Nov. 3, 1942. A. P. LIVAR 2,301,060

OIL BURNER

Filed March 11, 1940 2 Sheets-Sheet 1

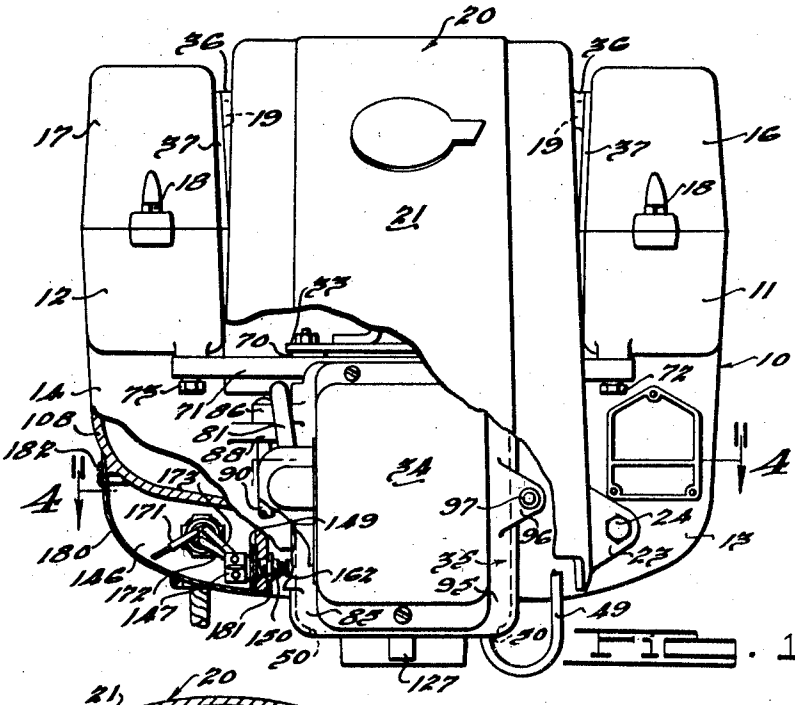


Fig. 1.

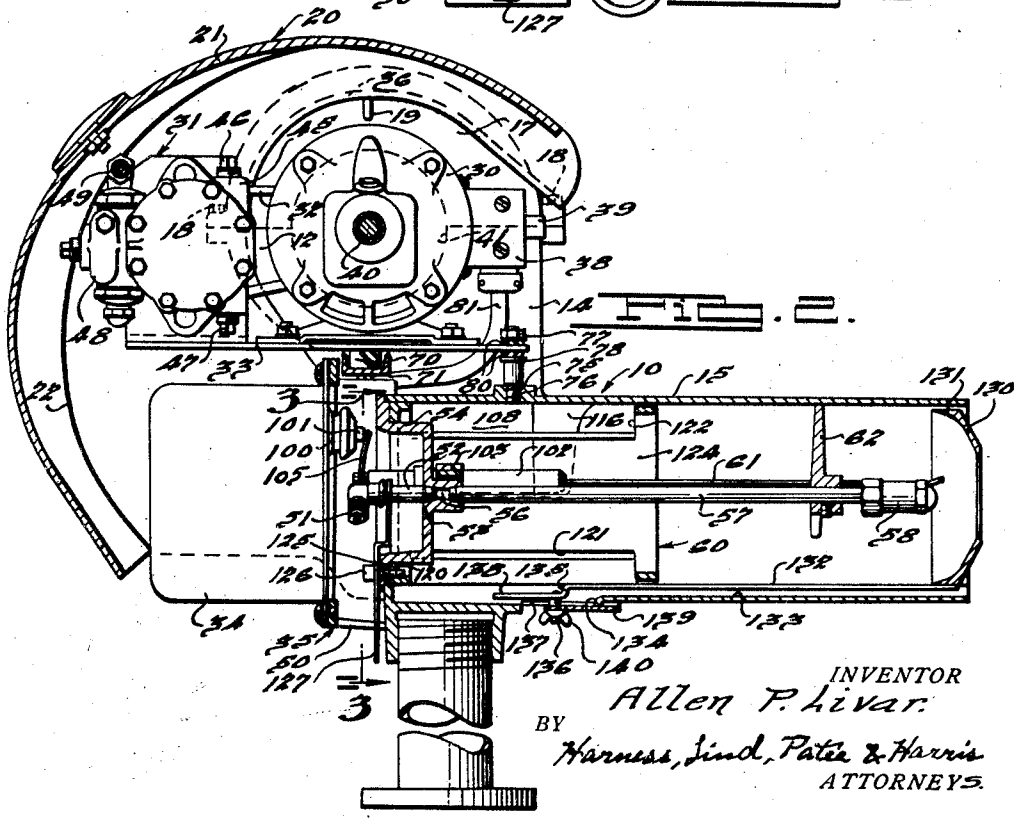


Fig. 2.

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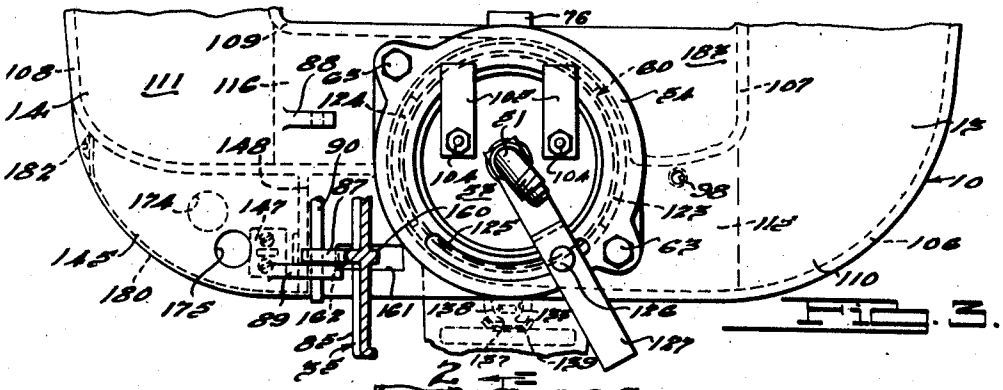


FIG. 3.

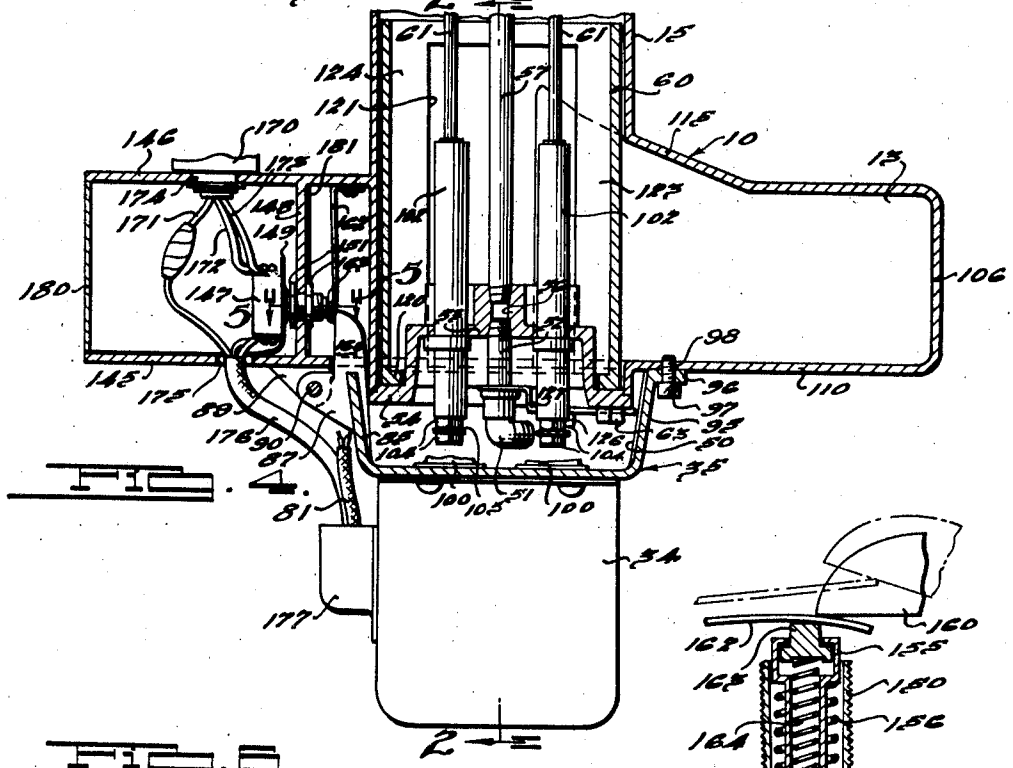


FIG. 4.

FIG. 5.

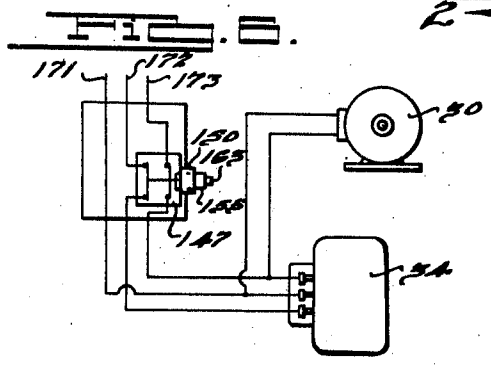


FIG. 6.

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2,301,060

OIL BURNER

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Application March 11, 1940, Serial No. 323,375

14 Claims. (Cl. 158—23)

My present invention relates to pressure atomizing oil burners. The principal object of the invention is to devise an oil burner of the pressure atomizing type which has improved firing characteristics and which may be adjusted to various types of combustion chambers with a minimum of effort and inconvenience.

A primary object of the present invention is to provide means for the adjustment of the flame characteristics of a pressure atomizing oil burner which may be utilized without stopping the firing of the oil burner in order that the flame characteristics may be observed during the act of adjusting, as distinguished from prior types of oil burners wherein the adjustment must be accomplished when the flame is extinguished. The result of the accomplishment of this object of the invention is to make it possible to vary the flame infinitesimally and progressively toward a desired type of flame, as distinguished from the prior practice of trial-and-error adjusting.

Specifically, the invention comprises a pressure atomizing oil burner wherein two blowers are provided, one on each side of a blast tube, the output of each blower being directed tangentially and forwardly into the rear of the blast tube at diametrically opposed points so as to produce a whirling stream of air in the blast tube. An object of the invention is to provide means at the outlets of the blowers, where the air enters the rear end of the blast tube, to adjust the quantity of air admitted to the blast tube. Another object of the present invention is to provide means for simultaneously and coextensively adjusting the volume of air issuing from each blower outlet, and to accomplish such adjustment at the outlet of the blower rather than the inlet so as to level off pulsations in pressure characteristic of the performance of blower wheels. A further object of the invention is so to combine the blowers, blower outlets and blast tube as to produce a whirling cylinder of air directed spirally forward along the blast tube.

The burner also comprises an end cone for adjusting the point of mixture of the spirally stream of air issuing from the blast tube with the cone of spray issuing from the fuel atomizing nozzle, which end cone is so constructed and arranged as to permit adjustment thereof longitudinally of the blast tube without suspending firing of the oil burner. A further object of the invention is to provide means whereby the volume of air supplied for combustion may be adjusted without suspending operation of the oil burner and at the same time that the end cone is being adjusted, the two adjusting mechanisms being such as to be adjustable separately or simultaneously as desired by the operator.

A further object of the present invention is to provide means for the ready removal and inspection of the fuel atomizing nozzle in order to permit rapid replacement or cleaning of the nozzle in the event that it should become clogged with a fine piece of grit or lint. The usual pressure atomizing oil burner nozzle comprises a member having one or more oil metering slots from three to five ten-thousandths of an inch in width, which are obviously so narrow that foreign particles which may escape through the finest filter could slog one or more of the slots with the result that the nozzle must be cleaned or replaced. Since this is a fairly common occurrence, in spite of the attempts of oil companies to produce and deliver absolutely clean oil and the attempts of manufacturers to manufacture perfect filters, it has been long realized that a very simple mechanism for permitting such removal should be provided. However, a part of the usual nozzle assembly comprises a pair of electrodes which must be maintained at exact distances form the nozzle tip, these electrodes being connected during operation to a transformer for the purpose of producing arcing current; and for safety the connections to the transformer are usually placed inside of the blast tube which means that complicated and relatively inaccessible connecting means are provided between the electrodes and the transformer, thus adding to the difficulties of inspection. It is a further object of the present invention to provide simple connecting means whereby the connections between the transformer and electrodes may be instantaneously made or broken, in combination with means permitting the rapid removal or insertion of the oil nozzle assembly bearing the electrodes.

It is a further object of the present invention to provide means in a pressure atomizing type of oil burner for the mounting of the power assembly, comprising the usual motor, the fuel pump and the two blower wheels necessary for producing the separate streams of air whereby vibrations and noises from the power assembly are reduced to a minimum, thus producing a more quiet and more lasting mechanism.

A further object which is achieved in part by insulating the power assembly is to make the power assembly readily removable. Heretofore, it has been common practice to repair or replace

individual parts in the field; so that the repair man usually carried a stock of parts consisting of spare motor, spare pump, etc., and after ascertaining the difficulty, proceeded to replace the defective or worn out part in the field with the result that operation of the burner was usually suspended for a lengthly period of time and, more important, alignment of the various parts was usually poorly accomplished due to the lack of assembling fixtures or aligning instruments. An object of the present invention is to make it possible to replace the entire power assembly with a factory aligned and tested power assembly in a few minutes. A further object of the present invention, which goes with the foregoing object, is to make all operating parts of the oil burner readily replaceable so that, by actual tests, every operating part of the oil burner may be removed and replaced and the oil burner again operating in approximately five minutes. This results in customer satisfaction due to immediate response to a complaint, and permits the inspection and repair of the defective part at the shop or factory where facilities are available.

A further object of the present invention is to make a pressure atomizing oil burner, of the type having the foregoing objects and advantages, as fool-proof as practical application of safeguards can make it. It is the usual practice of an oil burner service man upon receiving a complaint to check the thermostat or other instruments controlling the oil burner, then to check the supply of oil and oil connections, and then to check the oil burner nozzle. If inspection showed that the passages of the nozzle were clogged he might clean and replace the nozzle and test the oil burner to see if that was the total cause of failure. As previously stated, it is necessary to break the connections between the transformer and electrodes and service men frequently forget to replace the connections when testing the nozzle. If the connections between the transformer and electrodes were so difficult to make that it would require several minutes there might be no substantial harm result from starting the pump and allowing it to operate for a few seconds before observing that the connection had not been made since, by the time that the pump had been stopped and the transformer connections made, the fumes in the fire box of the furnace or boiler might have dissipated. However, this invention makes it possible instantaneously to make or to break the transformer connections with the result that it might be possible for an operator to observe after a few seconds operation of the oil pump that the transformer connections were broken, then negligently to make the connections, and thus cause a serious explosion due to the injection of a firing spark into a fire box filled with an explosive mixture of oil vapor and air. It is an object of the present invention to prevent such an occurrence by making it impossible to operate the fuel pump unless the transformer connections are made.

A further object of the present invention is to provide an oil burner, having the efficient and improved characteristics outlined above, which is symmetrical in design and pleasing in appearance, and which has all normally exposed parts protected by a hood which prevents dust and other objects from falling into the motor, pump, etc., and which makes it impossible for careless persons or animals to be injured by contact with electrically charged parts or moving parts. As an adjunct of the foregoing the hood is so arranged as to cause a stream of air to flow over the motor and transformer so as to cool the same and cause them to operate efficiently at all times. Also related to the foregoing is the fact that the end cone adjustment device and the air volume adjustment device may be reached and manipulated without removing the protective hood, and are so arranged as to make it physically impossible for an operator to touch a charged contact or a moving part during the operation of adjusting either or both devices.

The foregoing and other objects of the invention will be more fully appreciated from the following description taken in connection with the accompanying drawings wherein a preferred embodiment of the invention is disclosed in detail.

In the drawings,

Fig. 1 is a rear elevation of the oil burner with the hood in place and with parts of the hood and the oil burner broken away for better illustration;

Fig. 2 is a vertical section taken substantially along line 2—2 of Fig. 4;

Fig. 3 is a partial, rear view showing the rear end of the blast tube and the outlets from the blowers, with the transformer support mostly broken away and with the air volume and end cone adjustment means shown in dotted outline, the view being taken substantially along line 3—3 of Fig. 2;

Fig. 4 is a partial, horizontal section taken irregularly and substantially along the line 4—4 of Fig. 1, showing details of the air volume adjustment means, the transformer mounting means, and the safety switch;

Fig. 5 is a partial section on an enlarged scale taken along the centerline of the operating plunger of the safety switch, substantially along the line 5—5 of Fig. 4; and,

Fig. 6 is a portion of a wiring diagram showing the method of incorporating the safety switch in a burner control circuit.

The improved burner comprises a principal casting 10 which includes the lower half 11 of the right hand blower housing, the lower half 12 of the left hand blower housing, the outlets 13 and 14, respectively, of the right and left blowers and the blast tube 15. Separate upper halves 16 and 17 of the right and left blower housings, respectively, are attached to the main casting by bolts 18. The inwardly facing, outer surfaces of the upper halves of the blower housings are provided with inwardly projecting lugs 19 which support the protecting hood 20, which is formed as a substantially semi-cylindrical top portion 21 and side skirts 22, the lower extremities of which are provided with lugs 23 which may be bolted to the blower outlet tubes 13 and 14 by means of bolts 24. The hood encloses the power assembly, comprising the blower wheels, and the motor 30 and pump 31 which are connected by belt 32 and mounted upon a supporting plate 33, and also encloses the transformer 34 and its hinged mounting plate 35. The side skirts 22 of the hood are provided at their upper edges with lateral flanges 36 machined to match lateral flanges 37 on the upper halves of the blower housings, and which engage the supporting lugs 19. Thus there is formed a protecting enclosure having an opening at the bottom adjacent the rear end of the blast tube which is partially blocked by the transformer 34 and an opening at the front above the top of the blast tube which is partially blocked by the motor 30. The motor 30 is preferably provided with an overload and excess voltage pro-

tective device 38 having a reset button 39 located at a point beneath the forward edge of the top portion 21 of the hood where it can be reached easily so that resetting in case of overload or excess voltage failure can be readily accomplished. The double-ended shaft 40 of the motor extends through blower inlet openings 41 (only one of which is shown in Fig. 2, there being another such opening into the blower housing 11, 16) provided by matched semi-circular openings in the inner flanges of the separable halves of the blower housing, and the ends of shaft 40 are attached to blower wheels (not shown) in the housings. Air drawn into the blower wheels through the inlets 41 must travel across the motor and across the transformer and thus keeps the two devices cool and efficient. This aspect of my invention is now claimed in the divisional application, Serial No. 376,115, filed January 27, 1941, and copending herewith.

The fuel pump is preferably of the latest type comprising a filter portion 45 having removable plugs 46 and 47 at top and bottom, respectively, to either of which the fuel supply line (not shown) may be connected, the fuel supply line being led in through the front opening adjacent the motor or through the lower opening adjacent the transformer. The fuel pump 31 also comprises a pressure regulating device 48 to which a tube 49 leading to the nozzle may be connected. The tube 49 preferably extends down between the right skirt of the hood 20 and the outer edge of the transformer mounting plate 35, then extends upward through a large opening 50 provided in the lower surface of the transformer mounting plate 35, to connect with an elbow 51 on a short section of pipe 52 projecting rearwardly from the recessed central portion 53 of a blast tube closing cap 54. A passage 56 is drilled through the portion 53 and a nozzle supporting tube 57 extends through the blast tube 15 from the passage 56 and supports the nozzle 58 at its outer end. The elbow 51, tube 52, cap 54, tube 57, and nozzle 58 are assembled with an air volume adjusting damper 60, electrodes 61, and three-legged centering spider 62 to complete a nozzle assembly which is removable as a unit from the blast tube upon removal of bolts 63 and disconnection of tube 49, so that rapid inspection of the nozzle can be accomplished.

The power assembly supporting plate 33 is supported principally by resilient, rubber bumpers 70 fastened to the lower surface of the supporting plate and resting in an inverted channel member 71 having its ends fastened to the rearwardly extending, overhanging portions of the lower halves 11 and 12 of the blower housings by bolts 72 and 73, respectively. The center of gravity of the power assembly is preferably to the rear of the channel member 71 and the plate is restrained from tipping rearwardly by a restraining bolt 75 mounted in a boss 76 on the central, upper surface of the blast tube 15. The upper end of bolt 75 is provided with a nut 77 and the lower portion of bolt 75 is enclosed in a flanged spacer 78. Rubber washers 80 are inserted between the nut 77 and plate 33 and between the spacer 78 and plate 33; thus the only contacts of the power assembly with the other metal parts of the burner are through the rubber bumpers 70 and rubber washers 80, through the rubber insulated cable 81 leading power to the motor, and through the tube 49 which may be provided with anti-hum devices, so that noises and vibrations from the power assembly are substantially prevented from reaching other parts of the mechanism. The entire power assembly may be removed by removing bolts 24, lifting off the hood 20, disconnecting the oil supply line and the tube 43, removing bolts 18 and the upper halves of the blower housings, disconnecting the motor wires and removing nut 77. None of these operations require much time, and an entirely new power unit may be put in place of the old one without any alignment problem.

The transformer 34 is mounted on the transformer plate 35 which is formed substantially as a channel open at the top and open at 90 at the bottom. The left side 85 of plate 35 is provided with upper and lower hinge members 86 and 87, respectively, which rest upon hinge bosses 88 and 89, respectively, extending from the rear surface of the main casting 10. The hinge members and bosses are drilled to receive a hinge pintle 90 about which the transformer may swing. The right side wall 95 of the transformer supporting plate is provided with an ear 96 through which passes a retaining screw 97 which fastens into a threaded hole 98 in the main casting 10 to retain the transformer in operating position. The transformer is provided with inwardly extending insulators 100 surrounding transformer terminal contacts 101 which are spaced above the center of the blast tube 15 and at each side of the centerline thereof so as to be substantially in line with, but above, the rear ends of the electrodes 61. The electrodes extend through the recessed central portion 53 of the blast tube cap 54, being insulated therefrom by insulators 102 and retained in adjusted position thereon by a clamp 103, and the rear extremities of the electrodes 61 are threaded and provided with lock nuts 104 between which are clamped the lower ends of vertically extending leaf springs 105 made of a conductive, resilient material such as phosphor bronze. The free ends of the springs 105, which constitute ignition assembly contact members, are in such position as to be engaged and bent inwardly by the transformer terminals 101 when the transformer is in operative position and clamped tightly by the screw 97. When inspection of the electrodes or the nozzle is deemed necessary the first step is to loosen the screw 97 so that the transformer may be swung about the pintle 90 to make bolts 63 accessible, the initial opening movement of the transformer being accomplished by springs 105 returning to normal position. Bolts 63 may then be removed and the entire nozzle assembly comprising the cap 54, adjusting damper 60, electrodes 61, oil tube 57, spider 62, and nozzle 58 may be withdrawn rearwardly from the blast tube.

As more clearly disclosed in Figs. 3 and 4, the outlet 13 from the right blower is partially defined by an outer wall 106 which curves inwardly from a vertical upper extremity to a substantially horizontal lower extremity which is tangential to the lowermost portion of the blast tube; and by an inner wall 107 which is roughly parallel thereto but terminates substantially normal to the center of the blast tube so that any air from the right blower enters the blast tube in the lower half thereof. The outlet 14 of the left blower wheel is partially defined by an outer wall 108 which curves inwardly from a vertical upper extremity to a substantially horizontal inner extremity normal to the center of the blast tube and a substantially parallel inner wall 109 which terminates horizontally and tangentially of the upper extremity of the blast tube so that air

admitted from the left blower enters the blast tube in the upper half thereof. The rear walls 110 and 111, respectively, of the outlets are substantially in the same plane and practically in the plane of the rear end of the blast tube. The forward wall of the outlet 13 includes a portion 115 which slopes forwardly so that the air is directed forwardly into the blast tube, and similarly the outlet 14 from the left blower is provided with a forwardly sloping forward wall 116. The net result of the two streams of air entering at diametrically opposed points in substantially tangential and forwardly inclined directions is to cause a whirling cylinder of air to move forward through the blast tube 15.

In order to control the volume of air admitted to the blast tube so that the flame characteristics may be regulated thereby there is provided the adjustment damper 60 which is cylindrically shaped and rotatably mounted within the blast tube 15, being given reasonably loose tolerances so as to rotate easily but still fitting snugly so as not to permit undue leakage between the two surfaces. The cylinder is provided with a rear flange 120 which is rotatably journalled on the trunnion provided by the inwardly recessed portion 53 of the cap 54 and which abuts the inner surface of the flange of the cap. The cylinder is machined to provide a pair of longitudinally extending openings 121 and 122, at the bottom and top thereof, respectively. The right section 123 of the cylinder wall between the openings constitutes a damper for regulating the quantity of air admitted from outlet 13 and the left section 124 constitutes a damper for regulating the quantity of air admitted from outlet 14. The air from the outlet 13 passes through the slot between the wall 106 and the lower edge of section 123 and the air from outlet 14 passes through the slot between the upper edge of section 124 and the wall 109. The cylinder 60 may be rotated from a position substantially as shown in Figs. 3 and 4, where as much air as can be used by the burner at any time is being admitted, to a position such that the sections substantially block the openings so that little or no air may be admitted. In order to rotate the cylinder the flange of the cap 54 is provided with an arcuate slot 125, of such length as to limit rotation of the damper between selected extreme positions, through which extends the stem of a thumb screw 126 threaded into the flange 120 of the cylinder. The stem of the screw 126 extends through an adjusting lever 127 which is pivotally mounted on the section of tubing 52 and retained thereon by the elbow 51, and the free end of which extends beneath the lower edge of transformer mounting plate 35 through the opening 58. The screw 126 is so placed that it may be reached and manipulated by the thumb and forefinger extended upward through the opening 59 in order that the lever 127 may be shifted to adjust the damper 60 and hence the quantity of air admitted from each outlet. When the final adjustment has been made screw 126 may be tightened to clamp the cylinder in adjusted position. An advantage of the foregoing is that adjustment of the cylinder may be accomplished while the burner is operating since the transformer need not be opened, and a further advantage of the arrangement is that it is physically impossible to touch the springs 105 or other charged portions of the apparatus when the transformer is in position.

It is to be noticed that the sections 123 and 124 are coextensive and diametrically opposed so that simultaneous and equal adjustment of the opposite air streams is accomplished by rotating the single damper member. A further advantage of the construction is that the volume of air is regulated at the outlets from the blowers instead of, as heretofore accomplished, at the inlets. The result of this is to cause the stream of air to be free from pulsations since the blower wheels always operate against a back pressure caused by the obstruction of the damper.

In order to obtain further adjustment of the flame characteristics there is provided means for adjusting the point of impingement of the cone of fuel spray issuing from nozzle 58 and the rotating cylinder of air issuing from the blast tube. As clearly seen in Fig. 2 the end of the blast tube is partially restricted by an end cone 130 having a central aperture large enough to permit the cone of spray to issue therethrough without impingement but substantially smaller than the diameter of the blast tube. The inner surface of the end cone is curved so as to restrict the rotating cylinder of air without interfering with the rotation thereof and the angularity thereof is such as to direct the air through the cone of spray for intimate mixture therewith a short distance beyond the end of the blast tube. The end cone 130 is an important adjunct of the oil burner since it controls the point of mixture of the fuel and combustion supporting air; hence the longitudinal spacing of the orifice of the end cone from the orifice of the spray nozzle is important and changes thereof regulate the thoroughness of combustion and adjust the shape of the flame to various shapes and sizes of fireboxes. It is also necessary to adjust the end cone for different spray nozzles, there being nozzles available having different angles of spray.

In order to adjust the end cone without suspending firing of the oil burner it is provided with a cylindrical guiding flange 131 loosely fitting the interior wall of the blast tube 15, and it is attached at its lower extremity to a bar 132 extending along a channel 133 at the bottom of the blast tube. The channel 133 terminates at its rear end in a shoulder 134 which acts as a limiting abutment by engaging a bend 135 in the rear end of the bar 132. Immediately adjacent the bend there is attached a threaded member 136 which extends downward through a longitudinal slot 137 in the bottom of the draft tube. The horizontal, free end 138 of the bar closes the portion of the slot 137 to the rear of the threaded member 136 and a small channel-shaped member 139 loosely mounted on the threaded member 136 closes the portion of the slot 137 in advance of the threaded member 136. A wing nut 140 is screwed onto the threaded member 136 to retain the channel member 139 and to clamp the bar and channel member in adjusted position so as to block the slot 137 against leakage and retain the end cone 130 in adjusted position. The nut 140 is placed immediately in advance of the standard upon which the burner rests so as to be available to the operator for substantially simultaneous adjustment of the damper 60 and the cone 130.

As stated in the objects of the invention it is sometimes advisable to remove the electrodes and oil nozzle for inspection or replacement in which case the circuit to the electrodes is broken. It would be extremely dangerous to permit the electrodes to be replaced and the oil pump started without having the transformer in circuit with the electrodes, since completion of the cir-

cuit after creating an explosive mixture in the fire box might result in a fatal explosion. In order to prevent this from happening a safety device is provided as follows: The wall 111 of outlet 14 is provided with a depending flange 145 having an outline such as to match the contour of wall 110, and wall 116 is provided with a similar depending flange 146. Between the flanges 145 and 146 there is mounted a safety switch 147 upon a cross brace 148, the switch being guarded from the flanges and cross brace by a sheet of insulating material 149. The mounting means of the switch preferably comprises a threaded, plunger-guiding member 150 upon which clamping nuts 151 may be placed to engage the brace 148. A switch operating plunger 155 is guided in member 150 and urged to disengaged position by a confined spring 156. Movement of the plunger 155 against the spring 156 results in the closing of switch members in the controlling circuit, and outward movement of the plunger 155 by spring 156 opens the controlling circuit. Closing of the switch is effected by a switch lever 160 formed as a continuation of the hinge member 87 on transformer supporting plate 35 which swings inwardly through an opening 161 in the flange 145. The switch lever 160 is so designed as to engage the free end of a leaf spring 162 mounted on the flange 146 and extending beyond and in front of the end of the plunger 155. As seen in Fig. 5 the leaf spring is substantially parallel to the flat, operating face of the switch lever 160 when the switch is closed, and the end of the leaf spring 162 is preferably extended beyond the end of the switch plunger so as to be engaged by the operating face of the lever 160 and bent thereby around the end of plunger 155, thus directing a substantially longitudinal thrust against the plunger 155 rather than the radial thrust of the lever 160. As a further precaution against damage and in order to permit efficient operation without holding close tolerances, the switch plunger 155 is preferably provided with an override button 163 which actually engages the leaf spring 162 and which is thrust outwardly by a spring 164 seated in a longitudinal socket in the plunger 155. The spring 164 is designed to resist compression to a greater extent than the spring 156 so that the button and plunger move as a unit unless the movement of the lever is greater than necessary, in which case damage to the switch is obviated by movement of the button relative to the plunger.

As seen in Fig. 4, the burner is provided with a clamp 170 for attachment of the cable containing the control circuit wires from the thermostat or other operating controls. Such systems usually comprise three wires 171, 172, and 173, the latter two being connected to the terminals of the double pole switch 147. An opening 174 is provided in the flange 146 for the admission of wires to the space between the flanges and to the switch, and an opening 175 is provided in flange 145 through which a three-wire cable 176 may pass, the wires comprising continuations of the wires 171, 172, and 173. The cable 176 passes into the junction box 177 on the transformer 34, in which wires 171 and 173 are tapped by the wires of the two-wire cable 81 leading to the motor 30. By placing one pole of switch 147 in one of the two wires leading to the motor 30 and controlling the operation of the transformer 34, it is made impossible for either the motor or the transformer to operate unless the switch 147 is closed, which cannot happen unless the operator has engaged the screw 97 in the opening 98. Accidental swinging of the transformer to an extent sufficient to close the switch is prevented by the spring means including leaf spring 162, plunger spring 156 and spring contacts 105. It is thus made certain that operation of the oil burner will not accidentally occur; and if it should so happen that operation of the power assembly occurs when the operator is not expecting it, no explosion can result since such operation can only occur when the electrodes are in place and in contact with the transformer.

In order completely to enclose the space between the flanges 145 and 146, there is preferably provided a curved plate 180, similar in contour to the lower wall 106 of the outlet 13, which is retained in position by a flange 181 embracing the lower edge of the brace 148 and a screw 182 threaded into the wall 108. For the sake of symmetry the wall 110 of the outlet 13 may be provided with a flange 183 similar in shape to the inner extremity of wall 111 of the outlet 14.

It is to be noticed that the button 163 of switch 147 and spring 162 may be engaged by fingers thrust upwardly between the flanges 145 and 146 so that temporary operation of the motor and charging of the transformer may be accomplished by manual operation of the switch 147. This is sometimes required for testing purposes.

The operation of the present invention is as follows: Closing of the transformer terminals by engagement of the switch operating lever 160 with the spring 162 and closing of the switch 147 thereby prepares the oil burner for operation. In the event that the controls close so as to cause the burner to operate, current is transmitted to the transformer 34 and motor 30. The motor 30 drives the fuel pump 31 causing fuel to be forced through the tube 49 and the tube 57 and to be sprayed through the nozzle 58. Simultaneously air is drawn upward around the transformer 34 and around the motor 30 into the blower inlets 41, where the blowers force it downward, then tangentially into the blast tube at opposed upper and lower points to create a spiralling cylinder of air under pressure. This spiralling cylinder of air moves forward and is caused to be discharged through the cone of oil spray by the end cone 130. Simultaneously a spark is created by the electrodes 61 which ignites the fuel and air mixture. It is, of course, obvious that the usual control member may be provided in series with wire 172 so that operation of the transformer after an appreciable period of time will be suspended without causing suspension of operation of the motor 30. The operator may then loosen screw 126 and manipulate lever 127 to increase or decrease simultaneously the streams of air from the blowers, thereby altering the flame characteristics. At the same time he may loosen nut 140 to shift end cone 130 longitudinally of the blast tube to change the shape of the flame and the characteristics thereof.

Inspection of the nozzle and electrodes may be accomplished by opening the transformer. If the burner is in operation, this immediately stops the operation of the burner since the motor circuit is now broken. Upon swinging the transformer to one side the tube 49 may be disconnected from elbow 51 and bolts 63 removed so that the nozzle assembly, consisting of the nozzle, electrodes and regulating damper 60, may be withdrawn through the end of the tube. After inspection and reinsertion of the nozzle assembly no accidents can happen since the motor will

not start unless the transformer is in operating position. Also, if the tube 49 has not been reconnected no oil will be sprayed from the nozzle even though a spark may jump between the electrodes; and if the tube has been reconnected the motor cannot operate to drive the pump and create an oil spray unless the electrodes are in operating contact.

Having described a preferred embodiment of my invention it should be apparent to those skilled in the art that the same permits of modifications in arrangement and detail. All such as come within the scope of the following claims are considered a part of my invention.

I claim:

1. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; means movably mounting said transformer whereby said transformer may be moved from operating position to disengage said terminals from said contacts; and means disconnecting said transformer from the source of current when said transformer is moved from operating position.

2. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; means movably mounting said transformer whereby said transformer may be moved from operating position to disengage said terminals from said contacts; and means simultaneously disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position.

3. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position; and means operated by said pivoted mounting means for disconnecting said electric motor from the source of current when said transformer is swung from operating to non-operating position.

4. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position; and means operated by said pivoted mounting means for disconnecting said transformer from the source of current when said transformer is swung from operating to non-operating position.

5. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position whereby said terminals may be disengaged from said contacts; and means for disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position.

6. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position; and means operated by said pivoted mounting means for disconnecting said electric motor from the source of current when said transformer is swung from operating to non-operating position; said last means comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means.

7. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture, electrodes terminating

adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position; and means operated by said pivoted mounting means for disconnecting said transformer from the source of current when said transformer is swung from operating to non-operating position; said last means comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means.

8. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position whereby said terminals may be disengaged from said contacts; and means for disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position; said means for disconnecting said motor and said transformer comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means.

9. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position whereby said terminals may be disengaged from said contacts; and means for disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position; said means for disconnecting said motor and said transformer comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means, said switch comprising a spring-loaded plunger, and said operating lever being so arranged as to swing through an arc about the pivot of said pivoted mounting means; in combination with a leaf spring having one end fixed and its free end extending beyond the end of said plunger toward the pivot of said pivoted mounting means to be engaged by and bent around the end of said plunger by said lever whereby to direct the thrust of said lever longitudinally of said plunger.

10. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivery fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position whereby said terminals may be disengaged from said contacts; and means for disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position; said means for disconnecting said motor and said transformer comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means, said switch comprising a spring-loaded plunger and a spring-loaded override button mounted in the end of said plunger, and said operating lever being so arranged as to swing through an arc about the pivot of said pivoted mounting means; in combination with a leaf spring having one end fixed and its free end extending beyond said override button toward the pivot of said pivoted mounting means to be engaged by and bent around said override button by said lever whereby to direct the thrust of said lever longitudinally of said plunger.

11. A pressure atomizing oil burner comprising a power assembly including an electric motor and a fuel pump driven thereby for delivering fuel oil under pressure to the firing region of said oil burner; an ignition assembly including a fuel atomizing nozzle connected to said pump for spraying fuel oil into the atmosphere to form a combustible mixture therewith, electrodes terminating adjacent said nozzle for creating a spark for the purpose of igniting said mixture, and contacts connected to said electrodes; a transformer having terminals in position to engage said contacts when the transformer is in operating position; pivoted mounting means for said transformer which may be pivoted to swing the transformer from operating to non-operating position whereby said terminals may be disengaged from said contacts; and means for disconnecting said electric motor and said transformer from the source of current when said transformer is moved from operating position; said means for disconnecting said motor and said transformer comprising a switch mounted on a fixed portion of the oil burner and a switch operating lever extending from said pivoted mounting means, said switch comprising a spring-loaded plunger and a spring-loaded override button mounted in the end of said plunger, the spring-loading of said override button being more resistant to compression than the spring-loading of said plunger, and said operating lever being so arranged as to swing through an arc about the pivot of said pivoted mounting means; in combination with a leaf spring having one end fixed and its free end extending beyond said over-

ride button toward the pivot of said pivoted mounting means to be engaged by and bent around said override button by said lever whereby to direct the thrust of said lever longitudinally of said plunger.

12. A pressure atomizing oil burner comprising a power assembly including an electric motor; a blast tube upon which said power assembly is mounted and through which combustion supporting air may be directed; an ignition assembly including a cap detachably fastened to and closing the rear end of said blast tube, oil conducting means including a tube mounted on said cap and extending through said blast tube to the front end thereof, an oil atomizing nozzle on the front end of said tube, electrodes mounted on said cap and terminating adjacent said nozzle, and contacts mounted on the rear of said cap and connected with said electrodes; a transformer hingedly mounted at the rear end of said blast tube and covering said cap when in operating position, said transformer having terminals in position to engage said contacts when the transformer is in operating position and the mounting of said transformer being such as to permit swinging thereof to a non-operating position whereby to expose said cap, said contacts, and said terminals and to permit access to and detachment of said cap from the rear end of said blast tube in order that said ignition assembly may be removed from the blast tube as a unit.

13. The construction set forth in claim 12 in combination with means simultaneously disconnecting said electric motor and said transformer from the source of current upon movement of said transformer from operating position.

14. The construction set forth in claim 12 in combination with fastening means to hold said transformer in operating position; spring means resiliently opposing swinging movement of said transformer to operating position; and means disconnecting said motor and said transformer from the source of current when said fastening means is unfastened and the transformer moved toward non-operating position.

ALLEN P. LIVAR.

CERTIFICATE OF CORRECTION.

Patent No. 2,301,060. November 3, 1942.

ALLEN P. LIVAR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 46, for "spirally" read --spiralling--; and second column, line 27, for "form" read --from--; page 6, second column, line 75, claim 7, after "mixture" and before the comma insert --therewith--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of January, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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