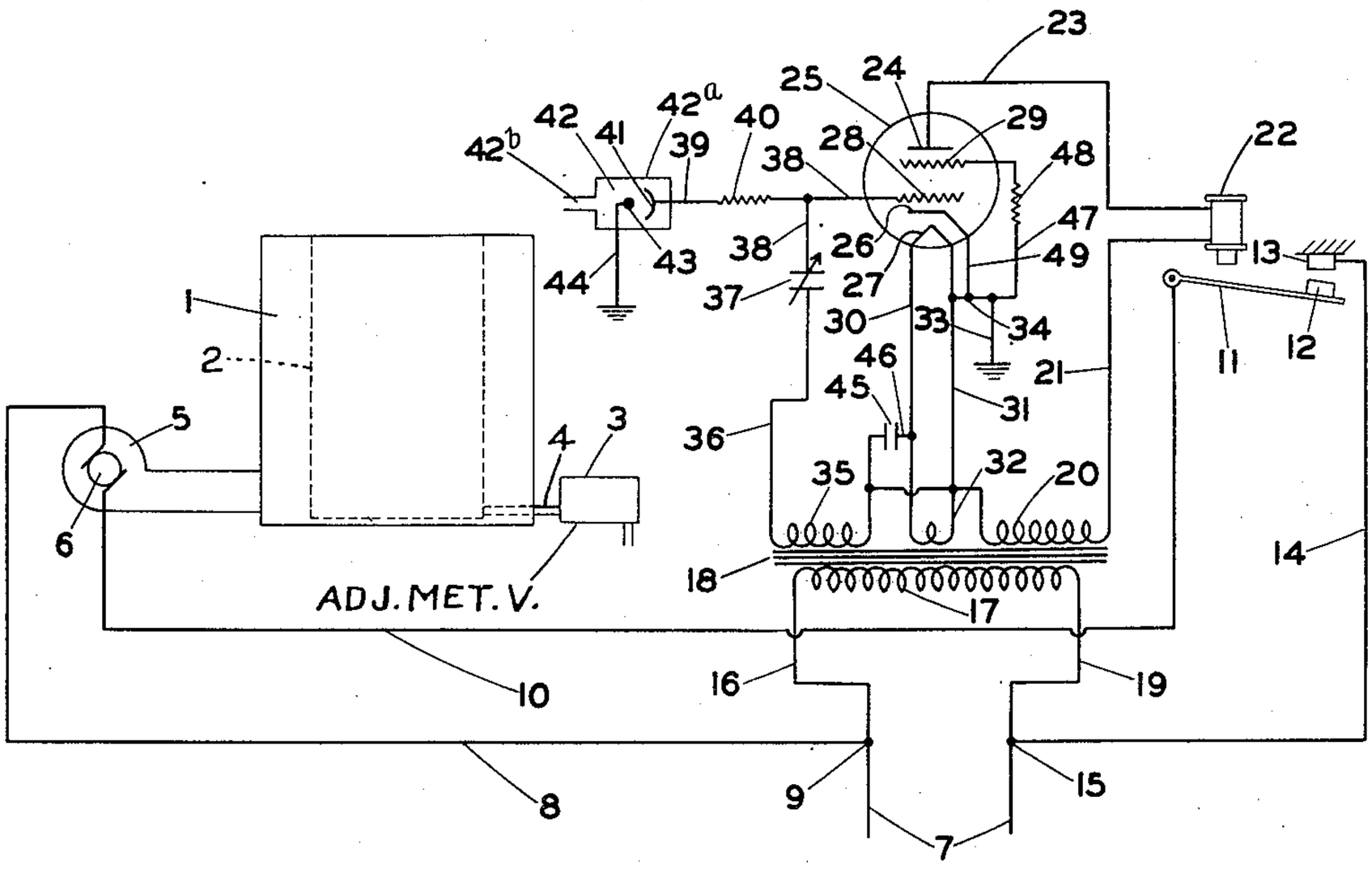
Jan. 23, 1951

F. B. AUBERT

2,538,856

COMBUSTION AIR CONTROL SYSTEM
FOR VAPORIZING BURNERS
Filed March 11, 1947



INVENTOR.
Fred B. Aubert
BY
Andrew K. Foulds
his ATTORNEY

Patented Jan. 23, 1951 2,538,856

UNITED STATES PATENT OFFICE

2,538,856

COMBUSTION AIR CONTROL SYSTEM FOR VAPORIZING BURNERS

Fred B. Aubert, Detroit, Mich.

Application March 11, 1947, Serial No. 733,858

7 Claims. (Cl. 158—28)

1

This invention relates to new and useful improvements in burner control devices and more particularly to one in which there is a means to control the supply of air to a burner for high-fire operation.

An object of this invention is to provide a burner control device or system whereby additional air will be supplied to the burner upon the supply of a predetermined rate of fuel.

Another object of this invention is to provide a burner control device or system for a vaporizing type liquid fuel burner whereby the occurrence of flame above a predetermined height above the level of burning fuel will cause additional air to be supplied thereto for high-fire operation.

Another object of this invention is to provide a burner control device or system which is of simple construction, efficient operation and inexpensive to manufacture.

The invention consists in the cooperable arrangement of parts to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing to be taken as part of this specification there is fully and clearly illustrated a preferred embodiment of this invention, in which drawing the figure shown is a wiring diagram and diagrammatic view of the burner and control device.

Referring to the drawing by characters of reference, the numeral 1 refers to a vaporizing type liquid fuel burner shown as having a pot 2. A gravity or constant level unit comprising a fuel metering valve 3 meters fuel to the pot 2 through a fuel supply conduit 4. The unit 3 provides an adjustable metering valve for controlling flow of fuel over a range from a low flow or "pilot" rate to a "high fire" rate and being of conventional structure is merely shown as a labeled rectangle. A fan or blower 5 driven by a motor 6 supplies the necessary air to the fuel in the pot 2. A main power source 7 supplies current for the energization of the motor 6. A lead wire 8 runs from an electric terminal or contact point 9 to the motor 6. Another lead wire 10 runs from the motor 6 to a relay switch 11 having two contact points 12 and 13. Another lead wire 14 runs from contact point 13 of the relay switch 11 to a terminal or contact point 15 of the main power source 7. The circuit from the main power source 7 through the motor 6 and the relay switch 11 is operable to be energized at all times that the main power source is turned on and functions subject to the control of the relay switch 11. A lead wire 16

2

runs from the terminal 9 to the primary 17 of a transformer 18, the circuit being completed by a lead wire 19 running back to terminal 15 of the main power source 7. A portion 20 of the secondary of the transformer 18 is connected in circuit by a lead wire 21 with the electromagnet 22 of the relay switch 11. Another lead wire 23 runs from the electromagnet 22 to the anode 24 of an electron tube 25. The electron tube 25 is preferably of the gas-filled type such as an R. C. A. #2051 or 2D21, having an anode 24, a cathode 26 of the filament heated type, a heater or filament 27, a control grid or electrode 28 and a screen grid 29. The heater 27 is connected by wires 30 and 31 to a portion 32 of the transformer secondary, the wire 31 being connected to a ground wire 33 by a wire 34. Another portion 35 of the transformer secondary is connected by a wire 36 to a variable condenser 37 which is in turn connected by a wire 38 to the control grid 28 of the electron tube 25. The connection of the secondary 35 to the grid 28 is such that the current to the grid 28 is reversed relative to the current to the plate or anode 24 and 180° out of phase with respect thereto. The variable condenser 37 further shifts the current flow so that maximum negative potential on the grid 28 leads the maximum potential on the plate 24 by about 90° with the result that less negative swing or less negative potential on the grid 28 is required to block current flow through the tube 25. The wire 38 to the grid is connected by a wire 39 and resistor 40 to the cathode 41 of a photo-electric tube 42 having its anode 43 connected by a wire 44 to ground and surrounded by a light shield 42^a having a light admitting aperture 42^b. The transformer secondary 35 has one end isolated from ground by a fixed condenser 45 connected by a wire 46 to wire 30 of the heater filament 27. The screen grid 29 is connected to ground by a wire 47 having in series therewith a resistor 48 and is connected to wire 33 leading to ground. The cathode 26 is connected by a wire 49 to wires 33 and 34 leading to ground. The resistor 48 functions to reduce external capacitance affecting the electron tube 25. The photo-electric tube 42 is positioned with the light aperture 42^b directed so that the occurrence of flame from the burner pot 2 above a predetermined height will cause activation of the tube 42 thus resulting in the closing of the switch contact points 12 and 13.

In operation this invention functions as follows:

When the main power supply is turned on, the circuit through the motor 6 will be energized

subject to the control of the relay switch 11. At the same time that the main power supply is turned on the transformer 18 is energized thus preparing the electron tube circuit for control. The relay switch 11 is initially open but is closed for energization of the motor 6 upon flow of current through the electron tube 25. The electron tube 25 is positioned in the circuit through the electromagnet 22 of the relay switch 11 as to block current flow therethrough. The photo-electric tube 42 is positioned so that the occurrence of flame in the pot 2 of the burner 1 above a predetermined height, for example, above the top of the pot, will cause light rays from the flame to impinge through the aperture 42b upon the cathode 41 of the photo-electric tube 42 causing the negative potential to be reduced on the control grid 28 of the electron tube 25. The functioning of the photo-electric tube 42 renders the electron tube 25 conductive permitting current flow through the electromagnet 22 thus closing the relay switch 11 and energizing the motor 6. It should be obvious then that when the gravity unit or metering valve 3 meters a sufficient amount of fuel to the pot 2 for flame to reach the height of view of the aperture 42b of the photo-electric tube 42 the relay switch 11 will then close subject to the controls heretofore described thus energizing the motor 6 to drive the fan 5 for the supplying of air for high-fire operation. Similarly if the supply of fuel is reduced or cut off so that the flame in the burner 1 falls below the field of view of the photo-electric tube 42 the control grid 28 will become more negative thus blocking flow through the electron tube 25 and thus causing the relay switch 11 to open and deenergize the motor 6.

It will be apparent that the air delivery by the fan 5 to the burner 1 may be regulated as distinguished from being started and stopped and that this regulation can be accomplished by operation of the relay switch to control inlet or outlet air dampers for the fan or to control the voltage of the motor 6 to control the fan speed, all of which modes of controlling the air delivery by fan speed or air throttling are well known in the prior art.

What is claimed and is desired to be secured by Letters Patent of the United States is:

1. In a burner control device, a vaporizing type liquid fuel burner, a metering valve for metering fuel to said burner at a predetermined low rate for low-fire operation and at a predetermined increased rate for heating operation, means for supplying air to said burner at a low rate for said low-fire operation, a fan for supplying air to said burner at a rate sufficient for efficient heating operation, a relay switch for energizing said fan, an electron tube for controlling said relay switch, a photo-electric tube for controlling current flow through said electron tube, a shield surrounding said photo-electric tube and having an aperture for the admission of light, and said photo-electric tube and shield being positioned so that the occurrence of flame within the field of view of said aperture will activate said photo-electric tube thereby to start said fan.

2. In a burner control system, a vaporizing type liquid fuel burner, a metering valve operable to meter fuel to said burner at a predetermined low rate for pilot combustion and at a predetermined high rate for heating operation, means for supplying air for efficient pilot combustion, a fan operable upon energization to supply an increased amount of air for efficient combustion of fuel at said high rate, means for energizing said fan for heating operation and including photo-sensitive means responsive to burner flame to energize said fan, means cooperable with said photo-sensitive means to provide a "line of sight" within which flame must occur for response thereby, and said photo-sensitive means being positioned with the lower limit of its "line of sight" sighting across said burner at a height above the maximum height of a pilot flame and within the range of height of a "high rate" flame.

3. In a burner control system, a vaporizing type liquid fuel burner, a metering valve operable to meter fuel to said burner at a predetermined low rate for pilot combustion and at a predetermined high rate for heating operation, means for supplying air for efficient pilot combustion, a fan operable upon energization to supply an increased amount of air for efficient combustion of fuel at said high rate, a relay switch controlling energization of said fan, an electron tube controlling energization of said relay switch, a photo-electric tube controlling activation of said electron tube and operable in response to burner flame to activate said electron tube and energize said relay switch and said fan, means cooperable with said photo-electric tube to provide a "line of sight" within which flame must occur for response thereby, and said photo-electric tube being positioned with the lower limit of its "line of sight" sighting across said burner at a height above the maximum height of a pilot flame and within the range of height of a "high rate" flame.

4. In a burner control system, a vaporizing type liquid fuel burner, means to meter fuel to said burner at a predetermined rate for heating operation, a fan for supplying air for efficient combustion of said fuel, means operable to energize said fan at the start of a cycle of heating operation at the precise moment when the burner has heated sufficiently to vaporize fuel at a rate requiring the additional combustion air supplied by said fan, said last-named means including photo-sensitive means responsive to burner flame to energize said fan, means cooperable with said photo-sensitive means to provide a "line of sight" within which flame must occur for response thereby, and said photo-sensitive means being positioned with the lower limit of its "line of sight" sighting across the burner at a height corresponding to the height of flame at which the additional air supplied by said fan is first required.

5. In a burner control system, a vaporizing type liquid fuel burner, means to meter fuel to said burner at a predetermined rate for heating operation, a fan for supplying air for efficient combustion of said fuel, means operable to energize said fan at the start of a cycle of heating operation at the precise moment when the burner has heated sufficiently to vaporize fuel at a rate requiring the additional combustion air supplied by said fan, said last named means including a relay switch controlling energization of said fan, an electron tube controlling energization of said relay switch, a photo-electric tube controlling activation of said electron tube and operable in response to burner flame to activate said electron tube and energize said relay switch and said fan, means cooperable with said photo-electric tube to provide a "line of sight" within which flame must occur for response thereby, and said photo-electric tube being positioned with the lower limit

of its "line of sight" sighting across the burner at a height corresponding to the height of flame at which the additional air supplied by said fan is first required.

6. In a burner control system, a vaporizing type liquid fuel burner, means to supply air sufficient to maintain flame in said burner, means to supply fuel to said burner at a rate sufficient to maintain a predetermined "high" flame for heating operation, means for igniting fuel in said burner, means to supply air at an increased rate sufficient for efficient combustion of fuel at said "high-fire" rate, and means to render said increased air supply means effective subsequent to the initiation of supply of fuel at said "high-fire" rate, said last-named means comprising photo-sensitive means positioned for response to burner flame and including means establishing a "line of sight" therefor, and positioned with said "line of sight" intersecting said burner at a predetermined flame height indicative of a rate of fuel vaporization requiring an increased supply of air.

7. In a burner control system, a vaporizing type liquid fuel burner, means for maintaining a pilot flame in said burner, means to supply fuel to said burner for a larger flame extending beyond said

burner, means to supply air for effcient combustion of said larger flame, control means for rendering said last-named means effective and including photosensitive means responsive to said larger burner flame, means establishing a "line of sight" for said photosensitive means intersecting the area of the extended larger flame so that upon intersection of the larger flame with said "line of sight" said photosensitive means will render said control means effective thereby to supply said combustion air.

FRED B. AUBERT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,259,845	Valjean	Oct. 21, 1941
2,269,248	Breese	Jan. 6, 1942
2,269,674	Liddel et al.	Jan. 13, 1942
2,306,073	Metcalf	Dec. 22, 1942
2,324,821	Campbell	July 20, 1943
2,360,532	Yates	Oct. 17, 1944