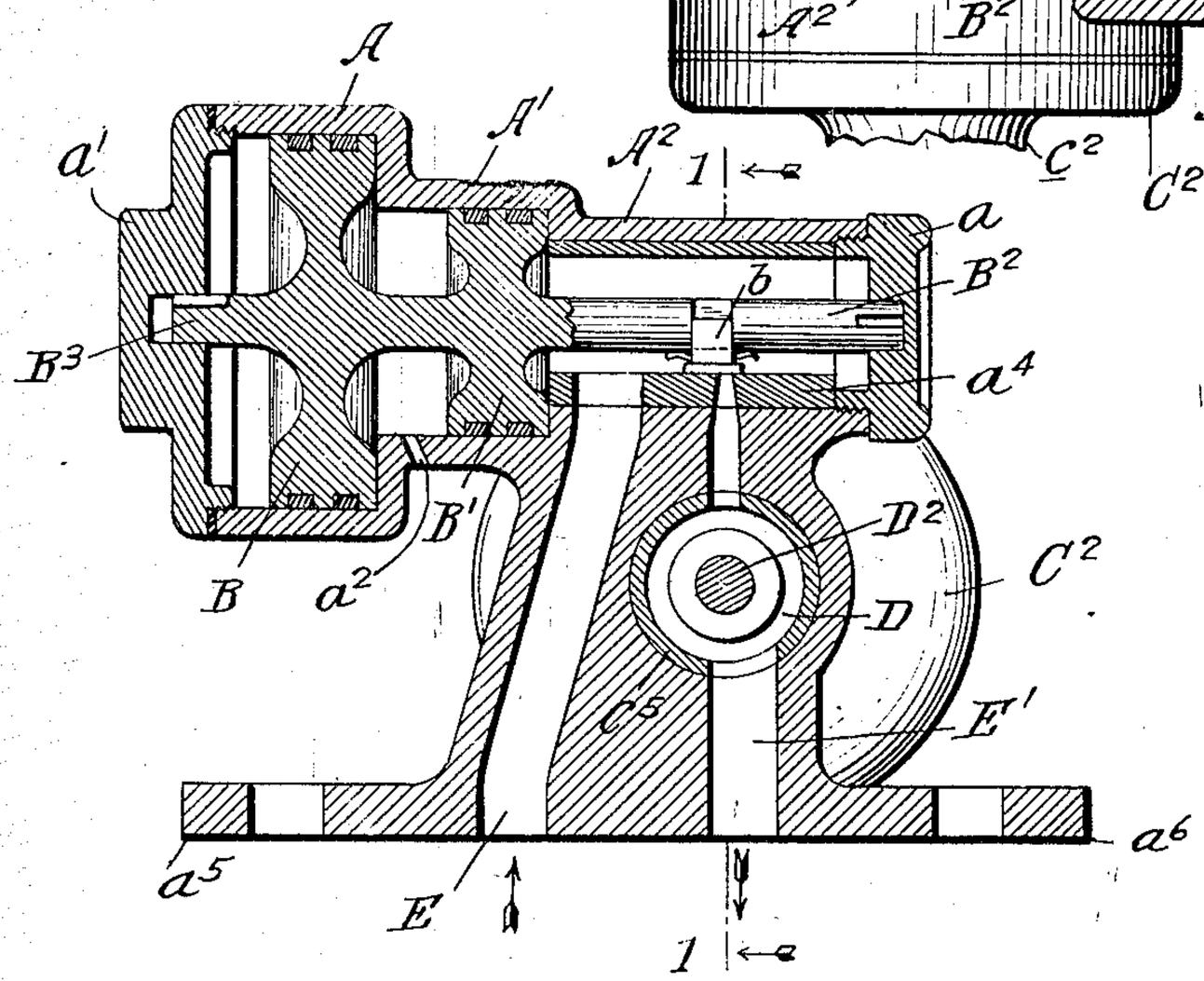


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

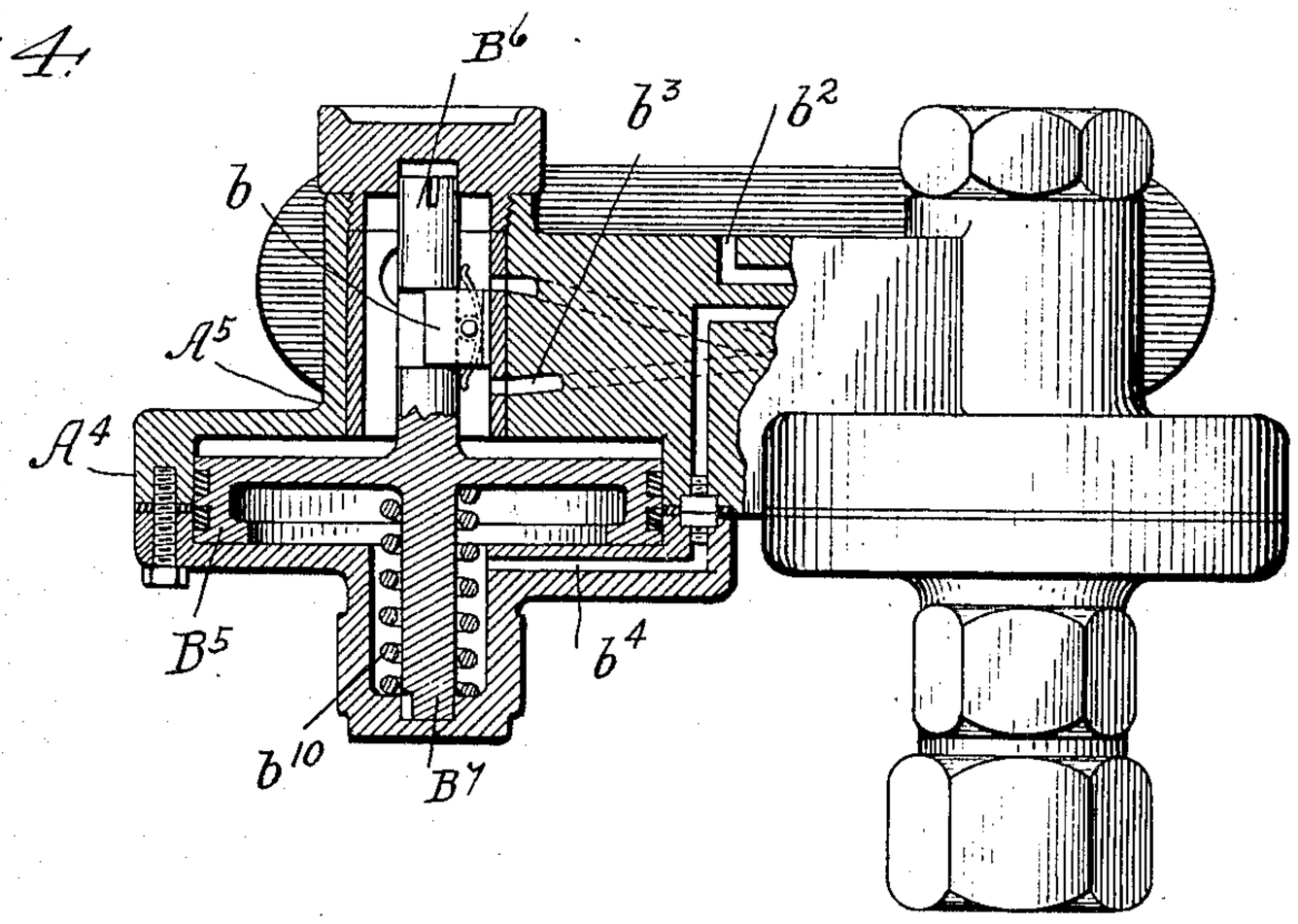
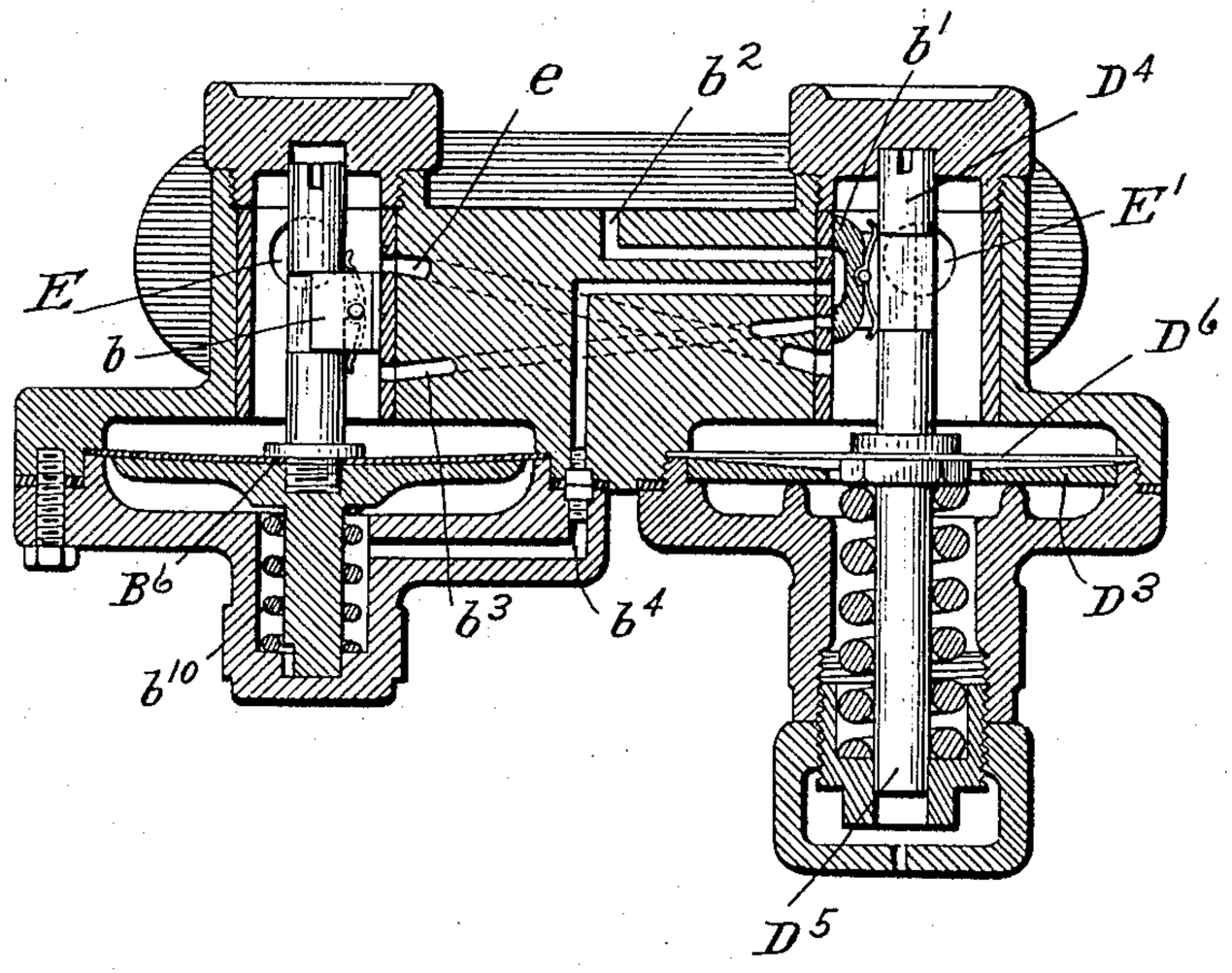


Fig. 5.



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UNITED STATES PATENT OFFICE.

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FEED-VALVE.

No. 860,384. Specification of Letters Patent. Patented July 16, 1907.

Application filed July 20, 1905. Serial No. 270,459.

To all whom it may concern:

Be it known that I, BRICE H. JEFFRIES, a citizen of the United States, and a resident of Chicago, Cook county, and State of Illinois, have invented certain new and useful Improvements in Feed-Valves; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in feed valves and more particularly to a feed regulating valve adapted for railway use and whereby train line pressure is maintained practically uniform.

In the devices heretofore constructed for this purpose, numerous springs have usually been deemed necessary and in some constructions the restoration of train line pressure after a reduction is necessarily slow owing to the fact that the operation depends on looseness of fit of one or more of the valves permitting leakage past the valves. Furthermore, because of the comparatively slow closing due to the slow leakage of air past the valve, the air in flowing through the valve is restricted, or as it is sometimes termed wire drawn, thus causing a very slow and often unreliable action, proving a serious objection to the valve.

The object of this invention is to afford an instantaneous regulating feed valve, whereby train line pressure is regulated after each reduction to that for which the vlave is set, (usually seventy pounds to the square inch).

A further object of the invention is to provide a quick acting automatically operating feed regulating valve, of strong, simple and durable construction in which the parts are so constructed and arranged, and combined as to afford economy both in construction and maintenance.

It is a further object of the invention to afford a construction operating at all times with the pressure affording instantaneous and full opening and closing.

The invention consists in the matters hereinafter described and more fully pointed out and defined in the appended claims.

As shown in the drawings: Figure 1 is a vertical section of a device embodying my invention the section being taken as shown on line 1—1 of Fig. 2. Fig. 2 is a section taken on line 2—2 of Fig. 1. Fig. 3 is a section taken on line 3—3 of Fig. 1. Fig. 4 is a top plan view partly in section of a modified construction embodying my invention. Fig. 5 is a view in a horizontal section of a similar construction in which a diaphragm is used in the pressure cylinder.

In said drawings: Referring first to Figs. 1, 2, and 3 a casing of cast metal or any suitable material is cored to afford a main pressure cylinder having as shown three bores A, A′ and A^2 of different sizes and in axial alinement. In the bores A and A′ of said cylinder are close fitting, rigidly connected, ringed pistons B and B′ the rod or stem B^2 of which extends from the smaller piston axially through the smallest bore A^2 and when said piston is at its inner limit of travel engages in a central seat in a cylinder head *a* which closes said bore. In a like manner a piston rod or stem B^3 extends axially from the larger piston and into a seat in the cylinder head *a′* which closes the larger end of the cylinder. Said stems and the seats in the heads determine the extent of travel for said pistons in either direction. To prevent air pressure between the pistons a port a^2 opens to the atmosphere through the smaller bore A′ of the cylinder, from between the pistons. Arranged at a right angle with said pressure cylinder and in the same casing therewith as shown is a train pipe cylinder C which communicates with a smaller cylinder C′ in axial alinement therewith and which is closed by a cylinder head *c*. A cylinder head C^2 closes the larger end of the cylinder and acts to secure a diaphragm D, to its place. Said head is provided with an axial outwardly extending tubular boss c^2. The diaphragm D comprises a thin sheet of steel or other suitable material the periphery of which is engaged between the end of the cylinder C, and the head C^2, as shown in Fig. 1 affording a tight joint. As shown in Fig. 1, and at the rear of said diaphragm is a suitably shaped collar or flange *d* of a width to extend to near the periphery of the cylinder. Connected therewith as shown is a diaphragm stem or rod D′ of a length as shown slightly greater than the boss c^2 and which fits into an axial seat in an adjusting nut d^2 which threads into the end of said boss, and acts to adjust the tension of a strong coiled pushing spring d^5 which bears against the diaphragm flange or collar and determines the pressure required to move the diaphragm. A jam nut d^3 is threaded over the end of the adjusting nut d^2 and serves as a lock to hold the same in adjusted position. From the opposite side of the diaphragm and rigidly secured in the collar or flange *d* is a stem or rod D^2, which extends to near the opposite end of the cylinder C′ and seats in a suitable recess in the removable head *c*. Said casing as shown, is provided parallel with the pressure cylinder with flat, ground faced, oppositely extended apertured lugs a^5—a^6 which afford attachment with the rest of the pressure system, and through which the pressure is communicated through suitable ports. As shown main pressure is admitted into said casing and the pressure cylinder at the smallest end A^2 of said cylinder through an unvalved port E, and is admitted to the train line through a port E′ which opens through the side of the train line cylinder. Said port E′ is controlled by a slide valve *b* carried on the stem or rod B^2, in the cylinder end A^2 which acts to

close said port when the pistons are at the inward limit of their movement and to open the same as the piston moves outwardly.

Carried on the diaphragm stem D^2 in the end C′ of the train line cylinder is a slide valve closure b' concave on its under side and which covers a port b^2 opening to the atmosphere and a port b^3, opening into the end A^2 of the pressure cylinder. Positioned between the ports b^2 and b^3, and also covered by the valve closure b' is a port b^4 which opens into the large end A of said main pressure cylinder between the piston B and the head a'.

The operation is as follows: The spring d^5 having been adjusted to exert the required pressure upon the diaphragm collar d, or in other words the desired train line pressure, and the valve casing having been properly connected with the pressure system so that the main drum pressure pipe, communicates in the port E and the train pipe communicates in the port E′, the pressure of the spring d^5 acts to hold the diaphragm inwardly in position for the **D** valve b' to close the port b^3 leading into the main pressure cylinder. The ports b^2 and b^4 now communicate beneath the **D** valve b' thus the chamber in the large end A of the cylinder is in communication with the atmosphere. The pistons B—B′ are thus moved outwardly carrying the valve b therewith and opening the port E′ to the train pipe through the train line cylinder. Inasmuch as the spring d^5 is adjusted to train line pressure (usually about 70 pounds) the diaphragm is not moved and the valve b' in the diaphragm cylinder is not shifted until the pressure in the train line and in said train line cylinder rises slightly above the tension of the spring. When this occurs the diaphragm is forced outwardly as shown in Fig. 1 shifting the **D** valve b' which now closes the port to the atmosphere and bringing the ports b^4 and b^3 into communication beneath said **D** valve. When this occurs main pressure air from the small end of the pressure cylinder flows from said cylinder through the port b^3, into the port and passage b^4 into the chamber between the head a' and the piston B which owing to its greater area overbalances the main pressure on the piston B′ thereby closing the valve b, and cutting off the air supply to the train line, when train line pressure had been restored. When reduction occurs in the train line, the spring d^5 acts instantly to shift the valve b' again bringing the ports b^2 and b^4 into communication instantly relieving the pressure on the piston B and permitting the valve b to open fully and to remain open until the train line pressure is restored to normal when the valve b' is immediately shifted by movement of the diaphragm thereby immediately increasing pressure on the piston B which insures the immediate and full closure of the valve b. So called wiredrawing of the air is thus entirely prevented and a very quick sensitive and positive action is insured.

In the construction illustrated in Fig. 4 the diaphragm and the train line cylinder, are constructed as before described and the **D** valve b' and the arrangement of ports are identical with those illustrated inFigs. 1, 2 and 3. The pressure cylinder however has a large bore A^4 in which is provided a ringed piston B^5 on one side of which and extending axially of the smaller end A^5 of the cylinder which corresponds with the cylinder end A^2 in Fig. 3 is a piston rod or stem carrying the valve b before described. On the other side of said piston is a rod B^7 on which is secured a pushing spring b^{10} which acts to force the piston inwardly when the pressures on opposite sides thereof are equalized through the port b^4.

In the construction illustrated in Fig. 5 the train line cylinder is constructed as before described and secured therein is a fixed diaphragm plate D^3, concave on its front side and through which extends a rod or stem, one end D^4 of which is provided with a **D** valve b' as before described, and the other end of which corresponds with the end D′ and provided with a strong spring as shown in Fig. 1. The diaphragm D^6 is rigidly secured at its center on said rod or stem by any suitable means and engaged as usual or in any suitable manner in the cylinder and is free to spring toward the back plate D^3, or forwardly therefrom in shifting the **D** valve b'. The ports are arranged as before described. The pressure cylinder is also provided with a diaphragm indicated as a whole by B^6 at the rear side of which is a weak spring, b^{10} such as before described which acts to shift said valve controlling the port e when pressures are equalized.

The train line and the pressure cylinders may be arranged either parallel as shown in Figs. 4 and 5 or at an angle with each, shown in Figs. 1 to 3, dependent upon the space available for the same and convenience in construction and attachment.

If preferred a piston may be used in the train line cylinder with the same effect as a diaphragm and either a piston such as shown in Figs. 2 and 3, with which no spring is required, or a piston such as shown in Fig. 4, or a diaphragm as shown in Fig. 5 in conjunction with a spring may be employed in the pressure cylinder. The ports may be arranged in any convenient manner to afford immediate release of pressure at the rear of the moving element in the pressure cylinder when it is desired to open the valve and to balance the pressure when it is desired to close the valve.

Furthermore though slide valves are shown and described any suitable valve may be employed I therefore do not purpose limiting this application for patent otherwise than necessitated by the prior art as obviously many details of construction and arrangement may be varied without departing from the principles of my invention.

I claim as my invention:

1. A feed and pressure regulating valve embracing a casing having a main pressure and a train line cylinder therein communicating respectively with a main pressure pipe and the train line, a movable partition in each, a valve in each cylinder operated by the partition therein, a port connecting the cylinders on the inner side of the main pressure partition and controlled by its valve and ports controlled by the valve in the train line cylinder leading respective to the air and to both sides the main pressure partition.

2. In a device of the class described a main pressure cylinder and a train line cylinder, a movable partition in each, a valve carried on the partition in the main pressure cylinder and controlling a port opening to the train line cylinder, a spring bearing against the partition in the train line cylinder and adapted to be set to train line pressure, a valve actuated by said partition and controlling ports opening one in each end of the main pressure cylinder and one to the atmosphere.

3. In a device of the class described a main pressure cylinder and a train line cylinder, a movable partition in each, a valve carried on the partition in the main pres-

sure cylinder and controlling a port opening to the train line cylinder, a spring bearing against the partition in the train line cylinder and adapted to be set to train line pressure, a valve actuated by said partition and controlling ports opening one in each end of the main pressure cylinder and one to the atmosphere, said ports being so arranged that when the valve is in one position the port from the rear side of the main pressure partition opens to the atmosphere and when in the other, opens into the port leading to the opposite side of the partition.

4. In a valve of the class described, a main pressure cylinder, a movable partition therein, a valve controlling the flow to the train line, a regulating valve, and ports opening from both ends the main pressure cylinder and controlled by the regulating valve and communicating when train line pressure is normal, that from the rear end said cylinder communicating with the atmosphere when train line pressure is low.

5. In a device of the class described a main pressure cylinder, a movable partition therein, a train line valve connected therewith, a regulating valve adapted to be set to move by variation of train line pressure and a port opening to the atmosphere and controlled by the regulating valve and adapted to instantaneously relieve the pressure behind the main pressure partition when train line pressure is low thereby opening the train line valve and to restore pressure behind said partition when train line pressure is high, thereby closing the train line valve.

6. In a device of the class described a main pressure cylinder adapted to be connected with a main pressure pipe, a differential piston therein, the smaller end subject to main pressure, a train pipe valve operated by said piston, a regulating valve adapted to be set to train line pressure, said regulating valve controlling ports opening respectively on opposite sides the differential piston, and one opening to the atmosphere, said regulating valve normally connecting the ports leading on each side of said piston but connecting the port to the larger end of said piston with the atmosphere when pressure falls below normal.

7. In a device of the class described a main pressure cylinder, a train pipe valve therein, a movable partition in said cylinder connected with and adapted to actuate the valve, a train line controlled by said valve, means balancing the pressure on both sides said partition when train line pressure is normal and mechanism acting to instantly relieve the pressure behind said partition to the atmosphere when train line pressure falls below normal thereby shifting the train line valve with the pressure.

8. In a device of the class described a main pressure cylinder, a main pressure pipe opening thereinto, a service pressure pipe communicating with said cylinder, a valve normally closing the service pipe, means within the main pressure cylinder operated by the pressure, acting to hold the valve closed when service pressure is normal, and positively actuated mechanism acting when service pressure is lower than normal to relieve to the atmosphere one end of the main pressure cylinder thereby opening the service valve.

9. In a device of the class described a main pressure cylinder, a movable tight fitting head therein dividing the same into two chambers, a main pressure pipe opening into, and a service pipe opening from, one of the chambers, a valve therein normally closing the service pipe and rigidly connected with and movable with of said head, a regulating valve adapted to be set to service pressure, ports controlled by said regulating valve through which the chambers in said cylinder communicate when service pressure is normal and a port opening to the atmosphere and also connected by the regulating valve and with which the port leading to the chamber remote from the valve communicates when service pressure is below normal thereby opening the service valve.

10. In a pressure operated and pressure regulated valve, a main pressure cylinder, a tight fitting movable head therein dividing the same into two chambers, a main pressure pipe opening into and a service pipe opening from one of said chambers, a valve connected with the head and controlling the service pipe opening a port connecting the chambers and through which pressure is equalized therein, a regulating valve controlling said port, regulable pressure operated means for actuating said regulating valve to open the port connecting the chambers when service pressure is normal, and to release to the atmosphere the pressure on the rear side the head when service pressure is below normal and auxiliary means acting on the head to close the valve when pressures are equal in said chambers.

11. In a device of the class described, a casing having ports adapted for connection with a main pressure pipe and a train line, a cylinder into which the train line port opens, and from which a train line passage opens to the main pressure cylinder, a head in the latter, a movable partition in said train line cylinder, a spring bearing against the rear side of said partition and adjusted to support approximately the train line pressure, a valve controlling the train line passage and operated by the movement of said head, ports opening to each side of the head and to the atmosphere from the train line cylinder, a D valve controlling the same and operated by the partition and through which the ports to the main pressure cylinder communicate when train line pressure is normal and the port leading to the rear side the head communicates with the atmosphere when pressure is below normal and means acting by pressure assisting to move said head in closing the valve.

12. In a device of the class described a main pressure cylinder having a large and a small end, a differential, movable head therein, a train line cylinder a movable partition therein, a valve actuated by the head and controlling a passage to the train line cylinder, a regulating D valve connected with the partition and controlling ports opening on each side of the head in the main pressure cylinder and opening to the atmosphere, a spring set at train line pressure and bearing against said partition, said regulating D valve being so adjusted with reference to the ports controlled, that low train line pressure shifts said D valve and relieves pressure at the rear of said head by venting to the atmosphere.

13. In a feed valve the combination with a main pressure cylinder in open communication with the main pressure pipe of a movable head therein having greater pressure area on the rear than on the front side thereof, a valve connected with the front side of said head and controlling the passage to train line cylinder, a movable tight fitting partition in the train line cylinder, a regulating valve connected with said partition and controlling ports leading to each side of the head and a port to the atmosphere, a spring bearing against said partition and set to train line pressure, said partition acting normally to hold said regulating valve in position for the ports to the main pressure cylinder to communicate holding its valve closed, said spring acting with reduced train line pressure to shift said regulating valve thereby connecting the port from the rear side the head with the port to the atmosphere thereby shifting said head outwardly and opening its valve.

14. In a device of the class described the combination with a main pressure cylinder and a train pipe cylinder of a valve in the main pressure cylinder controlling the flow to the train line cylinder and positively acting means operated by relief to the atmosphere from the main pressure cylinder acting to open the valve in the main pressure cylinder to restore train line pressure after reduction.

15. In a feed valve of the class described the combination with a main pressure cylinder and a valve therein controlling the passage to the train line, of means operated by reduction of train line pressure acting to vent the main pressure cylinder to the atmosphere, thereby opening the valve and also acting to close the vent when train line pressure is restored.

16. In a device of the class described a main pressure cylinder, a tight fitting head therein and ports connecting opposite sides of the head, a train line valve operated thereby, positively acting means acting to bring the chambers on each side of the head into communication when train line pressure is normal closing said valve and to vent the chamber at the rear side of the head to the atmosphere, opening the valve when train line pressure falls below normal.

17. In a device of the class described the combination

with a main pressure cylinder having a normally open passage connecting the train line, a piston in said cylinder, a valve movable therewith adapted to close said passage when the pressure exceeds normal, a port opening in said casing on each side of said piston, a valve adapted to connect said ports at one limit of movement and a port exhausting into the atmosphere adapted to communicate with one of said ports at the opposite limit of movement of the last mentioned valve.

18. In a valve the combination with a main pressure cylinder and a cylinder having communication therewith, a piston in said main pressure cylinder, passages connecting opposite ends of the main pressure cylinder and the other cylinder, a valve in the last named cylinder adapted to afford communication between the passages to operate the piston in one direction and said valve adapted to afford communication between one side of the piston and atmosphere to move the piston in the opposite direction by main line pressure.

19. In a valve the combination with two cylinders connected by a relatively large passage, a valve in one cylinder to control said passage, a piston connected with said valve and dividing said cylinder into a plurality of chambers, passages affording communication between said chambers and the other cylinder, a valve in said cylinder adapted to afford communication between said passages to move the piston in one direction and to cut off the communication between said passages and to vent one to the atmosphere to move the piston in the opposite direction depending upon the pressure within said cylinders thereby closing or opening the large passage.

20. In a device of the class described the combination with a cylinder of a piston therein, a valve operated by said piston and controlling the train line port, a passage admitting main pressure into the cylinder, a train line cylinder, a valve therein, means movable with said valve for operating said piston by main pressure, said valve connecting ports opening into both ends of the first named cylinder and communicating when pressure is above normal, said port in said cylinder behind the piston adapted to exhaust to the atmosphere in opening said first mentioned valve.

21. In a feed valve the combination with a main pressure cylinder provided with a port opening to the train line, a controlling valve for said port, a piston connected therewith, means for supplying main pressure behind said piston to close said port and automatically operated means for venting the pressure behind said piston to the atmosphere when train line pressure is below normal.

22. In a feed valve the combination with a main pressure cylinder of a differential piston therein, a train line cylinder having a port communicating with the main pressure cylinder forward of the piston, a port opening from the train line cylinder to the main pressure cylinder behind said piston and a port opening from behind said piston to the atmosphere.

23. In a feed valve the combination with a main pressure cylinder of a piston therein, a valve on said piston adapted to control admission to the train line, means connecting ports opening into the cylinder on each side of the piston for operating said valve to close the train line when pressure raises above normal and a port in said cylinder opening to the atmosphere and adapted to communicate with the port behind the piston.

24. In a feed valve the combination with a main pressure cylinder of a piston therein, a valve on said piston adapted to control the train line pressure, means for conducting main pressure behind said piston and closing the valve when train line pressure rises above normal, a port for releasing the pressure behind said piston to the atmosphere when train line pressure falls and means whereby said valve is opened by train line pressure.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

BRICE H. JEFFRIES.

Witnesses:

C. M. HIUS,

W. W. WITHENBURY.