Jan. 19, 1932. E. J. TE PAS 1,842,335

FUEL CONTROL SYSTEM

Filed April 21, 1928 2 Sheets-Sheet 1

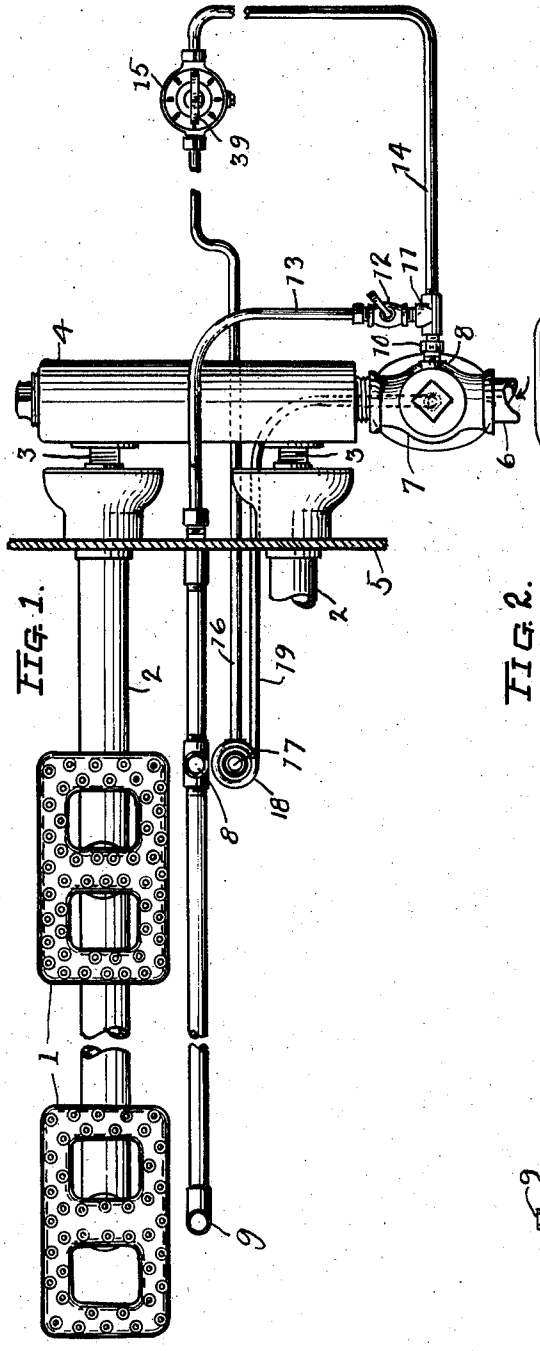


FIG. 1.

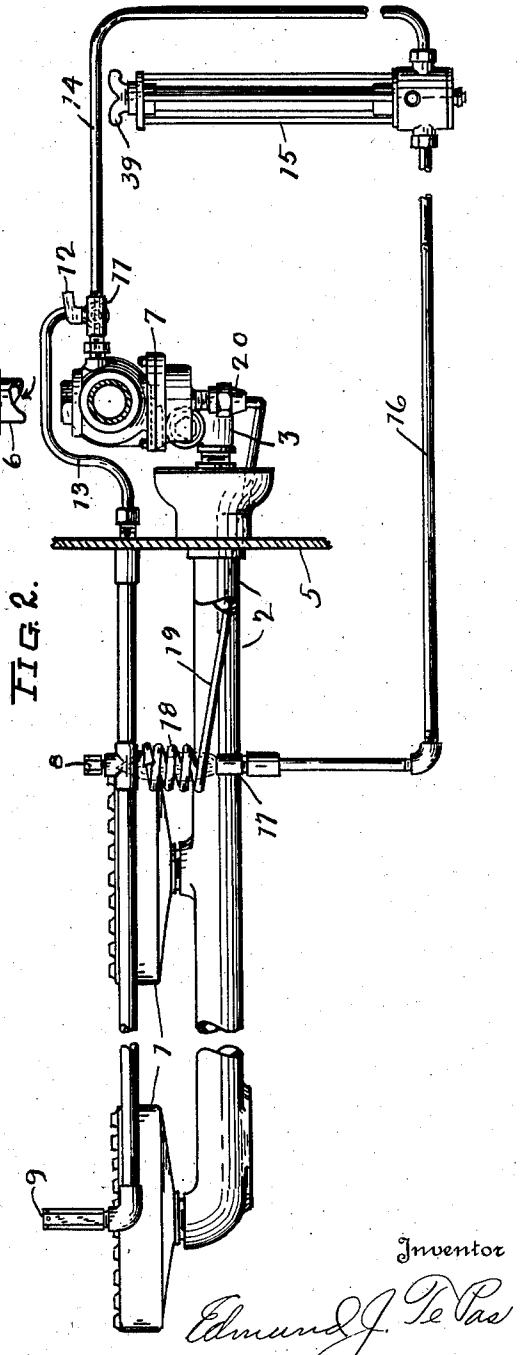


FIG. 2.

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Fig. 3.

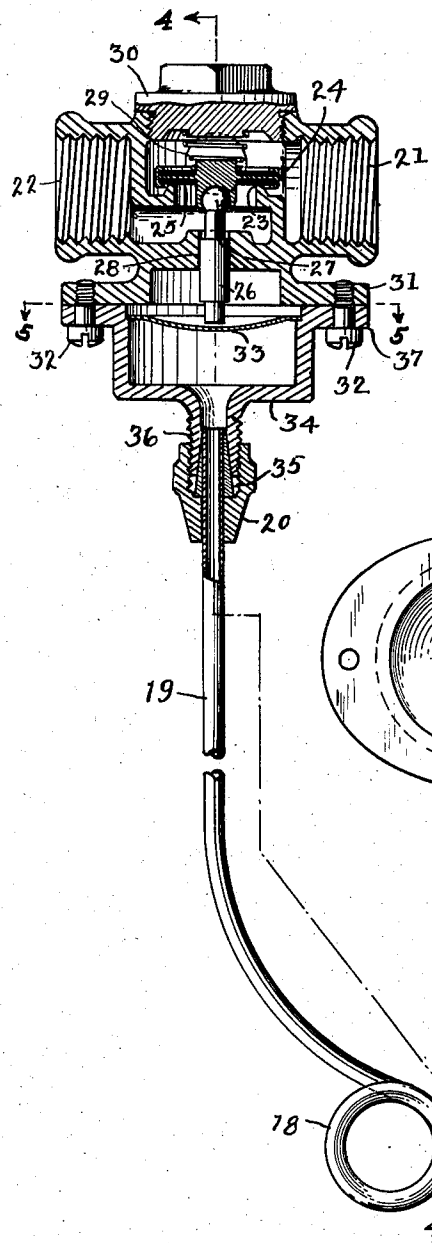


Fig. 4.

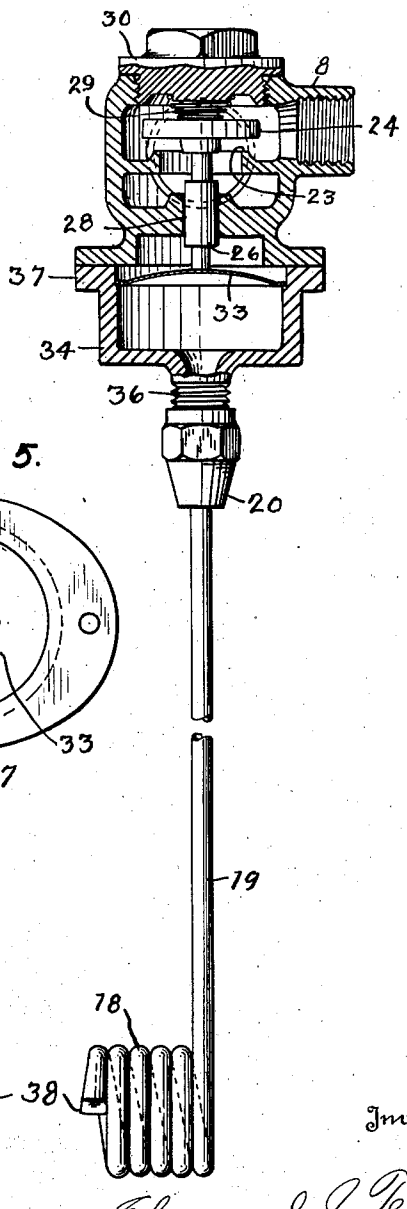
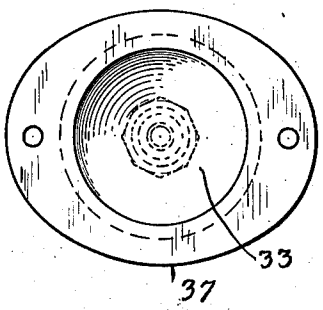


Fig. 5.



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UNITED STATES PATENT OFFICE

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FUEL CONTROL SYSTEM

Application filed April 21, 1928. Serial No. 271,806.

This invention relates to automatically controlled gas burning appliances and in particular the thermostatic control means used in connection therewith.

In automatically controlled gas fired heating appliance of the conventional type it is customary to have a constantly burning pilot light adjacent the main heating burner of the appliance so that when the control valve is opened admitting gas to the main burners an ignition flame is present to ignite the gas issuing from these burners. In the event of extinguishment of the pilot light under these circumstances raw gas will escape from the main burners and may cause a serious explosion or lead to other hazardous results.

As a means to prevent the escape of unburned gas due to pilot light failure, thermostatic safety switches controlled by the heat of the pilot flame and in circuit with the operating valve have been proposed. When the pilot light is burning such safety switches are normally in a closed position and the electrically operated valve may be controlled by the first named thermostatic switch. Upon extinguishment of the pilot light the safety switch automatically opens breaking the circuit to the electrically controlled valve and preventing its opening and admitting gas to the main burner.

The above arrangement is objectionable due to the use of a plurality of separate control devices which are relatively expensive and complicated. Furthermore, such a control requires an electrician for its servicing as the ordinary gas appliance service man does not understand the operation and repairing of electrical devices.

It is an object of this invention to provide an automatically controlled heating appliance having an all gas control which can be readily repaired and serviced by the average gas appliance service man and which has incorporated in its arrangement certain features of safety combined in a simple inexpensive control including a novel thermally actuated valve.

With the above mentioned and other objects in view, the invention consists in the novel construction, arrangement and combination of parts, hereinafter described, illustrated in some of its embodiments in the accompanying drawings and particularly pointed out in the appended claims.

Stated in general terms my improved gas burner control comprises thermostatic flame operated valve which requires the presence of an ignition or pilot flame for its operation. The ignition flame which is instrumental in opening the main supply valve is further used to ignite the gas admitted to the main burner, upon the opening of this valve.

The principal advantage of my improved control is that the main gas supply valve is thermally operated and requires the presence of a flame at the pilot burner before it is possible to open the valve. By operating the valve in this manner it provides a safe means of operation for large gas fired heating units. The pilot flame that lights the burner causes the gas supply of the burner to be turned on.

Referring to the drawings showing one embodiment of my invention; Fig. 1 is a plan elevational view showing my improved valve as applied to a multiple burner gas burning appliance. Fig. 2 is a side elevational view of the elements shown in Fig. 1. Fig. 3 is a side elevational view in section, showing my improved thermostatic valve. Fig. 4 is a section taken on line 4—4 of Fig. 3. Fig. 5 is a section taken on line 5—5 Fig. 3.

Fig. 1 illustrates in part, some of the elements of the burner assembly of a multiple burner gas burning appliance. This arrangement may refer to a house heating furnace or boiler or any other gas burning appliance which is intended to be controlled at some distant point by means of a thermostatic

valve responsive to the temperature of the medium which is being heated.

The reference numeral 1 indicates the main heating burners of the appliance which are preferably constructed as shown as Bunsen or atmospheric type burners. The burners 1 are mounted on gas and air mixing tubes 2, which are connected to adjustable valves 3 of the usual type which regulate the maximum height of the flame of the burner 1. The valves 3 are threadedly received in the burner manifold 4, located outside the heating appliance.

The reference numeral 5 indicates the front wall of the appliance, which in the present case is used to support the inlet ends of the mixing tubes 2. Gas to the burners 1 is supplied by way of the fuel feed pipe 6, which is connected to the inlet end of a thermostatic valve 7, that is in turn connected at its outlet end to the manifold 4. The thermostatic valve 7 is provided with an internally threaded outlet 8 which communicates with the inlet side of the valve 7 and is provided for the purpose of connecting the constantly burning pilot burners 8 and 9 to the gas supply line 6. This connection is affected by means of a fitting 10 which is received in the outlet 8. A T fitting is connected to the fitting 10 and is connected at one of its branches to a small gas valve 12 which is connected to the conduit 13 leading to the pilot burners 8 and 9.

The other branch of the T fitting 11 is connected to the conduit 14 which is connected to a room temperature responsive thermostatic valve 15 adapted to be located at a point some distance from the heating appliance and for the purpose of controlling its operation. The outlet end of the thermostatic valve 15 is connected to conduit 16 which terminates in a small gas burner 17. The gas burner 17 is positioned adjacent to and below the constantly burning pilot burner 8 and is in lighting proximity to this burner.

A helical coil of tubing 18 is positioned above and in axial alignment with the burner 17 and is adapted to surround the flame of this burner. The coil 18 forms a part of the conduit 19 which is connected by the apertured nut 20 to the valve 7. The coil 18 and the conduit 19 are filled with vaporizable liquid. The operation of the valve 7 will be described in detail shortly after the manner in which it is controlled by the room thermostat 15 has been stated.

Assuming for the present purposes that when a flame is present at the burner 17, heating of the coil 18 will serve to open the valve 7 admitting gas to the manifold 4 and burners 1. The valve 15 is of conventional design and is adapted to open when the temperature of the surrounding medium drops below the temperature for which the valve is set, and to close when the temperature reaches the valve setting.

By locating the valve 15 in one of the rooms of a home which the burners 1 are adapted to heat when the room reaches the desired temperature the valve 15 closes cutting off the supply of gas to the burner 17 causing the extinguishment of its flame which allows the coil 18 and its fluid contents to cool and condense and permit the closure of the valve 7.

When the temperature of the room in which the thermostat 15 is located drops below the temperature for which this valve is set, the thermostat 15 opens its valve, admitting gas to the burner 17 which is ignited from the pilot burner 8 and which then serves to heat the coil 18 causing the valve 7 to open and admit gas to the main burner.

Should the pilot light 8 remaining extinguished at the start of the operations just stated, the gas burner 17 would not remain ignited to heat the coils 18 and consequently the valve 7 would have remained in a closed position. Under these conditions the gas supply to the main burners will be cut off until the pilot burner 8 was relighted.

By this arrangement a safety control is provided for gas burning appliances which at all times is under control of the pilot burner which is provided for the ignition of the main burner. Upon extinguishment of the aforementioned pilot light it will be impossible to turn on the main burner gas supply and the control valve will remain in a normally closed position until the pilot light is relighted. The height of the flame from the burner 17 should be adjusted so that this flame extends above the burners 1 and assists in their ignition.

Figure 3, 4 and 5 illustrate in detail the construction of my improved thermostatic valve. The valve 7 comprises a valve body having an internally threaded inlet opening 21 and an internally threaded outlet opening 22. A valve port is formed centrally of the valve body and is defined by the valve seat 23. A valve head 24 cooperates with valve seat 23 to control fluid flow through valve. The valve head 24 is faced with a yielding material 25 such as leather and is adapted to readily make a gas tight contact with the valve seat 23.

The valve head 24 is mounted upon a valve stem 26 by means of a ball and socket joint 27. The valve stem 26 is journaled at 28 in and extends through the side of the valve body. A spring 29 is compressed between the valve head 24 and the valve cap 30 serves to move the valve head 24 into engagement with its seat 23. The annular flanged portion 31, of the valve body casting is secured by means of screws 32 to the valve actuating mechanism housing 34.

The actuating mechanism for the valve

consists of a metallic buckling diaphragm 33 which seals the one end of the fluid container or housing 34. The fluid container 34 is provided with an annularly flanged extending portion 37 by means of which it is secured to the correspondingly flanges portion 31 of the valve body. The chamber defined by the container 34 is connected to the conduit 19 by means of the apertured nut 20 and the conical sleeve 35 which is secured in a fluid tight manner as by soldering, to one end of the conduit 19. The conical member 35 is received in a correspondingly formed outlet in the extension 36 of the container 34 and locked in a fluid tight engagement therewith by the nut 20.

The expression "buckling diaphragm" as used in connection with the element 33 is intended to cover only diaphragms constructed of a relatively rigid material formed with a curved surface. One of the characteristics of such a diaphragm is that its curvature may be reversed changing from concave to convex or vice versa with a snap when subjected to sufficient pressure. Diaphragms of this type are commonly used in connection with oil cans.

The conduit or tubing 19 terminates in a helical coil 18 the end 38 of which is sealed. The coil 18, conduit 19 and container 34 are adapted to provide a hermetically sealed chamber adapted for the reception of a vaporizable liquid. The liquid used may be selected in accordance with the purpose for which the valve is to be used and in some cases it may be advisable to have the sealed chamber filled with a vapor instead of a liquid.

There are a large variety of fluids which may be used for this purpose, including a list of liquids whose boiling points vary between boiling point of ether and the boiling point of glycerin which represent the two extremes in liquids which may be readily obtained for this purpose. One of the factors which determine the liquid to be used in connection with the valve is the temperatures within the appliance at the point where the coil 18 is located.

The liquid used should have a boiling point sufficiently high so that when the appliance is in operation with the main burners supporting a flame, the liquid within the coil 18 will be wholly responsive to the gas flame of the burner 17, so that regardless of the temperatures encountered within the appliance at the point where the coil 18 is located, it will be possible to open and close the valve 7 only through the operation of the burner 17. In other words the liquid within the coil 18 can only be vaporized by the flame of the burner 17 and in the absence of such a flame will condense or remain in a liquid regardless of the operation of the appliance. This desirable result is accomplished in a large measure by reason of the positioning of the coil 18 which is located below the flame zone of the main burners 1 and is in the path of the secondary air supply of these burners.

The volumetric capacity of the coil 18 is equal to the increase in capacity of the container 34 that is produced by the expansion of the buckling diaphragm 33. When the diaphragm 33 is distended or in the position shown in Fig. 4 the liquid contents of the coil 18 have been expelled into the conduit 19 and the container 34. Under these conditions the coil 18 is filled with the vapor of the liquid used and it may be subjected to considerable heat without affecting the operation of the valve or causing further movement of the diaphragm. Upon extinguishment of the flame from the burner 17, the vapor within the coil 18 condenses to a liquid allowing the diaphragm 33 to assume its normal unstrained position as shown in Fig. 3.

By the use of a concave metallic diaphragm of the type shown in connection with fluid pressure producing means, it is possible to provide a snap acting valve which has but one operating element, namely, the diaphragm. Diaphragms of this type when operated in the manner disclosed move from one extreme position to the other with a snap.

This characteristic of buckling diaphragms is due to the fact that the initial resistance is the maximum resistance and its requires the building up of sufficient pressure behind the diaphragm to move it to its extreme position before any movement at all takes place. The thermostatic valve shown in Figs. 3 and 4 could be used in conjunction with a tank thermostat such as is used on automatic water heaters, hot water boilers and many other gas burning appliances.

An important feature of my improved control is the fact that there is always present a flame for ignition of the main burner when the gas valve 7 is open as the flame of the burner 17 functions as an igniter in the event of extinguishment of the pilot burners 8 and 9.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

I claim:

1. An automatically controlled heating appliance comprising a main heating burner, a source of fuel supply therefor, a valve for controlling the supply of fuel to said burner, heat responsive means for actuating said valve, an auxiliary burner in communication with said source independently of said main burner for supplying heat to said heat responsive means, a constantly burning pilot burner for igniting fuel issuing from said

auxiliary burner, and a thermally actuated valve for controlling the flow of fuel to said auxiliary burner, said last mentioned valve being operable directly in accordance with room temperature conditions remote from said appliance.

2. In an automatically controlled heating appliance, a main heating burner, a source of fuel supply therefor, a pilot burner positioned in lighting proximity to said main heating burner, an auxiliary burner located well below and in lighting proximity to said pilot burner, a thermally actuated valve for controlling the fuel supply of said main burner responsive in its operation to the heat supplied by said auxiliary burner, said auxiliary burner being in communication with said source in advance of said valve to operate independently of the operation of said valve, and a thermostatic valve remote from the appliance for controlling said auxiliary burner and thereby the operation of said thermally actuated valve.

3. In an automatically controlled heating appliance, a main heating burner, a source of fuel supply therefor, a constantly burning pilot burner located adjacent said main heating burner for igniting the same, an auxiliary burner positioned below said burner arranged to be ignited by said pilot burner and adapted at times to also provide a flame for assisting the ignition pilot of said main heating burner, a thermally actuated valve for controlling the fuel supply of said main burner responsive in its operation to the heat provided by said auxiliary burner, and a thermostatic valve remote from the appliance for controlling said auxiliary burner and thereby the operation of said thermally actuated valve.

4. In a heating appliance, a main burner, a source of fuel supply therefor, a thermally actuated valve between said source of fuel supply and said main burner to control the fuel supply thereto, a constantly burning pilot burner for igniting said main burner, an auxiliary burner positioned below and in lighting proximity to said pilot burner providing a flame also in lighting proximity to said main burner when gas is supplied thereto, and a thermostatic actuator for said valve responsive to the heat supplied by said auxiliary burner.

5. In a heating appliance, a main burner, a source of fuel supply therefor, a thermally actuated valve between said source of fuel supply and said main burner to control the fuel supply thereto, a constantly burning pilot burner for igniting said main burner, an auxiliary burner positioned below and in lighting proximity to said pilot burner providing a flame also in lighting proximity to said main burner when gas is supplied thereto, and thermo-sensitive fluid pressure means responsive to the heat of said auxiliary burner for the actuation of said valve.

6. In a heating appliance, a main burner, a source of fuel supply therefor, a thermally actuated valve between said source of fuel supply and said main burner to control the fuel supply thereto, a constantly burning pilot burner for said main burner, an auxiliary burner positioned below and in lighting proximity to said pilot burner providing a flame in lighting proximity to said main burner when gas is supplied thereto, and a thermostatic actuator for said valve positioned so as to be substantially unaffected by the heat of said main burner and responsive to the heat supplied by said auxiliary burner.

7. In a heating appliance, an atmospheric type main gas burner adapated to be supplied with secondary air from below the burner to complete the combustion of fuel supplied thereto, a source of fuel supply for said main burner, a thermally actuated valve between said source of fuel supply and said main burner to control the fuel supply thereto, a constantly burning pilot burner for said main burner, an auxiliary burner positioned below and in lighting proximity to said pilot burner providing a flame in lighting proximity to said main burner when gas is supplied thereto, and a thermostatic actuator for said valve positioned below said main burner and in the path of the secondary air stream thereto, said actuator being responsive to the heat supplied by said auxiliary burner for the actuation of said valve.

8. An automatic room temperature controlling device for house heating appliances and the like comprising the combination of one or more hydrocarbon fuel fired heating burners, a source of fuel supply therefor, a pilot burner adapted to ignite one or more of said heating burners, a thermostatically operated regulating valve remote from said appliance and being responsive to room temperature conditions for maintaining the temperature thereof at a predetermined point, a fuel supply valve for said heating burners, and means comprising an auxiliary burner controlled by said regulating valve and adapted to be ignited by said pilot burner, said auxiliary burner being in communication with said fuel supply in advance of said fuel supply valve to operate independently of the operation thereof, and a heat responsive device responsive to the heat of said auxiliary burner for effecting the operation of said supply valve whereby said heating burners are connected to said source of fuel supply only when said pilot light is burning.

9. An automatic room temperature controlling device for house heating appliances and the like comprising the combination of a hydrocarbon fuel fired heating burner, a fuel supply conduit therefor, a pilot burner for igniting said heating burner, a fuel supply valve in said conduit for controlling the sup-

ply of fuel to said heating burner, a heat responsive fluid pressure means for actuating said valve, an auxiliary burner arranged to be ignited by said pilot burner for supplying heat to said fluid pressure means, said auxiliary burner being in communication with said supply conduit in advance of said supply valve to operate independently of the operation of said valve, and an automatic regulating valve solely operatable in accordance with predetermined room temperature conditions for controlling the operation of said auxiliary burner.

In testimony whereof I affix my signature.

EDMUND J. TE PAS.