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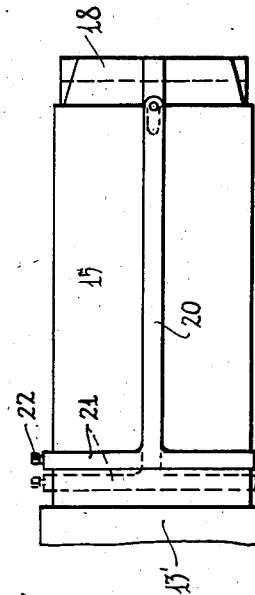
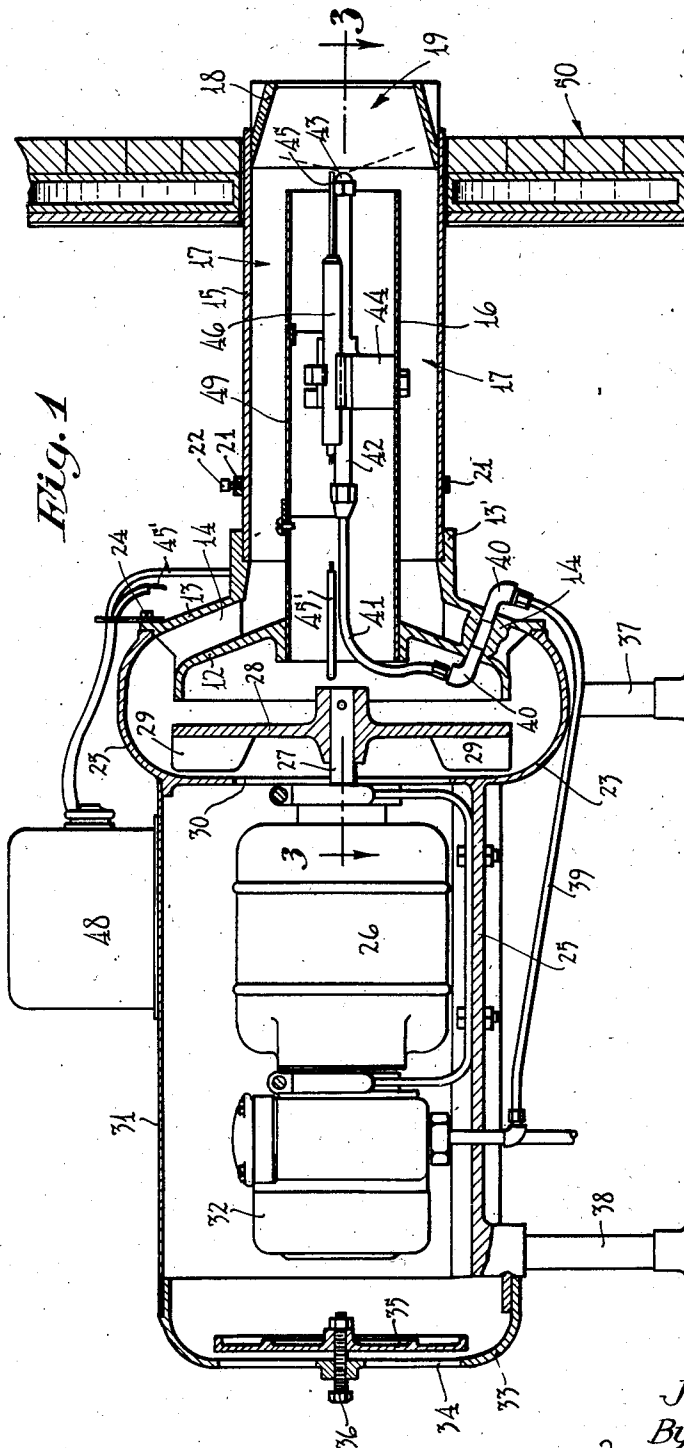
J. P. SCHWARTZ

2,292,664

OIL BURNER

Filed March 21, 1940

3 Sheets-Sheet 1



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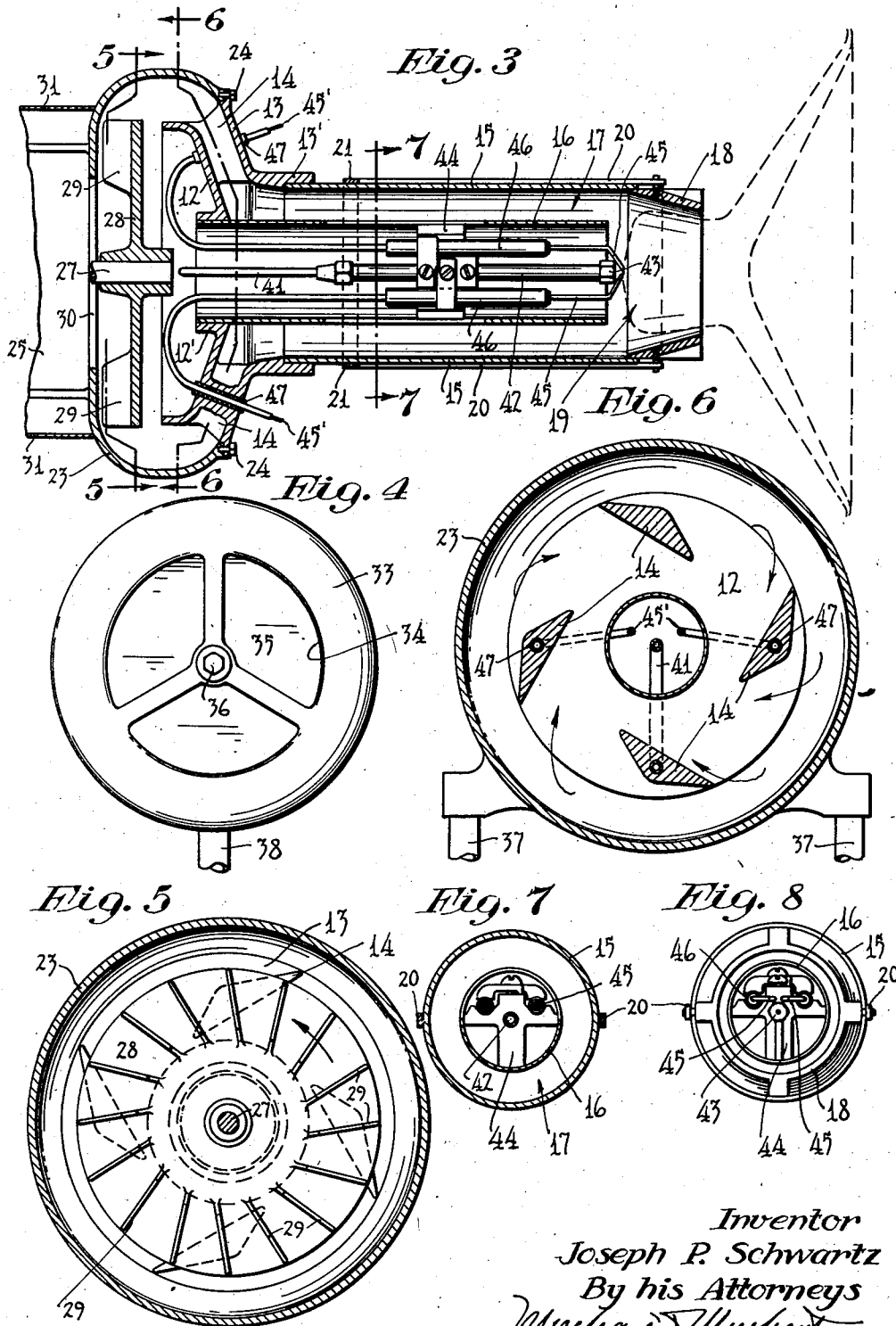
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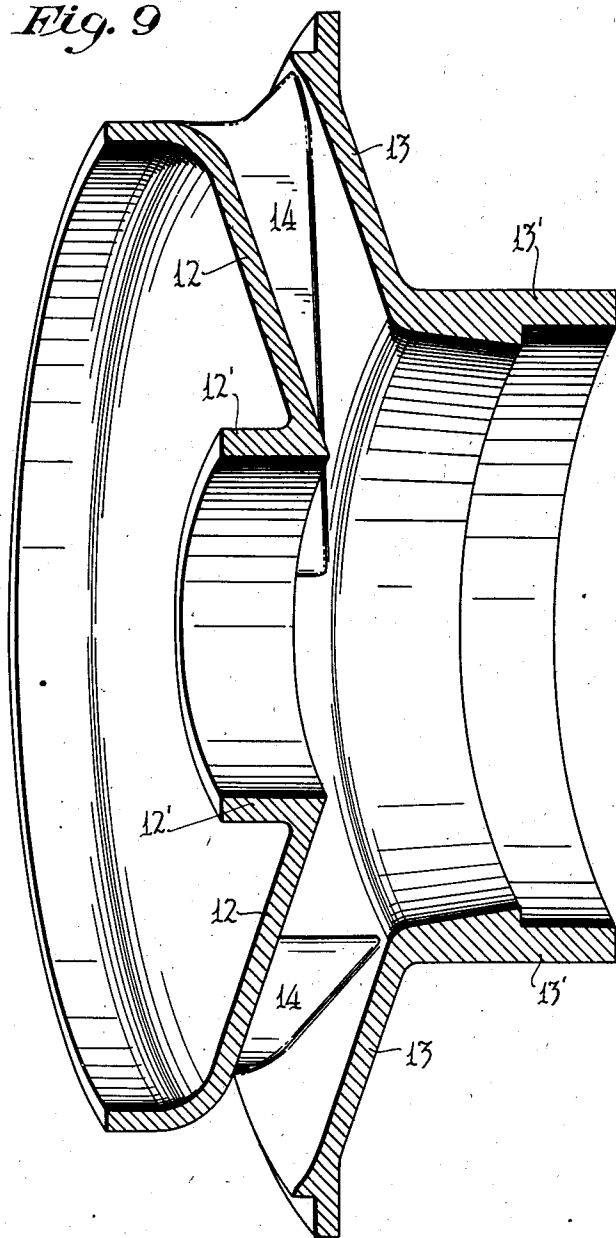
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Fig. 9



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UNITED STATES PATENT OFFICE

2,292,664

OIL BURNER

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2 Claims. (Cl. 158-76)

My invention provides an improved and highly efficient oil burner adapted to burn not only volatile but very heavy and low-grade hydro-carbon oils, such as crude oil. Generally stated, the invention consists of the novel devices, combinations of devices and arrangement of parts, and of an improved method or process, whereby the objects above generally stated are accomplished.

As a salient feature of the invention, the air, for supporting the combustion of the hydro-carbon fluid, is caused to travel spirally in the form of a hollow cylinder or tube and the oil or hydro-carbon fluid is projected radially outward from the axis of the air cylinder and against the inner surface of the spirally rotating air. In this way the hydro-carbon and air are thoroughly commingled with a body of air that has a relatively slow axial movement, but has a relatively high angular velocity. This commingling of the air and hydro-carbon is caused to take place within a relatively closed portion of the commingling chamber of the burner and before the commingled hydro-carbon and air are projected into the furnace. By this briefly indicated arrangement and operation, the initial combustion will cause gasification of the hydro-carbon within the burner, and the completion of the combustion within the furnace.

From the improved arrangement various other highly important actions are caused to take place; but these are a matter that will be more readily understood after having first described a commercial form of the improved burner illustrated in the accompanying drawings.

Referring to the drawings, wherein like characters indicate like parts throughout the several views:

Fig. 1 is a vertical axial section taken through the complete burner and showing the same positioned to discharge into the furnace;

Fig. 2 is a fragmentary plan view showing the discharge or delivery end portion of the burner;

Fig. 3 is a horizontal section taken approximately on the line 3-3 of Fig. 1;

Fig. 4 is an end elevation looking at the burner from the rear end of Fig. 1;

Fig. 5 is a transverse section taken on the irregular line 5-5 of Fig. 3, looking at the same from the left toward the right in respect to said view;

Fig. 6 is a transverse section taken on the irregular line 6-6 of Fig. 3, looking at the same from the left toward the right in respect to said view;

Fig. 7 is a transverse section taken on the line 7-7 of Fig. 3;

Fig. 8 is a view in elevation looking at the delivery end of the burner and in a direction from the right toward the left in respect to Figs. 1 and 3; and

Fig. 9 is an enlarged perspective showing the so-called spinner head of the burner, which constitutes an important feature of the invention.

The spinner head is made up of a pair of dished or bowl-like members 12 and 13 that are tied together and spaced by circumferentially spaced deflecting blades 14 preferably cast integral therewith forming a structure, the details of which are best illustrated in Fig. 9. For an important purpose, hereinafter to be more fully disclosed, the deflecting blades 14, as best shown in Fig. 6, are oblique to lines radiating from the axis of the spinner head or, otherwise stated, are tangential to an imaginary circle drawn about midway between the axis and the perimeter of the spinner head so that, as will hereinafter more fully appear, they will act upon the air delivered thereto to set up a whirling or spiral movement of the air. Preferably, as shown, these deflecting blades have thickened central portions so that wire conduits and a fluid delivery pipe may be extended therethrough.

The said inner and outer sections 12 and 13 are provided, respectively, with hub portions 12' and 13'. A relatively large outer air tube 15 is secured to and projects from the hub 13', and a core, in the form of an inner tube 16, is secured to the hub 12' and extends into the outer tube 15 but is spaced therefrom to form an annular air channel 17 that leads from the space between the two sections 12 and 13. The inner tube 16 terminates short of or inward of the delivery end of the tube 15 to afford an initial combustion chamber within the burner proper. The outer tube 15 is provided with an annular firing head or ring 18 that extends to the tube 15 and affords at least a part of an initial combustion chamber 19 just outward of the adjacent end of inner tube 16. Preferably, this head or ring 18 is outwardly contracted and its inner end is telescoped into the tube 15. Moreover, this head or ring 18 is made axially adjustable preferably by means of thrust rods or straps 20 connected to a ring 21 that surrounds the tube 15 and is adjustably held by a set-screw 22 or the like.

For delivering air into the air space between the inner and outer shells 12 and 13 of the spinner head, I provide a fan head and casing together with motor means for operating the fan

and certain other devices. The fan casing indicated by the numeral 23, in radial section is concavo-convex and the edge of the extended wall thereof is rigidly but detachably secured to the outer shell 13 by suitable means, such as machine screws 24. In the preferred arrangement this fan casing is cast integral or otherwise rigidly secured to an extended base 25 upon which is mounted an electric motor 26. The rotor shaft 27 of this motor carries the fan head, preferably made up of a disc 28 with circumferentially spaced blades 29. The disc 28 runs quite closely to the rear edge of the inner shell 12 and the blades 29 are on the receiving side of the fan head. The fan casing 23 which has a large axial air intake passage 30 and an approximately cylindrical housing 31 is secured on the base plate 25 and to the fan casing 23 and encloses the electric motor 26 and also an oil pump 32 which latter is driven in the well-known manner from the rotor of the motor. Air to the fan will be drawn through the casing 31 and around the motor and pump assisting in keeping the same cool. At its receiving end the casing 31 has a spider-like head 33 with an air intake passage 34 adapted to be opened and closed to a greater or less extent by a disc-like valve 35 shown as adjustably secured to the hub of the spider-like head by a screw 36.

The burner is shown as adapted to be supported by legs 37 and 38 depending, respectively, from the fan casing 23 and the rear end of the base 25.

The oil or hydro-carbon fuel is shown as supplied from the pump 32 through an oil delivery pipe, as shown, made up of sections 39, 40, 41 and 42, the latter of which terminates in a spraying head 43. The pipe section 40 is shown as extended through one of the deflecting blades 14. The oil pipe section 42 is axially located within the inner tube 16 and is rigidly secured to a bearing bracket 44 mounted on the interior of said tube 16. The spraying head 43 is located approximately at or just forward of the front end of the tube 16 and in the preferred arrangement has obliquely directed perforations that will cause the oil to be projected approximately on angles indicated by dotted lines on Fig. 1.

In this burner I have preferably employed ignition means including a pair of electrodes 45, the sparking points of which are located close to but just in advance of the spraying head or nozzle 43. These electrodes 45 are extended through insulating sleeves 46 secured to the bearing bracket 44. The wires 45' that lead to the said electrodes 45 are shown as extended outward through insulating sleeves 47 passed through certain of the deflecting blades 14. These wires 45' will lead to and from a high tension transformer 48 shown as mounted on the casing 31 and electrically charged by well-known means.

The outer tube 15 is telescoped into the hub 13' but is capable of being slid axially outward thereof to afford access to the interior of the tube 16; and to afford access to the electrodes, and the oil delivery tube or pipe, when the outer tube is thus slid forward, said inner tube is shown as provided with a removable section 49.

In Fig. 1 the numeral 50 indicates a furnace wall through which the delivery end of the burner is projected.

Operation

Under the action of the fan rotated in a counter-clockwise direction in respect to Fig. 5, or in a clockwise direction in respect to Fig. 6, the air

drawn through the casing and the air intake passage 30 will, by centrifugal force, be thrown against the concave surface of the fan casing 23 and will be directed into the channel formed between the shells 12 and 13 and will be thrown against the deflecting blades 14 and from thence will be forced through the tubular air channel 17. Under the action of the fan, in addition to forcing the air in the direction stated, the fan blast will initiate or start a whirling movement of the air and as the air comes into contact with the deflecting blades 14, this whirling motion of the air will be greatly increased so that the air passing through the tubular air channel 17 will travel a spiral course.

This spiral travel of the air will be at relatively high velocity but the forward advance movement of the air will be relatively slow so that the air when it passes beyond the inner tube 16 will continue its spiral travel or spinning rotation within the annular firing head or ring 18. The total volume of air thus delivered can be regulated by adjustments of the intake valve 35 so that the amount of air may be properly proportioned in respect to the oil or hydro-carbon delivered into the spirally travelling air.

The oil spray discharged from the head 43 will be projected outward and against the inner portion of the tubular air blast that is within the annular firing head or ring. The angle at which the fluid fuel may be projected may vary, but will preferably be about as indicated by dotted lines marked on Fig. 1.

It is highly important that this initial commingling of the hydro-carbon fluid and the air take place within the burner proper and before the commingled air and fuel are delivered into the furnace. In actual practice I have found that the initial combustion will start quite close to the head 43 and within the annular firing head, and that the combustion will be substantially as indicated by dotted lines in Fig. 3. The annular firing head or ring will confine the flame or initial combustion so that the flame will not expand to any great extent until it has passed out of the firing ring, whereupon it will be rapidly expanded within the furnace.

By careful tests I have demonstrated that the so-called "short" ends of the oil will start combustion close to the head 43 and the ignition electrodes, while the "long" ends of the oil will be shot or driven further into the surrounding spirally whirling air, but will be intercepted by that portion of the air that is travelling at high angular velocity but with slow axial movement against the inner surface of the firing ring. The above action is indicated by the dotted lines in Fig. 3 which indicate the fact that actual combustion of the oil against the inner surface of the firing ring does not take place, due to the fact that the air in contact with the firing ring acts as sort of a cushion, preventing the oil from actually coming into contact with the said ring. This action is improved by contracting or tapering the firing ring substantially as shown.

As the burning mixture of air and oil passes out of the burner proper and into the combustion chamber of the furnace, the whirling spirally travelling movement causes the flame to rapidly expand radially rather than axially of the projected flame. This action is due largely to the relatively slow axial movement of the air in respect to the whirling movement.

In contra-distinction to high-pressure oil burners which project a long shaft-like flame, this

burner produces a wide rapidly expanding flame. This action is made possible by the projection of the oil or hydro-carbon into a relatively slowly advancing surrounding cylinder or tubular volume of air that is under relatively low pressure.

Adjustments of the annular firing head or ring 18 make it possible to adjust the flame for any particular furnace or for other varying conditions in the action of the burner. With the adjustments properly made, there will be no actual burning of the oil against the inner surface of the annular firing head for the reason that the burning oil strikes the blanket of air and will not completely penetrate the same.

For the lack of a better name and for the sake of definition, the spirally revolving body of air may be designated as a substantially horizontal tubular column of spirally moving air. The space within the outer tube 15 forward of the front end of the inner tube 16, but rearward of the extreme front or delivery portion of the annular firing head or ring 18, may properly be designated as the primary combustion chamber; and the space within the furnace or boiler combustion chamber may be likewise properly designated as the secondary combustion chamber.

In the operation above described there will be a slow forward flow of air through the core afforded by the inner tube 16. This is a very mild flow and just sufficient to produce a slight mixing of air with the oil close to the nozzle 43. The extent of this mild flow through the tube 16 will depend more or less upon the distance the the disc of the fan 28 is spaced from the adjacent edge of the inner shell 12. The centrifugal force will throw the air directly against the interior of the concave fan casing but there will be a slight pressure tending to force the air through the said tube 16.

In practice I have found decidedly the best results are obtained by forming the conical surface of the shell 12 at an angle of approximately 70° to the axis of the tube 16. Also, I have found that the best results are obtained by setting the operative faces of the deflecting blades 14 ap-

proximately 20° from a radius drawn from the axis of the tube 16 and touching the outer edge of the said blade. I have also found that the best results have been obtained by the use of four of the said deflecting blades.

The above degrees and numbers, however, are capable of variation within the scope of the invention disclosed and claimed.

From the foregoing it will be further understood that while I have, in accordance with the statutes, fully disclosed the complete operative machine or device, that various alterations in the details of construction and arrangement of parts may be made within the scope of the invention herein intended to be broadly claimed.

What I claim is:

1. In a device of the kind described, a fan casing having an axial air inlet and a contracted axial air outlet, on outer tube connected to said air outlet, an inner tube in said outer tube spaced therefrom to form an annular air delivery channel and terminating inside the outer tube, said inner tube having an expanded inner end portion spaced from the front wall of said casing, a liquid fuel supply pipe having a nozzle positioned axially of said tubes and located to spray fuel inside said outer tube and forwardly of said inner tube, a motor-driven fan axially aligned with and of greater diameter than the air intake passage of said casing and arranged to blow a blast of air into the annular space between said inner and outer tubes, and ignition means including conductors extended through said inner tube and terminating in sparking electrodes located within said outer tube beyond the delivery end of said inner tube and adjacent said nozzle.

2. The structure defined in claim 1 in which there are obliquely disposed deflecting blades in the converging space between the expanded end portion of said inner tube and the adjacent front wall of said casing, the said fan being of disc-like form and having a diameter that is approximately the same as the expanded inner portion of said inner tube.

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