

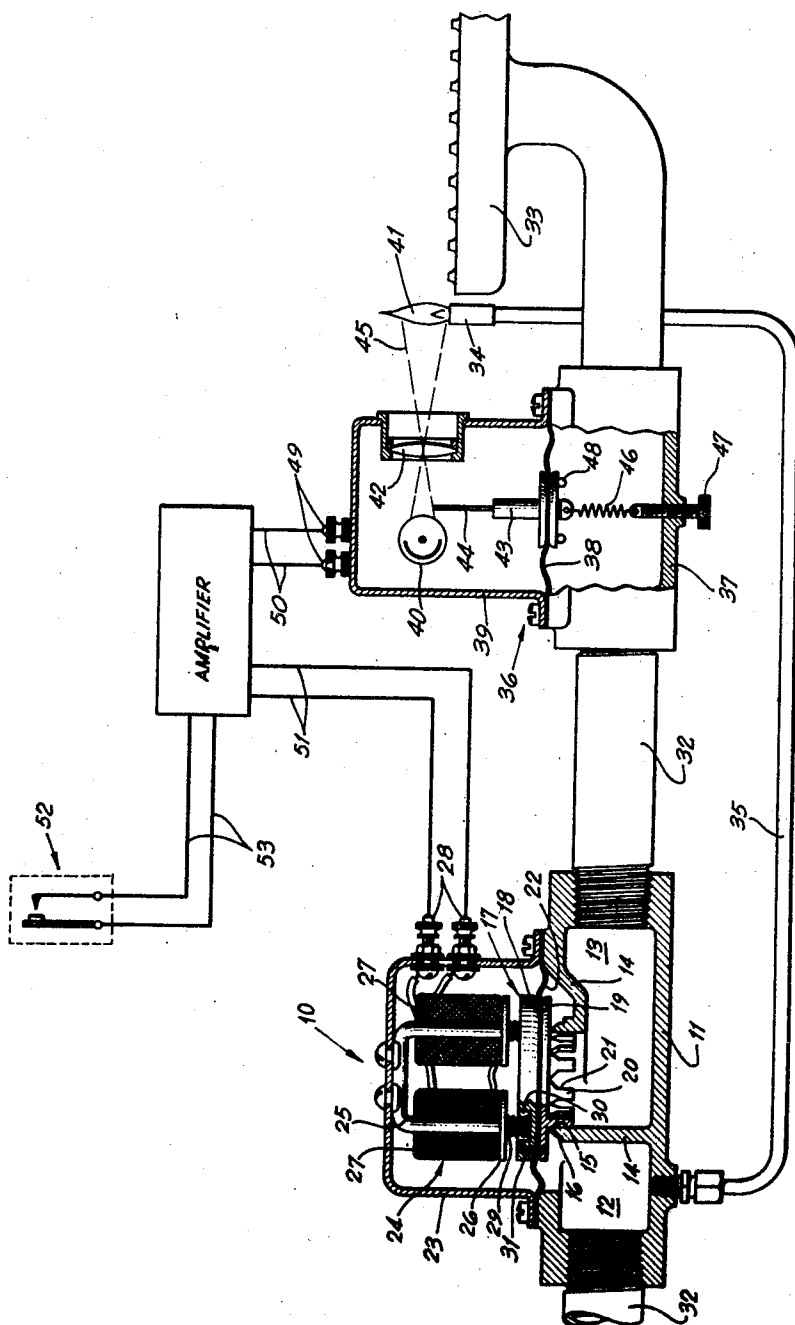
May 25, 1948.

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2,442,145

PHOTOELECTRIC REGULATING AND SAFETY BURNER CONTROL SYSTEM

Filed June 3, 1946



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UNITED STATES PATENT OFFICE

2,442,145

PHOTOELECTRIC REGULATING AND SAFETY
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Application June 3, 1946, Serial No. 674,060

5 Claims. (Cl. 158—117.1)

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This invention relates to photoelectric regulating and safety burner control system and more particularly to one which includes means for regulating the pressure of gaseous fuel delivered to a burner under the control of a valve.

The present invention may be characterized as an improvement on the system disclosed in my copending application Serial No. 511,436, filed November 23, 1943, wherein an impedance device, the value or setting of which is varied in accordance with variation of pressure of gas delivered by a throttling valve to a main burner, is arranged to control (through an amplifier) the degree of energization of an electromagnet urging the throttling valve toward open position against the force of a closing bias so as to effect regulation of the outlet pressure; a "safety" feature of the system residing in the provision of means, in circuit with a thermostat normally controlling on-and-off operation of the valve, for effecting closure of the valve in the event of extinguishment of the flame of a pilot burner for igniting the main burner.

An object of the present invention is to provide unitary means combining the regulating and safety functions of the prior invention described in the preceding paragraph; this object being accomplished by the provision of photoelectric means, illuminated by the flame of the pilot burner, for energizing the electromagnet, and gas-pressure responsive means for varying the illumination of the photoelectric means (and thereby the energization of the electromagnet) in accordance with variation of the pressure, the arrangement being such that the valve is closed upon extinguishment of the pilot-burner flame.

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 claims.

The single figure of the drawing is an elevation, partly in section and in diagram, of a burner control system embodying the invention.

Generally indicated in the drawing by the numeral 10 is a valve comprising a casing 11 having an inlet chamber 12 and an outlet chamber 13 separated by a partition 14. This partition has a cylindrical port 15 therethrough, a portion of the partition being raised around the port to form a circular valve seat 16. Cooperable with seat 16 is a two-part closure member 17, the upper part 18 of which is in the form of a disk of magnetizable material, the lower part 19 being

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a disk from the underside of the central portion of which there extends an annulus 20 which is a sliding fit in the port 15. This annulus is provided with a plurality of notches 21 through which, when the closure member is raised from its seat, fluid can pass from inlet 12 to outlet 13; the flow capacity of the valve increasing progressively as the closure member is raised, due especially to the tapering form of the upper end of the notches. The upper and lower parts of the closure member are secured together by suitable means (not shown), and between them is the medial portion of a flexible diaphragm 22 which is clamped at its margin between the top surface of casing 11 and the flange of a housing 23, which housing covers an opening through the top wall of the casing around the valve seat 16.

Attached to the top wall of housing 23 is an electromagnet, generally indicated at 24, which comprises a U-shaped core 25 having at the end of each of its side arms an enlarged pole-piece 26. Around each side arm of the core is an energizing coil 27, these coils being interconnected in series-aiding relation and having leads which extend to terminal posts 28. The electromagnet is adapted, when energized, to attract the closure member 17, the upper part 18 of which constitutes an armature; the extent of upward movement of the closure member being determined by the resultant of the force produced by the electromagnet and the opposing force exerted by a pair of springs 29 compressed between the closure member and the pole-pieces 26—the flow capacity of the valve thus being proportional to the degree of energization of the electromagnet. Recesses 30 are provided in the armature 18 for receiving the lower ends of the springs 29, the depth of the recesses being such as to permit direct engagement of the armature with the pole-pieces when the electromagnet is sufficiently energized. A restricted opening 31, extending completely through the closure member near its periphery, permits communication of fluid between the inlet of the valve and the chamber above the closure member and diaphragm 22; the pressure of the fluid tending to stabilize movement of the closure member in operation.

The valve 10 is adapted to control supply of gas through a conduit 32 to a main burner 33; a pilot burner 34, for igniting the main burner, being connected by a pipe 35 to the inlet chamber of the valve. Connected in the conduit between the valve and the main burner is a pres-

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sure responsive device 36 comprising a casing 37 a portion of the top wall of which is formed by a flexible diaphragm 38 clamped at its margin to the casing by the flange of a housing 39 secured to the casing. Mounted on the back wall of this housing is a photocell 40, of conventional type, which is arranged to receive light from the flame 41 of the pilot burner, the light being concentrated on the photocell by means of a lens 42 mounted in an opening through the side wall of the housing. Preferably, the arrangement is such that the photocell is not influenced by light from the flame of the main burner. Secured to the central portion of the diaphragm 38 is a support 43 for a vane or mask 44 which is adapted to penetrate or move across the path of illumination (indicated by the broken lines 45) of the photocell when gas pressure is applied to the underside of diaphragm 38. This diaphragm is urged downwardly by the force of a spring 46 the tension of which can be adjusted by manipulation of a screw 47, threaded in the bottom wall of casing 37, to which the lower end of the spring is attached; stop-pins 48, engageable by the mask-support 43, limiting downward movement of the diaphragm and mask.

The electrodes of photocell 40 are connected (by wiring, not shown) to terminals 49 which in turn are connected by wires 50 to the input of an electronic amplifier indicated by the legend; the output of this amplifier being connected by wires 51 to the terminals of the electromagnetic valve 10. Automatic on-and-off control of this valve is effected by a thermostat 52 connected by wires 53 to some suitable point of the amplifier between its input and output; the thermostat being of conventional bimetallic type and arranged to respond to the temperature of a space heated by the main burner 33. The amplifier is of conventional design and is adapted (when the thermostat is closed) to pass current to the electromagnet while the photocell is illuminated by the flame, the degree of energization of the electromagnet being proportional to the amount of light received by the photocell.

As shown in the drawing, the contacts of the thermostat are open so that the valve is deenergized and closed, and the mask 44 in its lowest position wherein illumination of the photocell is unobscured; therefore, when the thermostat subsequently closes in response to demand for heat, the full amount of electrical energy is momentarily supplied to the electromagnet, ensuring initial opening of the valve against the full pressure of the gas acting on the top surface of closure member 17, and the biasing force of springs 29.

The valve therefore tends to open to its full extent, but as gas pressure builds up below the diaphragm 38 of the pressure responsive device the mask 44 is raised into the path of illumination of the photocell and the energization of the electromagnet consequently decreased, so that the valve closure is arrested in a throttling position corresponding to the desired pressure for which the device 36 is adjusted; any variation of the pressure being compensated for by the resultant change of position of the mask and variation of energization of the electromagnet. In the event of extinguishment of the pilot-burner flame, the valve closes due to the absence of illumination of the photocell.

The embodiment of my invention herein shown and described is obviously susceptible of modification without departing from the spirit of the in-

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vention, and I intend therefore to be limited only by the scope of the appended claims.

I claim as my invention:

1. In a burner control system: a main burner; a conduit for supplying gas to said main burner; a throttling valve in said conduit for controlling flow therethrough; an electromagnet for operating said throttling valve; a pilot burner for igniting said main burner; photoelectric means, influenced by the flame of said pilot burner, for energizing said electromagnet; and means, responsive to the pressure of the gas in said conduit, for so varying the illumination of said photoelectric means by said flame that the flow capacity of the valve is varied to compensate for variation of said gas pressure.

2. In a burner control system: a main burner; a conduit for supplying gas to said main burner; a throttling valve in said conduit for controlling flow therethrough; an electromagnet for so operating said throttling valve that the flow capacity of the same is varied according to the degree of energization of the electromagnet; a pilot burner for igniting said main burner; photoelectric means, influenced by the flame of said pilot burner, for energizing said electromagnet; and means, responsive to the pressure of the gas in said conduit, for so varying the illumination of said photoelectric means by said flame that the flow capacity of the valve is reduced with increase of said gas pressure.

3. In a burner control system: a main burner; a conduit for supplying gas to said main burner; a throttling valve in said conduit for controlling flow therethrough; an electromagnet for so operating said throttling valve that the flow capacity of the same is a function of the degree of energization of the electromagnet; a pilot burner for igniting said main burner; photoelectric means for energizing said electromagnet and including a photocell illuminated by the flame of said pilot burner; means movable in response to variation of the pressure of the gas in said conduit between the valve and the main burner; and masking means movable in the path of illumination of said photocell and so operated by said pressure responsive means that the energization of the electromagnet is varied in accordance with variation of said gas pressure.

4. In a burner control system: a main burner; a conduit for supplying gas to said main burner; a throttling valve in said conduit for controlling flow therethrough and biased to closed position; an electromagnet for urging said throttling valve toward open position, so that the flow capacity of the valve is determined by the resultant of the biasing force and the electromagnetic force; a pilot burner for igniting said main burner; photoelectric means for energizing said electromagnet and including a photocell illuminated by the flame of said pilot burner, the arrangement being such that energization of the electromagnet is decreased with decrease of illumination of the photocell; means movable in response to variation of gas pressure in said conduit between the valve and the main burner; and a mask carried by said pressure responsive means and arranged to move across the path of illumination of said photocell so as to vary the energization of the electromagnet by the photoelectric means in accordance with variation of said gas pressure, said mask being so arranged that increase of the gas pressure effects decrease of the illumination.

5. In a burner control system: a main burner; a conduit for supplying gas to said main burner; a throttling valve in said conduit for controlling

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flow therethrough and biased to closed position; an electromagnet for urging said throttling valve toward open position, so that the flow capacity of the valve is determined by the resultant of the biasing force and the electromagnetic force; a pilot burner for igniting said main burner; a photocell arranged to be illuminated by the flame of said pilot burner; a pressure responsive device connected to said conduit at the outlet side of said valve and comprising a casing having a wall subjected to, and movable in response to variation of, the pressure of the gas supplied to the main burner; a mask carried by said movable wall and arranged so to move across the path of illumination of said photocell that increase of gas pressure effects decrease of the illumination; and an electrical amplifier connecting said photocell to said electromagnet and so designed that energization of the electromagnet is decreased with decrease of illumination of the photocell, whereby upon ex-

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tinguishment of the pilot-burner flame the electromagnet is deenergized and the valve closed under the force of its bias.

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