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W. F. MILLER
 APPARATUS FOR DETECTING ON IGNITION ARC
 AND CONTROLLING A BURNER
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2,771,942

FIG. 1

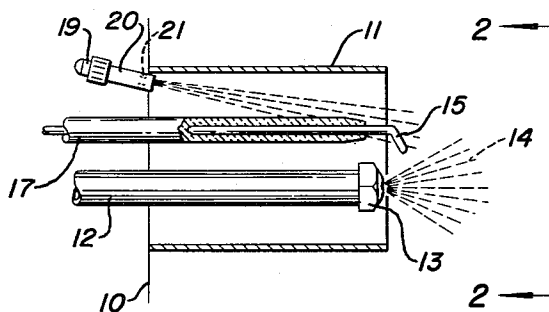


FIG. 2

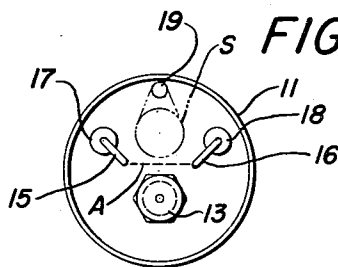


FIG. 3

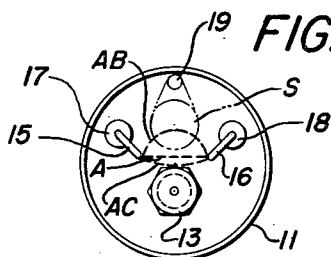
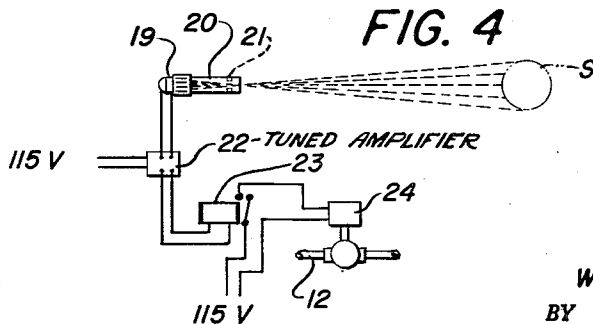


FIG. 4



INVENTOR.
 WILLIAM F. MILLER
 BY *W. B. Harpman*
 ATTORNEY

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APPARATUS FOR DETECTING AN IGNITION ARC AND CONTROLLING A BURNER

William F. Miller, Youngstown, Ohio

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1 Claim. (Cl. 158—23)

This invention relates to apparatus for automatically determining whether or not an ignition arc, such as used for igniting fuel delivered by an oil burner, is operating.

The principal object of the invention is the provision of apparatus for detecting an ignition arc.

A further object of the invention is the provision of apparatus for detecting an electric arc and particularly an arc employed as ignition means in connection with an oil burner wherein air and oil are introduced into a combustion area.

A still further object of the invention is the provision of apparatus for detecting an ignition arc and controlling an oil burner or similar device to prevent operation of said oil burner or similar device at such times as the ignition arc is not functioning.

A still further object of the invention is the provision of apparatus for detecting an ignition arc which utilizes infrared radiation of the arc and more particularly energy pulsations of the arc.

A still further object of the invention is the provision of apparatus for detecting an ignition arc through the use of a photocell scanning a restricted target area adjacent a straight path between the electrodes supporting the arc to detect the energy pulsations of the arc varying from said straight path as occurs during the normal operation of an oil burner.

The apparatus for detecting an ignition arc disclosed herein is of particular value in supervising the operation of an oil burner and particularly an oil burner in a relatively large industrial installation where a considerable volume of vaporized oil may be introduced into a combustion area in a relatively short time.

Those skilled in the art will recognize that many commercial oil burner installations in operation at the present time introduce several gallons of oil in atomized form in a relatively few seconds and that the absence of an ignition arc from the precise moment of starting the introduction of the fuel may result in a highly dangerous volume of explosive air and fuel mixture.

It has heretofore been believed impossible to detect the actual ignition arc utilized in such oil burner installations quickly enough to prevent the introduction of a dangerous quantity of vaporized fuel into the associated equipment. Those skilled in the art will appreciate that industrial oil burning equipment and usage has therefore been denied the safety factor that has existed with gas burning equipment inasmuch as apparatus for instantaneous detection of pilot flames has been available and widely used.

The present invention utilizes a lead-sulphide photocell responsive to a pulsating infrared radiation. The lead-sulphide photocell is unlike the rectifying types of photocells commonly used for detecting oil flames as the lead-sulphide photocell is most sensitive to infrared radiation, which energy striking the cell reduces its electrical resistance and thus changes the voltage across the cell. The pulsations of energy therefore vary the cell resistance and set up small fluctuations in voltage. These

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fluctuations produce the effect of an A.-C. voltage signal of mixed frequencies.

In a typical installation utilizing the herein disclosed apparatus, the lead-sulphide photocell is used in connection with an adapter comprising a tuned amplifier having a maximum response to a signal of approximately 13 cycles from the photocell. The amplifier converts the A.-C. signal to a small D.-C. signal which is sufficient to actuate a relay controlling the fuel source of the controlled installation.

The photocell is focused on a small target area immediately adjacent a straight path between the tips of the ignition arc electrodes of the equipment supervised so that an arc following a straight path between the electrodes is out of the target area whereas fluctuations in the arc, as are common and which are due in part to air introduced along with the fuel charge adjacent the ignition electrodes, cause the arc to move alternately into and out of the target area.

Fluctuations of the arc thus occur in the target area as long as the arc exists and the detection of the arc is therefore possible and the associated equipment enabled to control the fuel source in the absence of the arc and thereby prevent the introduction of explosive mixtures in the absence of an ignition arc.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being the intention to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

The invention is illustrated in the accompanying drawing, wherein:

Figure 1 is a symbolic illustration of an air and oil delivering section of an oil burner together with the ignition electrodes adjacent thereto and illustrates the positioning and scanning area of a detection photocell.

Figure 2 is an end view of the apparatus of Figure 1 showing the scanning area adjacent a straight ignition arc path.

Figure 3 is an end view of the apparatus shown in Figure 1 showing in dotted lines the normal fluctuation of an ignition arc into and out of the photocell scanned area.

Figure 4 is a symbolic diagram illustrating the target and apparatus controlled by the photo-electric cell.

By referring to the drawings and Figure 1 in particular, it will be seen that a wall 10 of a combustion area is indicated and that a tubular member or air blast tube 11 is positioned therethrough so as to extend into said combustion area. An oil delivering pipe 12 extends into the area of the tubular member 11 and terminates with a nozzle tip 13 through which atomized oil or other suitable fuel 14 is introduced. The tubular member or air blast tube 11 provides a passageway for the introduction of air into the combustion area.

Electrodes 15 and 16 covered throughout the majority of their length by porcelain insulators 17 and 18 extend alongside the oil delivering pipe 12 and terminate adjacent the nozzle tip 13 and in spaced relation to one another.

The electrodes 15 and 16 are downturned at their outermost ends and angularly positioned with respect to one another so that their outermost ends or tips are more closely spaced to one another than the remaining portions thereof. When a suitable source of electrical energy is connected with the electrodes 15 and 16, a suitable ignition arc is established between the tips of the

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electrodes, as indicated by the dotted lines in Figures 2 and 3 of the drawings.

The structure just described will be recognized by those skilled in the art as being conventional and it will occur to those skilled in the art that if the introduction of oil and air takes place through the air blast tube 11 and the nozzle tip 13 and the ignition arc is not established across the tips of the electrodes 15 and 16, there will be a resulting creation of a highly explosive fuel laden atmosphere.

In order that this cannot occur, a photocell 19 responsive to pulsating infrared radiation and, preferably of the lead-sulphide type, is mounted in the wall 10 in alignment with a focusing tube 20, which may or may not be provided with a restricted orifice 21, so that the area scanned by the photocell 19 will comprise a small area immediately between the electrode porcelains 17 and 18 and just above a straight path between the tips of the electrodes 15 and 16.

The straight path is illustrated by dotted lines A in Figure 2 of the drawings and the scanned target area is indicated by a dotted circular line S in Figure 2 of the drawings.

At such time as a source of electrical energy is connected with the electrodes 15 and 16 and an ignition arc established on the dotted line A, it will characteristically fluctuate from the straight path of the dotted line to the bowed paths A, AB and AC, as shown in Figure 3 of the drawings. It will be observed that the bowed path AB is well within the scanning area S of the photocell 19 while the paths A and AC are not.

The fluctuation of the arc from the straight path A to the bowed paths AB and AC occurs continuously when air is being introduced through the air blast tube 11 by the equipment of the oil burner or the like and frequently occurs in the absence of such introduction of air. The arc therefore fluctuates with respect to its presence or absence in the scanning area S and is thereby capable of effectively actuating the photocell 19 with the resultant change of voltage across the cell.

As the pulsations of the existing ignition arc vary, the photocell 19 resistance will establish small fluctuations in voltage in a circuit through the photocell 19. Such small fluctuations in voltage are conveyed to a tuned amplifier 22, as illustrated in Figure 4 of the drawings, and converted thereby to a small D.-C. signal which is conveyed to a relay 23 which in turn is connected with the solenoid valve 24 in the fuel supply pipe 12 for the effective control thereof.

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Those skilled in the art will recognize that the amplifier 22 and the relay 23 require electric energy for their operation and are illustrated in Figure 4 of the drawings as connected with a suitable 115 v. power source.

The specific equipment is available commercially and includes the lead-sulphide photocell, the tuned amplifier and the relay and the invention relates to utilizing said radiant energy fluctuation response photocell and associated equipment with an ignition arc to enable the safety control of oil burner equipment and the like.

It will thus be seen that the herein disclosed method of detecting an ignition arc enables an oil burner installation dependent on an ignition arc for operation to be effectively supervised so that no oil will be introduced into the combustion area unless the ignition arc is first established and its existence determined by the photocell 19 scanning the normal fluctuation area of the ignition arc.

Having thus described my invention, what I claim is:

A burner control system including a burner having an outlet, fuel delivery means for said burner and ignition electrodes at said outlet, a photocell responsive to fluctuations of radiant energy positioned to scan only an area to one side of a straight path between the tips of said ignition electrodes whereby said photocell receives fluctuations of radiant energy caused by the movement of an ignition arc into and out of said area, a circuit including an electrically operable valve controlling said fuel delivery means, a tuned amplifier having an input circuit connected to said photocell and selectively responsive to the frequencies of said fluctuations, a power source for said amplifier, a relay including a coil connected to an output circuit of said amplifier for actuation by the output current of said amplifier upon occurrence of said fluctuations, a power source for said valve circuit, said relay having a switch in said circuit controlling said valve.

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