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## (54) Heating apparatus.

(57) Heating apparatus has a fuel injection device (10) arranged to discharge fuel into a combustion region for combustion by a burner. Means (8) are provided to supply fuel in a liquid state under pressure to a gasifying device (9) from which fuel is supplied to the injection device (10) in a state such that it emerges into the combustion region in a substantially gasified state. Igniter means (11) is provided to ignite the gasified fuel for burning in the combustion region. The gasified fuel may be mixed with another fuel prior to ignition by the igniter means.

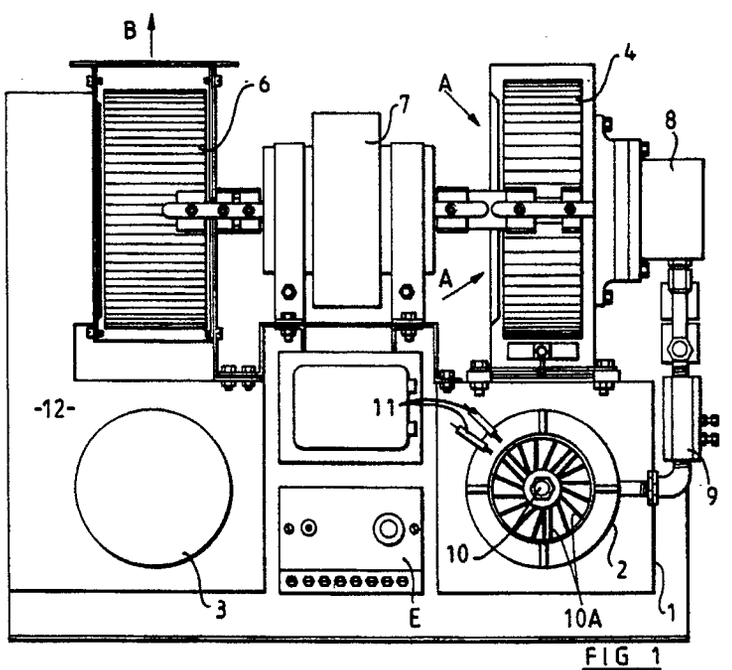


FIG 1

EP 0 410 707 A2

# HEATING APPARATUS

This invention relates to heating apparatus and is particularly concerned with a space heater useful for heating large spaces, such as factory interiors.

According to the invention, heating apparatus comprises a fuel injection device arranged to discharge fuel into a combustion region for combustion by a burner, means operable to supply fuel in a liquid state under pressure to a gasifying means from which the fuel is supplied to the injection device in a state such that it emerges into the combustion region in a substantially gasified state, and igniter means operable to ignite the gasified fuel for burning in the combustion region.

Preferably, the gasifying means is a heater for raising the temperature of the fuel to a value at which the fuel emerges from the injection device in a substantially gasified state.

The burner is preferably provided with a plurality of burner nozzles to which distinct fuel supplies are connected, in use, one nozzle being connected to said gasified fuel supply. The other nozzle may be connected to a separate gas supply, enabling either or both of said supplies to be used, as required.

In a preferred arrangement, flow means are provided to produce a flow of external air into the combustion region.

In one typical arrangement, the combustion region is formed adjacent the inlet end of an elongate combustion conduit, from the outlet end of which heated air and combustion products are expelled by a first flow means, further flow means being provided adjacent said outlet end and being operable to enhance gas flow along the conduit from the inlet end to the outlet end.

Preferably, both of the flow means, and conveniently also the fuel supply means, typically a pump, are driven from a single motive device which may conveniently be an electric motor.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is an end view of one form of space heating apparatus of the invention;

Figure 2 is a side view of the apparatus of Figure 1;

Figure 3 illustrates an alternative form of space heating apparatus incorporating alternative fuel supplies, and

Figure 4 illustrates, to an enlarged scale, one form of the burner used in the apparatus of the invention.

Referring to Figures 1 and 2, the space heating apparatus shown therein has a casing 1 which supports a generally U-shaped burner tube, of which the inlet end is illustrated at 2 and the outlet end at 3. Mounted on the upper part of the casing 1 is an air inlet fan 4 which draws in air as indicated by the arrows A, and expels it along a duct 5 connecting the fan to the inlet end 2 of the burner tube. The housing 1 also mounts an exhaust fan 6 connected by a duct 12 to the outlet end 3 of the burner tube and acting to draw exhaust gases towards the outlet 3.

The fans 4 and 6 are both connected to a single drive means in the form of an electric motor 7 disposed therebetween and mounted on the casing 1. Drive from the motor 7 is transmitted via the inlet fan 4 to a fuel pump 8 from which fuel oil is fed, in the illustrated arrangement, to a fuel heater 9 and thence to a burner injector nozzle 10. A pair of igniter electrodes 11 are disposed in the vicinity of the burner 10.

The sizes and operating characteristics of the fans 4 and 6 are chosen so that they provide the correct ratio between inlet air and exhaust gas flow when driven at the same speed by the motor 7. It would, however be possible to drive the fans at different speeds, using suitable gear transmissions, or to provide suitable throttling means for the fans which may be adjustable to enable the flow rate ratio to be varied. Similarly, the pump 8 is such as to provide a suitable flow rate at a desired pressure when driven at the same speed as the fans from a common drive shaft, as in the illustrated arrangement It would, however be possible to drive the pump via a gear transmission which may provide a variable ratio.

Oil fed to the heater 9 is heated to raise its temperature above atmospheric boiling point and the feed pressure produced by the pump 8 is chosen so that the heated oil emerging from the burner nozzle 10 vaporises as it enters the combustion tube. The fan 4 produces sufficient air flow to provide a combustible mixture when mixed with the gasified fuel and the combustible mixture is ignited by the electrodes 11. Swirl inducing vanes 10A are provided prior to the electrodes in conventional manner. Once ignited, the combustion becomes self sustaining and the function of the electrodes is then changed so that they become conducting probes which provide a continuous check on the existence and/or nature of the flame. The exhaust fan 6 draws the combustion products from the burner along the combustion tube and these are expelled, as indicated by the arrow B, either along a flue to atmosphere, or for re-direction into the inlet of the fan 4 or into a heat exchanger in which the heat may be recovered for further use. The heater operates under the control of an elec-

tronic control unit E.

Figure 3 illustrates an alternative form of space heater similar to that of Figures 1 and 2 but in which two distinct fuel supply sources feed fuel to respective burner nozzles 20A, 20B of the burner 20. The burner has the usual air inlet holes 20C and swirl inducing vanes 20D, to control the flame dimensions, in conventional manner. Liquid fuel, such as oil, is pumped from one source through a heater 9, similar to that in the previous embodiment, or other gasifying device and thence to the nozzle 20A which emits gasified fuel into an inlet 2 of a combustion conduit for ignition and monitoring by electrodes 11, as previously, exhaust gas being expelled through an outlet 3, as before. Inlet and exhaust fans may be employed as previously but are not illustrated in this embodiment. The other fuel is gas supplied via a pressure regulating valve 21 and an electrically controlled digital proportioning valve 22 to the other burner nozzle 20B. The valve 22 is similar in construction and operation to that described in our copending British application entitled "Flow Control Device", to which reference is made for a full description of the valve. It will be seen that either or both nozzles 20A, 20B may be supplied with fuel from the respective sources so that the two fuels may be burnt simultaneously, or the fuels may be employed alternatively depending upon the conditions. For example, it may be economically advantageous to use one fuel or the other over a particular period. It also enables a change to be made from one fuel to another in the event that supply difficulties occur with one of the fuels. It can be advantageous to supply the gasified fuel also via a proportioning valve, which may be similar to the valve 22. This enables a controlled mixture of fuels to be burnt with the proportions of the fuels fed to the respective burners each being variable between 0% and 100% depending upon requirements. It is possible to switch supplies remotely, using suitable electronic control apparatus, so that interruption of supply from one fuel source does not cause the shut down of the heater, as can happen in many conventional types of apparatus in which it is necessary to change burners when a change in fuel is required. Moreover, the aforesaid fuel proportioning may additionally or alternatively be subject to remote control from the aforesaid or another control apparatus.

It will be understood that the apparatus of the invention may take various forms other than those described above, such as boilers and process heaters. The liquid fuel may be gasified by means other than the heater described above for this purpose. Gasification may be effected, for example, by pressure reduction means, although it may then be necessary, for the achievement or satisfactory burning, to heat the gasified fuel prior to feeding it to the burner in order to replace the latent heat lost in the gasifying stage.

## Claims

1. Heating apparatus characterised by a fuel injection device (10, 20) arranged to discharge fuel into a combustion region for combustion by a burner, means (8) operable to supply fuel in a liquid state under pressure to a gasifying means (9) from which the fuel is supplied to the injection device in a state such that it emerges into the combustion region in a substantially gasified state, and igniter means (11) operable to ignite the gasified fuel for burning in the combustion region.

2. Heating apparatus according to Claim 1, characterised in that the gasifying means is a heater (9) for raising the temperature of the fuel to a value at which the fuel emerges from the injection device (10, 20) in a substantially gasified state.

3. Heating apparatus according to Claim 1 or Claim 2, characterised in that the burner (20) is provided with a plurality of burner nozzles (20A, 20B) to which distinct fuel supplies are connected in use, one nozzle (20A) being connected to the gasified fuel supply.

4. Heating apparatus according to Claim 3, characterised in that the other nozzle (20B) is connected to a separate gas supply.

5. Heating apparatus according to any one of the preceding claims, characterised in that flow means (4) are provided to produce a flow of external air into the combustion region.

6. Heating apparatus according to any one of claims 1 to 4, characterised in that the combustion region is adjacent the inlet end (2) of an elongate combustion conduit, from the outlet end (3) of which heated air and combustion products are expelled by a first flow means (4), further flow means (6) being provided adjacent said outlet end (3) and being operable to enhance gas flow along the conduit from the inlet end to the outlet end.

7. Heating apparatus according to Claim 6, characterised in that both of the flow means (4, 6) are driven from a single motive device (7).

8. Heating apparatus according to Claim 7, characterised in that the fuel supply means (8) is also driven from the same single motive device (7).

9. Heating apparatus according to Claim 6, wherein the first flow means (4) applies air under positive pressure into the inlet end (2) of the combustion conduit and the further flow means (6) draws gases from the outlet end (3) of the combustion conduit.

10. Heating apparatus according to any one of claims 3 to 9, characterised in that respective valve means (22) are provided for varying the proportions of the two fuels supplied to the injection device.

11. Heating apparatus according to Claim 10, characterised in that the valve means (22) are connected to a remote controller.

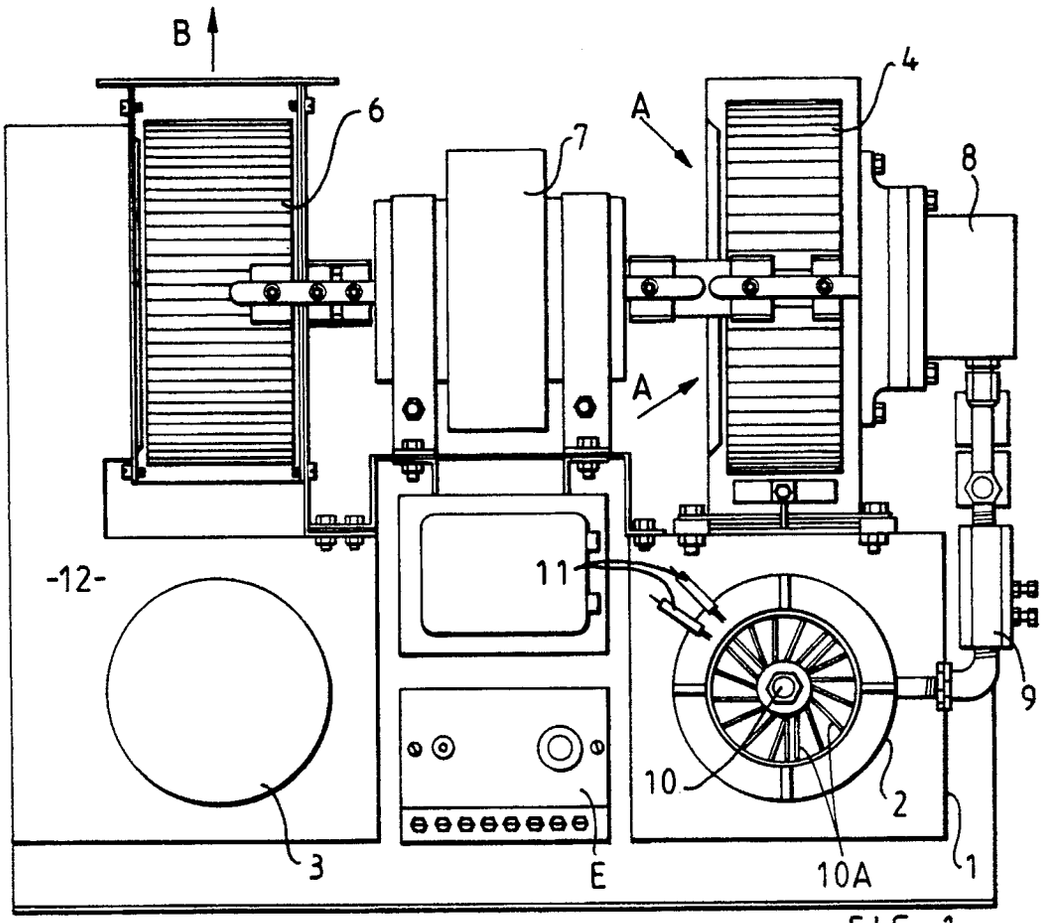


FIG 1

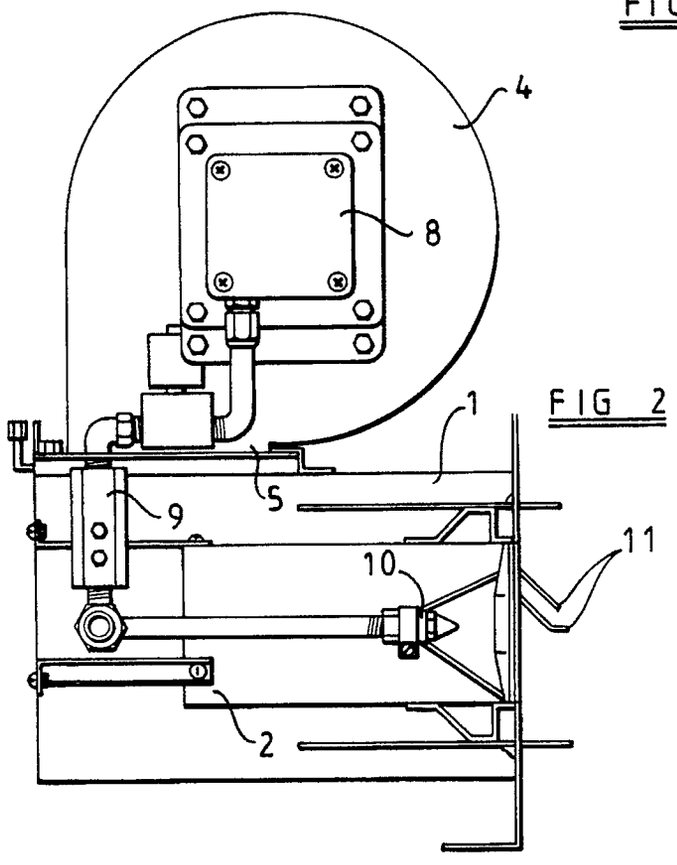


FIG 2

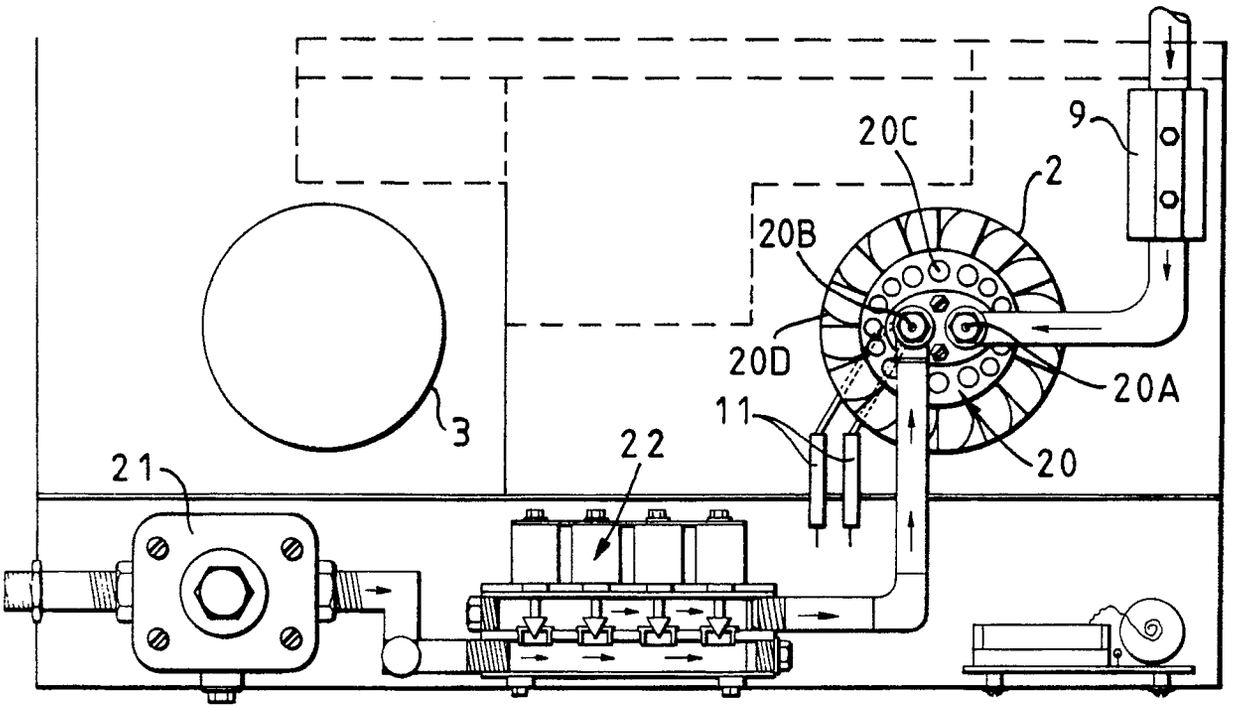


FIG 3

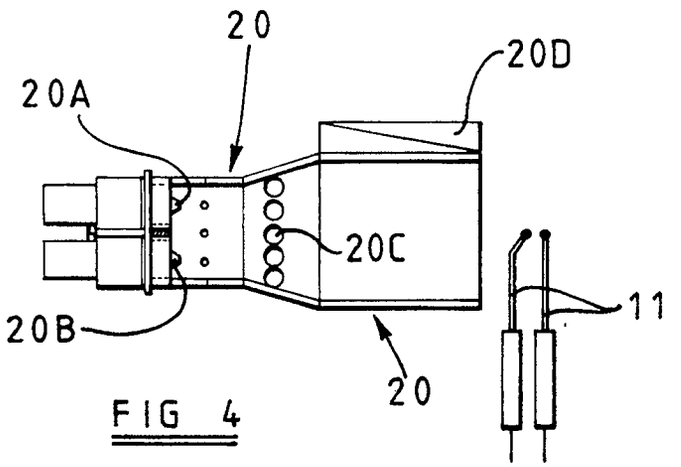


FIG 4