Aug. 23, 1955 H. G. V. HANSEN 2,716,000

DUAL THERMOSTATIC VALVES FOR GAS BURNERS

Filed Sept. 12, 1951 5 Sheets-Sheet 1

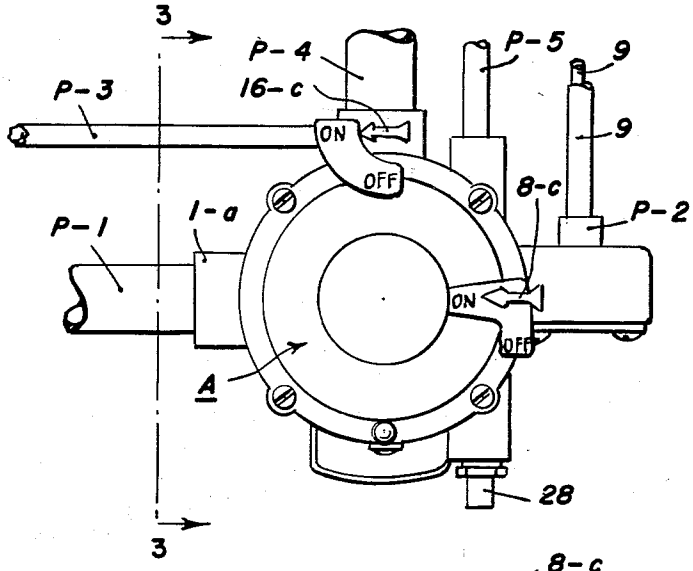


FIG. 1

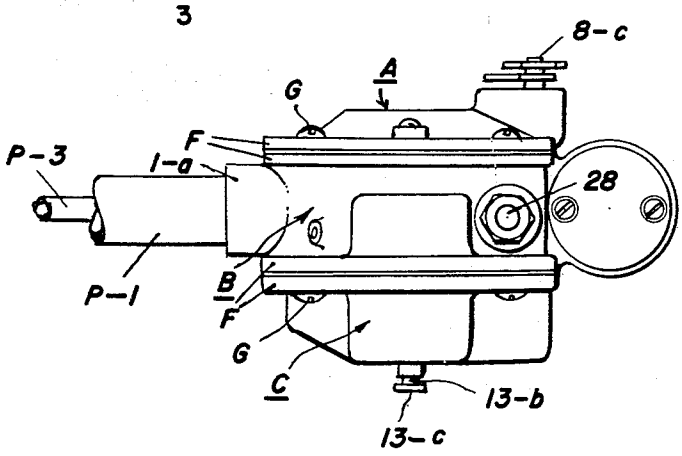


FIG. 2

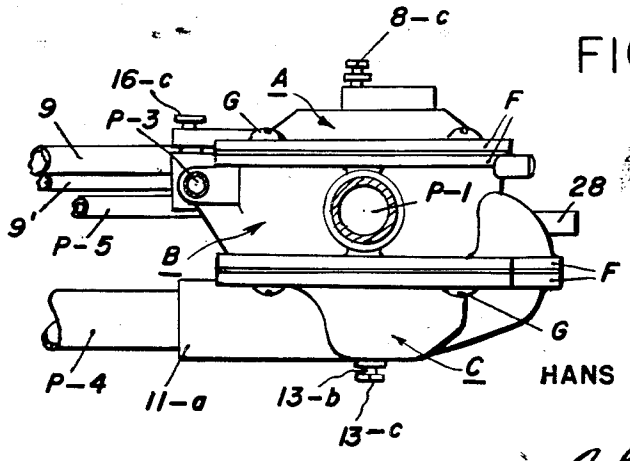


FIG. 3

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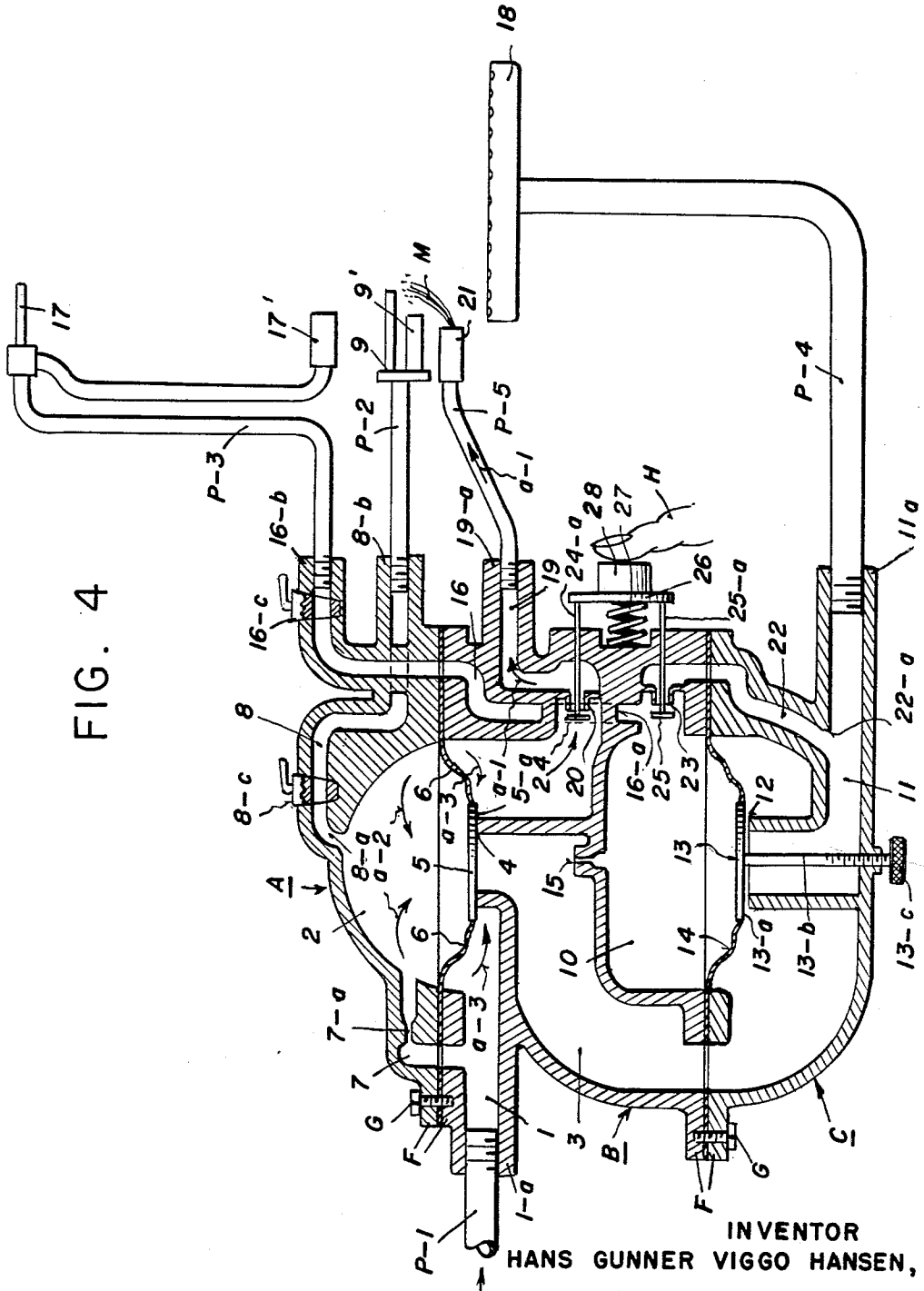
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DUAL THERMOSTATIC VALVES FOR GAS BURNERS

Filed Sept. 12, 1951 5 Sheets-Sheet 2

FIG. 4

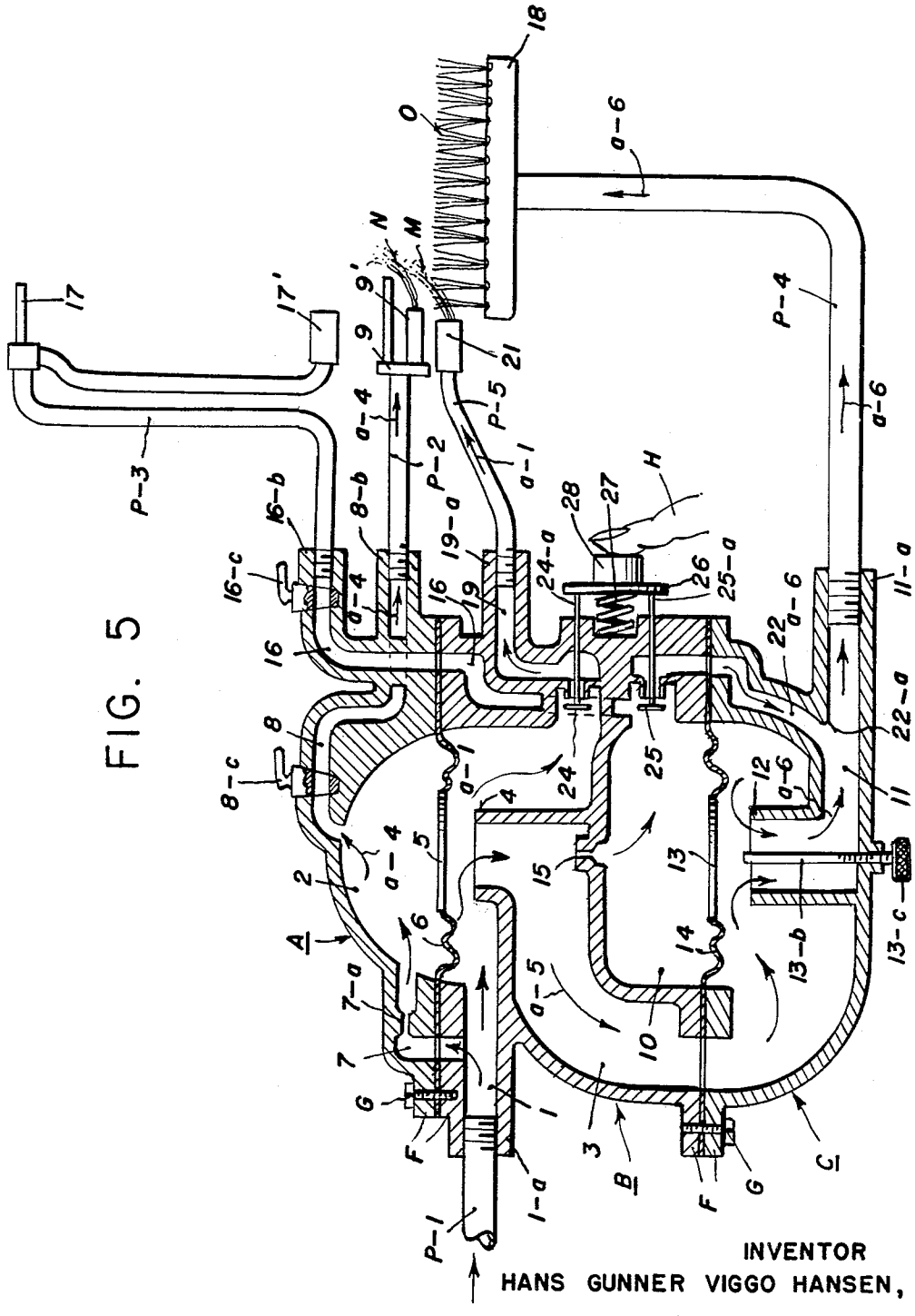


Aug. 23, 1955 H. G. V. HANSEN 2,716,000

DUAL THERMOSTATIC VALVES FOR GAS BURNERS

Filed Sept. 12, 1951 5 Sheets-Sheet 3

FIG. 5



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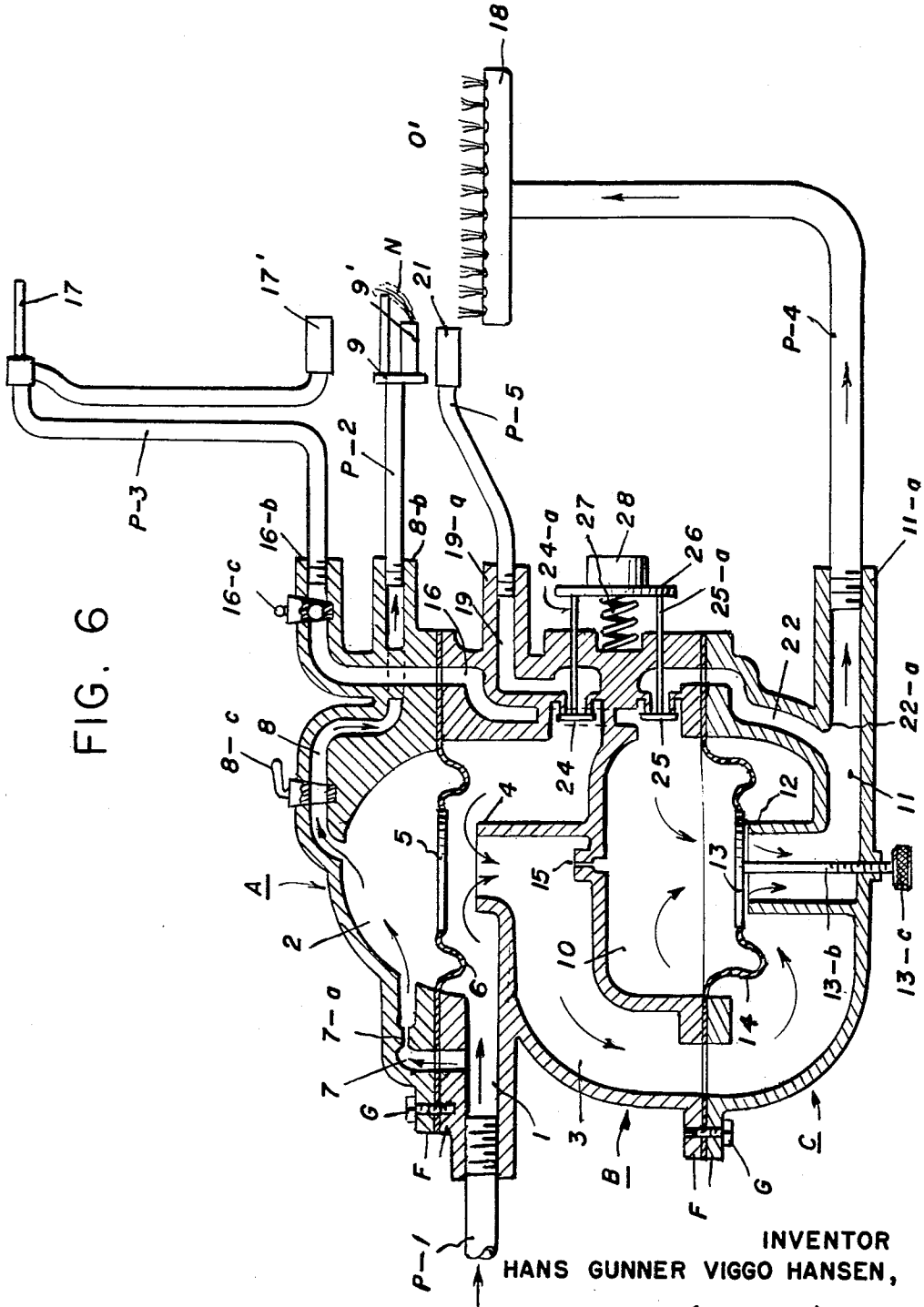
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Filed Sept. 12, 1951 5 Sheets-Sheet 4

FIG. 6



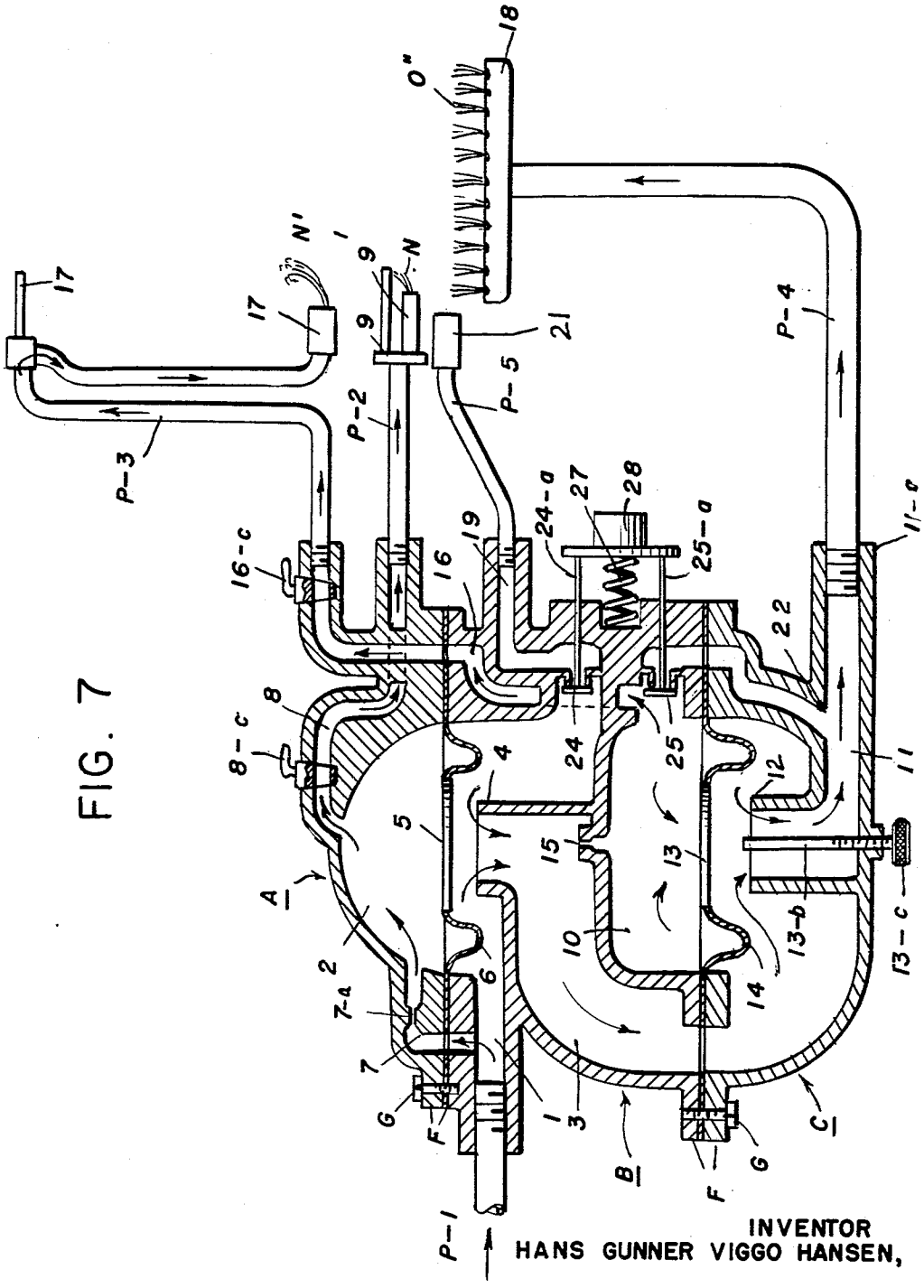
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Filed Sept. 12, 1951 5 Sheets-Sheet 5

FIG. 7



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United States Patent Office 2,716,000
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2,716,000

DUAL THERMOSTATIC VALVES FOR GAS BURNERS

Hans Gunner Viggo Hansen, Copenhagen, Denmark

Application September 12, 1951, Serial No. 246,209

5 Claims. (Cl. 236—80)

My invention consists in a new and useful improvement in valves for gas burners and is designed to provide a valve having two movable valve members for inter-action for controlling the flow of gas to the burner.

In automatic gas heating-plants different systems have hitherto been used, but they have had one characteristic in common: the use of two thermostats, one for providing the degree of heat required, and one to provide a maintenance flame, the latter being usually incorporated in the control tube of the former. Technical development has provided devices having great safety combined with simplified appearance. The requirements for such devices may be summed up as follows: Lighting of a pilot burner must take place outside of the fire box, the main flame must be adjustable together with a constantly burning maintenance flame adjustable to a gas supply from 0 to 100%, the main burner must be wide open at the time of lighting even if the thermostat providing the degree of heat required is closed at that time, the safety afforded by the maintenance flame must be 100%, i. e. must comprise all gas including the flame itself, and in addition it is desirable to avoid the many by-pass tubes generally used whether they are visible or concealed in the boiler or its casing.

The purpose of applicant's invention is to meet all of these requirements by having all gas for the burner pass through a double-member valve, a fact which makes it possible in the first place to secure all gas by a safety flame controlled thermostatically and in the second place to control the gas in accordance with the amount of heat required and yet retain the possibility of adjusting a constantly burning maintenance flame which is also controlled, and to admit gas at full pressure when lighting.

Applicant's device comprises a valve for thermostatically governed gas-relays of the kind having a thermostat for providing the degree of heat required, and a thermostat for providing a maintenance flame. In the ordinary gas-relays, the latter gets its supply of gas either from the admission side of the valve or from the pipe governed by the thermostat for providing the degree of heat required. In the former case, if all flames are put out owing to faulty performance, one cannot prevent a constant outflow of gas through the maintenance flame burner, and in the latter case such an outflow of gas cannot be prevented either, although it will not occur until the need for heat arises at the time when the main burner is to be re-lighted. These drawbacks are eliminated by the improved device of applicant's invention, the essential feature of which is the insertion in the supply passage to the main movable member of a second movable member whose control ante-chamber is placed outside the main gas supply passage and communicates with a passage to the maintenance flame burner, whereas the control chamber for the main movable member communicates with a passage to the thermostat for providing the degree of heat required.

By means of applicant's valve, in case all flames are put out, due to faulty performance, the flow of gas to the ignition burner for the maintenance flame and to the

thermostat for providing the degree of heat required will be cut off by the closing of said second valve member, and the burner for the maintenance flame will be closed by its own thermostat when the latter cools down after the putting out of the flames.

In addition, the invention entails other important advantages. Among other things it ensures that the main burner will be fully open at the time of lighting whether the thermostat for providing the degree of heat required is closed at the time of lighting or not. Furthermore, the various passages of the valve are reduced to a minimum as to number as well as length, an advantage which will be explained in detail below.

In the drawings:

Fig. 1 is a top plan of my improved valve.

Fig. 2 is a side elevation of the valve.

Fig. 3 is an end elevation of the valve, viewed from the line 3—3 of Fig. 1, in the direction of the arrows.

Fig. 4 is a greatly enlarged diagrammatic view of the valve and the burner, the parts being positioned for commencing the lighting of the burner.

Fig. 5 is a view similar to Fig. 4, the parts being positioned for the automatic lighting of the maintenance flame.

Fig. 6 is another similar view, the parts being positioned for the burning of the maintenance flame.

Fig. 7 is another similar view, the parts being positioned for the normal operation of the burner under its thermostatic control.

As illustrated in the drawings, applicant's improved valve has a body composed of three elements, a top A, a middle B, and a bottom C, made of suitable metal, to provide the necessary chambers, passages and valve seats, as hereinafter fully described. The elements are provided with the usual flanges F and bolts G for assembly.

The middle element B is bored to provide a passage 1 therein, in the intake end 1–*a* of which is threaded a pipe P–1 for supplying gas to the valve. The control ante-chamber 2 is formed in the top element A. A passage 3 is formed in the middle element B and the bottom element C, to which gas may flow from the passage 1. The intake end of this passage 3 is formed as a circular valve seat 4. A circular valve member 5 is provided for co-action with the seat 4 for opening and closing the intake end of the passage 3 to control flow of gas from the passage 1 to the passage 3. The member 5 is carried by a flexible membrane 6 suitably mounted between the flanges F of the elements A and B, and closing the lower end of the chamber 2. The member 5 and the seat 4 are co-axial and the diameter of the member 5 is sufficiently superior to the outside diameter of the seat 4 as to provide a peripheral portion 5–*a* projecting outwardly of the seat 4.

The top and middle elements A and B are bored to provide a passage 7 connecting the passage 1 and the ante-chamber 2. The passage 7 has therein a constricted portion 7–*a*. The top element A is provided with a passage 8 having its intake end 8–*a* leading from the ante-chamber 2 and its outlet end 8–*b* leading from the element A and in which is threaded a pipe P–2 connected to a thermostatic valve 9 having a tip 9' for the maintenance flame. The passage 8 is provided with a manual plug valve 8–*c*.

The middle and bottom elements B and C have formed therein the control chamber 10. A discharge passage 11 is formed in the bottom element C to which the gas may flow from the passage 3. The intake end of the passage 11 is formed as a circular valve seat 12. A circular valve member 13 is provided for co-action with the seat 12 for controlling the flow of the gas from the passage 3 to the passage 11. The member 13 is carried by a flexible membrane 14 suitably mounted between the flanges F of the elements B and C and closing the lower end of the chamber 10. The member 13 and the seat 12 are co-axial

and the diameter of the member **13** is sufficiently superior to the outside diameter of the seat **14** as to provide a peripheral portion **13**–*a* projecting outwardly of the seat **12**. A control rod **13**–*b* is threaded through the wall of the bottom element C, co-axial with the seat **12** and valve member **13** and is provided with a head **13**–*c* exterior element C for manual vertical adjustment of the rod **13**–*b* to bear against the member **13**.

A constricted bore **15** is provided in the middle element B connecting the passage **3** and the chamber **10**. The top and middle elements A and B have formed therein a passage **16**, its intake end **16**–*a* communicating with the chamber **10** and its outlet end **16**–*b* leading out of the element A and having threaded therein a pipe P–**3**. The passage **16** is provided with a manual plug valve **16**–*c*. The pipe P–**3** is connected to a thermostatic control valve **17** with a tip **17'**, for controlling the burner **18** which has its supply pipe P–**4** threaded into the outlet end **11**–*a* of the passage **11**.

The middle element B has formed therein a passage **19**, its intake end communicating with passage **1** and being formed as a valve seat **20** and its outlet end **19**–*a* leading out of the element B and having threaded therein a pipe P–**5** having on its outer end a tip **21** for the pilot flame. This tip **21** may be moved into and out of the fire box (not shown) in the well-known manner.

The middle and bottom elements B and C have formed therein a passage **22**, its intake end in the chamber **10** being formed as a valve seat **23** and its outlet end **22**–*a* connected with the passage **11**. The passage **22** may open to atmosphere directly instead of through the burner **18**, by any suitable means such as a pipe suitably connected to the passage **22** in any suitable manner (not shown).

Valve members **24** and **25** are provided to co-act with the valve seats **20** and **23** of the passages **19** and **22**, respectively, and are mounted on valve stems **24**–*a* and **25**–*a* slidable through the wall of element B and mounted on a head **26** exterior element B, biased by a spring **27** to seat the members **24** and **25**, and having a push button **28** operable by a finger H of the user.

Having described the structural details of my improved valve, and its associated mechanisms, I will now describe the use and operation of my improved valve.

It is obvious that when the valve members **5** and **13** with control rod **13**–*b*, the valve members **24** and **25** with their operative mechanism, and the plug valves **8**–*c* and **16**–*c* have been installed in the elements A, B and C, they are assembled by the bolts G in the flanges F. Thus the valve body is made ready for installation. Pipes P–**1** to P–**5** are then connected to passages **1** to **19**, respectively. Pipe P–**1** is connected to a source of gas supply. Pipe P–**2** is provided with the thermostatic valve **9** and tip **9'**. Pipe P–**3** is provided with the thermostatic valve **17** and tip **17'**. Pipe P–**4** is connected to the burner **18**. Pipe P–**5** is provided with the tip **21**. The device is then conditioned to function.

The plug valves **8**–*c* and **16**–*c* are manually adjusted to positions to open passages **8** and **16**, respectively (Fig. 4). The tip **21** is moved out of the fire box. The button **28** is pressed inwardly against pressure of the spring **27**, by the finger H of the user, thereby unseating valve members **24** and **25** and opening passages **19** and **22**. Gas under pressure having entered the valve through the pipe P–**1** and passage **1** and filled chamber **2** through passage **7**, passage **8** and pipe P–**2**, the gas now flows (arrows *a*–**1**) through the opened passage **19** and pipe P–**5** to the tip **21** where issuing from the tip **21** it can be ignited in any suitable way as by a match or mechanical or electrical lighter, to produce the pilot flame M (Fig. 4). The tip **21** is then moved into the fire box. The unheated thermostatic valve **9**, being thus far closed, has prevented escape of the gas in passage **8** and pipe P–**2**, thereby maintaining sufficient pressure of the gas in chamber **2** above the valve member **5** to maintain the valve member **5** seated on its valve member **5** to maintain the valve member **5** seated on its valve seat **4** to close passage **3**. As diagrammatically illustrated (Fig. 4) by the arrows *a*–**2**, it will be noted that the area of the upper face of the member **5** being so much greater than the area of the portion **5**–*a* of the lower face of the member **5** that the pressure indicated by arrows *a*–**2** prevails over the pressure on the lower face of the member **5** indicated by the arrows *a*–**3**. It will be noticed that the flame M is so disposed when the tip **21** is moved into the fire box as to cause its heat to affect the thermostatic valve **9**. When the valve **9** is sufficiently heated to cause it to open, the gas in passage **8** and pipe P–**2** issues from tip **9'** and is ignited by flame M to produce the maintenance flame N (Fig. 5). The flow of gas (arrows *a*–**4**) through the passage **8**, pipe P–**2** and valve **9** to produce the flame N, so reduces the pressure in chamber **2** above the member **5** that the pressure of the gas on the portion **5**–*a* of the lower face of the member **5** (arrows *a*–**3**) unseats the member **5** and opens the passage **3** for flow of the gas (arrows *a*–**5** of Fig. 5) which presses on the portion **13**–*a* of the lower face of the member **13** and unseats the member **13** thus opening the passage **11**. This effect is due to the fact that since the passage **22** has been opened by the unseating of the valve member **25** and passage **22** communicates with atmosphere either directly or through the burner **18**, and the gas supplied through passage **3** is at superatmospheric pressure, the pressure above the member **13** is substantially atmospheric. The relative diameter of the passage **15** to supply gas to the chamber **10** and the diameter of the passage **22** to effect atmospheric pressure are such that this result is produced.

The opening of the passage **11**, as above described, allows flow of the gas (arrows *a*–**6**) through passage **11** and pipe P–**4** to the burner **18** where issuing therefrom it is ignited by the flames M and N to produce the burner flames O. It will be noted (Fig. 5) that the flames O indicate that the burner **18** is operating at full pressure since the valve member **13** is in wide open position.

It should be noted that the thermostatic valve **17** will always be out of action at the time of lighting. This fact will, in the first place, ensure complete lighting of the burner **18**, and, in the second place, the user will realize at once that he may release the push button **28** which will then be retracted by spring **27** to seat valve members **24** and **25** closing passages **19** and **22**.

Since it is not desired that the burner **18** continue to operate at full pressure (flames O in Fig. 5), the flow of gas to burner **18** is automatically checked to produce flames O' (Fig. 6) the so-called "maintenance" flame for the burner. This result is effected by the closing of the passage **22** when push button **28** is released. The inflow of gas through passage **15** to chamber **10** which is now closed will cause increased gas pressure in chamber **10**, thereby almost seating member **13** (Fig. 6). It is obvious that adjustment of rod **13**–*b* determines the desired minimum opening through valve seat **12** to passage **11** to the burner **18**.

If it is desired to continue this adjustment, the manual valve **16**–*c* is closed (Fig. 6) thereby rendering the thermostatic control valve **17** inoperative.

When it is desired to control the operation of the burner **18** by means of the thermostatic control valve **17**, the manual valve **16**–*c* may be opened. The valve **17** is then set in such a way that when the temperature falls to a certain degree, the valve **17** opening will permit gas to flow through passage **16** from the chamber **10**, to pipe P–**3** through valve **17** to escape through tip **17'** where the gas is ignited by flame N to produce flame N'. It is obvious that this flow of gas induced by the flame N' produces somewhat similar effect on chamber **10**, valve member **13** and flow of gas through the passage **11** as that produced by the opening of passage **22** by operation of the button **28**, as above described. However, it is to be noted that there is this important dif-

ference: whereas the opening of passage 22 to atmosphere serves to permit unchecked escape of gas from chamber 10 thereby providing unchecked flow of gas to the burner 18 to produce the full flames O, the functioning of the valve 17 to produce flame N' effects controlled escape of gas from the chamber 10 and consequently controlled flow of gas to burner 18 to produce the desired form of flames O''. It is obvious that closing of valve 17 on a rise of temperature to a certain degree, closing passage 16, will effect the same result as the closing of passage 22 above described, to restore the "maintenance" flame O'.

When it is desired to put out burner 18, the manual valve 8–*c* is closed which will cause the flame N to be extinguished and the gas pressure in chamber 2 to rise sufficiently to seat member 5 on seat 4, thereby cutting off the supply of gas from the pipe P–1

The form of construction of the elements of my valve shown in the drawings has been given a rather schematic presentation to facilitate understanding, as much as possible. In practice the various parts of the device may be placed in more convenient relation to one another, it being possible to place the valves 24 and 25 tandem fashion so that the starting push button 28 may have a rod which is inserted into the casing and which has recesses or valve bodies for the opening of the valves 24 and 25 which may be placed in a position giving them a common center line. Moreover, the thermostatic valve 9 may be incorporated in the valve casing proper. In this way, all the parts of the device would form a unit which may be replaced collectively. This feature is of great practical value, for if a fault in the operation of a plant has arisen, an unskilled workman may exchange the whole device in a moment so that the plant may quickly again operate with a new valve, while the old one is taken to a workshop to be repaired. The devices hitherto known must be repaired on the spot by a skilled workman who will often have difficulty in ascertaining where the various parts of the device are placed among a great number of pipes.

Having described my invention, what I claim is:

1. In a valve device for controlling the flow of gas to a burner, the combination of a body having a conduit therethrough having an inlet and an outlet, for flow of gas from a source of supply to the burner; a first valve member in said conduit; a second valve member in said conduit between said inlet and said first valve member, said body having a control chamber for each of said members and a restricted passage connecting each chamber with said conduit for admission of the gas to the chambers; a wall for each of said chambers comprising a flexible membrane, said membranes being responsive to the pressure of the gas in the chambers, and adapted to actuate said valve members, respectively, said body having a pair of ducts leading out of said body from said chambers, respectively; a pair of manual valves in said ducts, respectively; a thermostatic valve, for a maintenance flame, connected to the outer end of the duct leading from the chamber for controlling said second valve member; a second thermostatic valve, for a control flame, connected to the outer end of the duct leading from the chamber for controlling said first valve member, said body having a duct communicating with said conduit and leading out of said body; a tip for a pilot flame on the outer end of said duct communicating with the conduit; a manual valve in said duct from said conduit; said body having a duct leading to atmosphere from the chamber for controlling said first valve member; and a manual valve in said duct leading to atmosphere, said thermostatic valves and said manual valves being adapted to control the pressure of the gas in said chambers.

2. In a valve device for controlling the flow of gas to a burner, the combination of a body formed with a gas conduit therethrough, a pair of control chambers, and

a restricted passage connecting each chamber with said conduit for admission of the gas to said chambers, each of said chambers having a gas-tight wall consisting of a flexible membrane and a valve member mounted on said membrane, said walls being responsive to the pressure of the gas in said chambers; a pair of valve seats in said conduit for co-action with said valve members to close and open said conduit when said members are seated and unseated, respectively, said body being formed with four ducts leading out of said body, one of said ducts leading from said conduit, one of said ducts leading from one of said chambers, and the other two ducts leading from the other of said chambers; a pipe, provided with a tip for a pilot flame, connected with the duct from the conduit; a pipe, provided with a tip for a maintenance flame, connected with the duct from the first chamber; a pipe, provided with a tip for a control flame, connected with one of the ducts from the second chamber; a pipe, leading to atmosphere, connected with the other duct from the second chamber; a thermostatic valve in each of said ducts to the pipes for the maintenance flame and the control flame; and four manual valves in said ducts, respectively, said thermostatic valves and said manual valves being adapted to control the pressure of the gas in said chambers.

3. In a valve device for controlling the flow of gas to a burner, the combination of a body having a conduit therethrough for flow of the gas from a source of supply to the burner, a pair of chambers, and a restricted passage connecting each chamber with said conduit for admission of the gas to said chambers; a pair of flexible membranes, each of which forms a wall of one of said chambers, and which are adapted to move in response to variations in the pressure of the gas in said chambers; a pair of valve members carried by said membranes, respectively, and adapted to open and close said conduit, by movement of said membranes, said body having a pair of ducts leading out of said body from said chambers, respectively, a duct leading out of said body from said conduit, and a duct leading from one of said chambers to said conduit; a pair of thermostatic valves in the ducts from the chambers, outside of said body; a pair of manual valves in the ducts having said thermostatic valves, said thermostatic valves and said manual valves being adapted to control the pressure of the gas in said chambers; a pair of tips for a maintenance flame and a control flame, respectively, on the ends of the ducts having the thermostatic valves, respectively; a tip for a pilot flame on the outer end of the duct from the conduit, outside said body; a valve in said duct having said pilot light tip, biased to closed position; a valve in said duct from said chamber to said conduit, biased to closed position; and manual means adapted to open said biased valves.

4. In a valve device for controlling the flow of gas to a burner, the combination of a body having a conduit therethrough for the flow of the gas from a source of supply to the burner, said body having two control chambers connected with said conduit by two restricted passages, respectively; two reciprocable valve members for closing and opening said conduit; two flexible walls of said chambers, respectively, on which said valve members are mounted, respectively, said walls being adapted to move in response to variations in pressure of the gas in said chambers, and to reciprocate said valve members, said body having formed therein four ducts, one of said ducts leading from said conduit to a tip for a pilot flame, one of said ducts leading from one of said chambers to a tip for a maintenance flame, the other two ducts leading from the other of said chambers to a tip for a control flame and to atmosphere, respectively; thermostatic valves in the ducts to the tips for the maintenance flame and the control flame, respectively; and a manual valve in each of said ducts, said thermostatic valves and said manual valves being adapted to control the pressure of the gas in said chambers.

5. In a valve device, according to claim 4, said body constituting a tripartite structure comprising an upper element, a middle element, and a lower element; means for assembling said elements with gas-tight joints, said middle element and said lower element having connected channels, respectively, forming part of said gas conduit through said body, said upper element housing one of said control chambers communicating with said conduit and said duct leading to the tip for said maintenance flame, said middle element housing the other of said control chambers and said ducts leading to the tip for said control flame and to the atmosphere, respectively.

References Cited in the file of this patent

UNITED STATES PATENTS

2,265,294	Lange	Dec. 9, 1941
2,273,127	McGoldrick	Feb. 17, 1942

FOREIGN PATENTS

695,603	Germany	Aug. 29, 1940