United States Patent [19]

Oldenburg et al.

[11] **3,737,664**

[45] **June 5, 1973**

[54] BURNER MONITOR APPARATUS

[75] Inventors: **Jerk Gunnar Oldenburg**, Genarp; **Allan Yngve Teodor Rosenberg**, Malmo, both of Sweden

[73] Assignee: **Kockums Mekaniska Verkstands AB**, Malmo, Sweden

[22] Filed: **Jan. 25, 1971**

[21] Appl. No.: **109,616**

Related U.S. Application Data

[63] Continuation of Ser. No. 818,293, April 22, 1969, abandoned.

[30] **Foreign Application Priority Data**

Apr. 29, 1968 Switzerland 5777/68

[52] **U.S. Cl.** .....**250/214 R**, 250/209 R, 250/217 F, 340/227

[51] **Int. Cl.** **H01j 39/12**

[58] **Field of Search** .....250/209, 214, 217 F, 250/83.3 UV; 340/227, 228.1, 228.2; 431/79

[56] **References Cited**

UNITED STATES PATENTS

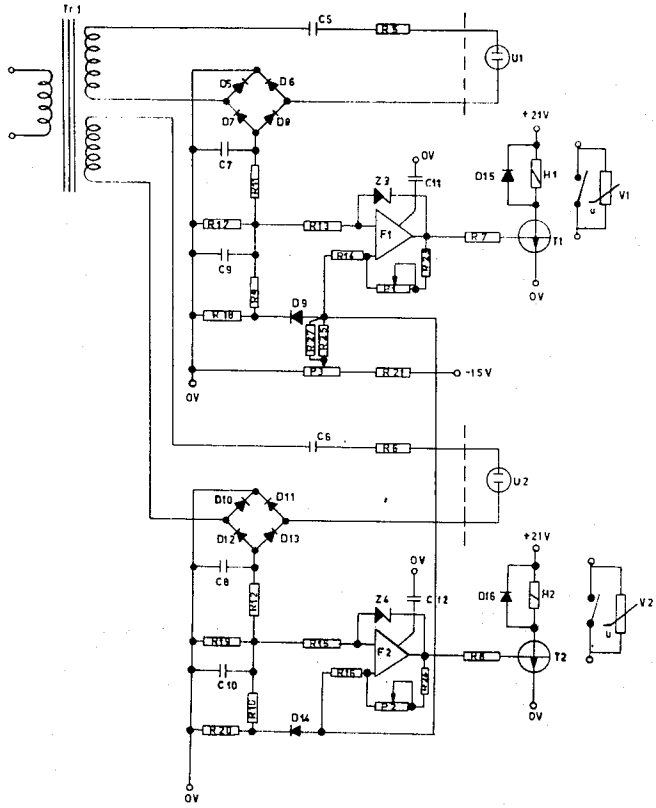
3,111,160	11/1963	Mellette	431/79
3,463,600	8/1969	Axmark	431/79
3,475,750	10/1969	Howell	340/227
3,451,759	6/1969	Engh	250/83.3 UV
3,280,884	10/1966	Eckelberry	158/28

Primary Examiner—James W. Lawrence
Assistant Examiner—D. C. Nelms
Attorney—Beveridge & De Grandi

[57] **ABSTRACT**

In a burner monitor apparatus comprising light intensity responsive means and comparator means, the light intensity responsive means are coupled to said comparator means for actuating the reference voltage of all said comparator means, whereby all the comparator means are responsive to all the light intensity responsive means.

5 Claims, 2 Drawing Figures



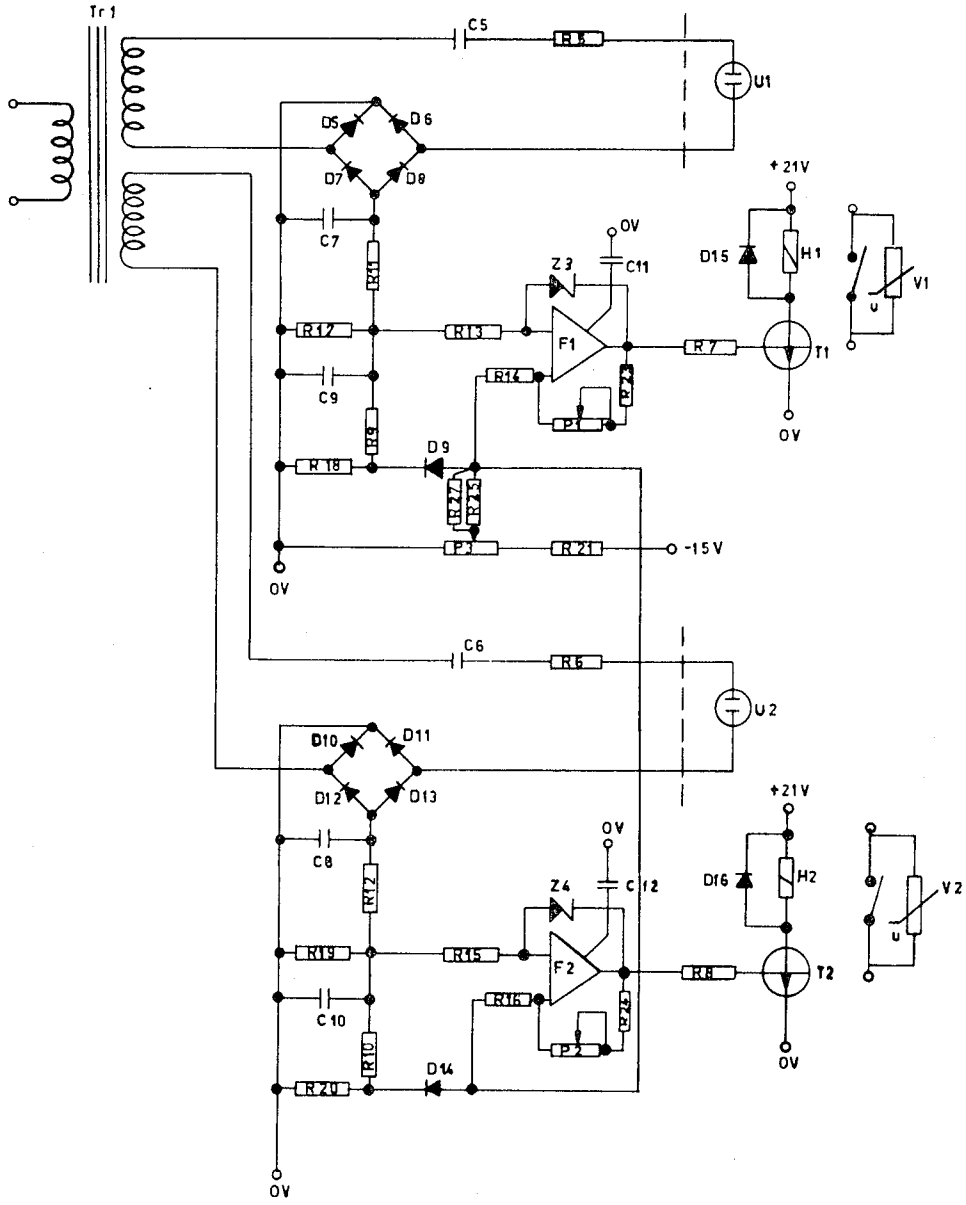


FIG. 1

INVENTORS:
JERK G. OLDENBURG
ALLAN Y. T. ROSENBERG
Browne, Selinger & Brumbaugh
ATTORNEYS

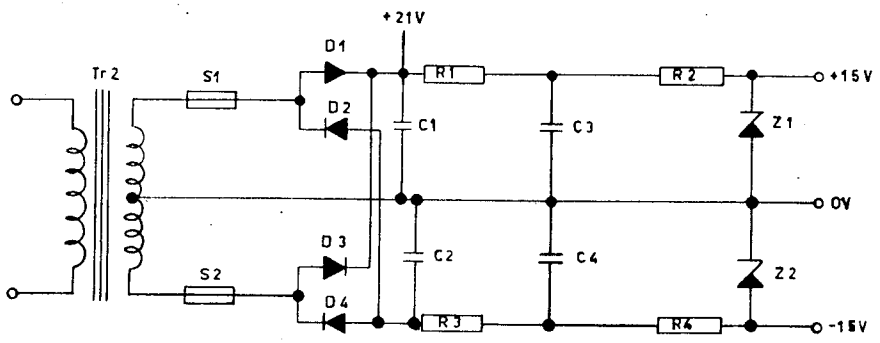


FIG. 2

INVENTORS:
JERK G. OLDENBURG
ALLAN Y. T. ROSENBERG
Brumm, Schuyler & Burridge
ATTORNEYS

BURNER MONITOR APPARATUS

This application is a continuation of Ser. No. 818,293, filed 4/22/69, abandoned.

This invention relates to an apparatus for monitoring the function of at least two burners in a boiler by sensing the light intensity of the flame from each of the burners, means responsive to light intensity being provided in the vicinity of each of the burners for sensing the light intensity in the flame from essentially the adjacent burner.

One of the main problems of previously known burner monitor apparatus is that the photocell of a burner is influenced also by the flames from the other burners. Thus the possibility exists for erroneous function since the output signal from one of the photocells may be maintained by reason of the flames from burners other than that which is associated with the photocell. These prior art monitor apparatus are thus unreliable, and this will become particularly apparent after the apparatus have been in operation for some time, since the photocells cannot be kept entirely free from dirt. Due to the photocells being dirtied the sensitivity of the monitor apparatus has to be reduced, whereby the flames from the burners will have a greater influence on each other.

In the apparatus outlined in the foregoing this problem is solved by the present invention in that the means responsive to light intensity are each connected to one comparator and that the comparators are so interconnected that each of the means responsive to light intensity actuates the reference voltage of all comparators whereby the light intensities from the burners are compared to each other.

The present invention will now be more fully described with reference to the accompanying drawings in which:

FIG. 1 is a wiring diagram of a burner monitor apparatus according to the invention;

FIG. 2 is a wiring diagram of a mains unit for the burner monitor apparatus shown in FIG. 1.

The burner monitor apparatus illustrated in FIG. 1 is intended for a boiler with two burners and has two photocells U1, U2, one for each of the burners. The photocells U1 and U2 are located at suitable points in the vicinity of the burners so as to be able to sense the light intensity of the flame emerging from the associated burner.

The photocell U1 is fed via one secondary winding of a transformer Tr1 having two secondary windings, and the other secondary transformer winding feeds the other photocell U2. The primary winding of the transformer Tr1 is connected to a suitable source of current. The photocell U1 is connected to one side of the secondary winding via a resistor R5 and a capacitor C5, and to the other side of the secondary winding via a rectifier bridge D5–D8. The connection between the rectifiers D5 and D6 in the rectifier bridge D5–D8 can be regarded as the zero lead of the circuit and is connected to a voltage input of 0V. The connection between the rectifiers D7 and D8 in the rectifier bridge D5–D8 is coupled via a resistor R11 and a resistor R13 to one input of an operational amplifier F1, and said one input of the amplifier F1 is also connected via a Zener diode Z3 to the output of the operational amplifier. This amplifier output is coupled via a resistor R23 and a potentiometer P1 to the other input of the operational amplifier F1. The other input is coupled via a resistor R14, a diode D9 and a resistor R9 to the connection between the resistors R11 and R13. Moreover, the connection between these two resistors is connected to the zero lead of the circuit via a resistor R17 connected parallel with a capacitor C9. The connection between the resistor R11 and the rectifier bridge D5–D8 is coupled to the zero lead of the circuit via a capacitor C7. A resistor R18 is connected between the zero lead of the circuit and the connection between the diode D9 and the resistor R9. The connection between the resistor R14 and the diode D9 is connected via two parallel-connected resistors R25, R27 to the sliding contact of a potentiometer P3 one terminal of which is connected to the zero lead of the circuit, while the other terminal of the potentiometer P3 is coupled to a voltage input of −15V via a resistor R21. Moreover, the operational amplifier F1 is coupled to a voltage input of 0V via a capacitor C11. The output from the operational amplifier F1 is coupled via a resistor R7 to the base of a transistor T1 whose emitter is connected to a voltage input of 0V and whose collector is coupled to a relay coil H1 connected parallel with a diode D15. The other terminal of the relay coil is connected to a voltage input of +21V. Said relay can be of any suitable type whatever but in the present instance is a tongue relay whose contact is connected parallel with a varistor V1 which serves to extinguish an arc of light, if any. The relay is suitably inserted in a control circuit which controls the supply of oil to the burner associated with the photocell U1.

The photocell U2 is coupled to one terminal of the other secondary winding via a resistor R6 and a capacitor C6 and to the other terminal of the secondary winding via a rectifier bridge D10-D13. The connection between the diodes D10 and D11 in the rectifier bridge D10–D13 is coupled to a voltage input of 0V and can thus be considered as being the zero lead of the circuit. The connection between the diodes D12 and D13 in the rectifier bridge D10–D13 is coupled via resistors R12 and R15 to one input of an operational amplifier F2, and said one input of the operational amplifier is also coupled to the output of said amplifier via a Zener diode Z4. The output of the operational amplifier F2 is coupled via a resistor R24 and a potentiometer P2 to the other input of the operational amplifier F2. Said other input of the amplifier F2 is coupled via a resistor R16, a diode D14 and a resistor R10 to the connection between the resistors R12 and R15. Said connection is coupled to the zero lead of the circuit via a resistor R19 connected parallel with a capacitor C10. The connection between the resistor R12 and the rectifier bridge D10–D13 is coupled to the zero lead of the circuit via a capacitor C8. The zero lead of the circuit is coupled via a resistor R20 to the connection between the resistor R10 and the diode D14. The operational amplifier F2 is further coupled to the voltage input of 0V via a capacitor C12. The output of the operational amplifier F2 is coupled via a resistor R8 to the base of a transistor T2 whose emitter is coupled to a voltage input of OV and whose collector is coupled to a relay coil H2 connected parallel with a diode D16 and having the other end connected to a voltage input of +21V. Said relay can be of any suitable type whatever but in the present instance is a tongue relay whose contact is connected parallel with a varistor V2 which serves to extinguish an arc of light, if any. The relay is preferably connected in

a control circuit which controls the supply of oil to the burner associated with the photocell U2.

As will be understood, the electronic circuit provided for the photocell U1 is identical with that provided for the photocell U2. The two circuits intended for the photocells U1 and U2 are interconnected by a conductor which runs from the connection between the resistor R14 and the diode D9 and the connection between the resistor R16 and the diode D14.

In operation the burner monitor apparatus illustrated in FIG. 1 will function as follows. Due to the connection between the two operational amplifiers F1 and F2 their reference voltage, whose initial value is adjustable by means of the potentiometer P3, will be dependent upon the light intensity sensed by the photocells U1 and U2. The operational amplifiers F1 and F2 being connected in the manner of comparators, the relays H1 and H2 will react only when the photocells U1 and 2 deliver a predetermined signal corresponding to a predetermined low light intensity. The reference voltage of the two operational amplifiers is dependent on the light intensity in such a way that if one photocell senses a high light intensity and the other photocell a low light intensity the reference voltage will fall so that the operational amplifier associated with the photocell of low light intensity delivers an output signal at its output for actuation of the relay associated therewith to interrupt the oil supply to the burner even if the light intensity sensed by the photocell is not as low as the predetermined value. Thus the relay for the photocell associated with an extinguished burner will interrupt the oil supply to the burner even if the photocell is influenced by another flame.

In FIG. 2 is shown a mains unit suitable for the burner monitor apparatus illustrated in FIG. 1. The primary winding of a transformer Tr2 is connected to a suitable source of current. The secondary winding of the transformer Tr2 has a middle tap which constitutes the zero lead of the unit and at the same time a voltage output of OV. One end of the secondary winding is coupled via a fuse S1 to the connection between the diodes D1 and D2 in a rectifier bridge D1–D4. The connection between the diodes D3 and D4 is coupled via a fuse S2 to the other end of the secondary winding. The connection between the diodes D1 and D3 forms a voltage output of +21V and is connected via two resistors R1 and R2 to a voltage output of +15V. The connection between the diodes D2 and D4 is coupled via two resistors R3 and R4 to a voltage output of −15V. A capacitor C1 is inserted between the connection between the diode D1 and the resistor R1 and the zero lead of the unit, while a capacitor C2 is inserted between the connection between the diode D4 and the resistor R3 and the zero lead of the unit. The connections between the resistors R1 and R2 and the resistors R3 and R4 are coupled to the zero lead of the unit via a capacitor C3 and a capacitor C4, respectively. Inserted betwen the zero lead of the unit and the voltage output of +15V is a Zener diode Z1, and inserted between the zero lead of the unit and the voltage output of −15V is a Zener diode Z2.

As already mentioned, the burner monitor apparatus described in the foregoing is intended for a boiler having two burners, but it can be enlarged without difficulty to serve a boiler having three or more burners by supplementing the circuitry shown in FIG. 1 with an electronic circuit associated with each photocell and identical with the electronic circuits associated with the photocells U1 and U2, and by interconnecting the additional circuits in the same way as the circuits for the photocells U1 and U2 are interconnected.

While only one embodiment of the present invention has been described and shown it will be readily realized by those skilled in the art that the invention can be modified within the scope of the invention defined in the appended claims.

We claim:

1. An apparatus for monitoring the function of at least two burners disposed in a boiler comprising in combination; at least two light intensity responsive means respectively associated with the burners in the vicinity thereof for sensing the light intensity in the flames from their associated burners, at least two comparator means respectively associated with and connected to said light intensity responsive means for comparing the signals received from the associated light intensity responsive means with the reference voltages of the comparator means, and means interconnecting said comparator means such that each of said light intensity responsive means instantaneously actuates the reference voltages of both of said comparator means which reference voltages will thereby become proportional to the highest of the intensities monitored.

2. Apparatus defined in claim 1 wherein said comparator means are operational amplifiers each having two inputs, wherein one of said light intensity responsive means is connected to one input of one operational amplifier and the other light intensity responsive means is connected to one input of the other operational amplifier, and wherein the other of said one operational amplifier is connected to the other input of the other operational amplifier.

3. Apparatus as defined in claim 2 further including a resistor and capacitor network, and wherein the input of each operational amplifier is connected to the input of the other operational amplifier via said resistor and capacitor network.

4. Apparatus as defined in claim 2 wherein said light intensity responsive means are each photocells.

5. Apparatus defined in claim 4 wherein said photocells are UV-cells.

* * * * *