

June 12, 1928.

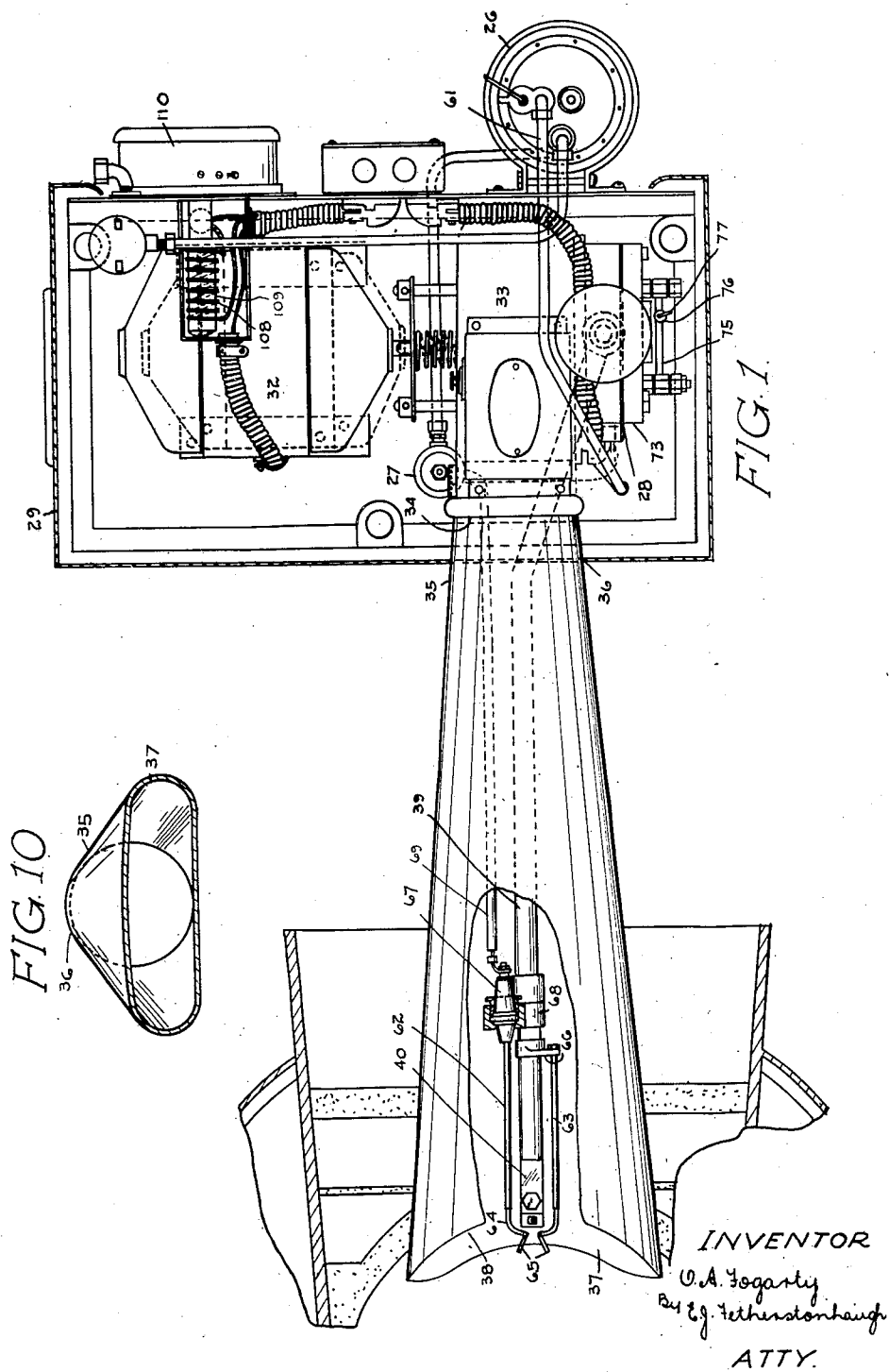
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O. A. FOGARTY

OIL BURNING MECHANISM

Filed June 26, 1926

6 Sheets-Sheet 1



June 12, 1928.

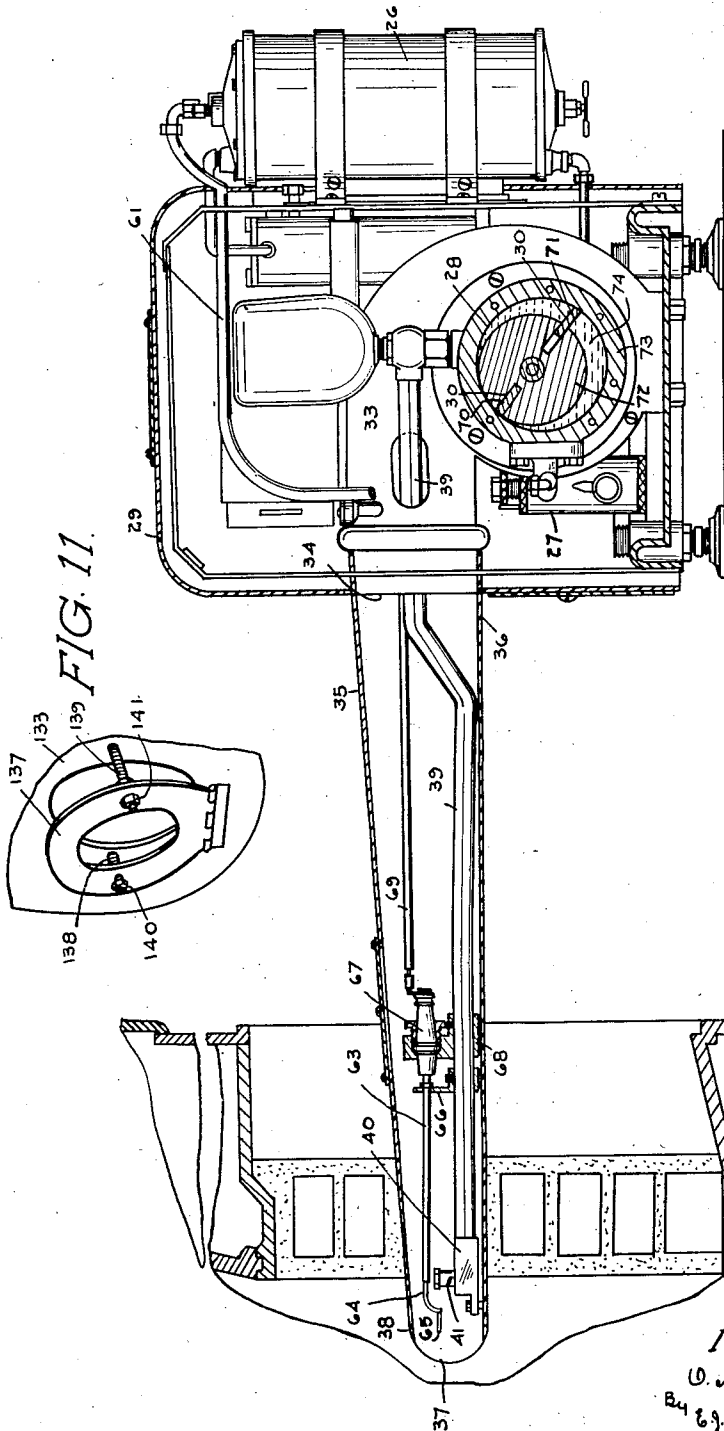
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6 Sheets-Sheet 2



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OIL BURNING MECHANISM

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6 Sheets-Sheet 3

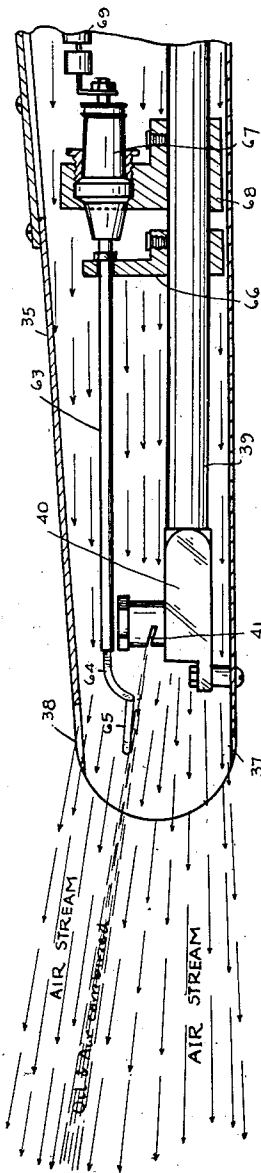


FIG. 3.

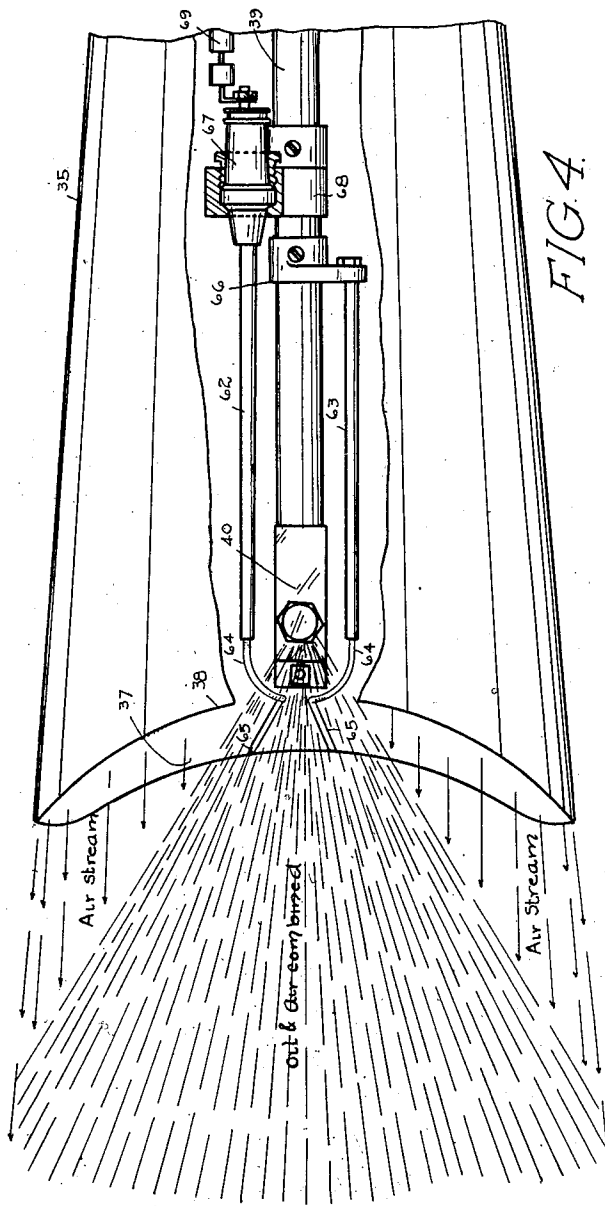


FIG. 4.

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6 Sheets-Sheet 4

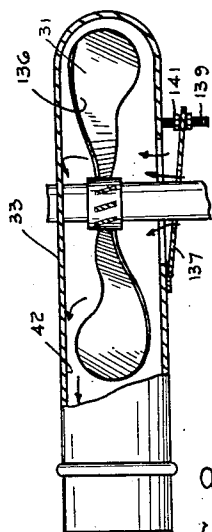


FIG. 8.

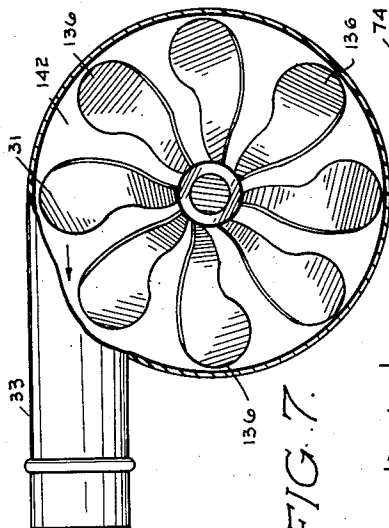


FIG. 7.

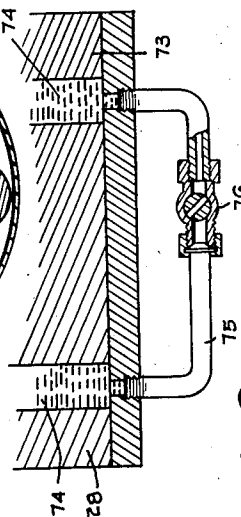


FIG. 9.

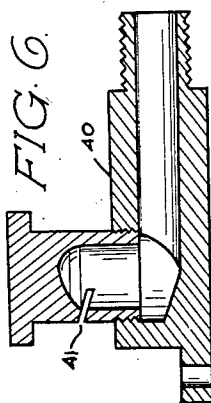


FIG. 6.

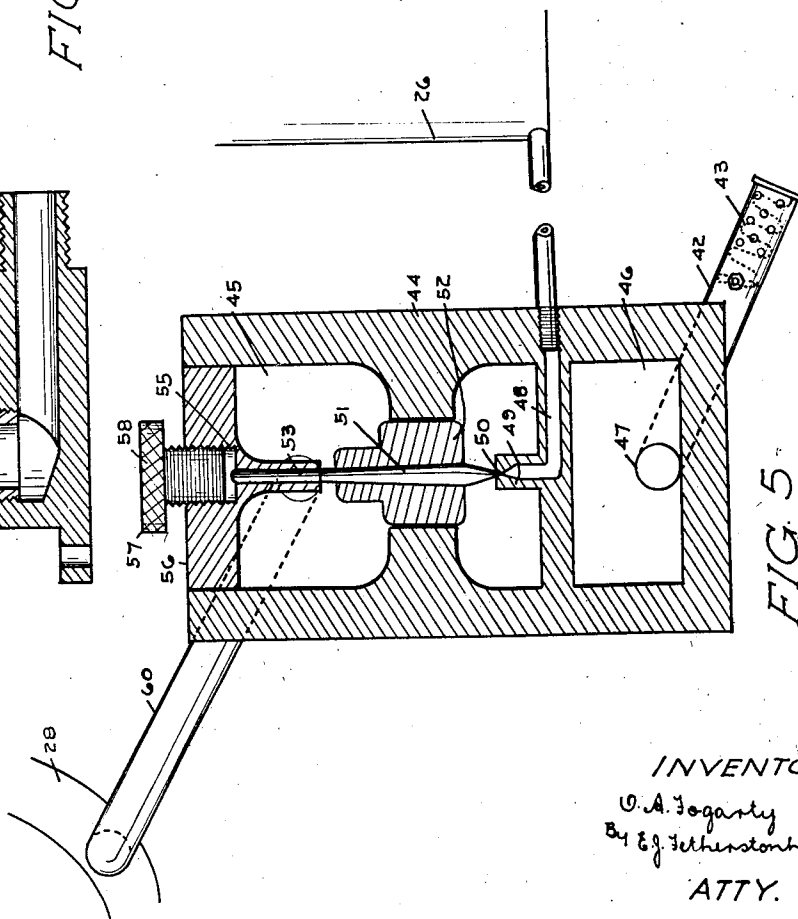


FIG. 5.

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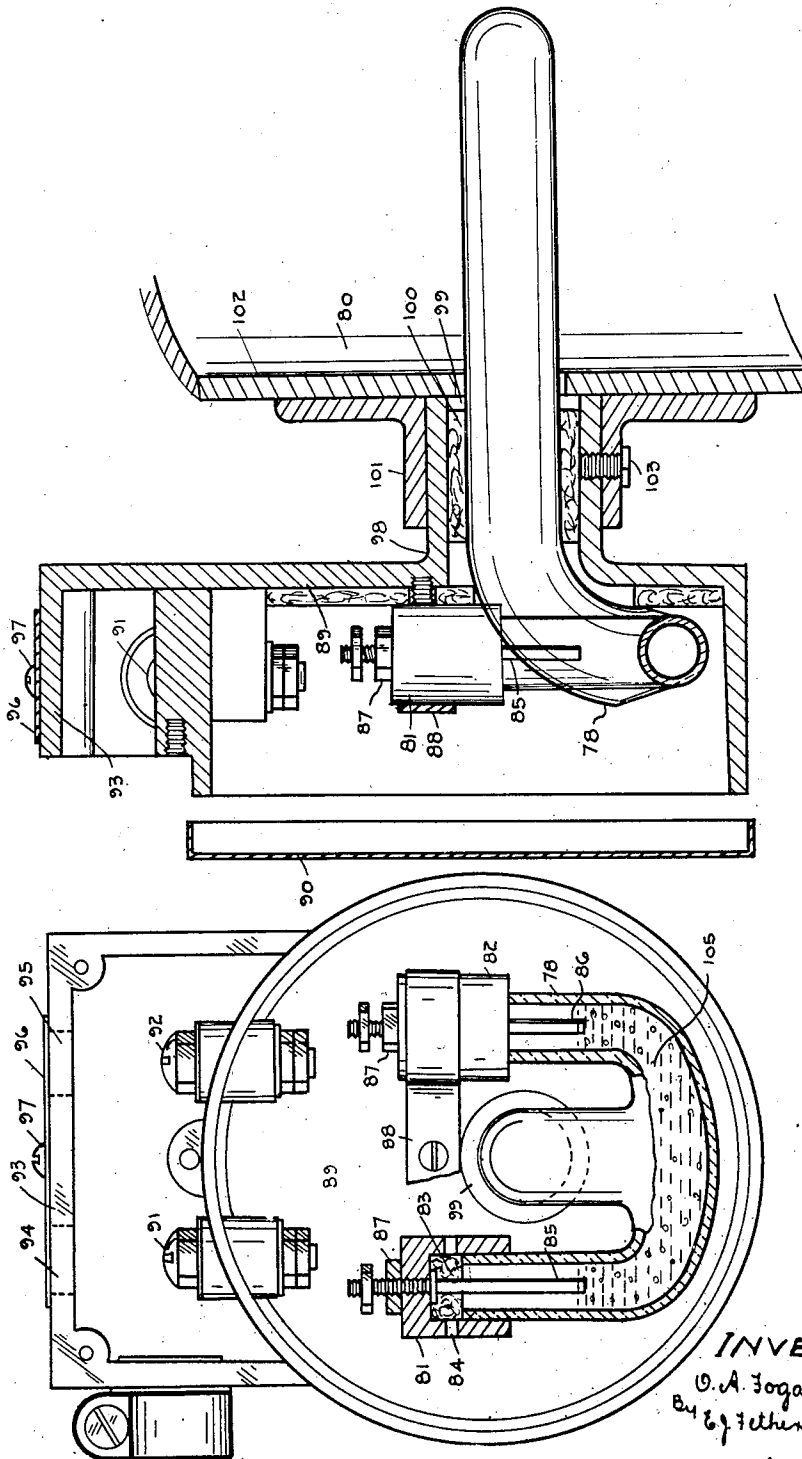


FIG. 13

FIG. 12

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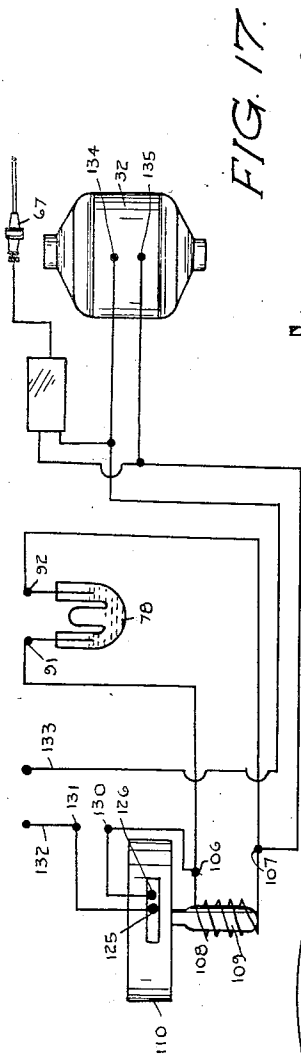
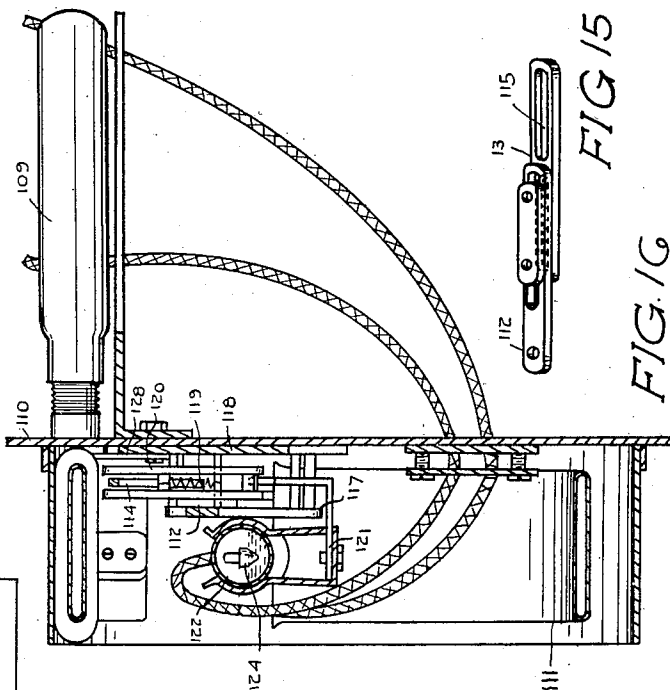
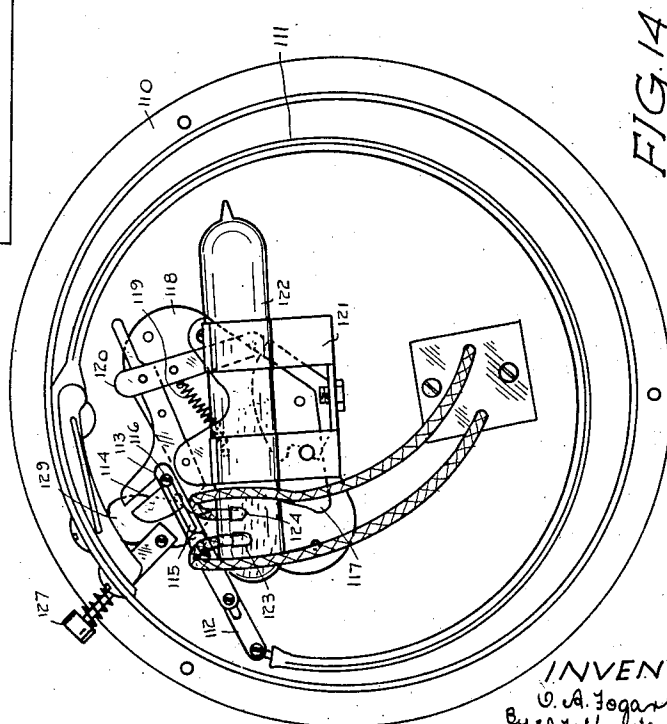
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OIL BURNING MECHANISM

Filed June 26, 1926

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE.

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OIL-BURNING MECHANISM.

Application filed June 26, 1926. Serial No. 118,807.

The invention relates to an oil burning chamber adapted to produce the rich mixture.

Figure 6 is a sectional detail of the 55 nozzle.

Figure 7 is a side elevation of the blower casing apart from the mechanism, showing the inlet and the deflecting wall.

Figure 8 is a cross sectional view of the 80 blower casing showing the direction of the air in being drawn into the fan and deflected to the forced draft air delivery.

Figure 9 is a sectional detail of the pressure regulator of the pump. 85

Figure 10 is a front view of the forced draft air delivery tube, showing the comparative shapes and areas of the inlet and discharge mouth.

Figure 11 is a detail of the adjustable 70 cover plate for the blower inlet.

Figure 12 is a vertical sectional view of the mercury electric switch of the U-tube used in the heated zone in connection with the operation of the safety device. 75

Figure 13 is a vertical sectional view of the same switch showing the thermostat tube.

Figure 14 is a plan view of the rocking mercury switch operated by an expansion member and included in the starting circuit and forming another part of the safety device. 80

Figure 15 is a perspective detail of the slotted connecting bar in the rocking mercury switch. 85

Figure 16 is a vertical sectional view through the rocking mercury switch.

Figure 17 is a plan view of the wiring including the two mercury switches and the motor, and ignition coil. 90

Like numerals of reference indicate corresponding parts in the various figures.

Referring to the drawings, this mechanism is based on the suction of oil from the main fluid tank 25, which may be placed 95 anywhere, either elevated or buried in the ground or standing on the level as found most convenient.

The suction occurs through the vacuum tank 26 the mixing chamber 27, and the 100 pump 28, as the original suction member and likewise the impelling member. These parts, namely, the vacuum tank, the mixing chamber and the pump, are assembled with

5 same.

10 The invention consists essentially of the novel features of construction pointed out broadly and specifically in the claims for novelty following a description containing an explanation in detail of an acceptable form of the invention.

15 The objects of the invention are to economize in the consumption of fuel oil and at the same time insure an intense heat; to furnish a burner to the public that is adaptable to many types of coal or wood furnaces now in existence, and yet equally adaptable to entirely new structures for oil heating only; to facilitate the regular and uninterrupted feed of the oil, so as to avoid the cooling off of the heated premises during a prolonged absence of the attendant; to insure sanitary and hygienic conditions for the occupants of the heated building; to 20 eliminate many of the objectionable features so well known in oil burning mechanisms by producing a machine requiring little service; to construct a mechanism that can be reset by an unskilled person for test following the operation of the safety 30 appliance; and generally to provide a reliable and an efficient means of burning crude oil, that will conserve fuel and guarantee a steady and satisfactory temperature.

35 In the drawings, Figure 1 is a plan view of the burning mechanism, showing the forced draft air delivery tube of the furnace broken away to disclose the ignition.

40 Figure 2 is a side elevation of the oil burning mechanism, showing the forced draft air delivery tube in longitudinal section, and disclosing the ignition.

45 Figure 3 is a diagrammatic view illustrating the end of the forced draft air delivery tube in vertical section, and pointing out by the means of arrows the direction of the additional air and the rich mixture.

50 Figure 4 is a plan view of the discharge showing diagrammatically the probable lines of the oil and air on leaving the forced draft air delivery tube.

Figure 5 is a sectional detail of the mixing

the frame 29, which may be of any desired shape, but it is here shown as rectangular, the vacuum tank 26 being immediately outside the frame, and the mixing chamber 5 inside the frame, also the pump. The pump 28 is rotary and has its pistons 30 mounted on a shaft common to the air rotor 31 and electric motor 32, said electric motor 32 being the actuating member of the mechanism. The fan 31 is housed in the blower casing 33, having the outlet 34, to which the circular end of the forced draft air delivery 35 is secured.

This forced draft air delivery tube 35 is gradually flattened from the circular end 36 until it reaches the delivery end where it flares to a wide shallow oval discharge opening 37 centrally recessed from the ends as shown at 38, and forming an inwardly curved mouth of greater area than the circular inlet end 36, thereby slightly relieving the force of the air, and permitting a more thorough mixture with the atomized oil that is drawn from the feed pipe by the rush of air.

The oil pipe 39 extends from the outlet of the pump 28 into the blower casing 33, and from there through the circular inlet 36 to the tube 35, and along said tube centrally though near to the bottom. Just inside this mouth the nozzle 40 is mounted on the end of the pipe 39, and extends thereabove having the arc-shaped upwardly inclined jet orifice 41, which is as wide as possible according to the dimensions of the nozzle head.

It will thus be seen that the oil brought by suction from the main fuel oil tank is first broken up in the mixing chamber 27, where the primary air is simultaneously drawn through a tube 42, having a muffler 43 at the outer end thereof. This air mixes with the broken particles of oil and finds its way through the compartments of the mixing chamber into the pump 28.

In the mixing chamber, the casing 44 is divided in the interior into upper and lower chambers 45 and 46, the lower chamber having an inlet for the air ingress tube 47, while intermediate of the height of this lower chamber the oil inlet passage 48 is formed and terminates in a central upwardly projecting and perforated discharge nipple 49 having the needle valve seat 50. The feed pipe leads from the vacuum tank 26 into the inlet oil passage 48, directly to the perforated boss or nipple 49, through the valve seat 50 in the upper end of the said nipple.

The needle valve 51 carries the solid cylindrical body 52 above the tapered end of the needle valve 51 said body having the reduced upper end 53 extending into the upper chamber 45. The stem 53 of the needle valve projects upwardly into the centrally threaded

orifice 55 in the casing cover 56, this threaded orifice 55 being closed by the screw plug 57 having a knurled head 58, by means of which the limit of movement of the needle valve may be accurately adjusted, according to the conditions of installation.

The annular partition between the upper and lower chambers is fairly deep, so as to coact with the body 52, which is slidable therein. Thus the rich mixture may pass in the thinnest of films through the annular port around the body 52. This body of course forms a weight, which maintains the needle valve on its seat, except during suction movements, and just as soon as there is a vacuum created by the operation of a pump piston, this needle valve will be withdrawn from the seat 50 to the extent permitted by the adjustment, and the oil drawn from the vacuum tank will pass through the needle valve port and there be comminuted. This divided oil is taken up by the air, which is also drawn by the suction and the mixture of broken particles of oil and primary air as the rich mixture finds its way through to the upper chamber around the body 52 and then passes through the outlet 60 to the pump 28, where it is rapidly driven by the pistons into the tube 39 as explained.

In the pump 28, the mixture enters the suction end and is discharged at the pump outlet into the oil pipe 39, where it flows along to the nozzle 40. Meanwhile the electric motor has been driving the fan 31 and the air taken in through the side inlet of the lower casing 33 is deflected in the direction of the forced draft air delivery tube 35 around and about the oil pipe 39. The rush of this air, which is reduced by the deflection to a more moderate speed, draws the rich mixture from the jet orifice 41, which produces a spreading flat stream shot forth from the nozzle at considerable speed through the great speed of the additional air, with which it thoroughly mixes, in order that the actual fuel consumed by the oil burning mechanism shall be comparatively light and thin though of a high combustible nature.

There are parts in this combination of elements mentioned which have been used before with some success, as for example, the suction mechanism in general is similar to the same equipment on motor driven vehicles, that is to say, there is the vacuum tank, the carbureter and the pistons, which means that the pump really takes the place of the engine pistons, in creating the vacuum necessary for the suction, but in this application of these devices there is an extremely essential construction in regard to the mixing chamber 27, which takes it out of the class of the carbureters, as they are used on the vehicles, in other words, the original mixing to produce the rich mixture,

has to be done in a way peculiar to oil burning mechanisms, and therefore in the present invention the mixing chamber is merely a turning in the passage, where there is never an accumulation, as it is merely an intermediary between the vacuum tank and the pump suction chamber, consequently this begins to take the invention away from the ordinary uses of a vacuum tank, carbureter and internal combustion engine.

The delivery of the rich mixture and the lightening up of the same hereinbefore mentioned, is accomplished under entirely new methods, by means of a tube which guides the air in such a manner as to give it the required force for the withdrawal of the rich mixture, and yet sufficiently moderate to mix well and not rush ahead of the mixture that it has withdrawn from the nozzle. This feature is of essential importance and constitutes the difference between operability and inoperability, for you can send the air at such a speed that the oil mixture in its rich state merely follows the forced draft, being drawn after it, and therefore it does not properly lose its richness, which reduction is an essential in this invention.

This explanation will perhaps show, that in the adoption of well known principles, the invention and redesigning of certain parts brings forth efficiency and an entirely new machine.

The vacuum tank 26 is practically the same as is used in the motor car equipment, and the pump pistons create the vacuum through the carbureter and suitable connecting pipes, one of which 61 enters the vacuum tank at the upper end.

The ignition of the rich mixture is accomplished immediately in front of the discharge opening, otherwise the jet orifice 41, and the electrodes 62 and 63 have the down turned and inturned points 64 and flaring extension wires 65. The electrode 63 is clamped to the collar 66, which is mounted on the oil pipe 39, thus this particular electrode is grounded. The electrode 62 projects directly from the spark plug 67, which is mounted on the bracket 68, secured to the oil pipe 39. The length of the electrodes brings the spark plug a considerable distance inwardly from the mouth 37, and the insulated wiring 69 is connected to said spark plug and extends to the source power.

The spark produced across the gap between the points 64 is extended by the draft to form a miniature flame, therefore no failure is likely to result in ignition.

The pump 28 is a conventional rotary pump, having the sliding pistons 70 and 71 mounted diametrically opposite one another in the rotor 72 driven by the motor 32.

The pump piston is eccentrically arranged in the pump casing 73, and forms the rotor of the machine, this being a type of pump

commercially recognized and procurable on the market. Naturally one side of the piston vane is a suction chamber and the other side a pressure chamber.

It is desirable in the oil burning business, that at times some relief should be given in the pump suction chamber, because the feed often is entirely too strenuous for the burner in small installations, of course in a very large installation, there is not much trouble about such matters, but for the average installation, the various adjustments provided by this system are found so useful as to make the oil burning mechanism very practical for any plant.

Now to relieve the great driving force of the pump, a by-pass 75 is provided, which enters the suction chamber 74 at the suction end, and also at the compression end, and intermediately of the pipe forming the by-pass, the valve 76 is introduced this valve being permanently adjusted for the particular installation by means of a key applied to the stem 77, therefore should the feed be greater than required for the circumstances of the installation, it can readily be relieved by the very slight opening of this valve and the stem locked by a jam nut or in any other suitable manner.

In all oil burning mechanisms it is essential to have a safety device whereby overheating and underheating is positively guarded against. The accidents including conflagrations resulting in the use of oil burning mechanisms are always due to the crudity of the devices intended to stop the burner mechanism within a very few minutes, as for example, using the weight of the unburnt or crude oil, which usually occupies the most prominent place in many safety mechanisms.

There are a great many electrical devices on the market, but the customary action is to close a broken circuit, in order to operate the safety mechanism to stop the feed.

The safety device in this invention, which is adaptable to any efficient oil burning mechanism, is based on the part standard practice, that is to say, it relies for its operation on the expansion of air or other gas to mechanically actuate the switches to shut off the motor.

In this device, there is a U-shaped tube 78 having a rise 79 in the middle thereof, from which extends the stack tube 80, this part is probably made of pyrex glass, that is to say, glass that will be able to stand a considerable degree of heat.

The tops of the U-shaped tube 78 are closed by the caps 81 and 82 respectively, and are held at the desired distance by the nuts 87. These contacts also extend through the felt pads 83 and in extending downwardly terminate intermediate of the height of the legs of the U-tube 78.

The strap 88 encircles the caps 81 and 82 at either end, and in the centre is screwed to the casing 89, which contains this mechanism, this casing being closed in by the cover plate 90.

The terminals 91 and 92 are fixedly secured at the upper end of the casing 89 and are intended to communicate with the contacts 85 and 86. These terminals at their outwardly projecting ends are hooded by the overhanging wall 93, which at the upper end is provided with two holes 94 and 95, normally covered by the cover plate 96 held by the screw 97.

At the back of the casing 89 a circular flange 98 projects around the opening 99, and it is through this opening that the stack tube 80 projects, said stack tube 80 being packed in said opening 99 by the asbestos packing 100.

The flange 98 is inserted in an adapter 101, this adapter being screwed to the stack pipe 102 through suitable screw holes, and locked in position on the flange 98 by the set screws 103.

It will now be seen that an unusually sensitive device is provided for the mercury electric switch. The mercury or other suitable chemical partially fills the bottom of the U-tube 78, and this mercury on the expansion of the air in the stack tube 80, is forced upwardly in the legs of the tube, until it reaches the contacts 85 and 86, then the electric connection is established between these two contacts and maintained constantly while the pressure remains normal.

The air bubbles, which are indicated by the numeral 105, represent a surplusage and these are readily passed through the mercury and out through the felt pads 83 and air holes 84, thereby relieving any undue pressure, without permitting the ingress of any foreign element.

The terminals 91 and 92 are connected to the terminals 106 and 107, and the latter terminals are connected by the coil 108, so that the U-tube 78 and connecting wires form a shunt from the starting circuit and eventually part of the operating circuit as will clearly be seen.

The coil 108 is wound around a blind tube 109 containing acetone or spirits readily expansible, and this tube 109 extends from a casing 110. The tube is connected to a Bourdon tube 111, the loose end of said Bourdon tube being pivotally secured by the connecting bars 112 and 113 to a slotted pivoted lever 114.

The chief difference in this construction now being described is that in the bar 113, there is an elongated slot 115, through which the operating pin 116 extends, otherwise the machine may be bought on the market.

The lever mechanism is contained between

two fixed plates 117 and 118, and compresses said pivoted lever 114, and the spring connection 119, drawing on said pivoted lever by means of the bars 120, secured to one arm of said lever.

The rocking bracket 121 supports the mercury tube 122, which has the two contacts 123 and 124 therein, and projecting outwardly therefrom and connected to the terminals 125 and 126.

The bracket 121 is pivotally secured to the plates 117 and 118 and rocks with the motion of the pivoted lever 114, and as the Bourdon tube 111 is pivotally secured to the slotted pivoted lever 114, the expansion of this tube will release the mercury tube bracket and throw its nose downwardly with the result that the connection between the terminals 125 and 126 is broken. This may be restored by pressing on the spring held button 127, this button having a stem 128, engaging the cam 129 and returning the lever 114 to its original connected position.

In this particular invention the importance of this second switch cannot be over estimated, though the actual details of its working and the description of its parts has not to do with the invention, for it is purchased on the market as a standard machine, in fact it is a waterstat, the only difference is the use it is put to, with the exception of the slotted bar which facilitates the return motion.

The terminal 106 is connected to the terminal 130, which in turn is connected to a terminal 126, and the terminal 131 is connected to the terminal 125.

The wire 132 from the terminal 131 is connected to the source of power, from which the motor derives its movement. The wire 133 leads from the source of power.

The motor terminals 134 and 135 are thus connected, one directly to the source of power and the other through the terminal 107, and by changing routes to the wire 132.

The blower casing 33 is much the same as many blowers in use so far as appearance is concerned, but the propellers 136 of the air rotor 31 are formed to draw the air in at considerable speed and deliver it therebehind in the form of backstream common to aerial propellers. The volume of air admitted is governed by the gate valve 137 regulated by the adjusting bolts 138 and 139 and nuts 140 and 141.

The backstream from the propellers 136 hits the side wall 142 of the blower casing and turns the flow in the direction of the outlet 34, from which it flows in the direction of the oil feed pipe nozzle and out of the mouth of the forced draft and delivery tube, thus it will be seen that the forced draft is twice moderated, once by the deflection of the backstream and again by the wid-

ening of the delivery end of the tube and increasing the area of the mouth over the blower outlet.

The operation of this oil burning mechanism is begun through the starting circuit including the coil 108, which is around the acetone tube, because the stack tube 80 is then of course quite cold, and the circuit disconnected in the U-tube 78. This, however, is only a matter of a few seconds, as the first flame from the mixture will heat the U-tube 78, resulting in the expansion of the air and the spreading of the mercury, so that it will rise in the legs of the tube to meet the electric contacts 85 and 86. Just as soon as this happens the current switches that is to say, it transfers itself to the shunt circuit, including the U-shaped switch and relieves the acetone tube of any heat while the burner is operating.

The connection to the motor, and particularly to the terminal 130 from the source of power is through the wire 132 to the terminal 125, which is connected to the terminal 126, to the contacts 123 and 124 immersed in the mercury solution in the tube 122.

The terminal 126 is connected to the terminal 106, and in the operating circuit this terminal is connected to the terminal 91 of the U-tube. The expansion of the air in the stack tube connects the contacts 85 and 86 as explained, so the motor current flows through said mercury to the terminal 92, and is from there connected to the terminal 107, and from this terminal it is connected to the said contact 130. Therefore there are two mercury switches in the operating mechanism of the safety device, and immediately from whatever cause, the fire goes out, the stack tube will cool and the mercury drop to its lower position, thereby clearing the contacts 85 and 86. This puts all the current from the source of supply on to the coil 108, which heats up the acetone and expands it in the Bourdon tube 111, which pulls on the safety mechanism and upsets the mercury tube 102, so that it points nose downwards. The result of this is that the circuit is absolutely broken, but any person can without skill in the matter, restore by means of the spring button 127 the connected position of the mercury tube 122, and when that is done, the oil burning mechanism may recover some temporary disarrangement and perhaps continue, but it is only a matter of a minute or so, unless some more serious readjustment is required, as the Bourdon tube will again operate, and then the only thing that will restore the operation of the oil burning mechanism is to effect the necessary readjustments so as to pass the current into the shunt circuit and relieve the coil 108, and when this is accomplished, the burner is in excellent working condition again. Every

precaution is taken to avoid any undue operation of the safety device, and reasonable margin given when possible in minutes and seconds, to start its operation, as for example, may be two minutes to two minutes and a quarter before the current will be shunted from the coil circuit to the U-tube circuit, as it is not necessary to have anything quicker than that, in fact it is not at all customary, but it is the positive part of it that is all important, for it will be noticed that it is thrown out by the stack tube and put on the starting circuit with the coil, and if it is only a temporary dislocation of thirty or forty seconds, it will shunt again to the U-tube circuit, but where the remedy is not automatic, it will positively be cut out by both mercury switches, even though one may be restored temporarily to see if it is actually out of business. It will not operate through the first or second mercury switch, unless everything is absolutely correct, thereby giving a large measure of safety to the oil burning mechanism.

What I claim is:—

1. An oil burning mechanism, comprising a vacuum tank, directly connected to the oil supply, a mixing chamber having air and oil inlets and an air and mixture outlet, a rotary pump connected to said vacuum tank indirectly through said mixing chamber, a discharge pipe from said pump terminating in an upturned nozzle, a forced draft air tube containing said discharge at the bottom thereof and widened at the mouth to form a horizontal inward taper and a vertical outward taper, a blower delivering air to said tube, a motor grouped with said pump and blower and associated parts, and a spark plug within said tube having extended electrodes and extensions therebeyond over said nozzle.

2. In oil burning mechanism, a forced draft air delivery tube having a flat bottom, a domed top, in cross section and extended sides and an oil feed pipe and nozzle adjacent to said bottom and delivering fuel oil, upwardly and outwardly and forming with said tube an atomizer in which the air tube flares outwardly at the sides from a circular blower opening and tapers to a flat mouth.

3. An oil burning mechanism, a forced draft system comprising a blower and an air delivery tube therefrom changing in form to a flat mouth at its delivery end, a spark plug within said tube, having suitable electrical connections, a pump feeding an oil pipe and nozzle, and projecting into said tube, a vacuum tank connected to the oil supply, a mixing chamber connected to said tank and said pump for suction purposes, a motor driving said blower and pump to maintain a steady fuel oil and air supply adapted to form the final combustible mixture beyond the discharge mouth of the air delivery tube, and

electrodes extending from said spark plug beyond a grounded collar and having double offsets at the gap ends.

4. An oil burning mechanism, comprising
 5 a main supply tank, a vacuum tank permanently connected therewith, a mixing chamber adapted to draw the primary air from the atmosphere and the fuel oil from the vacuum tank and mix the two and iron out
 10 the mixture before delivery, a rotary pump furnishing the suction for drawing the oil through said mixing chamber and impelling the mixture at adjusted pressure through its outlet, a motor driving said pump, an oil
 15 feed pipe extending from said pump outlet and terminating in a nozzle, a blower casing having a central side feed opening and adjustable gate valve for said opening, an air rotor in said casing and driven by said motor
 20 and furnishing a backstream deflected by the blower casing wall, a forced draft air delivery tube extending from said blower casing and terminating in a flat mouth just beyond said nozzle, ignition means having extended electrodes and enclosed within said
 25 tube, and an electric safety device including a starting and an operating circuit and means for shifting the current automatically on change from normal.

30 5. In oil burning mechanism, an oil reservoir, a vacuum member adapted to withdraw oil from said reservoir to feed the burner a pump drawing oil from said vacuum member, tubular connections furnishing
 35 a passage for a continuously flowing stream of constant volume from said vacuum member to said pump and in passage drawing in air for mixing with the oil during the uninterrupted flow of the latter to the delivery
 40 end of the pump and means for closing said tubular connections governed by the stoppage of said pump and the consequent stoppage of the indraft thereto through said tubular connections.

45 6. An oil burning mechanism comprising an oil feed mechanism including a reservoir, a vacuum tank, a pump, a through tubular fuel connection and a supplementary tubular
 50 air connection from said vacuum tank to the pump, a valve controlled air inlet pipe, leading into said tubular fuel connection, and a valve in said fuel connection beyond said air inlet opened owing to the
 55 reduced pressure above the valve structure in relation to the pressure therebelow in the line of the fuel stream and maintained thereby in said open position during the opera-

tion of the burner and forming the point of caruretion in the continuous stream of oil and air passing thereby.

7. An oil burning mechanism comprising a feed mechanism having a pump connected to the supply by a tubular passage, a valve casing and seat in said passage, a valve in
 60 said passage on said seat and having a stem slidable in a guideway, and an adjusting screw regulating the length of the opening and closing stroke of said valve and stem and the volume of the constant fuel stream,
 70 and an air intake member having a controlling valve adjusted to regulate the inflow of air for the mixture and differentiate the pressures on either side of the valve structure in the fuel stream to maintain said valve in
 75 the fuel stream in its open position during burning operations.

8. In oil burning mechanism, a forced draft delivery tube formed at the delivery
 80 end into a transversely extended mouth inwardly arced at the top and bottom in curves of different radii forming a projecting inwardly curved lip at the bottom adapted to mitigate the rumble due to the
 85 discharge of the mixture taken up by the forced draft.

9. In oil burning mechanism, a forced draft air tube adapted to be attached to a
 90 blower at its circular inlet end and tapering from the latter to a wide flat mouth of greater area than the circular inlet to relieve the blast of air at the fuel nozzle, said mouth being inwardly curved from the sides and shortened at the top to leave
 95 a clear space above the discharge of the fluid fuel.

10. An oil burning mechanism comprising a feed mechanism including a motor driven
 100 pump drawing oil and air from the fuel feed members, tubular members forming a through passage for the fuel and having an enlarged section and a valve having a stem carrying a compressing member in the form
 105 of a piston dividing said section into a vacuum chamber resulting from the pump action and a mixing chamber adapted to contain the fuel mixture at a greater pressure than the pressure in said vacuum chamber during the operation of the pump and
 110 thereby hold the valve continuously open during burning operations.

Signed at Montreal, Canada, this 14th day of June 1926.

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