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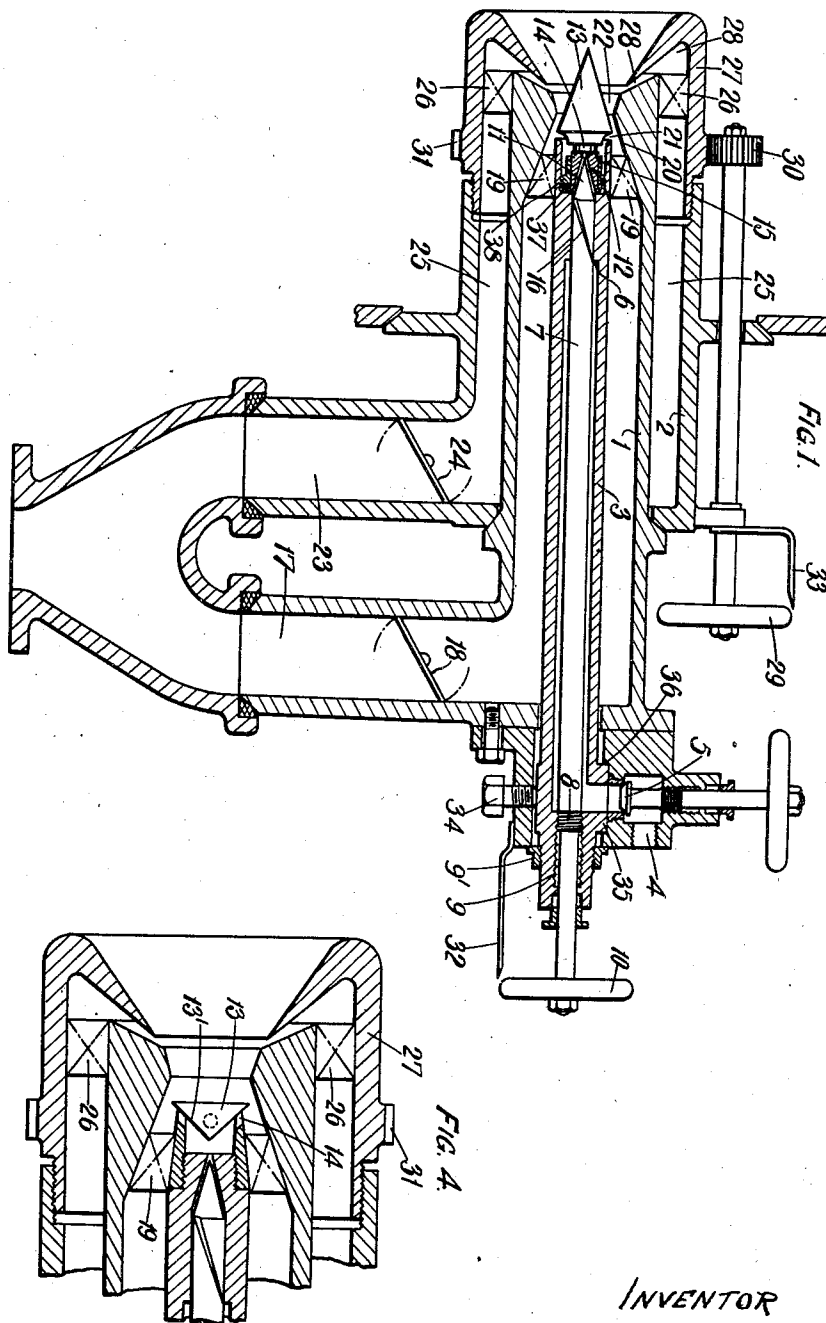
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1,934,837

LIQUID FUEL BURNER OR ATOMIZER

Filed Oct. 23, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

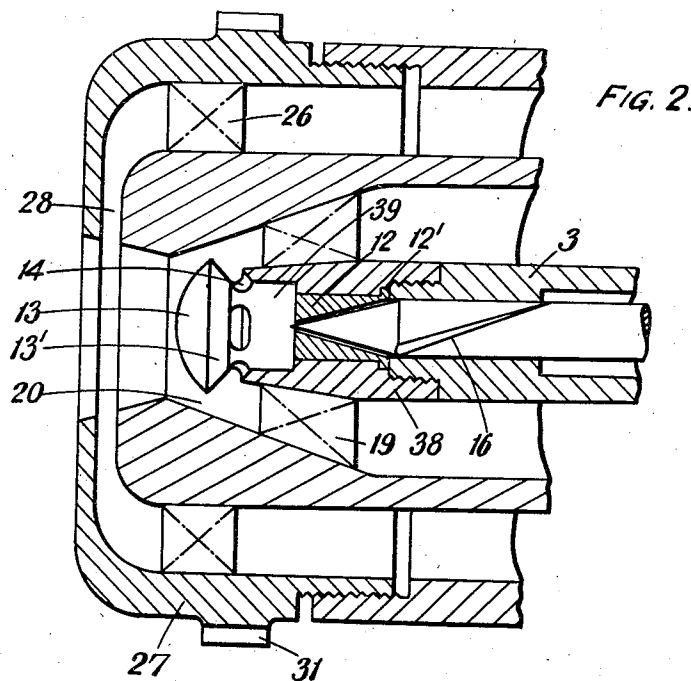


FIG. 2.

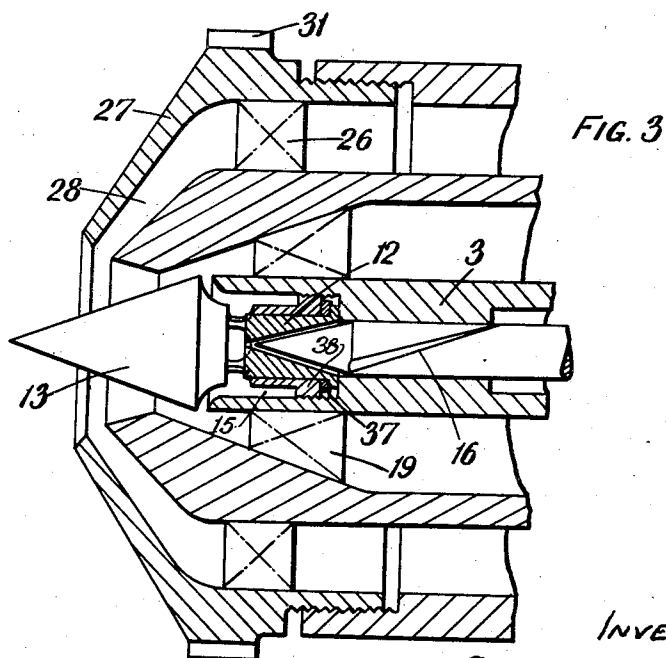


FIG. 3

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1,934,837

LIQUID FUEL BURNER OR ATOMIZER

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Application October 23, 1931, Serial No. 570,695,
and in Great Britain August 11, 1931

9 Claims. (Cl. 299—140)

This invention relates to oil burners or atomizers and has for its object to provide an improved construction of burner in which a very efficient atomization of the fuel takes place and in which the supply of oil to the burner can be regulated with great exactitude thereby ensuring that the burner operates in the most efficient manner under the different conditions in which it can be used and with the various grades of fuel-oil with which it may be supplied.

Various constructions of burners which are at present in use possess the disadvantage that the oil supply to the burner nozzle cannot be regulated with the necessary degree of fineness and it has been found, especially when using thick oils, that the flame is very liable to fade, with the result that the burner attendant has to keep operating the oil-supply control on the burner. It is important that this control should be altered with discretion, otherwise a large amount of oil can be passed to the burner nozzle, which is very undesirable both in boilers and furnaces; in the case of boilers, quantities of objectionable smoke are liable to be produced and overloading may take place. In these constructions also the control spindle and the button against which the oil impinges are all in one which increases the difficulty of obtaining accurate adjustment of the oil supply.

The above-mentioned disadvantage is avoided in the liquid fuel burner according to the invention, and accurate control and adjustment of the burner is obtained, although full flexibility over a good range of outputs is maintained.

The burner according to the invention is of the type including a central oil passage through which passes a spindle which controls the supply of oil to the burner nozzle, the control spindle being threaded for a portion of its length so that upon rotation it may be moved longitudinally towards or away from a diaphragm with which it co-operates, to control the supply of oil to the nozzle.

Accurate control of the fuel supply to the nozzle in a burner of this type is, according to the invention, obtained by providing the spindle with one or more tapered grooves, at its end adjacent the diaphragm with which it co-operates, in combination with a fine thread for effecting longitudinal movement and by providing a separate diaphragm having a hole of the size suitable for the outputs required.

Further features consist in making the oil annulus adjacent the diaphragm adjustable by the insertion of a distance piece or washer and in

the provision of supplies of primary and secondary air to the burner; the secondary air being led in at such an angle as prevents the oil from adhering to the metal faces of the parts of the nozzle.

Numerous other features of the invention will be apparent from the appended description and the accompanying drawings wherein Fig. 1 is a longitudinal section of one construction of burner, while Figs. 2, 3 and 4 are sections of the front end of a burner showing alternative constructions of air and oil nozzles.

Referring first to Fig. 1; the burner comprises a body portion 1 which is surrounded at its forward end by an outer sleeve 2 and has passing longitudinally through its centre an oil tube 3. Oil is supplied to this oil tube 3 from a supply pipe which is screwed into socket connection 4, the oil being controlled by stop valve 5 and passing from this valve through the interior of the oil tube 3 to the restricted portion 6 of this tube. At this point the oil comes under the control of the oil control spindle 7 which is a cylindrical rod passing longitudinally through the centre of the oil tube 3 and movable longitudinally to allow more or less oil to pass to the burner nozzle. The control rod is provided with a threaded portion 8 which screws into an internally threaded portion 9 of the oil tube 3, the rod being rotated by means of handwheel 10 to effect longitudinal movement thereof. Assuming that the control rod is in the position shown, the oil passes through one or more helical tapered channels or grooves 16 cut in the control rod 7, by which the oil is given a swirling motion, and thence passes through the conical space between the coned end 11 of the oil control spindle and the conical hole in the diaphragm 12. After passing through the hole in the diaphragm the oil impinges on the back face of button 13 and is thereby broken up and spread and passes through ports 14 to fill the annular space 15 surrounding the diaphragm. The amount of oil passing through the diaphragm is controlled by adjusting the position of the control spindle 7 to uncover more or less of the tapered channels 16, the threaded portion 8 of the control rod being made very fine so that accurate and minute adjustment of the spindle 7 can be obtained. A further control is obtained by making the channels 16 tapering, since when the channels are first uncovered only a fine opening is obtainable.

A supply of primary air to the burner is provided through port 17 under the control of damper 18 and this primary air passes through

the annular space between the interior of body 1 and the exterior of oil tube 3 and is given a swirling motion as it reaches the forward end of the burner by means of vanes 19 which are set at an angle in the inner air cone or nozzle 20. As the primary air passes through this inner air nozzle, which is of gradually decreasing diameter to increase the velocity of the air as it passes therethrough, it comes into contact with the oil issuing from the annular oil jet or nozzle 21 and the oil is clipped off by the stream of air and carried forward into the diverging portion 22 of the air cone or nozzle 20 where it meets the supply of secondary air. A blank or washer 9¹ is provided on the burner tube to prevent any air leakage from the primary air chamber. The secondary air is supplied through port 23, under the control of damper 24, and passes through the annular space 25 between the exterior of body 1 and the outer sleeve 2 and is given a swirling motion by vanes 26 which are supported, at an angle to the direction of flow of the air, between the body 1 and the outer cap 27. After passing through these vanes 26 the secondary air passes into the outer air cone 28 which is designed so that the secondary air supply meets the mixture of oil and primary air at a backward angle and prevents the oil from adhering to the metal faces of the burner. As the oil leaves the diverging portion 22 of the inner air cone it is pulverized by the secondary air supply which breaks it up into a very fine mist and holds the oil in suspension, at the same time swirling it at a very high speed. The outer cap 27 is constructed so that an annular pocket 28 is formed therein which acts as a reservoir for the secondary air and allows the latter to become heated before meeting the mixture of oil and primary air. The formation of the outer air cap 27 being of the conical type has the advantage of holding and steadying the flame.

The outer cap 27 is screwed by an airtight thread connection into the forward end of sleeve 2 and is arranged to be rotated by means of wheel 29, through the medium of a rack and pinion arrangement 30, 31 so that the position of the outer cap 27 can be adjusted longitudinally relative to the remaining portion of the burner to regulate the secondary air supply.

Both handwheel 10 and handwheel 29 are provided with engraved divisions thereon and with pointers 32, 33 respectively so that the amount of rotation of these wheels can be easily checked.

The oil annulus 15 and annular oil jet 21 are also made adjustable by the provision of a distance piece or washer 37 behind the diaphragm 12 which can be quickly replaced by another of different size to vary the position of the button relatively to the end of the oil tube, the button being carried on a sleeve 38 which is screwed into the end of the oil tube 3.

The coned end 11 of the control spindle 7 is of a length sufficient to allow the point of the spindle to project through the hole in the diaphragm when the spindle is screwed completely in so that this point may be used for cleaning the aperture in the diaphragm and this aperture in the diaphragm is designed so as to determine the maximum output to be obtained at any given pressure or head of oil supply.

The component parts of the burner are arranged to be quickly removable for cleaning or adjustment, the oil tube 3, control spindle 7, diaphragm 12 and button 13 being removable by unscrewing the fixing stud 34, which allows the

projecting portion 35 of oil tube to drop out of its socket 36 and the oil tube and its associated parts can then be withdrawn longitudinally from the body of the burner. The burner as a whole is secured in the furnace front or burner plate by means of wing nuts and slots and the main portions of the burner are also secured together by wing nuts so that the burner is readily removable from the furnace front and can also be taken apart with the minimum of trouble and effort.

Figs. 2, 3 and 4 show alternative constructions of the front end of the burner. In the construction shown in Fig. 2 the button 13 is made flatter and is attached to a sleeve 38 which is screwed on to the end of the oil tube 3 and clamps the diaphragm 12 in position by gripping flange 12¹ thereon against the end of the oil tube. The rear face 13¹ of button 13 is made conical instead of curved as in Fig. 1 and the oil passes through tube 3, through the tapered helical channel or channels 16, through the hole in diaphragm 12 and thence into the recess 39 from which it issues by means of ports 14 to meet the stream of primary air in the inner air cone 20. In this construction the supply of secondary air through the outer air zone 28 meets the stream of primary air and oil substantially at right angles to the general direction of this stream.

The construction shown in Fig. 3 is similar to that described with reference to Fig. 1, but in this case the supply of secondary air through the outer cone 28 does not meet the mixture of primary air and oil at a backward angle but meets the stream at such an angle that it assists in driving the oil spray forward in addition to effectively pulverizing the oil.

In the construction shown in Fig. 4 the button 13 is made entirely of conical form, the oil issuing from the hole in the diaphragm striking the conical face 13¹ of this button and being deflected through ports 14 to meet the primary air stream. In this case also the secondary air supply issues at a backward angle as described in the first mentioned construction.

In all the constructions described with reference to Figs. 2, 3 and 4 both primary and secondary air supplies are given a swirling motion by means of vanes 19 and 26 respectively, and the outer cap 27 is screwed in or out to adjust the secondary air supply by means of the rack 31 and pinion (not shown). The remaining portions of the burner which are not shown in these figures are constructed in a manner similar to the construction described with reference to Fig. 1.

The burner is suitable for the use of either air or steam to pulverize and break up the oil and when steam is to be employed it is preferable that steam be employed in the inside tube instead of the primary air while the usual supply of secondary air is provided through the outer annular tube.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An oil burner or atomizer for furnaces comprising in combination a burner nozzle, a tube for the supply of oil to said nozzle, a casing surrounding said tube, said casing being spaced from said tube to provide a passage for the supply of air to the burner, a control spindle passing through said tube, a diaphragm adjacent the nozzle, into which one end of the control spindle projects, one or more helical, tapered grooves or

channels on the control spindle at its end adjacent the diaphragm, the inlet to said grooves or channels being covered in normal position by a restricted portion of said oil tube, a fine screw thread on said control spindle cooperating with an internal screw thread on said tube whereby upon rotation of said control spindle it is moved longitudinally to uncover very gradually the grooves or channels to obtain accurate and precise control of the supply of oil to the burner nozzle.

2. An oil burner or atomizer for furnaces according to claim 1, wherein the diaphragm is formed separately from said nozzle and from the control spindle.

3. An oil burner or atomizer for furnaces comprising in combination, a burner nozzle, a tube for the supply of oil to said nozzle, a diaphragm at the end of said tube and located within said nozzle, a casing surrounding said oil tube and spaced therefrom to form a passage for the supply of air to the burner, a control spindle passing through said tube and projecting into said diaphragm, a helical tapered channel cut in said control spindle, the inlet to said channel being covered, in the normal position of said spindle, by a restricted portion of said oil tube and a fine screw thread on said spindle cooperating with an internal screw thread on said tube whereby upon rotation of said control spindle it is moved longitudinally to uncover very gradually the channel thereon to obtain accurate and precise control of the supply of oil to the burner nozzle, a button, supported by and spaced from said nozzle, against which the oil impinges, the space between said button and the end of the nozzle forming an oil annulus or jet, and means for adjusting the distance of said button from said nozzle to adjust the jet.

4. An oil burner or atomizer for furnaces comprising in combination, a burner nozzle, a tube for the supply of oil to said nozzle, a diaphragm at the end of said tube and located within said nozzle; a casing surrounding said oil tube and spaced therefrom to form a passage for the supply of air to the burner, a control spindle passing through said tube and projecting into said diaphragm, a helical tapered channel cut in said control spindle, the inlet to said channel being covered, in the normal position of said spindle, by a restricted portion of said oil tube and a fine screw thread on said spindle cooperating with an internal screw thread on said tube whereby upon rotation of said control spindle it is moved longitudinally to uncover very gradually the channel thereon to obtain accurate and precise control of the supply of oil to the burner nozzle, a button, supported by and spaced from said nozzle, against which the oil impinges, the space between said button and the end of the nozzle forming an oil annulus or jet, said button being supported by a sleeve surrounding said diaphragm and screwing into said nozzle, and means for adjusting said sleeve longitudinally within said nozzle to vary the distance of said button from said nozzle to adjust the jet.

5. An oil burner or atomizer according to claim 3, wherein the means for adjusting said sleeve longitudinally to adjust the jet consists of a replaceable washer between the end of said sleeve and the end of said diaphragm.

6. An oil burner or atomizer for furnaces comprising in combination a burner nozzle, a tube attached to said nozzle for the supply of oil

thereto, a button, supported by and spaced from said nozzle, against which the oil impinges, the space between said button and the end of the nozzle forming an oil annulus or jet, and means for adjusting the distance of said button from said nozzle to adjust the jet, a casing surrounding said tube and nozzle and spaced therefrom to provide a passage for a primary supply of air to the burner which clips the oil from the nozzle and carries it forward, the portion of said casing surrounding said nozzle being of restricted form to increase the velocity of the air and provided with vanes set at an angle to give the air a swirling motion, an outer sleeve surrounding said casing and spaced therefrom to provide a passage for a secondary supply of air to the burner, the forward end of said sleeve being formed into an outer air nozzle and provided with vanes set at an angle to give the secondary air a swirling motion, a control spindle passing through said oil supply tube, the end of said spindle projecting into said diaphragm, a helical, tapered groove in said control spindle at its end adjacent the diaphragm, the inlet to said groove being covered, in the normal position of said spindle, by a restricted portion of said oil tube, a fine screw thread on said control spindle cooperating with an internal screw thread on said tube and means for rotating said control spindle whereby the end of the spindle is withdrawn gradually from, or moved gradually into, the diaphragm to control the supply of oil passing therethrough and at the same time the helical tapered channel is gradually uncovered or covered to control accurately and precisely the supply of oil to the burner nozzle.

7. An oil burner or atomizer for furnaces according to claim 6, wherein the secondary supply of air meets the stream of oil and primary air at an angle, the secondary air supply moving in a direction opposed to that of the stream of primary air and oil.

8. An oil burner or atomizer for furnaces comprising in combination a burner nozzle, a tube attached to said nozzle for the supply of oil thereto, a button, supported by and spaced from said nozzle, against which the oil impinges, the space between said button and the end of the nozzle forming an oil annulus or jet, and means for adjusting the distance of said button from said nozzle to adjust the jet, a casing surrounding said tube and nozzle and spaced therefrom to provide a passage for a primary supply of air which clips the oil, from the nozzle and carries it forward, an outer sleeve surrounding said casing and spaced therefrom to provide a passage for a secondary supply of air to the burner, the forward end of said sleeve being formed as an air nozzle and separate from the main portion of said sleeve, means for adjusting said separated portion towards or away from the forward end of said casing and said burner nozzle to control the passage of the secondary air, a control spindle passing through said oil supply tube and having its end projecting into said diaphragm, a helical tapered groove in said control spindle at its end adjacent the diaphragm, the inlet to said groove being covered and closed, in the normal position of the diaphragm, by a restricted portion of said oil tube, a fine screw thread on said control spindle cooperating with an internal screw thread on said tube and means for rotating said control spindle whereby the end of the spindle is withdrawn gradually from, or moved gradually into, the diaphragm to control the supply of oil passing therethrough and at the same time the helical

tapered channel is gradually uncovered or covered to control accurately and precisely the supply of oil to the burner nozzle.

9. An oil burner or atomizer for furnaces comprising in combination, an oil supply tube, a diaphragm located at one end of said tube, a button, supported by and spaced from said diaphragm, and forming a spreader against which the oil issuing from said tube impinges, the space between said button and the end of said tube forming an oil jet or nozzle, a conical hole in said diaphragm, a constricted portion of said oil supply tube adjacent the diaphragm, a control spindle passing longitudinally through the centre of said oil tube and journaled in said constricted portion, a conical end to said spindle which projects into the conical hole in the diaphragm, a helical, tapered groove in the control spindle adjacent the conical end thereof, the inlet to said groove being covered by the constricted portion of the oil tube, a fine screw thread on said control spindle cooperating with an internally screwed portion on said oil tube, a hand-wheel on the rear end of said spindle, whereby said spindle may be rotated and thus moved longitudinally to withdraw the conical end thereof from the conical hole in the diaphragm and at the same time gradually uncover the helical groove in

said spindle to allow oil to pass through this groove and through the conical hole in the diaphragm, a stop valve controlling the supply of oil to said oil tube, a casing surrounding said tube and spaced therefrom to form a passage for a primary supply of air to the burner, the forward end of said casing being of gradually decreasing internal diameter to form a conical internal air nozzle, vanes in said internal air nozzle for giving the primary air a swirling motion, a damper controlling the supply of primary air, a cylindrical outer sleeve surrounding said casing and spaced therefrom to form a passage for a secondary supply of air to the burner, a damper controlling the secondary supply of air, a cap screwed in the forward end of said sleeve and forming an outer air nozzle, vanes in said cap giving a swirling motion to the secondary air passing through said outer air nozzle, a circular rack on the exterior of said cap, a pinion meshing with said rack, and a hand-wheel connected to said pinion whereby the cap may be rotated and screwed into or out of said sleeve and thus moved towards or away from the forward end of said inner air nozzle to control the supply of secondary air passing through the outer air nozzle formed by said cap.

CORNELIS ZULVER.

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