No. 659,207.

Patented Oct. 9, 1900.

A. W. CASH.

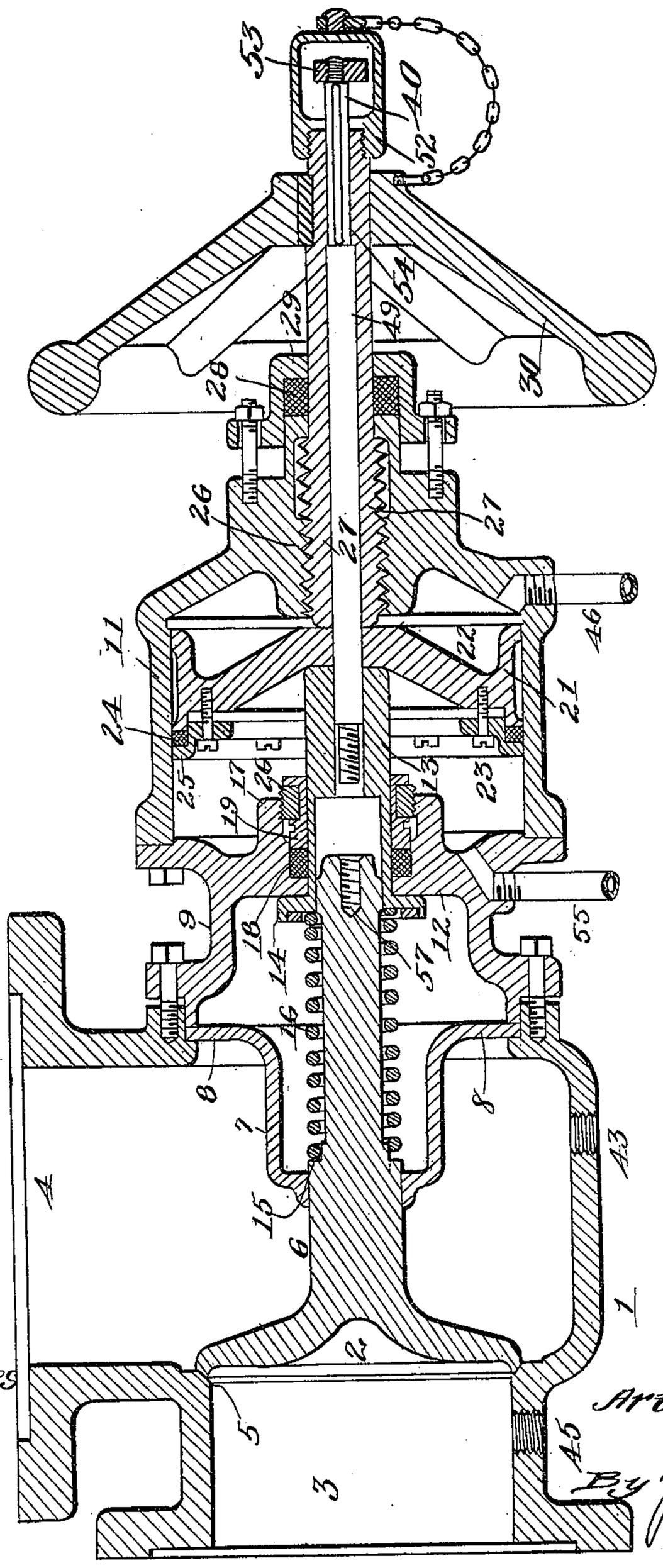
COMBINATION VALVE.

(Application filed Jan. 31, 1900.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



Witnesses
T. W. Keady
Dennis Sunly.

Inventor
Arthur W. Cash
By James L. Norris
Atty.

No. 659,207. Patented Oct. 9, 1900.

A. W. CASH.

COMBINATION VALVE.

(Application filed Jan. 31, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

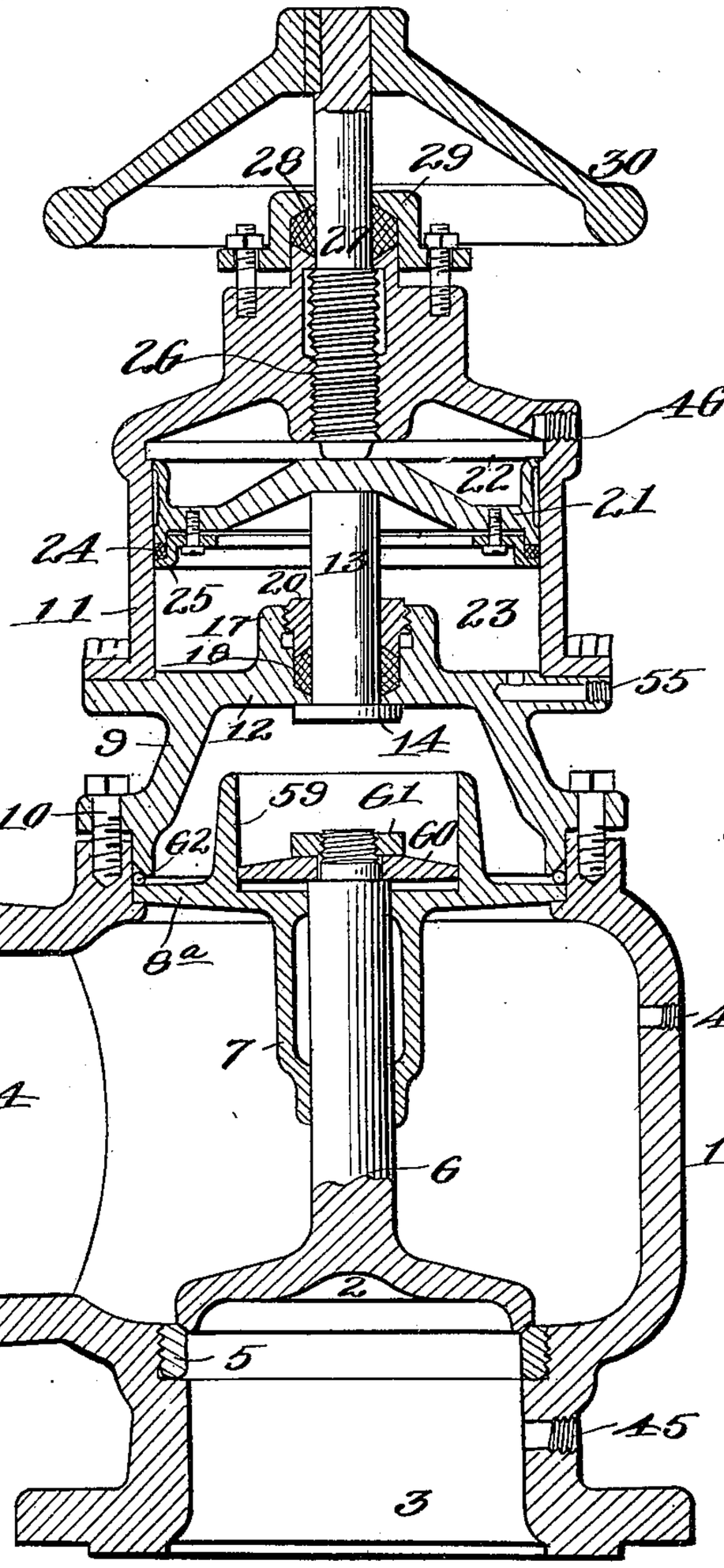
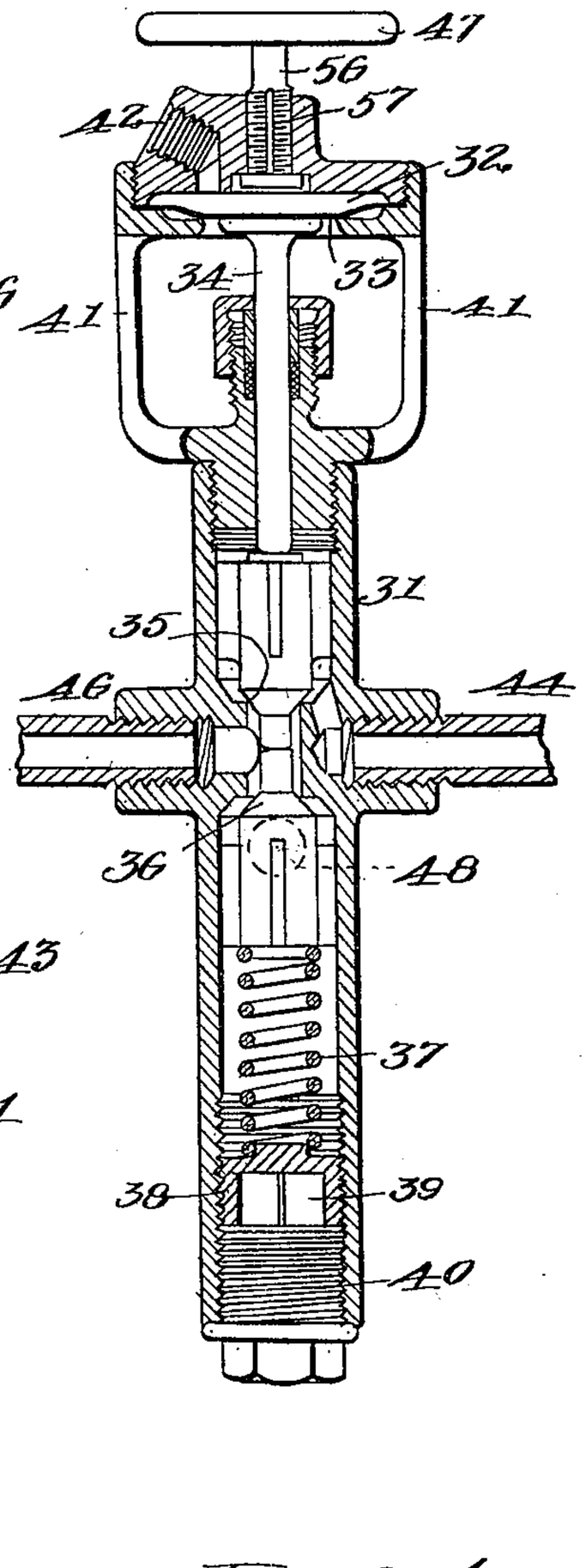


Fig. 2.



Witnesses:
J. B. Kerr
Dennie Sumby.

Inventor
Arthur W Cash
By James L. Norris
Atty

UNITED STATES PATENT OFFICE.

ARTHUR W. CASH, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE FOSTER ENGINEERING COMPANY, OF SAME PLACE.

COMBINATION-VALVE.

SPECIFICATION forming part of Letters Patent No. 659,207, dated October 9, 1900.

Application filed January 31, 1900. Serial No. 3,478. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR W. CASH, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Combination-Valves, of which the following is a specification.

This invention relates to an improved and thoroughly-effective combination-valve designed to serve as a reducing-valve, non-return valve, automatic and emergency stop valve, and hand-stop valve, as occasion may require.

It is also among the purposes of my invention to provide suitable safeguards against carelessness or oversight of attendants and means for operating the valve parts in both directions of movement or back and forth when there is no steam or other fluid pressure acting against the main valve.

Other features and advantages of my invention will appear from the description of the valve construction illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of one form of my improved combination reducing, non-return, automatic and emergency stop, and hand-stop valve. Fig. 2 is a sectional view of an auxiliary valve to be located at any convenient point and provided with suitable connections for effecting an automatic stop of the main valve. Fig. 3 is a sectional elevation of another form of my improved combination-valve to be employed in connection with an auxiliary valve of the same character as shown in the preceding figure.

Referring first to Fig. 1, the numeral 1 designates the main casing of the valve 2, said casing being provided with an inlet 3 and an outlet 4, each of which may be suitably flanged. In a steam plant the inlet 3 will connect with the boiler-pressure and the outlet 4 is to be connected to the main steam-pipe line. A suitable seat 5 is provided for the main valve 2 at the inlet to the main-valve casing. The valve 2 is provided with a stem 6, extended through the tubular neck 7 of a partition 8, which closes one side of the main-valve casing 1 opposite the inlet to said casing. This partition 8 is clamped in position between the main casing 1 and a substantially-tubular extension 9 of said valve-casing; screws 10 or other suitable fastenings being provided to connect these end casing parts. There is bolted or otherwise secured to a flanged portion of the tubular extension 9 a further casing extension 11, which is closed at its outer end, except for an opening therein for a purpose hereinafter explained.

By reference to Fig. 1 it will be seen that the stem 6 of the main valve 2 is extended through the partition 8 and into the sleeve portion of a piston 13, which passes through a partition 12 in the tubular extension 9 of the main-valve casing. The outer end of the valve-stem 6 enters the enlarged end portion of the tubular and flanged piston 13, which has its flanged end 14 within the tubular extension 9 of the main-valve casing. Between the piston-head or flange 14 and a shoulder 15 on the valve-stem 6 there is arranged a spirally-coiled spring 16, which may be more or less heavy or of a greater or less strength, as required, for the purpose of a reducing-valve. This spring 16 may be made from phosphor-bronze or other suitable material. There is a tubular neck 17 extended outward from the partition 12 around a portion of the tubular piston 13, and between this neck 17 and said piston 13 any suitable packing 18 may be placed and be secured in position by means of a gland 19 and a retaining-ring 20, screwed into said tubular neck.

The valve 2, Fig. 1, is held normally against its seat 5 by the spring 16, as shown, and if this spring is of sufficient strength to resist a pressure of, say, five pounds per square inch on the valve area the valve 2 will remain closed until the pressure in the boiler reaches five pounds, when the said valve will open to permit the required flow of steam at a pressure of five pounds per square inch less than in the boiler. This reducing or lowering of pressure in the main steam-pipe line will be greater as the velocity or the flow of steam is increased, as from the speeding up of the engines. For greater reductions heavier springs may be used.

In the extension 11 of the main-valve casing there is placed a close-fitting piston-plate 21, that is in contact with the outer end of the piston 13 and which divides said casing

11 into two chambers 22 and 23, as shown. This piston 21 is constructed to move easily and freely in the cylindrical extension 11 and is provided on one side with suitable packing 24, held in place by an adjustable ring 25 or otherwise.

It has been stated that the cylindrical or tubular extension 11 is closed at its outer end, except for an opening therein, which is centrally located and also screw-threaded, as shown at 26 in Fig. 1. This screw-threaded opening 26 receives the screw-threaded portion of a hand-wheel stem 27, that may be tubular throughout its length, as shown in Fig. 1. It is preferable to place a suitable packing-ring 28 against the outer end portion of the cylindrical casing extension 11 around the opening that is provided therein for the passage of said hand-wheel stem. This packing 28 is held in place by a suitable flanged ring 29, which is bolted to the valve-casing extension, as shown. A hand-wheel 30 is fastened to the stem 29 in any suitable or convenient manner.

In connection with the main valve, above described, there is employed an auxiliary valve, Fig. 2, which may be located at any convenient point and which is provided with suitable small pipe connections with required parts of the main-valve.

The auxiliary valve comprises a tubular casing 31, having a diaphragm-chamber 32, attached at one end by two arms 41, Fig. 2. In this chamber 32 there is supported a flexible diaphragm 33, which bears against the stem 34, which in turn rests against a valve 35, located in the tubular portion 31 of the valve-casing. A projecting portion of the valve 35 abuts against a corresponding projection of a valve 36, that is normally pressed toward its seat by a spring 37, arranged in the opposite end portion of the tubular valve-casing. The outer end portion of this spring 37 has a bearing against a plug 38, that is screwed into one end of the auxiliary-valve casing. A socket 39 is provided in this screw-plug for engagement therewith of any suitable instrument for turning said plug in the proper direction to adjust the tension of the spring 37 as may be required. A solid screw-plug 40 may be employed to close the end of the valve-casing 31 after the adjustment of the spring 37 has been effected. Beyond the diaphragm 33 the diaphragm-chamber 32 is provided with an opening 42 for connection with a pipe leading from an opening 43 on the outlet side of the main-valve casing 1, or said pipe may be connected with the main pipe-line at some more distant point. The auxiliary valve is also connected by a pipe 44, Fig. 2, with the boiler, as by an opening 45 at the inlet side of the main valve or at some point intermediate said valve and the boiler. Another pipe 46, Figs. 1 and 2, is provided to connect the auxiliary valve with the chamber 22 of the main valve.

The operation of the valve mechanism as a means for obtaining a reduction of pressure through the spring 16 has been already described. Any required reduction of pressure can be readily obtained by providing a more or less heavy spring.

As a non-return valve the operation is as follows: At the moment the flow of steam in the main ceases, as by the stopping of the engines, the valve 2 will instantly close against its seat regardless of pressure in the boiler or in the main. The rupture or blowing out of a tube in the boiler, that will permit the escape of a sufficient volume of steam to stop the flow past the valve 2, will permit the latter to instantly close, and thus prevent the escape of steam from the other boilers back through the disabled one.

The operation of the valve mechanism as an automatic and emergency stop may be explained as follows: The spring 37 of the auxiliary valve having been adjusted to resist a predetermined pressure—say one hundred pounds per square inch—in the diaphragm-chamber 32, it will be obvious that whenever from any cause the pressure in the main pipe-line falls to or below one hundred pounds the spring 37 will instantly close the valve 36 and open the valve 35, thus allowing full pressure to flow from the boiler through the auxiliary valve and into the chamber 22 of the main valve against the piston 21, which being of greater area than the valve 2 will instantly close the valve 2 against its seat and prevent the flow of steam in either direction. The valve 2 having been closed either automatically, as described, or manually, as through the hand-wheel 30, and the pressure in the steam-pipe line or main having fallen below one hundred pounds, the valve 2 will remain closed until pressure above one hundred pounds from some connecting-boiler is admitted to the main, or by means of a hand-wheel 47, with which the auxiliary valve is provided, as shown in Fig. 2, the valve 35 may be closed, and simultaneously the valve 36 is forced open. The pressure from the chamber 22 of the main valve will now flow back through the auxiliary valve and escape to the atmosphere through a drain-pipe connected at 48 on the outlet side of the auxiliary valve. Now if the steam in this particular boiler is of greater pressure than in the main the valve 2 will be forced open to permit the required flow into the main. A number of small pipes may branch from the one leading to the diaphragm-chamber 32 of the auxiliary valve and be led to distant points in a ship, building, or elsewhere. On each of these branch pipes at an accessible point is located a three-way cock. The main valve may be instantly closed from any of these distant points by turning the said three-way cock in such a manner as will lead the pressure from the diaphragm-chamber 32 of the auxiliary valve, the inlet pressure at the diaphragm-chamber being supplied through a restricted opening in the pipe, as at 43.

As a hand-stop valve the use of the hand-wheel 30 will permit manual closing of the valve 2 against the flow of steam in either direction as easily and effectively as in the ordinary hand-stop valves.

For the purpose of operating the valve 2 manually and in both directions of movement back and forth when there is no steam in the boilers there is provided a rod 49, Fig. 1, which may be made from phosphor-bronze or other suitable material. This rod is passed through the tubular stem 27 of the hand-wheel 30 and into the tubular piston 13, as shown in Fig. 1. The inner end of said rod 49 is screw-threaded at 50 to engage in a screw-threaded socket 51 in the stem 6 of the main valve. By taking off a steam-tight cap 52, that is screwed onto a projecting portion of the hand-wheel stem 27, and then pushing the rod 49 inward and screwing it into the valve-stem 6 all the valve parts may be moved back and forth by means of the hand-wheel 30 being turned in the proper direction, as required, there being provided on the outer end of the rod 49 a nut 53, that provides a shoulder or bearing for the outer end of the hand-wheel stem 27 in drawing the valve 2 from its seat. After connecting the rod 49 with the valve stem 6, as described, and trying the valve the rod 49 must be run back to its original position, and the cap 52 may be then screwed to its place to prevent the escape of steam.

As a safeguard against carelessness of an attendant in leaving the rod 49 screwed into the valve-stem 6 when there is steam in the boiler there is provided in said rod 49 a groove 54, that will allow the passage of steam outward around said rod. Should the rod 49 be inadvertently left screwed into the valve-stem 6, there will be a leakage of steam around this rod out through the end of the hand-wheel stem 27, and this leakage will give warning of the improper position of the rod and can only be stopped by first running back the rod 49 to its proper position and then screwing on the steam-tight cap. The drain-pipe 55 is connected with the chamber 23 to carry off any leakage past the pistons 21 and 13, as shown in Fig. 1. Should the hand-wheel 47 of the auxiliary valve be left screwed against the diaphragm 33 in such manner as to leave the latter inoperative, there will be a leakage of steam out around the stem 56 of this valve, in which a groove 57 is provided, thus giving warning to the attendant, and this leakage can only be stopped by screwing the hand-wheel stem 56 backward into proper position or until an enlargement or flange 58 on its inner end comes to a stop in a recess portion of the auxiliary-valve casing.

In Fig. 3 I have illustrated a slightly-modified but somewhat more simple construction of non-return, automatic emergency-stop, and hand-stop valve, which is shown as arranged to operate in a vertical position only. It is to be understood, of course, that this modified form of combination-valve is designed to be used in connection with an auxiliary valve of the same character as already herein described. With either the construction of main valve shown in Fig. 1 or that shown in Fig. 3 the auxiliary valve, Fig. 2, will be located either in juxtaposition to the main valve or at some distant and more accessible point. In either case the auxiliary valve, Fig. 2, will be connected by suitable pipes with the boiler or inlet side of the main valve, as at 45, Figs. 1 and 3, and with the chamber 22, as at 46, in the manner hereinbefore described. It will also have in either case a pipe connection from the diaphragm-chamber 32 through 42 and 43 to the outlet side of the main valve or to some more distant point on the main pipe-line. The operation of the auxiliary valve, Fig. 2, is the same whether employed in connection with either form of main valve.

Referring now to the construction of main valve shown in Fig. 3, it will be seen that the stem 6 of the valve 2 is partly incased in the tubular neck 7 of a partition 8^a, that separates the lower section 1 of the main-valve casing from the next upper section. This partition 8^a forms the bottom of a dash-pot 59, in which there is fitted a piston 60, that is secured by a nut 61 on a screw-threaded end of the valve-stem. The dash-pot 59 and piston 60 are provided to prevent chattering or hammering of the valve 2 on its seat. The partition or dash-pot bottom 8^a is clamped at its periphery between the valve-case sections 1 and 9, as shown, and any suitable packing, such as a copper-wire ring 62, may be placed between the top of the diaphragm and the lower edge of the adjoining valve-case section. The valve-case sections 1, 9, and 11, chambers 22 and 23, and screw-stem 27, with hand-wheel 30 thereon, may be substantially the same as described with reference to Fig. 1. As already remarked, the connections with the auxiliary valve, Fig. 2, are the same as hereinbefore described.

Obviously the mechanism shown in Fig. 3 will operate as a non-return valve, as an automatic and emergency stop, and as a hand-stop in the same manner as the combination-valve shown in Fig. 1, and similar safeguards are provided in both forms of valve mechanism against carelessness or oversight of an attendant.

In Fig. 3 there is no provision shown for reducing the pressure; but it can be readily understood that a spring could be placed between the valve 2 and the bottom of the dash-pot 59 around the tubular neck 7 and lower portion of the valve-stem 6 and that an adjustment of such spring could be readily provided for by applying a nut to said tubular neck 7, thus obtaining the functions of a reducing-valve.

What I claim as my invention is—

1. In a valve of the character described, the

combination of an inlet and outlet casing, a main valve to control the inlet to said casing, a fluid-pressure chamber in an extension of the valve-casing, a piston in said chamber, an auxiliary valve having a diaphragm-chamber at one end and a spring at the other end to alternately control the operation of said auxiliary valve, pipe connections between the auxiliary valve and the inlet side of the main valve and between said auxiliary valve and the fluid-pressure chamber of the main valve, respectively, and a pipe connection between the outlet side of the main valve and the diaphragm-chamber of the auxiliary valve, substantially as specified.

2. In a valve of the character described, the combination of a main-valve casing having an inlet and an outlet at one end and provided at its other end with an extension containing a fluid-pressure chamber, a valve to control the inlet to said main-valve casing, a piston arranged in the fluid-pressure chamber and adapted to effect a closing of said valve, a hand-wheel having a screw-stem inserted through one end of the main-valve casing and adapted to exert a pressure against said piston for closing the valve, an auxiliary valve provided with a diaphragm-chamber, pipe connections between the auxiliary valve and the inlet side of the main valve and between said auxiliary valve and the fluid-pressure chamber of the main valve, respectively, and a pipe connection between the outlet side of the main valve and the diaphragm-chamber of the auxiliary valve, substantially as specified.

3. In a valve of the character described, the combination of a main-valve casing having an inlet and an outlet and provided with a fluid-pressure chamber, a valve to control the inlet to said main-valve casing, a piston arranged in the fluid-pressure chamber and adapted to effect automatic closing of said valve, means for closing said valve manually, an auxiliary valve provided with a diaphragm-chamber at one end and a spring at the other end to alternately control the operation of said auxiliary valve, a hand-wheel to control the auxiliary valve against the pressure of its said spring, pipe connections between the auxiliary valve and the inlet side of the main valve and between said auxiliary valve and the fluid-pressure chamber of the main valve, respectively, and a pipe connection between the outlet side of the main valve and the diaphragm-chamber of the auxiliary valve, substantially as specified.

4. In a valve of the character described, the combination of a main-valve casing provided with an inlet and an outlet and with a fluid-pressure chamber, a valve to control the inlet to said main-valve casing, a dash-pot connected with said valve, a piston arranged in the fluid-pressure chamber and adapted to effect the closing of said valve, means for manually operating said valve in both directions of movement, an auxiliary valve provided with a diaphragm-chamber, pipe connections between said auxiliary valve and the inlet side of the main valve and between the auxiliary valve and the fluid-pressure chamber of the main valve, respectively, and a pipe connection between the diaphragm-chamber of the auxiliary valve and the outlet side of the main valve, the parts of said mechanism being arranged to operate as a non-return valve, and also as an automatic and emergency stop and hand-stop, substantially as specified.

5. In a valve of the character described, the combination of a main-valve casing provided with an inlet and an outlet, a valve to control the inlet to said main-valve casing, a piston adapted to effect a closing of said valve, a hand-wheel having a screw-stem inserted through one end of the main-valve casing and adapted to be operated for manually closing the valve by pressure exerted against said piston, an auxiliary valve provided with a diaphragm and with a spring to alternately control said auxiliary valve and having a hand-wheel provided with a stem to be manually operated against said diaphragm and spring, and pipe connections between said auxiliary valve and the main-valve casing, substantially as specified.

6. In a valve of the character described, the combination of a main-valve casing provided with an inlet and an outlet, a reducing-valve to control the inlet to said valve-casing, a piston to automatically close said valve, means for manually acting upon said piston to close the said valve, an auxiliary valve having a diaphragm-chamber, and pipe connections between said auxiliary valve and parts of the main valve and between the auxiliary valve and the source of pressure, respectively, whereby the said valve mechanism is adapted to be operated as a reducing-valve, a non-return valve, an automatic and emergency stop, and hand-stop, substantially as specified.

7. In a valve of the character described, the combination of a main-valve mechanism, for controlling the flow from the source of pressure to a pipe-line, an auxiliary valve provided with a diaphragm-chamber, pipe connections between said auxiliary valve and parts of the main valve and with the source of pressure, respectively, a pipe connection between the diaphragm-chamber of the auxiliary valve and the outlet side of the main-valve mechanism, and hand-wheels for the main-valve mechanism and auxiliary valve, respectively, whereby said valve mechanism is adapted to be operated as a non-return valve, an automatic and emergency stop and hand-stop, substantially as specified.

8. In a valve of the character described, the combination of a main-valve mechanism having an inlet from the source of pressure and an outlet to the main pipe-line, a valve to control the inlet to said main-valve mechanism, a fluid-pressure chamber having therein

a piston adapted to close the main valve, an auxiliary valve provided with a diaphragm-chamber, a pipe connection between the source of pressure and said auxiliary valve, another pipe connection between the auxiliary valve and the fluid-pressure chamber of the main-valve mechanism, also a pipe connection between the diaphragm-chamber of the auxiliary valve and the outlet side of the main valve, and means for operating the main-valve mechanism and the auxiliary valve manually, substantially as specified.

9. In a valve of the character described, the combination of a main-valve casing provided with an inlet and an outlet and having a fluid-pressure chamber, a valve to control the inlet to said main-valve casing, a piston in the fluid-pressure chamber, an auxiliary valve communicating with said fluid-pressure chamber and also with the source of pressure, a pipe connection between the outlet side of the main valve and a diaphragm-chamber in the auxiliary valve, hand-wheels for the main-valve mechanism and the auxiliary valve, respectively, and drainage devices, substantially as specified.

10. In a valve of the character described, the combination of a main-valve casing provided with an inlet and an outlet and having a fluid-pressure chamber, a valve to control the inlet to said main-valve casing, a tubular piston in the fluid-pressure chamber, a hand-wheel having a tubular screw-stem inserted through one end of the main-valve casing and adapted to exert a pressure against said piston for manual closing of the valve, a rod inserted through said tubular hand-wheel stem and through the tubular piston and adapted to be detachably engaged with the stem of the valve, a steam-tight cap over the outer end of said rod, a nut on said rod to be engaged by the hand-wheel stem in drawing the valve from its seat, an auxiliary valve provided with a diaphragm-chamber, pipe connections between said auxiliary valve and the inlet side of the main-valve casing and between the auxiliary valve and said fluid-pressure chamber, also a pipe connection between the diaphragm-chamber and the auxiliary valve and the outlet side of the main-valve casing, and a hand-wheel for the auxiliary valve, substantially as specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ARTHUR W. CASH.

Witnesses:
MICHAEL SUGRUR, Jr.,
F. J. GREENBERG.