IGNITION DEVICE FOR BURNER INSTALLATIONS

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ABSTRACT

The invention relates to an oil burner ignition system of the type having an electrically heatable silicon carbide incandescent resistor. Aging of the resistor causes the resistance to increase with a resulting drop in the power input. A capacitor is used in series with the resistor to compensate for the increase in resistance of the resistor as it ages. It is also found that the capacitor causes the resistor to become incandescent more rapidly.

1 Claim, 2 Drawing Figures
IGNITION DEVICE FOR BURNER INSTALLATIONS

The invention relates to an ignition device for burner installations and having an electrically heatable silicon carbide incandescent resistor.

It is known practice to use electrically heatable silicon carbide rods as incandescent ignition elements for oil or gas burner installations. Since their resistance is dependent upon temperature, they can also be used for monitoring the flame. For the purpose of effecting ignition, a constant voltage, and in particular the mains voltage, is applied directly to the incandescent resistor through a suitable ignition switch. The resistance of the incandescent resistor when hot is so selected that the power consumed is capable of providing the power radiated at the required temperature at which incandescence occurs. With silicon carbide incandescent resistors having the normal dimensions, a power input of 20 to 25 watts can be expected in the case of gas burner installation, and one of 50 to 70 watts in the case of an oil burner installation.

It has been found that silicon carbide incandescent resistors undergo considerable aging which leads to an increase in the resistance when hot. If the resistance increases by 20% as a result of aging, the power input drops by more than 15%. The result of this is that the required incandescence temperatures are no longer attained. Conversely, it would also be desirable to avoid the use of an incandescent resistor having a resistance that is so low that the increase in resistance caused by aging is offset, since otherwise when the device is put into operation impermissibly high incandescence temperatures would have to be accepted.

The object of the invention is to provide an ignition device of the initially described kind in which the increase in the resistance of the silicon carbide incandescent resistor, caused by aging has only a slight effect upon the incandescence.

According to the invention this object is achieved by connecting the incandescent resistor in series with a capacitor, the capacitance C (in farads) of which is equal to or preferably somewhat greater than

\[ 2\text{W}/\omega V^2 \]

wherein W is the effective power (in watts) necessary for the required incandescence temperature, V is the supply voltage (in volts) of the series connection, and \( \omega \) is the cyclic frequency of this supply voltage.

Surprisingly, such a design and rating of the ignition device leads to very much smaller changes in the incandescence temperature in dependence upon the increase in resistance when hot caused by aging. With an appropriate design it is possible to keep the power input practically constant during the major part of the life of the device. A further surprising effect is that the incandescent resistors begin to flow more rapidly than previously. These effects will be described in greater detail hereinafter by reference to the drawings. Since it is no longer necessary to take into account the aging of the silicon carbide material, it is also possible to use considerably cheaper material than previously. Additionally, the ignition device takes a capacitive current, so that corresponding inductive loads, e.g. the motor for the blower and the oil pump of an oil-fired installation, are compensated.

Preferably a lower value is selected for the hot resistance R of a new ignition resistor than the value \( U_{T2}/N \).

This rating ensures that an increase in resistance when hot during the life of the device can lead only to an increase and not to a reduction in the power input. The permissible increase in the incandescence temperature determines the extent to which the capacitance of the capacitor should be greater than the above-stated value.

Within the context of the invention no trouble occurs and indeed it may be desirable if the capacitor also undergoes aging, so that cheaper capacitor can be used in which temperatures above room temperature are permissible. In particular, the capacitance of the capacitor should undergo a reduction of more than 10% during its permissible service life, as a result of aging.

The invention will now be described in greater detail by reference to the drawing, in which:

FIG. 1 shows a circuit diagram of an ignition device of the invention, and

FIG. 2 shows curves of equal effective power in a resistance - capacitance graph relating to this circuit.

The ignition device has a mains connection 1, a switch 2 which is actuated by a control means 3, a capacitor 4 and a rod-shaped incandescent resistor 5 made of silicon carbide.

If a constant A.C. voltage is applied across the terminals 1, it is found that a large number of matches of the hot resistance R of the ignition resistor 5 and of the capacitance C of the capacitor 4 are obtained at which the incandescent resistor consumes the same effective power and releases it as radiated heat. In particular, a pair of resistance values is associated with each capacitance value above a minimum capacitance definable for each effective power value. This is illustrated in the resistance - capacitance graph of FIG. 2 in which the realtionships for a 220 V, 50 cycle mains voltage are illustrated. There will now be considered an oil ignition device the radiation power of which should be in the order of 50 watts.

At the point a the capacitance C has the value

\[ 2 N U_{T2}^2 = 2.50 \times 314 = 2.50 \times 6.7 \mu F \]

At the same point the hot resistance R is

\[ U_{T2}/2 N = 220/2 \times 50 = 486 \text{ ohms} \]

If the point a is considered as the final point after aging for a hot resistance that should have increased 50% during the life of the device, then the hot resistance R of a new incandescent resistor is approximately 360 ohms. This is shown as point b in the graph of FIG. 2.

It will be seen that the deviation from the required power of 50 W is very small.

The values of R and C will generally be so selected that for a new incandescent resistor a predetermined power N is attained. In the present case this means that a slightly higher value for capacitance C than the above calculated minimum capacitance is selected. The working point c then lies exactly on the 50 W curve.

The form of the curves for constant power enable capacitor having pronounced aging characteristics to be used. If for example a capacitor of approximately 8 \( \mu F \) is initially used, then the associated hot resistance R is obtained from the point d in FIG. 2. If the capacitance drops to approximately 7 \( \mu F \) during the life of the capacitor, but the hot resistance R of the incandescent resistor at the same time rises again by approximately 50%, then a working point e is obtained. The change of the working point from d to e shows that during use the
deviation from the required power of 50 W is only slight.

If another relationship between the drop in capacitance due to aging and the increase in hot resistance caused by aging should result, other portions of the 50 W curve, including portions to the right of point d can be used in practice.

The curve f shows the approximate change in resistance R when the initially cold incandescent resistor heats up. The resistance curve intersects the 50 W curve at the point g. Upon further heating and consequent further decrease in resistance, the working point passes briefly into the higher power range. This means that additional heating power is passed to the incandescent resistor during the heating-up period. This leads to incandescence being reached more rapidly than previously. For the last-mentioned reason it is important for the capacitance of the capacitor not to be too close to the minimum value defined by the point a. The greatest possible deviations are obtained by using condensers having a considerable decrease in capacity caused by aging. The worse the aging conditions in relation to those of the incandescent rod, the greater is the upward shift of the upper limit of the range of permissible capacitance values specified as being “somewhat greater” than the calculated capacitance. The criterion for a rise above the range is whether the incandescence temperature either drops or rises in an impermissible manner as a result of changes in power during the service life.

We claim:
1. An oil burner ignition assembly comprising an electric circuit having a silicon carbide incandescent resistor in series with a capacitor, an AC power source for said circuit, said capacitor having a faradic value equal to twice the power input in watts to said resistor for a required incandescent temperature divided by the product of the frequency in radians per second times the voltage of said source squared, the ohmic value of said resistor when new is less than said voltage squared divided by twice said power unit.

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