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ELECTRICAL IGNITION DEVICE
FOR JETS FROM FUEL NOZZLES
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Fig. 1.

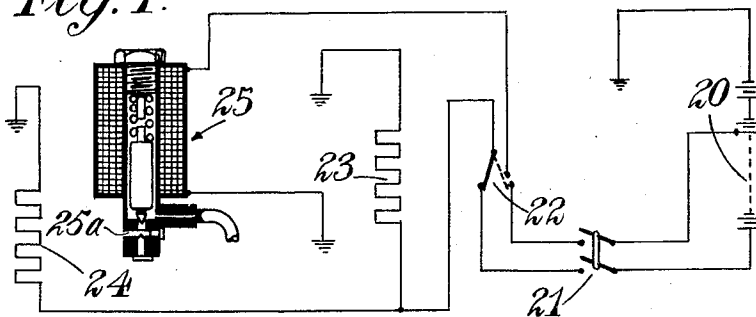


Fig. 2.

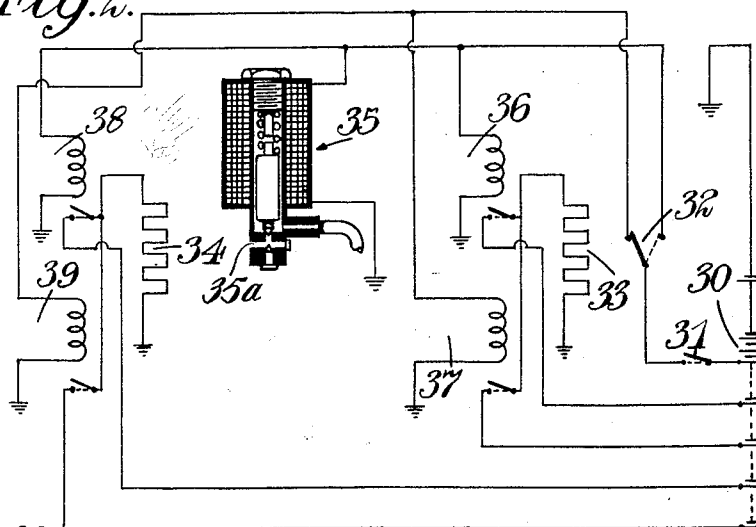
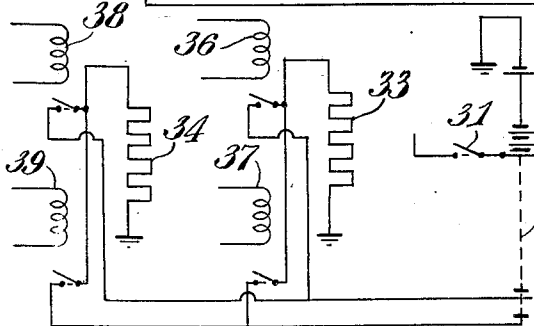


Fig. 3

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ELECTRICAL IGNITION DEVICE FOR JETS
FROM FUEL NOZZLES

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7 Claims. (Cl. 158—28)

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This invention relates to electrical ignition devices for igniting a jet of atomised or gaseous fuel by an electrically-heated filament disposed in the path of the jet, and may be used in connection with jet or turbine internal-combustion engines, oil or gas-fired boilers, furnaces and similar apparatus.

One of the objects of this invention is to provide a simple and reliable apparatus for igniting a fuel jet, utilizing only a low-voltage electric supply since the use of high voltage systems, such as with sparking-plugs, entails certain disadvantages in these particular uses.

To overcome these difficulties it has been proposed to use a low tension igniter consisting essentially of an electrically-heated filament situated in front of an atomising jet, the filament being supplied, through a master-switch, from a suitable source. When the filament attains the correct operating temperature, a delay action switch completes the circuit of an electromagnetically-operated valve which opens allowing fuel under pressure to pass through the jet and impinge upon the filament, which ignites it. Such an igniter suffers from the disadvantage that there is a delay of several seconds between switching on and the attainment by the ignition filament of a temperature at which ignition will occur with complete certainty on the opening of the fuel valve. The main object of the present invention is to overcome this disadvantage.

According to this invention means are provided to apply an alternative higher voltage electric supply to the electrically-heated filament during the operating time of the delay-action-switch and to apply a lower voltage electric supply when the delay-action-switch has operated to commence opening the fuel-valve.

According to a feature, the invention may comprise, in series with the master-switch, a two-position switch which in one position energises a relay to connect the electrically-heated filament with the alternative higher voltage electric supply, and in the other position breaks the energising circuit of the said relay, but energises a second relay to connect the filament with the low-voltage electric supply, and energises the valve-operating device.

According to another feature of the invention, the two-position switch may be thermally operated and automatically changed from one position to the other when a heating resistance attains a predetermined temperature corresponding to the operating temperature of the electrically-heated filament.

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According to yet another feature of the invention, the two-position switch may, in one position, energise a third relay to connect the heating resistance to an alternative higher voltage electric supply, and in the other position may break the energising circuit of the said third relay but may energise a fourth relay to connect the heating resistance to a lower voltage electric supply.

According to yet another feature of the invention the electrically-heated filament and the heating resistance may be alternatively supplied from the same higher voltage and low-voltage electric supplies.

According to yet another feature of the invention the electromagnetically-operated valve may be a needle-valve which is operated in the opening direction by a solenoid against the action of a spring.

Two constructions according to the invention suitable for use with a gas-turbine-engine will now be described with reference to the accompanying drawings in which

Figure 1 is a circuit diagram of one construction,

Figure 2 is a circuit diagram of an alternative construction and, Figure 3 is a modification of the arrangement shown in Figure 2.

In Figure 1, the reference 20 indicates a twenty-four-volt battery connected through a two-pole single-throw master-switch 21 to a thermally-operated bimetallic two-position switch 22 which connects either of two tappings from the battery to the heating resistance 23 of the switch 22, and to the filament 24. In its cold position the switch 22 connects the higher voltage supply to the heating resistance 23 and filament 24 which supplies them with larger currents than those required to maintain them at their operating temperatures, so that they rapidly attain those temperatures. When they attain the appropriate temperatures, the switch 22 changes to its other position to connect them to the lower voltage supply from the battery which supplies them with a lesser current suitable to maintain them at their operating temperatures. In this position the switch 22 also energises the solenoid of the fuel-valve 25 to open the nozzle 25a whose jet the filament 24 is to ignite.

The battery 20, heating resistance 23, filament 24 and solenoid of the solenoid-operated valve 25 are all grounded to complete their circuits.

Figure 2 shows an alternative construction employing relays and having different higher starting and lower running voltages for the heating resistance and filament respectively. In this con-

struction, reference 30 indicates a twenty-four-volt battery tapped to supply the thermally-operated bimetallic two-position switch 32 through the master-switch 31 with a voltage suitable to operate the relays 36, 37, 38, 39 and to energise the solenoid of the fuel-valve 35 controlling the nozzle 35a, the jet from which is to be ignited. When the master-switch is made the relays 37, 39 are energised to connect the higher starting voltages to the heater 33 of the switch 32 and the filament 34 respectively.

When the heater 33 attains a temperature corresponding to the operating temperature of the filament 34, the switch 32 changes to its other position thereby de-energising relays 37 and 39 and energising relays 36 and 38. This changes the supplies of the heater 33 and filament 34 to the lower-running voltages. In this position the switch 32 also energises the solenoid of the solenoid-operated valve 35.

The battery 30, heater 33, filament 34, solenoid of the valve 35 and relays 36, 37, 38, 39 are all grounded to complete their circuits. Figure 3 shows a construction similar to that shown in Figure 2 except that the resistances of the filament 34 and heater 33 are so chosen that they will operate appropriately when supplied with the same higher starting voltage and with the same lower running voltage.

The above examples are in no way intended to limit the invention and a number of modifications which may be employed without departing from the invention will be apparent to those well-skilled in the art.

We claim:

1. In combination a fuel nozzle the jet from which is to be ignited, an electromagnetically-operated valve operative when energised to permit fuel to flow to said nozzle, an electrically heated filament disposed in the path of the jet from said nozzle, a two-position switch, means operative to change said switch from a first position to a second position when said filament attains a predetermined temperature, a first electric supply, a second electric supply of lower voltage than said first electric supply and electric connections connected to provide a first electric circuit comprising said first electric supply, said two-position switch in its said first position and said filament in series with one another, a second electric circuit comprising said second electric supply, said two-position switch in its said second position and said filament in series with one another, and a third electric circuit comprising said second electric supply, said two-position switch in its said second position and said electromagnetically operated valve in series with one another.

2. A combination according to claim 1 wherein said two-position switch operating means is thermally-operated and comprises an electric heater and electric connections to connect said heater in parallel with said filament in both said first electric circuit and said second electric circuit.

3. In combination a fuel nozzle the jet from which is to be ignited, an electromagnetically-operated valve operative when energised to permit fuel to flow to said nozzle, an electrically heated filament disposed in the path of the jet from said nozzle, a two-position switch, means operative to change said switch from a first position to a second position when said filament attains a predetermined temperature, a first electric supply, a second electric supply of lower voltage than said first electric supply, a third elec-

tric supply, a first normally open relay-operated switch, a second normally open relay-operated switch, a first electric circuit comprising in series said first electric supply, said first normally open relay-operated switch and said filament, a second electric circuit comprising said second electric supply, said second normally open relay-operated switch and said filament in series with one another, a third electric circuit comprising said third electric supply, said two-position switch in its said first position and the relay coil of said first normally open relay-operated switch in series with one another, and a fourth electric circuit comprising said third electric supply and said two-position switch in its said second position in series with one another and with the relay coil of said second normally open relay-operated switch and said electromagnetically operated valve.

4. A combination according to claim 3 wherein said two-position switch operating means is thermally operated and comprises an electric heater, a third normally open relay-operated switch whereof the relay coil is connected in said third electric circuit in series with said third electric supply and said two-position switch in its said first position, a fourth normally open relay-operated switch whereof the relay coil is connected in said fourth electric circuit in series with said first electric supply and said two-position switch in its said second position, a fourth electric supply, a fifth electric supply of lower voltage than said fourth electric supply, a fifth electric circuit comprising said fourth electric supply, said third normally open relay-operated switch and said heater in series with one another, and a sixth electric circuit comprising said fifth electric supply, said fourth normally open relay-operated switch and said heater in series with one another.

5. A combination according to claim 4 wherein said first electric supply and said fourth electric supply are the same and wherein said second electric supply and said fifth electric supply are the same.

6. A combination according to claim 3 wherein said third electric circuit and said fourth electric circuit comprise an electric connection between said third electric supply and said two-position switch common to both said circuits and further comprising a master switch for said third electric circuit and said fourth electric circuit in said electric connection common to both said circuits.

7. A combination according to claim 1, wherein said second electric circuit and said third electric circuit comprise an electric connection between said second electric supply and said two position switch, common to both said circuits.

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