HEAT GENERATORS

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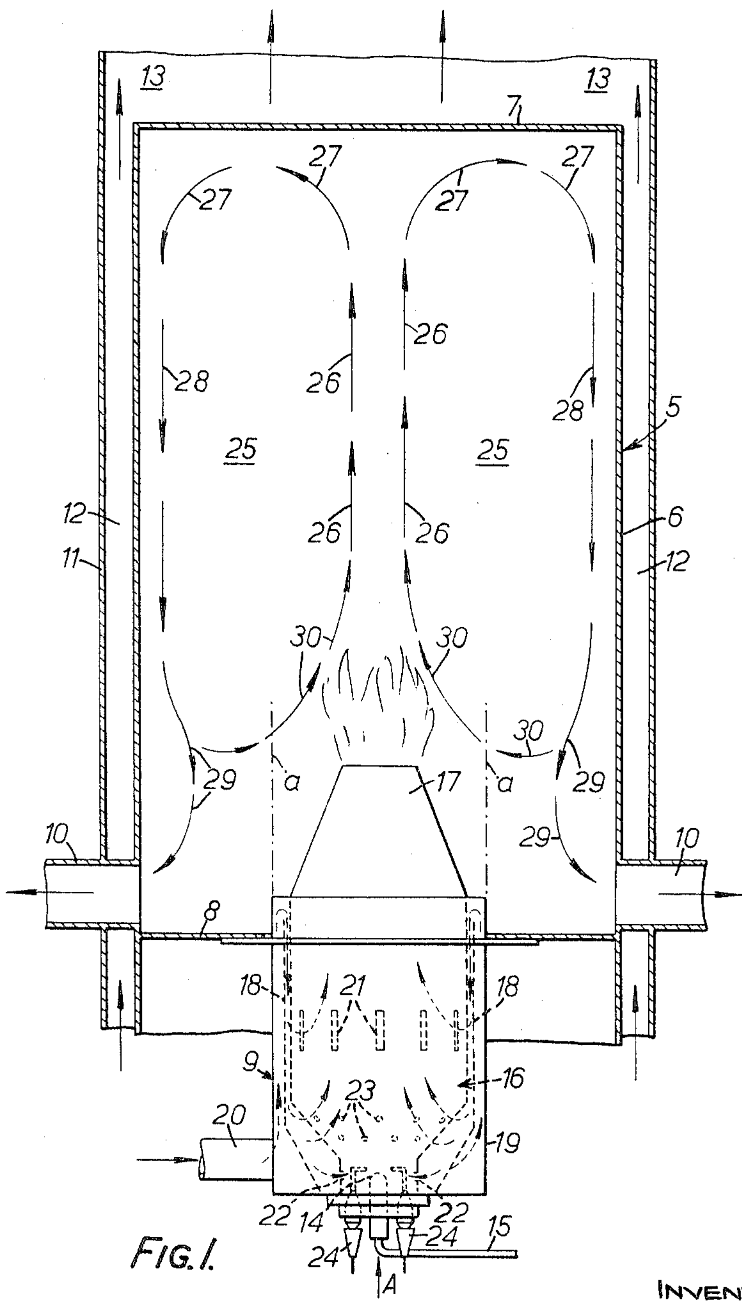

FIG. 1.

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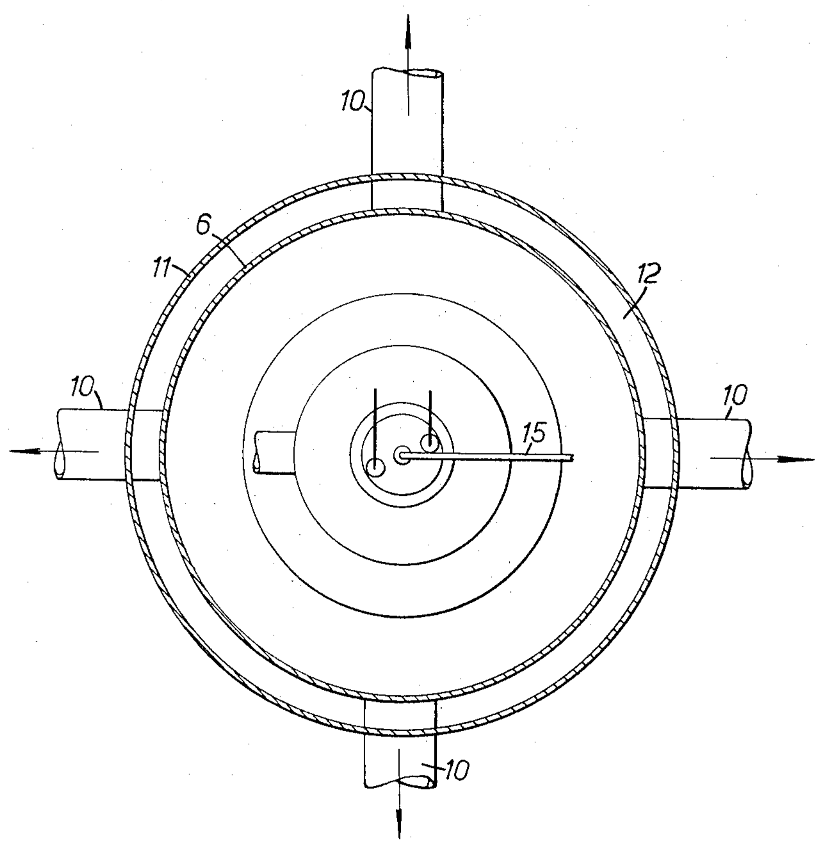

FIG.2.

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HEAT GENERATORS

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This invention concerns heat generators comprising a heat exchanger chamber and a liqoid or gaseous fuel burner, the heat developed in the chamber being used e.g. to heat air utilised for space heating in factories, offices, warehouses and so on.

According to this invention a heat generator comprises an elongated heat exchanger chamber having confronting end wall and a side wall therebetween which is substantially a surface of revolution about the longitudinal axis of the chamber, a liquid or gas burner carried substantially centrally of one end wall of the chamber and directed lengthwise thereof towards the opposite end wall, said burner being constructed and arranged to produce a flame which extends forwardly into the chamber and which is spaced substantially from the side wall of the chamber and ports in the chamber—for the discharge of combustion products—said ports being behind and radially outwardly of the flame whereby the hot gases are circulated within the chamber, firstly, as a stream lengthwise of the chamber and substantially centrally thereof towards said opposite end wall and, secondly, as a stream in the reverse direction over the side wall and past the flame towards the port, some of the second stream of gases being entrained as it passes the flame and being re-circulated, the remainder of the gases being discharged through the ports.

A practical application of the present invention is shown by way of example in the accompanying drawings of which FIG. 1 is a schematic sectional elevation of the heat generator and FIG. 2 is a view in the direction of the arrow A of FIG. 1.

For convenience the generator is assumed to be vertically disposed though of course it may be arranged in any other convienient way.

The heat exchanger chamber 5—5 which is preferably circular—comprises a side wall 6, a lower end wall 8 and an opposite, upper end wall 7. The lower end wall 8 carries an oil burner generally indicated at 9. A suitable gas burner may be used instead. Ports 10 are provided in the side wall 6 around the burner 9. The ports 10 are uniformly spaced around the combustion chamber (FIG. 2) and are provided for the discharge of combustion products as later more fully described. The ports 10 are referred to for convenience as exhaust ports.

The heat exchanger chamber is surrounded by a jacket 11 which provides an air space 12 around the chamber 5. Air is forced (e.g. by a fan—not shown) upwardly through space 12 between jacket 11 and heat exchanger chamber 5 thereby becoming heated. The jacket 11 surrounding chamber 5 constitutes the heat exchanger referred to above. This may be a primary heat exchanger, the air discharged at 13 and the combustion gases delivered through exhaust ports 10 being passed to a secondary heat exchanger, or in succession to several heat exchangers as required.

Referring now to the burner 9: the central axis of the burner coincides with the longitduinal axis of the chamber 5 (see FIG. 2). The burner 9 comprises an atomiser nozzel 14 supplied with fuel oil under pressure through pipe 15. Atomised fuel is sprayed upwardly into a combustion chamber 16 which is extended axially to form a flame discharge cone 17 constituting a neck means

which is convergent in the direction of flame propagation and projects to a limited extent into the heat exchanger chamber 5. A cylindrical casing 18 surrounds, and is spaced from, chamber 16 and is in turn surrounded, and spaced from, outer casing 19 of the burner 9. Combustion air delivered to the burner by pipe 20 passes upwardly around casing 18 and is then reverted to flow downwardly within casing 18. The downwardly-flowing air passes into chamber 16 through slots 21, 22 and holes 23. The air flowing within burner 9 as indicated is thus pre-heated before entering chamber 16. The slots 21, 22 impart rotation to the air passing therethrough, the air being rotated in opposite directions.

The burner 9 is fitted with electric igniters 24 which, in known manner, are connected to any convenient electric supply.

Air and fuel oil is supplied to the burner 9 to produce a flame which is substantially within the projected diameter *a*—*a* of burner 9, so that the maximum width of the flame within the heat exchanger chamber 5 is substantially equal to the width of the combustion chamber 16, and it is therefore spaced substantially from the side wall 6. Its axial extent forwardly of wall 8 is relatively short with the result that, for a relatively short heat exchanger chamber, as measured axially, and for a chamber of relatively small diameter, a relatively large air space 25 is provided around the flame. It is imperative for the satisfactory working of this invention that there is a relatively large space between the flame and the wall 6 and that the ports 10 are radially outwardly of the flame (i.e. radially outside the projected diameter *a*) and that they are behind the flame—as is apparent from FIG. 1. However, while it may be preferred that the flame be short axially this is not essential and in certain circumstances it may come very close to, or impinge upon, the end wall 7. In practice the flame width is approximately between one-third and one-half of the diameter of chamber 5.

In use: the hot gases flow with a relatively high local velocity caused at the flame discharge end of the cone 17 axially along chamber 5 and centrally thereof from the flame towards end wall 7. This is indicated by the arrows 26. Near wall 7 the gases are deflected outwardly (at 27) and return (as shown by arrows 28) along the side wall 6, constraining the axial stream from contact therewith. Around the flame the circulating stream of hot gases divides—some escape through ports 10 (arrows 29) and the remainer is entrained (arrow 30) by the flame due to the high local velocity adjacent the cone 17 and again flows in the direction of arrows 26. By this means a large quantity of the gases are continuously re-circulated so that the time during which the gases remain in the heat exchanger chamber is prolonged (and thereby greater use is made of the gases in heat exchange). The hottest gases form a central core extending axially of chamber 5 towards end wall 7. The relatively cooler gases sweep continuously over the side wall 6. These gases are at a temperature acceptable by the wall matterial and they form an annular blanket surrounding the central core and shielding the wall 6 from the core. There is no part of the chamber 5 exposed directly to the flame; the walls of the chamber are swept by gases at a relatively uniform temperature so that the walls are themselves at a uniform temperature and there is a high degree of heat transfer through the walls.

The flame and the hot gases therefrom are not permitted to pass directly to the exhaust ports—which reduces the duration of residence of the hot gases in the chamber and therefore prevents an optimum amount of heat being extracted from them in heat exchange. This result is achieved by arranging the ports in relation to the flame so that partial re-circulation is achieved.

The air flowing through space **12** passes around ports **10** before flowing over the wall **6**. Thus, the air at its lowest temperature is available to cool the ports **10**. Also, of course, the gases passing through the ports from chamber **5** have been cooled within the chamber and are not at an excessive temperature.

Any other suitable construction of burner may be used. For example, the burner may comprise an atomiser for liquid fuel and means for supplying a stream of air which rotates or swirls around the burner axis. The swirling stream of air and the fuel pass axially through the smaller-diameter end of a conical chamber having a cylindrical wall at its larger end to constrain the sideways spread of the flame.

We claim:

1. A heat generator comprising a heat exchanger chamber having confronting end walls and a side wall extending therebetween about a longitudinal axis of the chamber, a burner carried substantially centrally of one of said end walls of the heat exchanger chamber and directed lengthwise of such chamber towards the opposite end wall, said burner including a combustion chamber and wall means defining a flame discharge cone which forms an axial extension of the combustion chamber, which wall means is both internally and externally convergent towards the mouth of the cone in the direction of the flame propagation and projects to a limited extent into the heat exchanger chamber such as to produce a flame which extends forwardly from said mouth into the heat exchanger chamber and which is spaced substantially from the side wall thereof, and exhaust porting for the discharge of combustion products from the heat exchanger chamber located in the side wall adjacent said one end wall, the construction and arrangement being such that the hot combustion gases are circulated within

the heat exchanger chamber firstly as a stream lengthwise of the chamber and substantially centrally thereof from said mouth towards said opposite end wall and secondly as a stream in the reverse direction along said side wall and constraining the first stream from contact with the side wall, the second stream being caused to divide radially outwards of said cone and radially inwards of said porting with a substantial proportion becoming entrained radially inwardly into the first stream and the remainder flowing to a discharge through said porting.

2. A heat generator according to claim **1** wherein the maximum width of the flame within the heat exchanger chamber is substantially equal to the width of the combustion chamber, and such width is approximately between one-third and one-half of the width of the heat exchanger chamber.

References Cited by the Examiner

UNITED STATES PATENTS

1,666,367	4/1928	Clausing.	
2,072,048	2/1937	Leonard ____________	126—95
2,389,027	11/1945	Corbin et al.	
2,453,029	11/1948	Mills _______________	158—91
2,638,745	5/1953	Nathan __________	158—1.5 X
2,645,278	7/1953	Holthouse ________	126—110 X
2,993,479	7/1961	Thurley et al.	

FOREIGN PATENTS

876,161	8/1961	Great Britain.

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