T. H. MANCHESTER.

PRESSURE REDUCING DEVICE.

APPLICATION FILED APR. 11, 1911.

1,022,322. Patented Apr. 2, 1912.

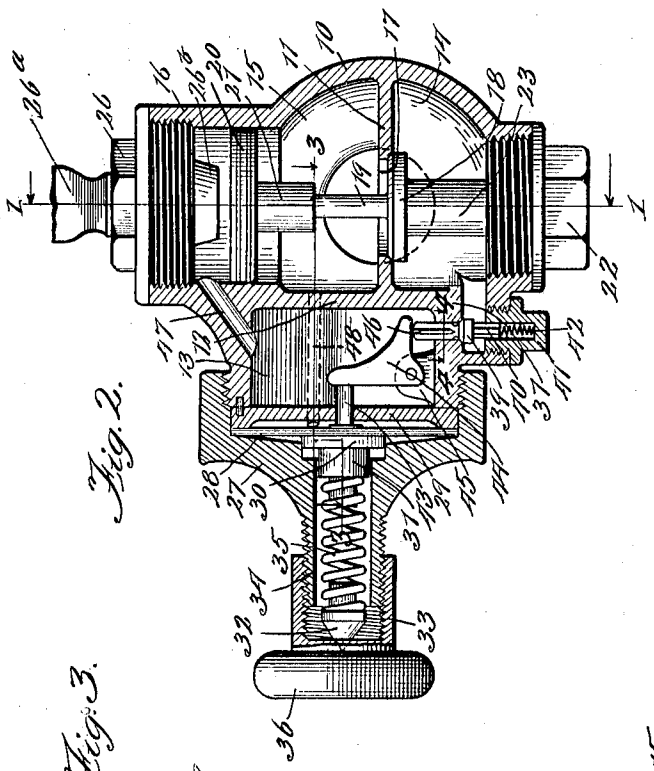

Fig. 2.

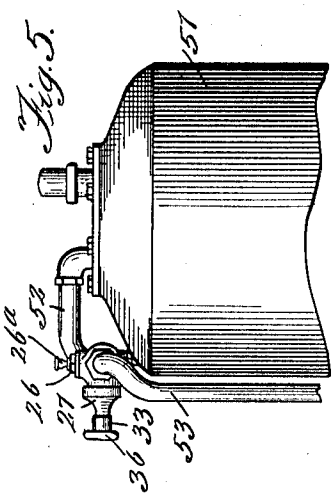

Fig. 5.

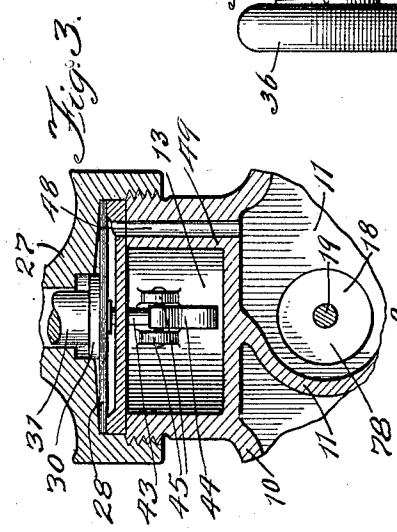

Fig. 3.

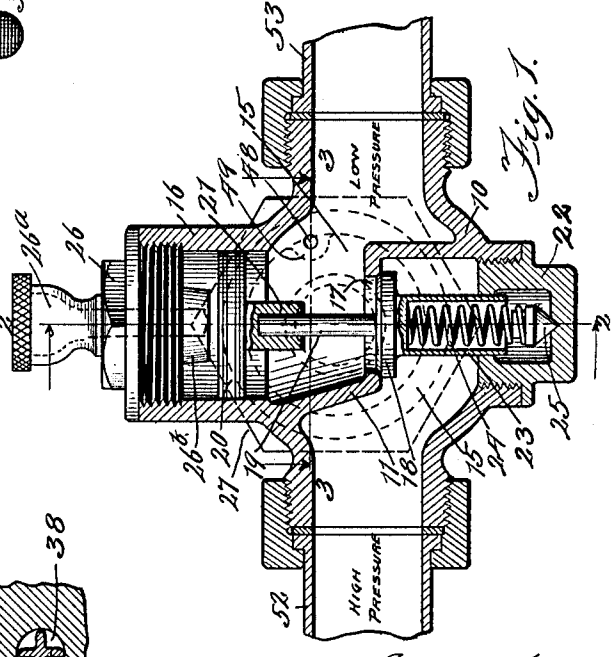

Fig. 1.

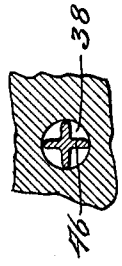

Fig. 4.

Witnesses:

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UNITED STATES PATENT OFFICE.

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PRESSURE-REDUCING DEVICE.

1,022,322. Specification of Letters Patent. Patented Apr. 2, 1912.

Application filed April 11, 1911. Serial No. 620,328.

To all whom it may concern:

Be it known that I, THOMAS H. MANCHESTER, 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 Pressure-Reducing Devices, of which the following is a specification.

My invention relates to a pressure reducing device of the type in which the main valve is operated by a piston acted upon by fluid pressure controlled by an auxiliary or controlling valve which is actuated by the movements of a diaphragm or like element also subjected to pressure; and one of the primary objects of the invention is to provide a pressure reducing device in which all of the movable parts are readily accessible and are so arranged that, in the event the device works improperly, the trouble may be easily and exactly located without danger to the person making the inspection.

A further object of the invention is to provide a pressure reducing device which is so constructed that the danger of the ports and passageways becoming clogged with dirt and the like, is minimized.

A further object of the invention is to provide a device made up of a few simple parts which can be cheaply made and require but little machining and which may be assembled without difficulty.

A further object is to provide a pressure reducing device which shall be very steady and accurate in its operation.

A further object of the invention is to provide a construction in which the piston operating the main valve may be conveniently oiled.

The invention has for further objects such other constructions, arrangements and devices in pressure reducing valves, particularly in pressure reducing valves adapted to be used on steam train pipes, as will be hereinafter described and claimed.

The invention is illustrated, in a preferred embodiment, in the accompanying drawings, wherein—

Figure 1 is a sectional view of the device taken on line 1—1 of Fig. 2; Fig. 2, a sectional view on line 2—2 of Fig. 1; Fig. 3, a fragmentary sectional plan taken on lines 3—3 of Figs. 1 and 2; Fig. 4, a similar view taken on line 4—4 of Fig. 2, and Fig. 5 a view in elevation of the end of a locomotive boiler showing the application of my pressure reducing device to the train pipe leading therefrom.

Like characters of reference indicate like parts in the several figures of the drawings.

Referring to the drawings, 10 designates a casing formed with the webs 11 and 12, the latter dividing off a portion of the space within the casing to form a chamber 13, the former dividing the remaining space within the casing into a high pressure chamber 14 and a low pressure chamber 15. The upper part of the casing is in the form of a cylinder 16 communicating with the low pressure chamber. In web 11, dividing the high and low pressure chambers, is a port 17 adapted to be closed by the main valve 18 having a stem 19 which projects into the low pressure chamber and supports a piston 20 snugly fitted into cylinder 16 and formed with a boss 21 extending around the end of the stem 19. Below the main valve the casing is formed with a threaded opening which is closed by the screw plug 22 or other suitable closure. The main valve is formed with a depending sleeve 23 which is guided in plug 22. A spring 24 is interposed between the under side of the main valve 18 and a conical pin 25 seated in the plug 22. The casing above piston 20 is formed with a screw threaded opening closed by a plug 26 preferably formed with the stop lug 26^b or other suitable closure. The valve and piston structure consisting of valve 18, sleeve 23, stem 19 and piston 20 is a substantially rigid structure, the stem 19 fitting closely into the boss 21 and is guided at two points only, to-wit, by the engagement of the piston with the cylinder and the engagement of the sleeve with the plug 22. The usual web dividing the low pressure chamber from the cylinder with its ports of relatively small size is eliminated. This does away with one source of clogging and simplifies the construction of the valve casing. The valve is freer to move and less apt to be cramped as it has two bearings instead of the usual three. As no web or partition intervenes between the low pressure chamber and the cylinder the inrush of steam past the main valve tends to keep the walls of the cylinder free from scale which eliminates another source of trouble. The chamber 13 is arranged at the side of the main valve 18 and its piston 20. The casing at

this side is circular and threaded for the bonnet 27 and a diaphragm 28 and a head 29 are interposed between the bonnet and the casing. A disk 30 bears against the outer surface of the diaphragm and between boss 31 formed on this disk and a conical pin 32 seated against the inner surface of a screw cap 33 threaded on a stem 34. Formed on the bonnet 27 is a spiral spring 35. The screw cap 33 has a hand wheel 36. The adjustment of the screw cap varies the tension of spring 35 and diaphragm 28.

The web 12, which divides off the chamber 13 has a horizontal portion 37 formed with a port 38 controlled by a valve 39 which is located in the high pressure chamber and the stem of which 40 extends into a bore in a plug 41 threaded into the under side of the valve casing. A spring 42 is interposed between the end of the plug and stem 40. Diaphragm 28 is provided with a pin 43 which bears against the longer arm of the bell crank lever 44 which is pivoted on a fork 45 formed on the valve casing within the chamber 13. The shorter arm of this bell crank lever bears on the upper end of stem 46 of valve 39. A port 47 puts the intermediate chamber 13 in communication with the interior of the cylinder 16 above piston 20. The chamber 13 is in fact an enlargement of the passageway leading from the high pressure chamber to the cylinder above the piston. A port 48 formed in a rib or boss 49 on the interior of the casing puts the low pressure chamber 15 in communication with the diaphragm chamber 50 formed by the diaphragm and the head 29.

Preferably the plug 26 located over piston 20 is provided with an oil cup 26^a. This takes care of oiling the piston which in the ordinary form of pressure reducing valve in which the diaphragm is placed above the piston is a matter of some difficulty. The provision of plug 26 with an oil cup incidentally provides a port which might, under some circumstances, be used as a vent for the piston cylinder. However I lay no claim in the present application to the provision of my pressure reducing device with an oil cup and I particularly wish it to be understood that I do not herein lay claim to any means for providing the piston cylinder with a vent as the provision of the part of the casing above the piston with a port specifically intended to serve as a vent to reduce the pressure above the piston is claimed in my co-pending application Serial No. 677,961 filed February 16, 1912. It will be understood that the oil cup, which is shown diagrammatically, is necessarily so constructed that when used as such no escape of steam from the cylinder is possible.

Fig. 5 shows the application of my reducing valve to a steam pipe leading from a locomotive boiler. 51 designates the boiler and 52, 53 the sections of pipe between which the reducing valve is placed. It will be seen that the adjusting hand wheel 36 is at the side of the valve and stands away from the pipes and boiler so as to be easily reached.

The device of my invention operates as follows: The main valve 18 is normally kept closed by the pressure on the under side thereof and by spring 24. When the auxiliary valve 39 is unseated steam from the high pressure chamber passes through the intermediate chamber 15 and port 47 to the part of cylinder 16 above piston 20. The area of piston 20 being greater than that of valve 18 the valve is opened to admit steam from the high pressure chamber into the low pressure chamber. Steam pressure from the low pressure chamber is admitted to the diaphragm chamber 50 through the port 48, and, acting upon the diaphragm, forces it back from the head 29. This allows the auxiliary valve 39, which is pressed upwardly by its spring 42, to seat and shut off pressure from the upper side of piston 20. The main valve 18 now closes. The operation of the pressure reducing device is adjusted by means of the screw cap 33, by means of which the pressure exerted by spring 35 upon the diaphragm and consequently upon valve 39 may be varied.

It will be seen that the main valve, the piston 20 and the auxiliary valve 39 are readily accessible for purpose of repair or for the removal of such dirt, sediment and the like as will interfere with the proper operation of the device. Each of these three parts of the device is located adjacent to a plug so that by the removal of the plug in question the part may be reached directly. It is not necessary to remove the valve casing from the pipe in which it is located in order to get at these three parts of the device which are the ones most likely to require attention. The device, moreover, is structurally very simple, the operating parts being inclosed within the single integral casing 10 and the bonnet 27.

The auxiliary valve and its seat are purposely located within the high pressure chamber so that they are subjected to the swirling and inrushing of the steam taking place when the main valve is opened. This tends to keep this critical part of the apparatus free from sediment, dirt, etc., tending to clog the valve. The valve seat is on the under side of the web in which the port is formed and the valve in vertical position. This minimizes the danger of clogging as there is no place for dirt, sediment and the like to lodge. There is no long passageway leading to the valve, the valve being, as above explained, located immediately in the high pressure chamber. The diaphragm is located at the side of the intermediate cham-

ber 13 so that when the diaphragm is removed, and also the head 29 which is under it, it is possible to observe the position and operation of the auxiliary valve. If the main valve is held open by the clogging of the seat, or for any other cause, when it should be closed, the trouble can be detected at once. It is also possible to determine whether the fault is with the auxiliary valve or with the main valve and its piston, because if it is the latter which are not operating properly there will be a leak around the piston and back through port 47. In pressure reducing valves now in use it is difficult if not impossible to accurately locate trouble as between the main and auxiliary valves. The diaphragm may be removed without danger as the leak of steam past the auxiliary valve or back through the port 47 will not in any case be very considerable. It is very desirable to have a pressure reducing valve in which defective operation can be accurately located while the device is under high pressure steam because it is not possible ordinarily to be sure that any trouble is remedied without a test under steam at the normal high pressure and unless it is possible to locate the difficulty with the device connected up with the steam considerable useless experimental work has to be gone through with before the exact cause of the defective operation is ascertained.

While I have described my invention as embodied in its preferred form it will be understood that some changes might be made in the construction, arrangements and devices employed without departure from my invention. Therefore I do not limit myself to the precise particulars shown and described except so far as the same are made specifically limitations on certain of the claims herein.

I claim:

1. A pressure reducing device comprising in combination a casing constructed so as to constitute a high pressure chamber, a low pressure chamber formed with a cylinder, a chamber intermediate the high pressure chamber and the cylinder which is open at the side, and ports between the high and low pressure chambers, the high pressure and intermediate chambers and the intermediate chamber and the cylinder; a main valve controlling the port between the high and low pressure chambers; a piston to operate the valve in the cylinder; an auxiliary valve controlling the port between the high pressure chamber and the intermediate chamber; removable elements closing the open side of said intermediate chamber and constituting together a diaphragm chamber which is located at one side of the axial line of the main valve, means providing a port between the low pressure chamber and the diaphragm chamber; and a diaphragm adapted to control said auxiliary valve.

2. A pressure reducing device comprising in combination a casing constructed so as to constitute a high pressure chamber, a low pressure chamber formed with a cylinder, a chamber intermediate the high pressure chamber and the cylinder which is open at the side, and ports between the high and low pressure chambers, the high pressure and intermediate chambers, and the intermediate chamber and cylinder; a main valve controlling the port between the high and low pressure chambers; a piston to operate the valve in the cylinder; an auxiliary valve controlling the port between the high pressure chamber and the intermediate chamber; removable elements closing the open side of said intermediate chamber and constituting together a diaphragm chamber, means providing a port between the low pressure chamber and the diaphragm chamber; a diaphragm; a bell crank in said intermediate chamber interposed between said diaphragm and said auxiliary valve, and a removable plug in which said auxiliary valve is mounted.

3. A pressure reducing valve comprising in combination a casing formed on its upper side with a cylinder open at the top and with webs dividing the casing into a high pressure chamber, a low pressure chamber, and a chamber intermediate the high pressure chamber and the cylinder which is open at the side, said casing having an opening on the under side below the cylinder; plugs to close the upper end of the cylinder and said opening in the casing, a head to close the open side of the intermediate chamber, a bonnet inclosing said head and forming therewith a diaphragm chamber which is located at one side of the axial line of the main valve, a diaphragm in the diaphragm chamber, a port in the web between the high pressure chamber and the intermediate chamber, an auxiliary valve located in said high pressure chamber to control said port and formed with a stem, a plug in the casing in which the auxiliary valve is mounted, a bell crank in the intermediate chamber interposed between the diaphragm and said auxiliary valve, a port leading from the intermediate chamber to the cylinder, a piston in the cylinder formed on the under side with a boss, a port in the web between the high and low pressure chambers, a main valve to control said port formed on its under side with a stem adapted to fit into said boss and on its lower side with a sleeve which is slidable in the plug on the under side of said casing.

4. In a pressure reducing device, the combination with a casing divided so as to form a high pressure chamber, a low pressure chamber one above the other, and a third

chamber at the side of the other two, of a main valve having reciprocating movement within the casing, a piston to operate said valve, a diaphragm arranged at one side of the axis of the main valve, an auxiliary valve adapted to control the flow of fluid to one side of said piston, and a bell crank lever interposed in said third named chamber between said auxiliary valve and said diaphragm.

5. In a pressure reducing device, the combination with a casing formed with webs dividing said casing into a high pressure chamber, a low pressure chamber and an auxiliary valve chamber, the web between the high pressure chamber and low pressure chamber being formed with a port and the casing formed so as to constitute a cylinder communicating with said low pressure chamber, of a main valve formed on its under side with a sleeve, a plug in the casing under said valve in which said sleeve is guided, a spring interposed between the plug and said valve, a stem on the upper side of said valve, a piston in said cylinder having a boss by means of which it is mounted on said stem, a plug in the casing directly above said piston, said casing being formed with a port leading from the high pressure chamber to the auxiliary valve chamber and having a seat in the high pressure chamber, and a port from the latter to said cylinder, a valve in the high pressure chamber controlling the first named port, a plug in which said valve is mounted, a bonnet on the side of said casing and formed with a threaded stem, a diaphragm and a head interposed between said bonnet and said casing, a screw cap having a hand wheel on the threaded stem of the bonnet, a spring interposed between said cap and said diaphragm, a pin on the diaphragm, a bell crank lever pivotally mounted within said auxiliary valve chamber and interposed between said pin and said auxiliary valve, and a rib formed on the inner surface of said casing with a bore which puts into communication with each other the low pressure chamber and the space between said diaphragm and said head.

6. In a pressure reducing device, the combination with means constituting a high pressure chamber, a low pressure chamber, a cylinder communicating with the low pressure chamber, an intermediate chamber, a port between the high and low pressure chambers, a port leading from the high pressure chamber to the intermediate chamber, and a port leading from the intermediate chamber to the cylinder, said last named ports being of small cross sectional area relative to the cross sectional area of the intermediate chamber; of a main valve having a piston located in said cylinder, an auxiliary valve controlling the port leading from the high pressure chamber to the intermediate chamber, and means for controlling the auxiliary valve in response to changes of pressure in the low pressure chamber; said intermediate chamber being constructed so that the interior of the same is accessible without disturbing said auxiliary valve.

7. In a pressure reducing device, the combination with means constituting a high pressure chamber, a low pressure chamber, a cylinder communicating with the low pressure chamber, an intermediate chamber, a port between the high and low pressure chambers, a port leading from the high pressure chamber to the intermediate chamber, and a port leading from the intermediate chamber to the cylinder, said last named ports being of small cross sectional area relative to the cross sectional area of the intermediate chamber, of a main valve having a piston located in said cylinder, a vertically arranged auxiliary valve in the high pressure chamber controlling the port leading from the high pressure chamber to the intermediate chamber; and means for controlling the auxiliary valve in response to changes of pressure in the low pressure chamber; said intermediate chamber being constructed so that the interior of the same is accessible without disturbing said auxiliary valve.

8. In a pressure reducing device, the combination with means constituting a high pressure chamber, a low pressure chamber, a diaphragm chamber communicating with the low pressure chamber, a cylinder communicating with the low pressure chamber, an intermediate chamber, a port between the high and low pressure chambers, a port leading from the high pressure chamber to the intermediate chamber, and a port leading from the intermediate chamber to the cylinder, said last named ports being of small cross sectional area relative to the cross sectional area of the intermediate chamber, of a main valve having a piston located in said cylinder, an auxiliary valve controlling the port leading from the high pressure chamber to the intermediate chamber, a diaphragm in said diaphragm chamber, and a bell crank interposed between the diaphragm and said auxiliary valve, said intermediate chamber being constructed so that the interior of the same is accessible without disturbing said auxiliary valve.

9. In a pressure reducing device, the combination with means constituting a high pressure chamber, a low pressure chamber, a cylinder communicating with the low pressure chamber, an intermediate chamber at the side of said high and low pressure chambers, a diaphragm chamber arranged at the side of said intermediate chamber, a

port between the high and low pressure chambers, a port leading from the high pressure chamber to the intermediate chamber, and a port leading from the intermediate chamber to the cylinder, said last named ports being of small cross sectional area relative to the cross sectional area of the intermediate chamber, of a main valve having a piston located in said cylinder, an auxiliary valve controlling the port leading from the high pressure chamber to the intermediate chamber, a diaphragm in said diaphragm chamber, and a bell crank in said intermediate chamber interposed between the diaphragm and said auxiliary valve; the diaphragm and associated parts being removable so as to expose the interior of the intermediate chamber for the purpose specified.

10. In a pressure reducing device, the combination with a casing divided so as to form a high pressure chamber, a low pressure chamber, one above the other, and a third chamber at the side of the other two having a removable cover whereby access may be had thereto, of a main valve having reciprocating movement within the casing, a piston to operate said valve, a diaphragm arranged at one side of the axis of the main valve, an auxiliary valve adapted to control the flow of fluid to one side of said piston, and means located in said third named chamber and interposed between said auxiliary valve and said diaphragm for causing movements of the diaphragm to be transmitted to the auxiliary valve.

11. A pressure reducing device comprising in combination a casing constructed so as to constitute a high pressure chamber, a low pressure chamber formed with a cylinder, a chamber intermediate the high pressure chamber and the cylinder which is open at the side, and ports between the high and low pressure chambers, the high pressure and intermediate chambers, and the intermediate chamber and cylinder; a main valve controlling the port between the high and low pressure chambers; a piston to operate the valve in the cylinder; an auxiliary valve controlling the port between the high pressure chamber and the intermediate chamber; removable elements closing the open side of said intermediate chamber whereby access may be had thereto and constituting together a diaphragm chamber which is located at one side of the axial line of the main valve; means providing a port between the low pressure chamber and said last mentioned chamber, and a pressure-actuated element in said last named chamber adapted to control said auxiliary valve.

THOMAS H. MANCHESTER.

Witnesses:
P. H. TRUMAN,
L. A. FALKENBERG.

Correction in Letters Patent No. 1,022,322.

It is hereby certified that in Letters Patent No. 1,022,322, granted April 2, 1912, upon the application of Thomas H. Manchester, of Chicago, Illinois, for an improvement in "Pressure-Reducing Devices," errors appear in the printed specification requiring correction as follows: Page 2, line 78, for the reference-numeral "15" read *13;* page 4, lines 15, 30, and 43, for the words "auxiliary valve" read *intermediate;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of May, A. D., 1912.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.