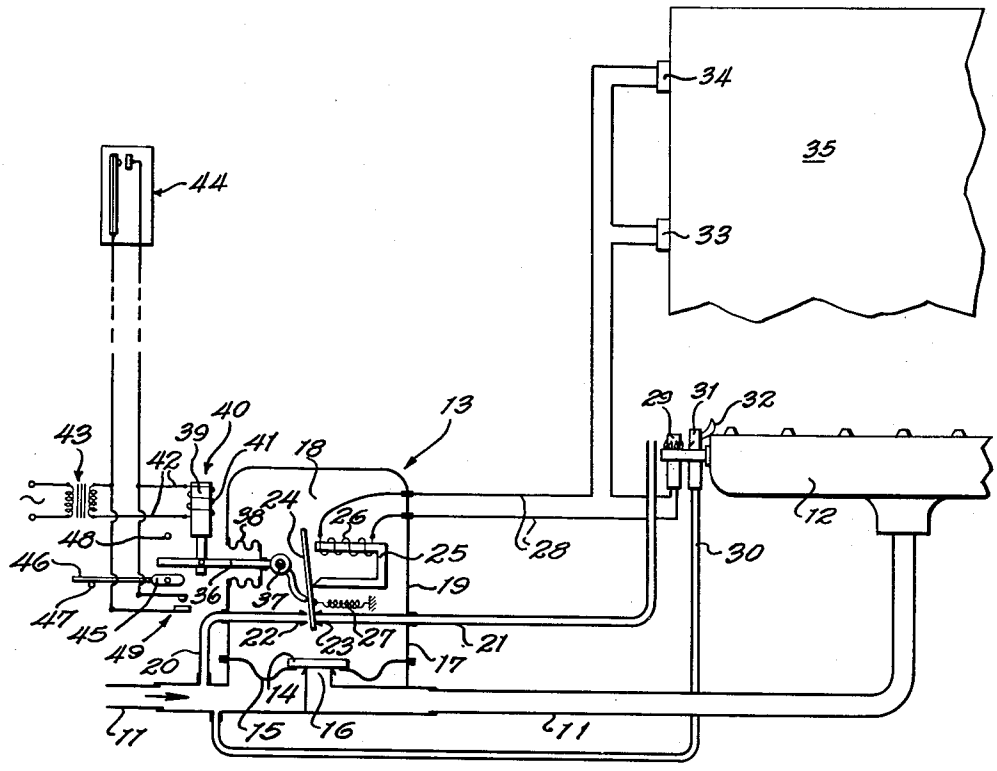
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GAS BURNER CONTROL SYSTEM

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GAS-BURNER CONTROL SYSTEM

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1 Claim. (Cl. 158—123)

This invention relates to electrically controlled gas-burner control systems, and more particularly to such systems which employ gas-supply valves whose normal operation depends on electric power supplied by the service companies. Inasmuch as supply of such external power is subject to periodic failure or interruption, it has been customary to provide means for then opening the gas-supply valve manually. But by so doing any safety means in the system depending on the external electric power are rendered ineffective, and dangerous conditions may result if the power failure is of more than brief duration. As an improvement, a source of electricity independent of the external service may be provided for operating the gas-supply valve, as by thermoelectric means heated by an auxiliary gas-burner; however, an arrangement of that kind is unsuitable when used in conjunction with other means operable only by external electric power, such as a motor-driven device for circulating a medium such as air or water heated by the gas burner, since in the event of failure of the external power the operation of the burner is unaffected although withdrawal of heat by the circulating means has ceased.

With the foregoing in view, it is an object of this invention to provide an improved gas-burner control system whose normal operation is under the control of means energized by external electric power (so that operation of the burner is immediately interrupted in the event of failure of that power) and having manually operable means for then supplying gas to the burner; my improved system including thermoelectrically energized means cooperating with the means normally energized by the external electric power, the thermoelectric means being arranged to effect shut-off of the supply of gas in the event of establishment of abnormal conditions in the system.

Another object of this invention is to provide a burner control system of the character described and wherein supply of gas to the burner is normally effected by a thermoelectrically energized valve, but only when opening of that valve is permitted by means energized by external electric power, or, in the event of failure of that power, by manually operable means.

Another object is to provide a novel control device or valve having particular utility in a burner control system of the character described, but susceptible of other uses.

For full understanding of this invention, and further appreciation of its objects and advantages, reference is to be had to the following detailed description and accompanying drawing, and to the appended claim.

The single figure of the drawing is a schematic view of a gas-burner control system embodying principles of the invention.

In the drawing the numeral **11** indicates a conduit for supplying fuel gas from a conventional source (not indicated) to a main burner **12**. In the conduit ahead of the main burner is a gas-pressure operated valve **13**. This valve comprises a closure member **14** carried by a flexible

diaphragm **15** and cooperating with a valve seat provided around a port **16** through a fixed partition separating the inlet and outlet of the valve.

The diaphragm **15** forms a movable partition separating the interior of the lower section **17** of the valve from a pressure chamber **18** above the diaphragm and defined by the upper section **19** of the valve. Communication between chamber **18** and the inlet of the valve is provided by a pipe **20**, and between the chamber and the atmosphere by a vent pipe **21**. The ends of pipes **20** and **21** within the chamber are formed to provide valve jets **22** and **23**, respectively, between which a cooperating blade-like closure **24** is disposed. This closure is of magnetic material and is fulcrumed on the end of the lower side-arm of a U-shaped electromagnet core **25** around whose upper side-arm is an energizing coil **26**. The armature-closure **24** is biased by a spring **27** into engagement with jet **23**.

The electromagnet coil **26** is connected by a pair of wires **28** to a thermoelectric generating device **29** which is normally continuously heated by combustion of gas supplied to the device through a pipe **30** connected to conduit **11** ahead of valve **13**; the gas from pipe **30** also being supplied to a pilot burner **31** whence it issues as a flame **32** for igniting gas at the main burner. The thermoelectric generating device **29** may be the same as disclosed in U. S. Patent No. 2,526,112 and comprises a plurality of thermocouples and an auxiliary burner for heating the same so as to effect generation of electricity in an amount sufficient for operative energization of the electromagnetic operator **24—36**; the flames of device **29** and pilot burner **31** being mutually igniting so that deenergization of the operator results if the pilot-burner flame becomes extinguished.

In place of the thermoelectric generating device **29** there may be employed thermoelectric means such as a thermal cut-out heated by the flame of a pilot burner and controlling a local source of electrical energy, such as a storage battery; the thermoelectric means being arranged to effect energization of coil **26** only while the pilot-burner flame exists.

A pair of safety devices or limit switches **33** and **34** are connected in one of wires **28** in series with each other and with device **29** and coil **26**. These switches are shown mounted on a structure **35**, above the main burner, for heating a medium such as water or air for circulation through a space or room to be heated. The switches **33—34**, which are normally closed, may be arranged to respond to a condition resulting from the operation of the burner, such as temperature, steam pressure or boiler-water level, and to open the circuit of coil **26** in the event of establishment of an abnormal degree of the condition.

Inasmuch as the thermoelectric generating device **29** is normally continuously heated, and the electromagnet coil **26** therefore normally energized, there is electromagnetic force normally urging armature-closure **24** to rock clockwise out of engagement with jet **23** and into engagement with the other jet **22**. This electromagnetic force is superior to the opposing force of bias spring **27**, but, with the parts in the positions shown in the drawing, such movement of closure **24** is prevented by a lever **36** pivoted at **37** and arranged to apply to closure **24** gravitational force superior to and opposing the electromagnetic force acting on this closure. Jet **23** thus being closed, the pressure of the fluid at the inlet of the valve, applied by way of pipe **20** and open jet **22** to chamber **18** and to the top surface of diaphragm **15**, balances the pressure of the fluid below the diaphragm so that the main closure member **14** remains seated by gravity.

The lever **36** extends outwardly of chamber **18** through an opening in the side wall of the chamber (a bellows device **38** being provided around the lever to seal this

opening) and there connected to the plunger 39 of a solenoid operator 40 comprising an energizing coil 41 connected by wires 42 to the secondary of a step-down transformer 43 whose primary is connected to a source of external electric power supplied by a service company and indicated by the A. C. symbol. One of the wires 42 is broken to insert the leads of a conventional thermostat 44 located in the space heated by the medium supplied thereto from the furnace structure 35.

When, in response to demand for heat, the thermostat 44 closes, the solenoid operator 40 is energized and the lever 36 rocked clockwise so that its portion within chamber 18 is moved out of the path of movement of the armature-closure 24, permitting clockwise rocking of the same under the force exerted by the thermoelectrically energized electromagnet 25—26 to effect closing of jet 22 and opening of jet 23. When this occurs the gas compressed in chamber 18 escapes to atmosphere through pipe 21 (this pipe being extended adjacent the pilot-burner assembly for ignition of the vented gas) so that the diaphragm is raised by the pressure of the gas below it and the main closure member 14 unseated so that gas passes to the main burner where it is ignited by the pilot-burner flame.

When the heating requirement of the space is satisfied and the thermostat consequently opens, the additional electromagnetic operator 40 is deenergized so that the resultant release of lever 36 effects counterclockwise rocking of closure 24 (against the thermoelectrically produced force urging it in the opposite direction) into engagement with jet 23 so that with the resultant rise of fluid pressure in chamber 18 the main valve is reclosed.

Means are provided for manually operating the lever 36 to raised position in the event of failure of the external electric power. These means comprise a cam 45 pivotally mounted at its center and provided with a handle 46 which normally rests on a stop-pin 47. To manually operate the lever 36, and thereby normally effect opening of the main closure member 14, the handle 46 is raised so that the left lobe of cam 45 engages the outer end of the lever and rocks it to a position wherein the inner end of the lever is out of the path of movement of closure 24 so that thermoelectric operation of the same to its alternate position is permitted, and opening of the main valve normally effected; the extent of this movement of handle 46 being limited by another stop-pin 48. During the manual rocking of lever 36 the right lobe of cam 45 engages and rocks to closed position a normally-open switching means 49 connected in parallel with the thermostat 44 so that the circuit of coil 41 is then completed independently of the thermostat. The handle 46 is maintained in raised position by friction between the cam and the parts engaged thereby.

Before placing the burner in operation manually, precautions obviously should be taken to avoid trouble which might result from operation of the burner in the absence of the external electric power. However, in the event that an abnormal condition does develop in the system, one or both of the limit switches 33—34 will operate to open the energizing circuit of electromagnet 25—26 so that closure 24 will move to its spring-biased position and effect shut-off of gas to the main burner.

Upon resumption of supply of external electric power the solenoid plunger is magnetically raised to a slightly greater extent, permitting the handle and cam to return by gravity to normal position. The resultant opening of the switching means 49 then effects deenergization of the solenoid operator, unless the thermostat is then in heat-demanding condition; operation of the system again being under the control of the thermostat, as well as that of the safety devices 33—34, and the safety means inherent in the thermoelectric generator whereby shut-off of gas to the main burner is effected if the pilot-burner flame is extinguished.

For the purpose of this invention a simple vent valve may be substituted for the three-way pilot or auxiliary valve constituted by jets 22—23 and closure 24; a port for bleed of pressure gas into chamber 18 then being provided, as is well known in the art. Moreover, in place of the fluid pressure operated valve 13 there may be employed a main-burner supply valve operated directly by the small amount of energy produced by the thermoelectric generator; a valve of that character being disclosed in my Patent No. 2,358,828.

Still further modification of the system herein disclosed may be made without departing from the spirit of the invention, and I intend therefore to be limited only by the scope of the appended claim.

I claim as my invention:

In a gas-burner control system: a main burner; a gas-supply conduit leading to said main burner; a valve in said conduit for controlling supply of gas to said main burner and biased to closed position; a pilot burner for igniting said main burner and connected to said conduit ahead of said valve; a first electromagnetic device adapted, while energized, to effect application of force to said valve in a sense to open it; means for normally continuously energizing said first electromagnetic device comprising a thermocouple device electrically connected thereto and subjected to the flame of said pilot burner; a second electromagnetic device for controlling the operation of said first electromagnetic device and thereby the operation of said valve, said second electromagnetic device being so biased and arranged that, when unenergized, it applies force to said first electromagnetic device superior to and opposing the force produced in the same by current from said thermocouple device so that said valve is then closed under the force of its bias, and, when energized, to permit electric operation of said first electromagnetic device so that opening of said valve is then normally effected; an external source of electric power for energizing said second electromagnetic device; a thermostat controlling the energization of said second electromagnetic device and thereby normally the operation of said valve; mechanical means for manually operating said second electromagnetic device to energized position in the event of failure of said external electric power so that said electric operation of said first electromagnetic device is then permitted in the absence of the external electric power; said mechanical means including switching means arranged to complete the energizing circuit of said second electromagnetic device, independently of said thermostat, when the second electromagnetic device is manually operated to said energized position; means, effective only while said second electromagnetic device is unenergized, for maintaining said mechanical means and the second electromagnetic device in manually operated position; and safety means responsive to a condition resulting from the operation of said burner for effecting deenergization of said first electromagnetic device, and thereby closing of said valve, in the event of establishment of an abnormal degree of said condition.

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