July 19, 1927.

E. S. DREW ET AL

1,636,464

LIQUID FUEL BURNER

Filed July 24, 1926

Fig. 1.

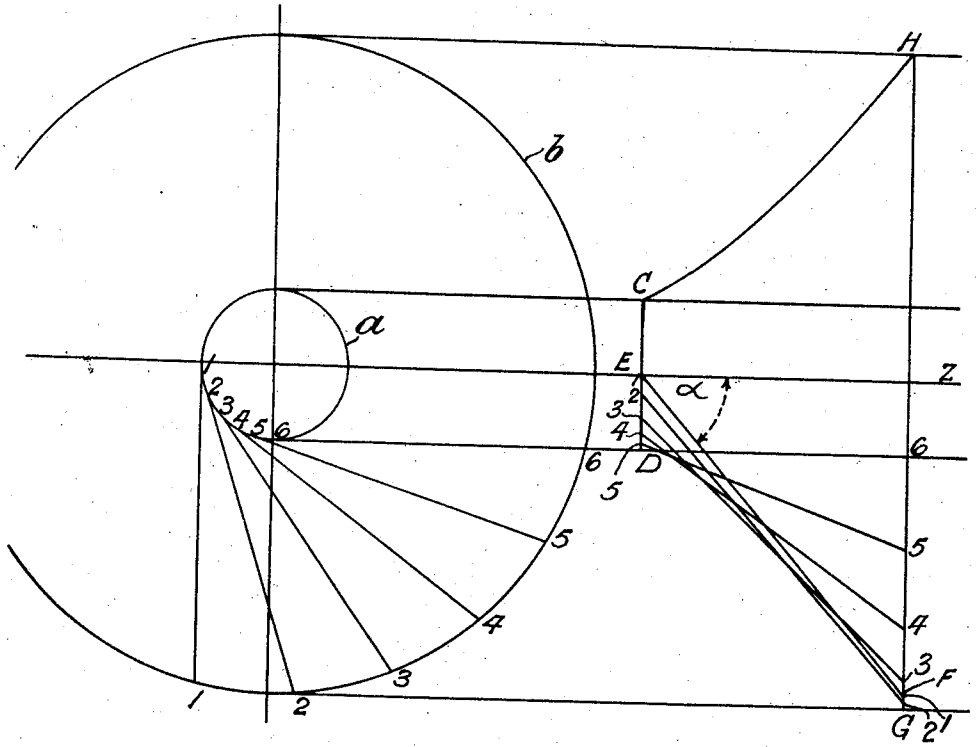


Fig. 3.

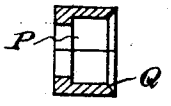
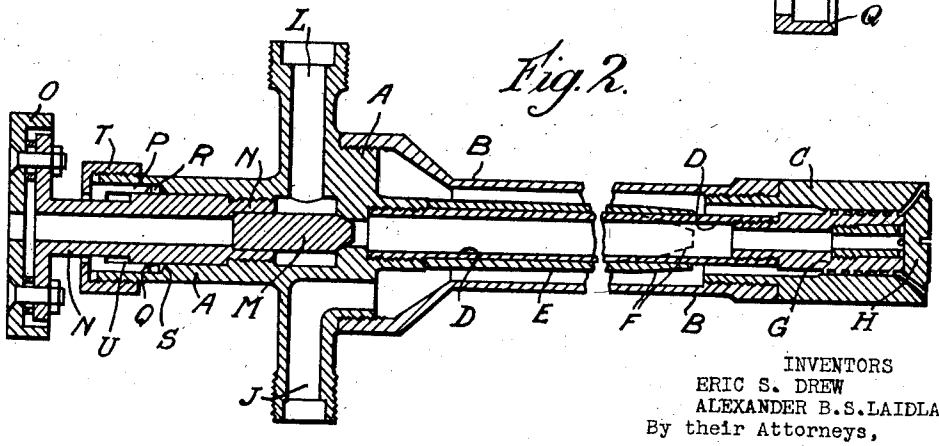


Fig. 2.



INVENTORS
ERIC S. DREW
ALEXANDER B.S.LAIDLAW,
By their Attorneys,

Baldwin & Wight.

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UNITED STATES PATENT OFFICE.

ERIC SUMMERS DREW, OF REGENTS PARK, LONDON, ENGLAND, AND ALEXANDER BANNATYNE STEWART LAIDLAW, OF BEECHWOOD, SKELMORLIE, SCOTLAND.

LIQUID-FUEL BURNER.

Application filed July 24, 1926, Serial No. 124,727, and in Great Britain August 4, 1925.

This invention principally relates to a method of controlling the shape of the flame produced by a burner similar to the one described in the British patent specification No. 219,378, accepted July 21, 1924.

The essential operative components are similar to those previously described in specification No. 219,378, the shape of the exit orifices being modified.

Figure 2 of specification No. 219,378 shows the ring *o* with a conical exit orifice, and the rear surface *i* of the screw *l* is also in the form of a cone.

According to this invention these two surfaces bound a hyperboloidal exit orifice, the generating lines of which bounding surfaces are tangential continuations of the screw thread of the swirler. The nature of the hyperboloid is determined by the degree of pitch of the helical grooves in the swirler. Air or steam passing down any one of the helical grooves on leaving the end of the swirler will have a motion in a straight line which is in a vertical transverse plane, tangential to the circular end of the swirler, and which in longitudinal plane at right angles thereto, makes an angle α with the axis of the swirler, the angle α being determined by the pitch of the grooves; for a long pitch the angle α is small and for a short pitch the angle α is large.

Where d is the diameter of the swirler and p is the pitch

$$\tan \alpha = \frac{\pi d}{p}$$

hence α may be found.

The hyperboloid bounding the edges of the exit orifice of the ring and the rear surface of the screw above mentioned may now be determined as follows:—

Referring to Figure 1 of the accompanying drawings, describe two circles *a* and *b* respectively representing the diameter of the swirler and the diameter of the mouth of the ring. Draw C D=the diameter of *a* and from its centre point E set out E F making angle Z E F=α, cutting the projection of the vertical tangent to circle *a* in F. Draw G H parallel to C D through F. Set out other tangents to circle *a* from points 2, 3, 4, etc., and project their extremities onto the straight lines C D and G H. The lines which join the respective projected points are tangents to the required curve. These lines are tangents to the required curve.

From the foregoing it will be seen that the shape of this curve depends entirely (1) on the diameter of the swirler, (2) on the pitch of the grooves.

When this pitch is long the resultant flame becomes long and narrow and as this pitch is shortened the flame becomes broader and shorter until with a very short pitch the flame is nearly a disk. But unless the exit orifices be curved as described above the shape of the flame is interfered with by eddying of the oil mist, previous to ignition.

In this burner the fuel can be atomized by either air or steam.

Figure 2 is a longitudinal section of a burner, and Figure 3 is a section of a split sleeve in the burner.

Referring to Figure 2, A is the body of the burner to which is screwed a casing B forming an outer wall of the air or steam passage and in the end of the casing B is screwed a nozzle C. To the body A is screwed a tube D forming the oil supply tube, on the outside of which is a heat insulating tube E which is held in position by spring tongues F. To the end of the tube D is screwed an air swirler G in whose end is also screwed a screw H, the co-acting surfaces of the nozzle C and the screw H being of the form set out above. The air or steam is supplied through a passage J controlled by a cock, and oil is supplied through the passage L controlled by needle M. The seating for needle M is preferably curved or is a circular edge in order to allow of needles of different tapers being employed.

The spindle N of the needle M screws into the valve body and terminates at the heat insulated wheel O. The spindle N is packed by means of an axially split sleeve P having an inner conical surface Q which when the valve is screwed home compresses a ring of packing R between the surface Q and a similar coned surface S on the valve body.

The sleeve P is secured in position by flanged nut T which screws on to the valve body whilst on the sleeve is a flange which engages with a shoulder U on the spindle N, the parts being so arranged that the spindle N is prevented from being unscrewed too great a distance.

It has been found that results approximat-

ing to the results obtained when a swirler and a hyperboloidal orifice are used, are obtained when the swirler is dispensed with, that is to say, that the exit orifice is formed as above described, although as there is no actual swirler the two bounding surfaces of the orifice have as generating lines tangential continuations of an imaginary screw of the swirler, that is to say, the bounding surfaces are substantially geometrically similar hyperboloids determined by the required shape of the flame. For example, if a flame is produced with 45° angled grooves of the swirler, this would be approximately produced by cutting the exit orifice to curves corresponding to the 45° angle but cutting no grooves whatever in the swirler.

What we claim is:—

1. A burner comprising two coaxial passages, one for supplying oil and the other for supplying a combustion supporting agent in a helical path, and a hyperboloidal exit orifice whose bounding surfaces bear a definite relation to the pitch of said helical path.

2. A burner comprising two coaxial passages and a hyperboloidal exit orifice which is bounded by surfaces which are substantially similar hyperboloids.

3. A burner comprising two coaxial passages, a swirler having helical grooves forming screw threads in one of said passages, and a hyperboloidal exit orifice, the surfaces bounding which have as generating lines tangential continuations of the screw threads of the swirler.

4. A burner comprising an oil supply passage, a coaxial passage adapted to supply a combustion supporting agent, a screw threaded swirler, and a hyperboloidal exit orifice, the surfaces bounding which have as generating lines tangential continuations of the screw thread of the swirler.

5. A burner comprising an oil supply passage, a coaxial passage adapted to supply a combustion supporting agent, and a hyperboloidal exit orifice the bounding surfaces of which are substantially similar hyperboloids.

6. A burner comprising a body, a tubular casing screwed to the body, a nozzle screwed to the end of the casing, a tube screwed to the body coaxial with and within the casing, a swirler screwed to the end of the tube, and a screw at the end of the swirler, the coacting surfaces of the nozzle and screw being substantially similar hyperboloids.

In testimony that we claim the foregoing as our invention, we have signed our names this 7th day of July, 1926.

ERIC SUMMERS DREW.
ALEXANDER BANNATYNE STEWART LAIDLAW.