No. 795,200. PATENTED JULY 18, 1905.

W. CUNNINGHAM.

APPARATUS APPLICABLE FOR BURNING LIQUID FUEL.

APPLICATION FILED JUNE 3, 1904.

2 SHEETS—SHEET 1.

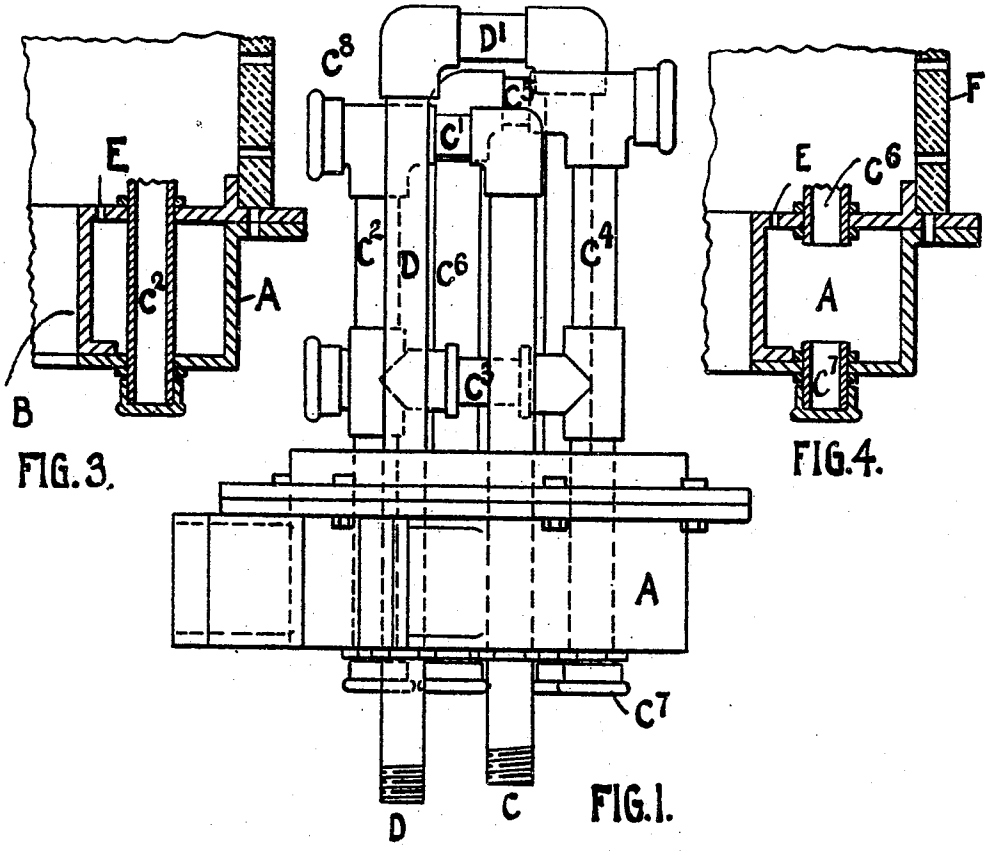
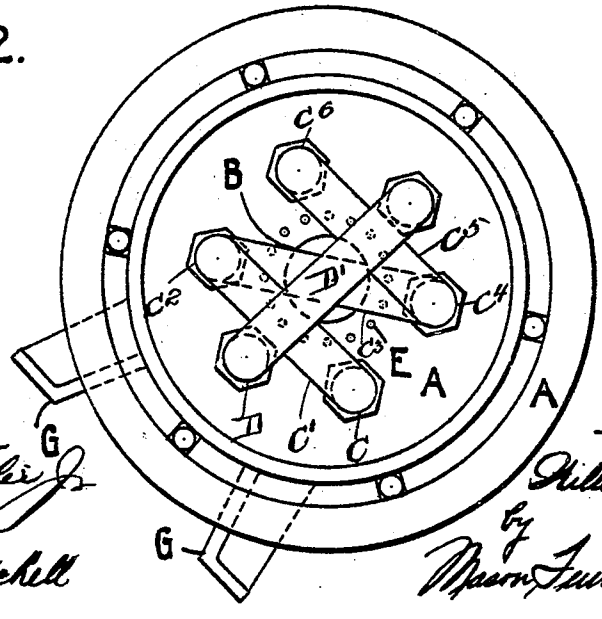


FIG. 1.

FIG. 3.

FIG. 4.

FIG. 2.



Witnesses

J. M. Fowler Jr.

Ruth J. Mitchell

Inventor

William Cunningham,

by Mason, Fenwick & Lawrence

Atty's.

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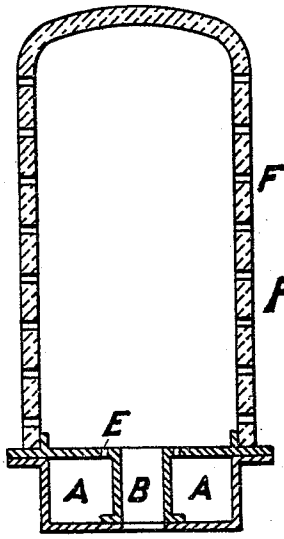

FIG. 6.

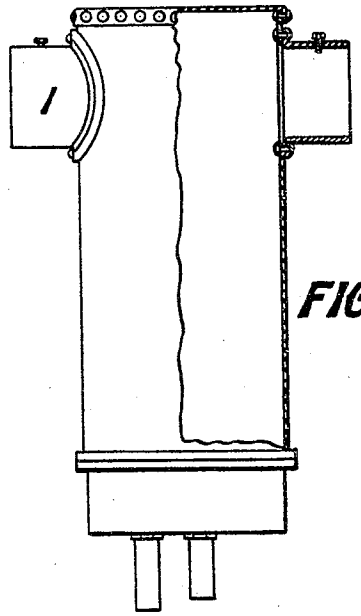

FIG. 5.

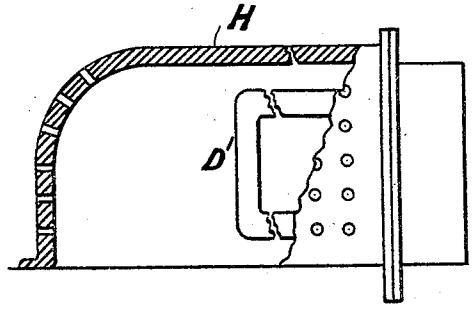

FIG. 7.

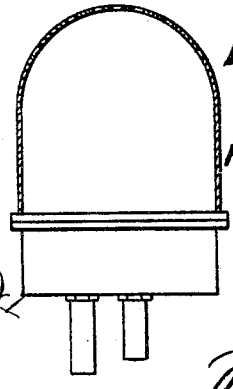

FIG. 8.

Witnesses

J. M. Fowler Jr.

Paul J. Mitchell

Inventor

William Cunningham,

by Mason, Fenwick & Lawrence

Attys.

No. 795,200. Patented July 18, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM CUNNINGHAM, OF BIRKENHEAD, ENGLAND.

APPARATUS APPLICABLE FOR BURNING LIQUID FUEL.

SPECIFICATION forming part of Letters Patent No. 795,200, dated July 18, 1905.

Application filed June 3, 1904. Serial No. 211,021.

To all whom it may concern:

Be it known that I, WILLIAM CUNNINGHAM, foreman iron-molder, a subject of the King of Great Britain, and a resident of Birkenhead, in the county of Chester, England, (whose post-office address is 14 Cavendish street, Birkenhead aforesaid,) have invented certain new and useful Improvements in Apparatus Applicable for Burning Liquid Fuel, (for which application has been made in Great Britain, No. 25,706, and dated November 25, 1903,) of which the following is a specification.

This invention has for its object an apparatus for burning liquid fuel in marine or land boilers and for heating and lighting purposes generally.

Referring to the drawings, Figure 1 is a plan view of my apparatus as applied to the heating of boilers; Fig. 2, an end view of the same; Fig. 3, a small detail showing the culde-sac and arrangement of end for the cleaning out; Fig. 4, a small detail showing arrangement of end for cleaning it; Fig. 5, an elevation, partly in section, of the device when used for the purpose of heating molds; Fig. 6, a sectional view of casing and base of device shown in Fig. 1, omitting the tubes and the holes for the same; Fig. 7, an elevation, partly in section, of arrangement for heating boilers when my device is placed on the fire-bars; and Fig. 8, an elevation of face with section of casing as applied to lighting purposes.

Like letters relate to like parts on all the drawings; but, referring first to Figs. 1, 2, 3, and 4, A is a whole base, preferably an annular cylinder, but it can be of other forms. This has a central opening forming an admission B for outside air through the base at the center of the annulus or in a central position in other forms. Oil or liquid is passed up through a primary pipe C, which preferably passes through the annulus and extending out any required distance. It is joined at the end to another pipe at right angles C' and this to another, C^2, at right angles to C', the junction having a cap C^8 for cleaning purposes. C^2 is preferably screwed into the base, but is plugged at the end, as set forth in Fig. 3. It is brought through the base in this way, so as to more easily clean it. In the same way the pipe C^2 is connected by a pipe C^3 to a second vertical pipe C^4, also preferably brought through the base in the same manner as C^2 and for cleaning purposes. This pipe is connected by a junction with a cleaning-piece to a horizontal pipe C^5 and this again in a similar manner to a pipe C^6, which passes into the annular mixing-chamber, as shown in Fig. 4. There is preferably below it a short pipe C^7, with a plug-head for cleaning purposes. Air under pressure or otherwise is passed by an auxiliary pipe D to a horizontal pipe D' and thence down into the annular chamber A in the manner shown as regards C^6 in Fig. 4. All round the center hole B are a series of air-orifices E. (Shown more clearly in Figs. 3 and 4.) F is a perforated casing, of fire-clay or equivalent material. (Set forth best in Fig. 6.) The mode of action in these figures is as follows: There being a plenum of gaseous matter, as hereinafter described, in the annular chamber A, this passes out in little streams at E all round the central orifice B. They are ignited at this point. Air passing up B completes the combustion and drives the products of combustion out through the casing F into the furnace. The casing is rapidly made red-hot. The oil passing up the tube C and circling round finally escapes as gas into the chamber A. Air also driven up the pipe D also finally escapes as hot air into the chamber A. The air and gas uniting are driven out through the orifices E, where they catch fire and burn, the combustion being completed to a considerable extent outside the casing E. If any of the tubes get dirty, the plugs C^8 C^7, &c., are taken off and the pipes scraped. The device can be fixed in any position or can be turned round so as to stand on the two brackets G G. Access to the casing C can either be horizontal, vertical, or in any other position. Sometimes, however, it is desired to put one or more of these burners on the top of an ordinary set of bars or a pervious or impervious floor or grate. In this case the burner is placed on its side, and instead of a cylindrical casing, as E in Fig. 6, I have a semi-

cylindrical or other equivalent shaped casing H, as set forth in Fig. 7. In this case only one of the pipes is shown, D′, and that only diagrammatically.

Fig. 5 shows my device when applied to heating molds. In this case in place of the casing F, I prefer to have an impervious casing of sheet-iron, with two or more short branches from it, I, on each side. This device is pushed up into the mold, and the gas and air tubes being connected and the apparatus lighted a strong current of products of combustion passes into the mold and gradually escapes at the bottom of the mold, drying the same.

In Fig. 8 my device is applied for lighting purposes. In this case a mantle or other incandescible material can be placed over the apertures of a metallic casing K, or a mantle in the shape of K can be used. In such case the pressure of air on the air-pipe should not be greater than the mantle can stand. Similarly, the oil should be regulated so as to supply an amount relative to the air, so that the products of combustion shall be almost entirely H_2O, CO_2, and the neutral gases of the atmosphere.

In fixing my apparatus into marine boilers only the tubes and the casing project into the fire-box, the burner preferably resting on an angle-iron bar fastened across the fire-box. In this case the fire-box is made practically air-tight, so that no air or gaseous matter shall pass through into it except through the burners. No fire-bars are therefore required, unless, indeed, the plan set forth in Fig. 7 is used. The connection to the air and oil pipes is preferably made by flexible pipes, so that the burners can be easily taken out. With heating I arrange the sizes of the orifices so that were it not for the central orifice carbonic oxid would be chiefly formed by the combustion of the oil-gas. The air, however, entering through the central orifice completes the combustion. In gas-lighting if no incandescent material be used I prefer to make a very incomplete combustion in the burner, the main combustion being effected outside the casing. Where, however, incandescent material is used, the orifices are so arranged that the mixture of gases passing through the mantle shall be practically equivalent to H_2O and CO_2 and the neutral gases of the atmosphere.

I claim as my invention—

1. In a device of the character described, the combination of an annular cylinder, a plurality of communicating parallel approximately U-shaped pipes secured upon and communicating with the mixing-compartment formed in said cylinder and forming a vaporizer, a pipe connecting said parallel pipes intermediate of their ends and forming communication therewith, and an approximately U-shaped pipe secured in a transverse position to said parallel pipes upon said cylinder and communicating with and adapted to direct a combustion-supporting medium to the mixing-compartment formed therein in the cylinder.

2. A device of the character described, comprising a cylinder having an annular mixing-compartment, a primary fuel-pipe comprising approximately U-shaped sections and communicating at one of its ends with the compartment formed in said cylinder and having its opposite end extending through and beyond the outer surface of said cylinder, an approximately U-shaped auxiliary air-pipe extending transversely of said primary pipe and positioned upon said cylinder, said auxiliary pipe communicating at one end with the compartment formed in said cylinder and having its opposite end projecting through said cylinder and beyond the outer surface thereof, and means formed upon said cylinder for permitting of the discharge of vapors therefrom.

3. In a device of the character described, the combination with a cylinder having an annular mixing-compartment, of a fuel-pipe extending through the same and having one end communicating with the compartment in the cylinder and its opposite end communicating with the exterior, said cylinder provided with a removable cap or the like positioned upon the same opposite the end of the fuel-pipe communicating with the compartment, a removable cap or the like positioned upon said pipe intermediate its ends, and an auxiliary air-pipe extending entirely through said cylinder and communicating near its opposite end with the compartment formed therein, and said auxiliary pipe provided with a removable cap or the like carried by the end communicating with the compartment of the cylinder.

4. In a device of the character described, the combination with a casing provided with a mixing-compartment, of a plurality of communicating, approximately U-shaped pipes positioned upon said casing and communicating with the compartment formed therein, each of said fuel-pipes provided with a removable cap or the like secured thereon intermediate their length, a removable cap or the like positioned upon one end of each of said pipes, and an auxiliary air-pipe secured upon the casing partly inclosing said approximately U-shaped pipes and communicating with the compartment formed in said casing.

5. In a device of the character described, the combination of a casing provided with a mixing-compartment and an approximately central passage, said casing having a plurality of apertures formed near said passage, a plurality of parallel bent fuel-pipes positioned upon said casing and communicating with the compartment formed therein, and a transverse bent air-pipe secured to said casing and partly inclosing said parallel pipes, said transverse pipe communicating with the compartment formed in said casing.

6. In a device of the character described, the

combination of an annular cylinder having a central passage, said cylinder provided with apertures formed therein near said passage, a curved, primary fuel-pipe extending through said cylinder and communicating with the compartment formed therein near its opposite end, an auxiliary curved air-pipe positioned upon said casing at right angles to said primary pipe, said pipes having openings, removable means mounted upon each of said pipes and closing said openings, and a removable casing positioned upon said cylinder and inclosing said pipes.

7. A device of the character described, comprising a casing provided with a mixing-compartment, a plurality of curved fuel-pipes positioned upon said casing and communicating with one another, one of said pipes opening into the compartment of said casing and another of said pipes extending through and beyond the outer surface of said casing, an air-pipe secured to and communicating with said casing, and a mantle positioned over said pipes and carried by said casing.

8. A device of the character described, comprising a casing provided with a mixing-compartment having a central passage extending therethrough, said casing having a plurality of apertures formed therein around the central passage, a curved fuel-pipe positioned upon said casing contiguous to said central opening and communicating with the compartment formed therein, an auxiliary curved air-pipe positioned upon said casing and at an angle to said primary pipe and communicating with the compartment formed in the same, the said pipes having exterior openings and removable means positioned upon and closing the exterior openings thereof.

9. A device of the character described, comprising an annular cylinder, a plurality of parallel curved fuel-pipes positioned upon and communicating with the compartment formed in said cylinder, a pipe secured at right angles to and providing communication between said parallel pipes, a pipe positioned around and partly inclosing said parallel pipes, said air-pipe secured to and communicating with the compartment formed in said cylinder, said pipes having openings, removable means positioned upon the pipes for closing said openings, and means formed upon said cylinder for permitting of the discharge of vapors between said air-pipes.

10. A device of the character described, comprising a casing provided with a mixing-compartment and an approximately central opening extending therethrough, said casing having a plurality of apertures formed near said opening, air and oil pipes positioned upon and extending entirely through said casing, and communicating near one end thereof with the compartment formed within said casing, said pipes having openings formed therein intermediate their lengths, and removable means positioned upon said pipes for closing said openings and also one of their ends.

11. In a device of the character described, the combination with a casing provided with a mixing-compartment, of a plurality of approximately **U**-shaped primary fuel-pipes positioned upon communicating with the compartment formed in said casing, a connecting-pipe secured to said pipes intermediate their length and providing communication therebetween, an approximately **U**-shaped air-pipe positioned around said primary pipes and secured to and communicating with the compartment formed in said casing, and a removable perforated mantle positioned upon said casing and inclosing said **U**-shaped pipes.

In witness whereof I have hereunto signed my name, this 24th day of May, 1904, in the presence of two subscribing witnesses.

WILLIAM CUNNINGHAM.

Witnesses:

G. C. DYMOND,

J. MCLACHLAN.