July 19, 1966 M. MOMCHILOVICH ETAL 3,261,389

OIL BURNER EQUIPMENT

Original Filed Nov. 9, 1962 5 Sheets-Sheet 1

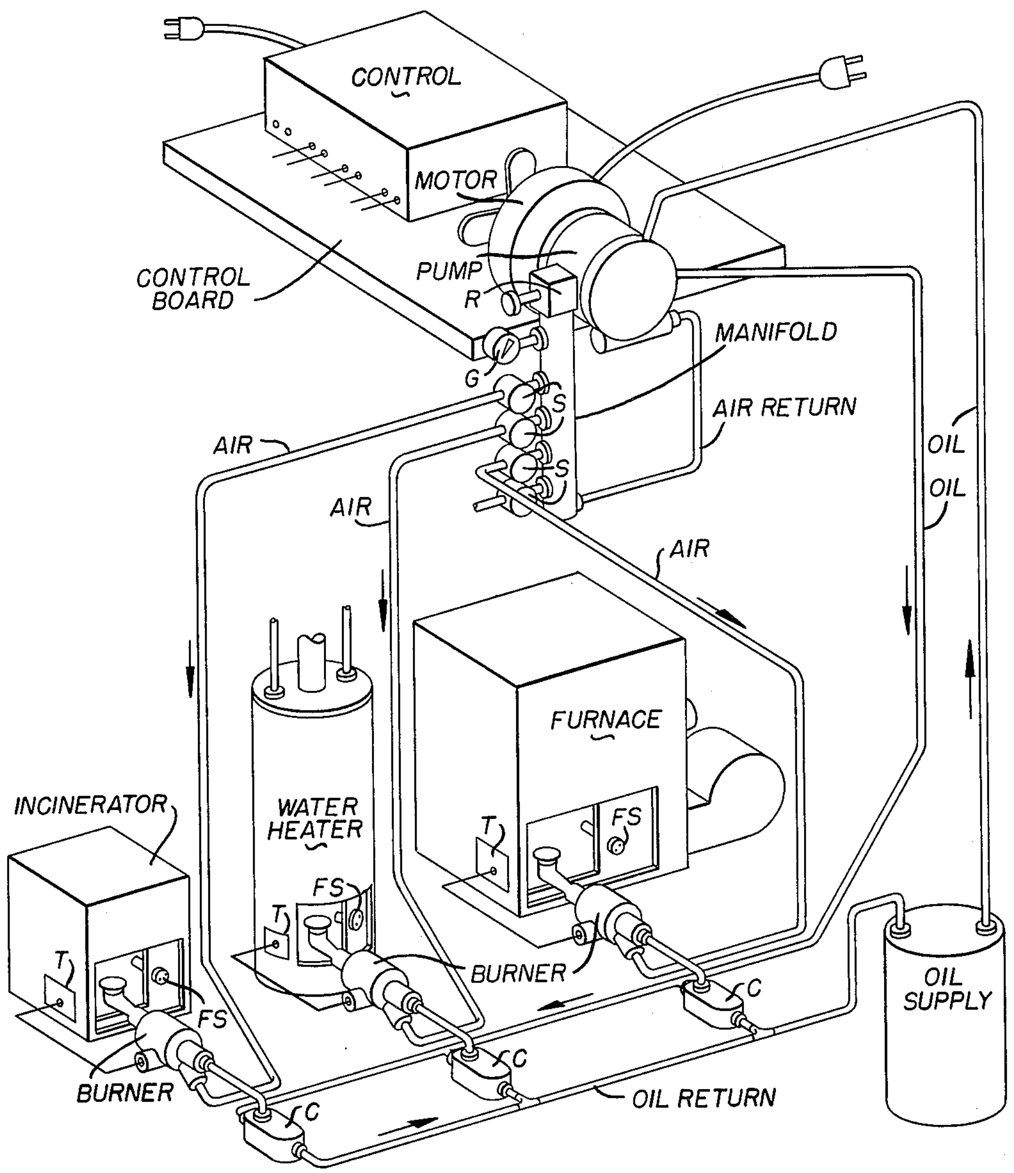

FIG. 1

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OIL BURNER EQUIPMENT

Original Filed Nov. 9, 1962 5 Sheets-Sheet 2

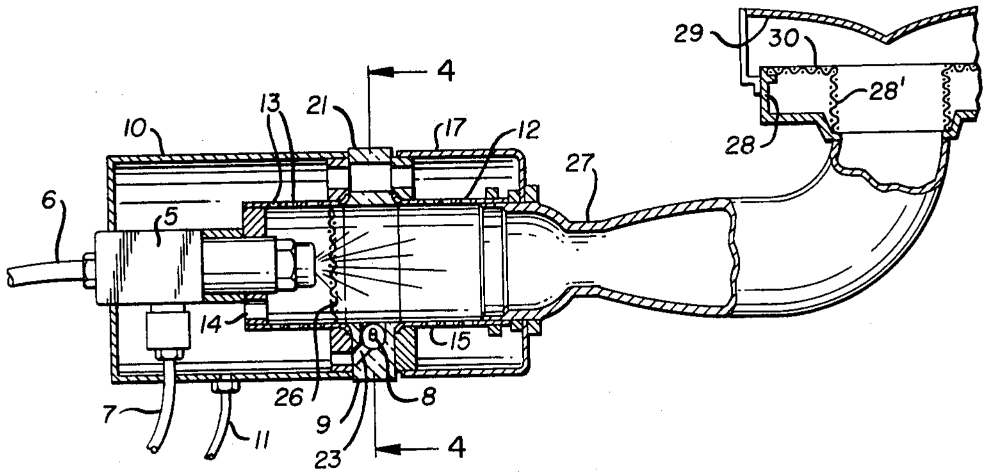

FIG. 2

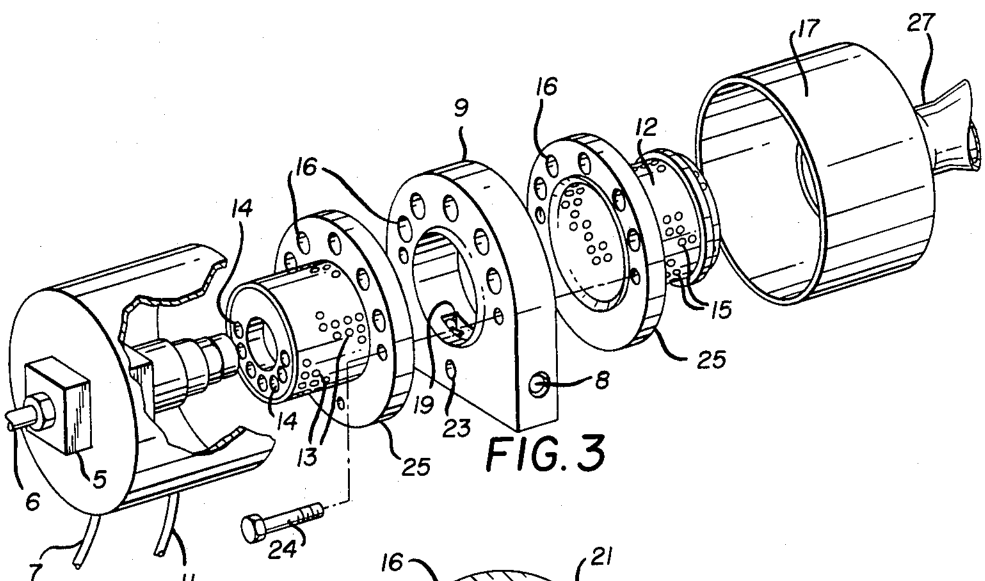

FIG. 3

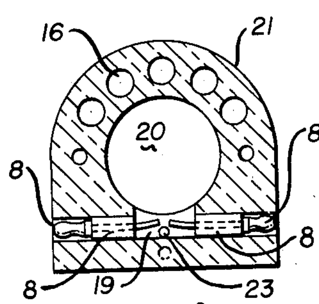

FIG. 4

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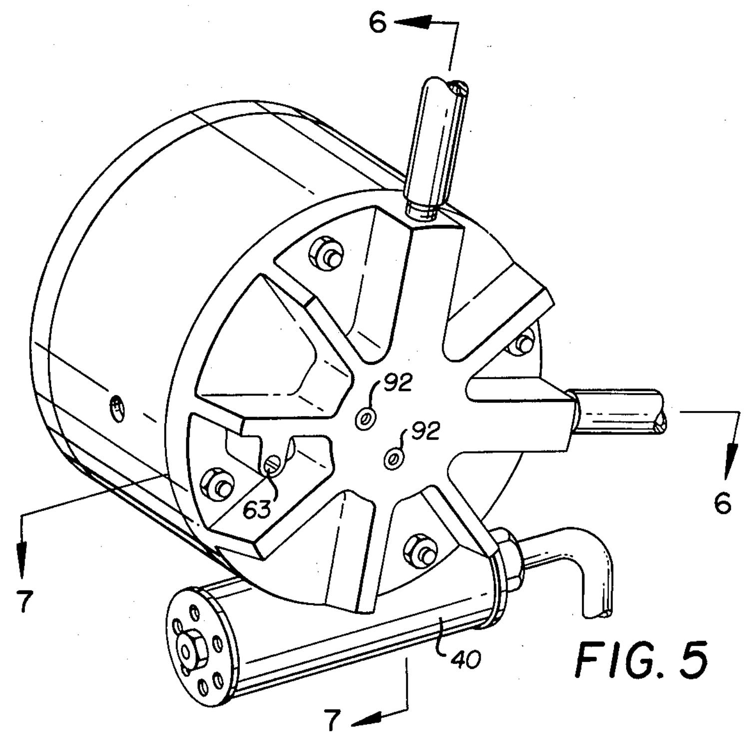

FIG. 5

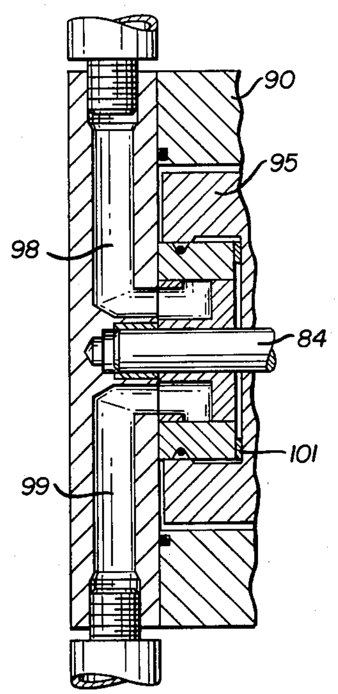

FIG. 6

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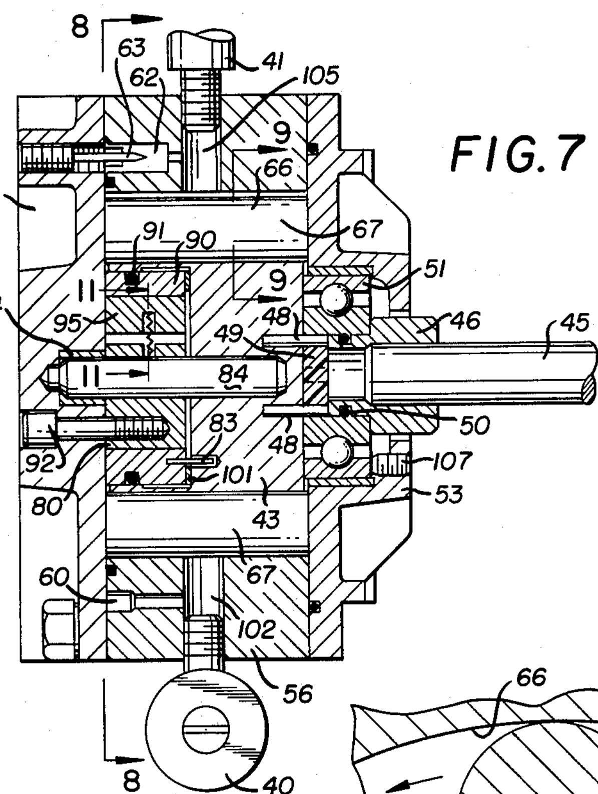

FIG. 7

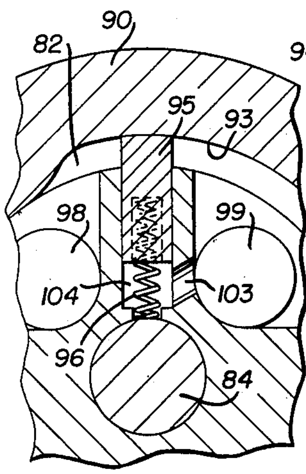

FIG. 10

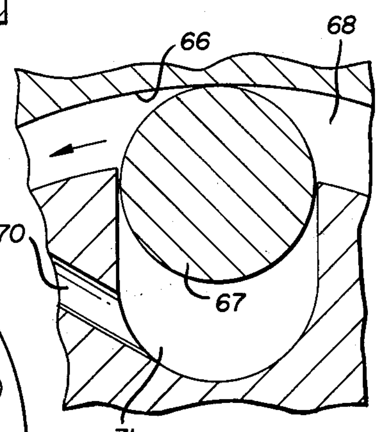

FIG. 9

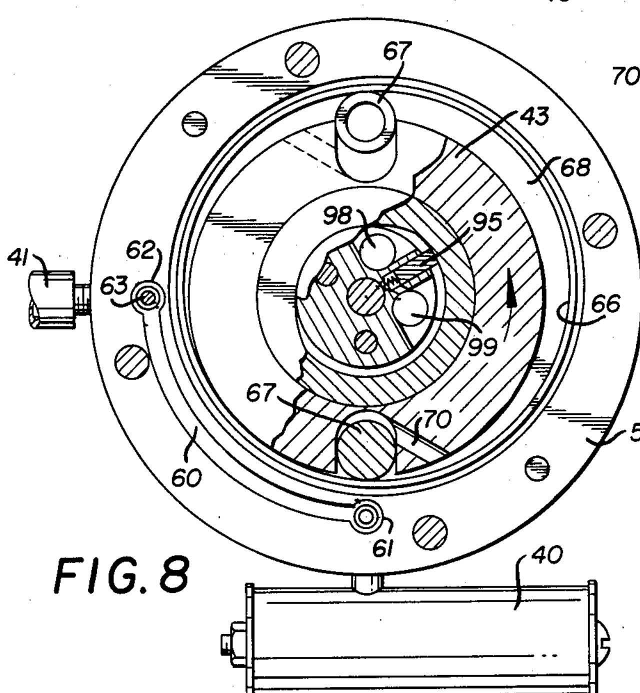

FIG. 8

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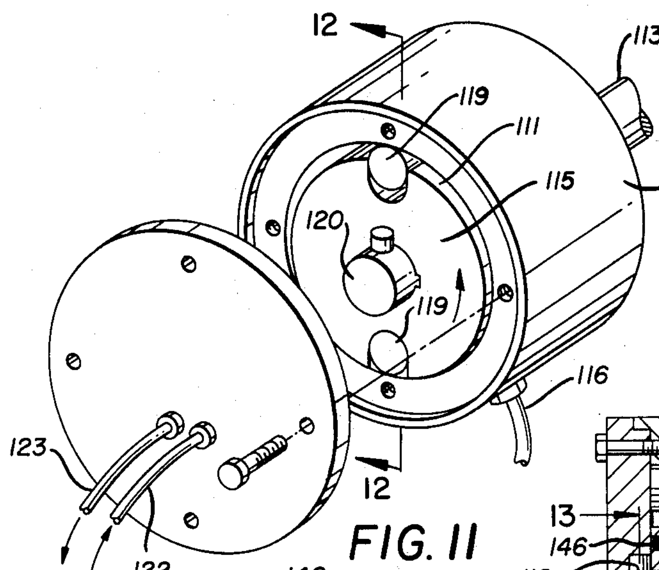

FIG. 11

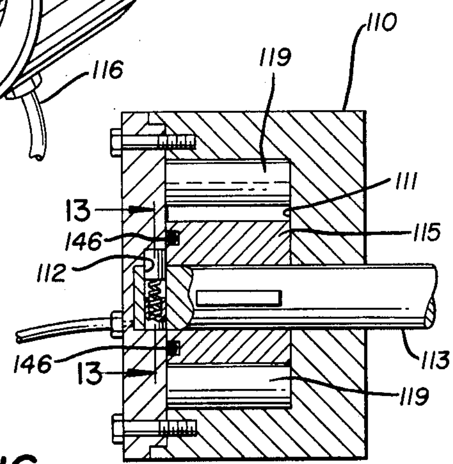

FIG. 12

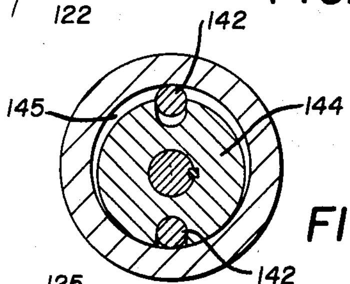

FIG. 16

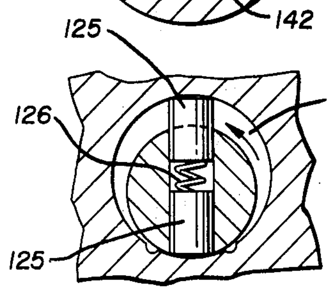

FIG. 13

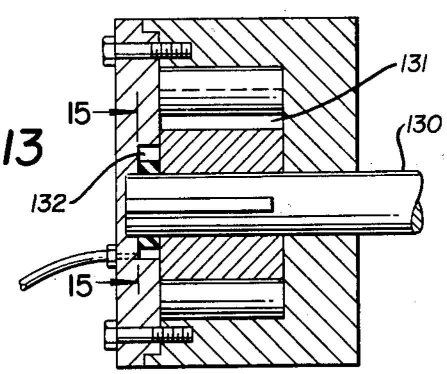

FIG. 14

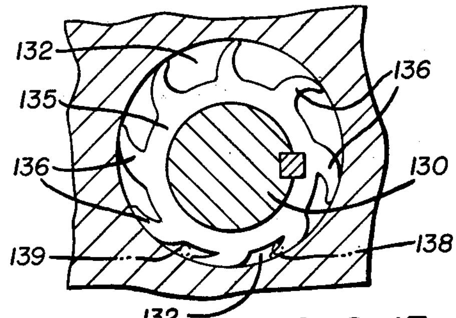

FIG. 15

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OIL BURNER EQUIPMENT

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Continuation of application Ser. No. 236,481, Nov. 9, 1962. This application June 23, 1965, Ser. No. 473,885
1 Claim. (Cl. 158—4)

This application is a continuation of our application Serial No. 236,481, filed November 9, 1962, now abandoned.

This invention relates to a new oil burner system and includes a new oil burner and also a new pump designed more particularly for supplying both air and oil to one or more oil burners.

In the system, air is supplied from a pump to a manifold connected to a plurality of burners, utilized from time to time, and oil is supplied to each burner preferably from the pump through a float control valve which maintains a supply of oil at a level just below that of the burners. In this system all of the burners are located at about one inch above the oil level, and as the oil is aspirated at the burner nozzle additional oil is drawn up into the burner. Because the oil is lifted into the burner, it is impossible for the oil to flood the burner. The air in the manifold is maintained at a low pressure in the range of 1 to 10, and preferably about 3 to 5, pounds per square inch. Unused air is advantageously returned from the manifold to the pump, either to the air intake or the chamber in which the air rotor operates.

The pump is provided with two chambers located side-by-side on a common axis, with an impeller in each chamber. The larger chamber has an air intake and outlet, and the intake of the smaller chamber is connected with an oil supply and this pump delivers the oil through a suitable outlet. The air aspirates the oil in one or more burners which generate heat in one or more appliances such as a furnace, an incinerator, a clothes drier, a hot-water heater, etc.

Although various means may be utilized for supplying low-pressure air to the burner, the preferred equipment utilizes a rotary pump in which roller pistons are employed. These pistons are thrown toward the circumferential wall of the chamber of the pump as the rotor is rotated. The motor which drives the pump may be an electric motor. A 0.1 H.P. motor operating at 1000 r.p.m. is satisfactory for low heat requirements. For larger burners, a larger motor may be required. The motor is preferably constructed as a unit with the pump housing.

Both of the chambers in the pump, viz. the oil chamber and the air chamber, are located in a single housing. The smaller chamber which is the oil chamber may be offset outwardly from the air chamber, or it may occupy space partitioned off from within the air chamber, or it may be located partially within the air chamber with the remainder extending out from the air chamber. The impeller within the oil and/or air chamber may rotate, or it may be a stator with the chamber rotating about it. No wall separates the two chambers and oil escapes from the oil chamber in a small amount sufficient to lubricate moving parts within the pump.

The preferred type of burner includes a chamber into which oil is aspirated by primary air. The exit from this chamber usually includes a Venturi and gases flow through the chamber under increasing pressure. As the gases pass through the Venturi their speed is increased. A flame is maintained at a point beyond the Venturi where the gases are fed with additional air. Terminal temperature is quickly reached.

Under a preferred set of conditions the chamber into

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which oil and primary air are fed serves as a conversion chamber in which the oil and air mixture is burned under starved conditions and the exit gases are subsequently burned with additional or secondary air. Under other conditions there is no separate conversion chamber but a continuous flame exists from the ignition point and this flame is directed by the flame guide.

The parts of the pump may be machined or stamped from metal or they may be cast of plastic such as an oil-extended rubber or other thermoset plastic. Roller pistons are advantageously used in the air chamber and at least one spring-pressed flat vane in the oil chamber. These impellers may be made of nylon or Teflon or the like which are light in weight and need no lubrication, although they may be metal. They may be plastic coated, or they may be a metal shell filled with plastic.

It is desirable to circulate oil through the oil stator to maintain the pump at relatively constant temperature. It is possible to similarly circulate air through the air rotor. This prevents the pump from heating up with resultant rise in the temperature of the oil and air which would vary its performance even to the point of preventing the oil from being raised to any great height by vacuum.

The oil is preferably aspirated by the air through a nozzle located at the entrance to the flame guide which is open at both ends. Secondary air is introduced into the conversion chamber in which the flame guide is located. Between the nozzle and the flame guide there is preferably located a screen or a perforated or annular plate which prevents a back-fire.

The burner may be generally horizontal, in which case the combustible gases generated within the burner may be introduced into either an elongated or annular chamber which becomes filled with the flame. Alternatively, the burner may be upright. The burner is provided with primary and secondary air supplies, and further air is advantageously mixed with the burning gases after they have passed from the flame guide through the Venturi tube. If it is vertical it may include a cone-shaped deflector at its top which spreads the flame.

The air from the blower outlet is preferably filtered to remove particles that may plug the orifice of the nozzle or otherwise interfere with the smooth operation of the equipment.

The invention is explained in connection with the accompanying drawings, in which:

FIGURE 1 is a view in perspective which shows an oil burner system which includes several appliances heated with individual oil burners supplied with oil and air from a single pump;

FIGURE 2 is a section through a preferred type of Venturi burner;

FIGURE 3 is an exploded view of the burner which shows the nozzle, the flame chamber, and adjacent parts;

FIGURE 4 is a section on the line 4—4 of FIGURE 2;

FIGURE 5 is a view in perspective of one end of a preferred pump, referred to herein as the back;

FIGURE 6 is a broken section on the line 6—6 of FIGURE 5, showing the oil inlet and outlet;

FIGURE 7 is a broken section through the pump on the line 7—7 of FIGURE 5;

FIGURE 8 is a view of the pump on the line 8—8 of FIGURE 7, the front plate being removed, with part of the rotor shown in section and part broken away;

FIGURE 9 is a sectional detail on the line 9—9 of FIGURE 7, showing one of the roller pistons floating in the pocket in which it reciprocates;

FIGURE 10 is a section on the line 10—10 of FIGURE 7 showing details of the oil pump construction including a passage between the vane chamber and the oil-outlet chamber of the oil pump;

FIGURE 11 is an exploded view of an alternative pump structure with an end plate removed from the body;

FIGURE 12 is a section on the line 12—12 of FIGURE 11;

FIGURE 13 is a section through the oil pump on the line 13—13 of FIGURE 12;

FIGURE 14 is a section through a pump of modified construction;

FIGURE 15 is a section through the oil pump on the line 15—15 of FIGURE 14; and

FIGURE 16 is a similar section through a further modification of oil pump for use with this type of oil-and-air pump.

The oil is lifted from a storage tank to the pump and supplied to a small reservoir near the burner in which the oil level is maintained below the burner nozzle a short distance, usually not more than one foot and preferably about one inch. The air is used under a relatively low pressure, for example 4 pounds. The action of the air passing through the nozzle creates a suction that lifts the oil into a chamber of the nozzle. There the two are mixed, the air aspirates the oil and the air-oil mixture leaves the nozzle as a mist. The oil is preferably No. 1, No. 2 or No. 3 fuel oil (ASTM definitions).

In the burners, the oil is completely burned. There is little, if any, carbon residue, depending upon the quality of the oil used. The burner is self-purging with respect to all such residue. Sufficient turbulence is maintained in the conversion chamber and final burner chamber to accomplish this. The flame temperature within the conversion chamber is in the realm of about 1200° F. to 1400° F. or even up to 1800° F. or more, depending upon the quantity and quality of oil used and the use made of the flame.

FIGURE 1 is a schematic showing of an oil burner system illustrative of the systems that may be employed. The type and number of appliances may vary, but for illustrative purposes FIGURE 1 shows a furnace, a water heater, and an incinerator, and indicates the possibility of also simultaneously supplying air to other air-consuming means.

The pump is shown connected directly with a motor, and these are mounted on a control board together with an oil-burner primary control. An air manifold is connected to the pump through a regulating valve R, and there are three air lines from the manifold to the three burners located at the appliances. The fourth air line from the manifold which is shown may be utilized or not. A solenoid switch S in each air line at the manifold is operated by a sensor FS at each flame, and if for any reason the flame at any burner is extinguished, the air to that burner is immediately shut off.

The solenoids are further controlled by means located in the several appliances. A thermostat in the furnace, an aquastat in the hot-water heater and a timer in the incinerator are connected with the several solenoids and control the operation of the individual burners.

The gauge G indicates the air pressure in the air manifold. There is a return line on the manifold to return excess air to the pump. There is a spring-loaded valve in the exit from the manifold into the air return generally set at four or five pounds to control the amount of air returned to the pump. The air return is shown as being connected with the muffler or silencer through which the air enters the pump, but it might be connected into the body of the pump either in the air inlet or in the air chamber itself. This permits the air compressor to remain in operation without carrying an overload when no air is being utilized or when only one or two appliances are operating. The air, if exhausted to the atmosphere, would make an objectionable sound.

Oil is lifted from the oil supply to the pump and then delivered to the burners through a single oil-supply line to three constant-level-valve containers C, there being one of these containers for each burner. They maintain a small body of oil for each burner at a level just below the level of the burner nozzle. There is an oil return line from these containers back to the oil supply. These containers C are connected in parallel between the oil supply line and the oil return.

The electrical control unit may include a transformer where a transformer is required, or there may be individual transformers T located at or near the several appliances, as shown.

In each of the appliances is a flame sensor connected with the control board so that in the event the flame sensor registers no flame in any of the appliances, the solenoid connected to that appliance is immediately operated, shutting off the air supply to the appliance. Since oil is maintained by the constant-level valves in containers C at a level just below the respective burner nozzles, as soon as the air supply to a burner is discontinued the oil supply automatically ceases because the oil is lifted by the air action from the containers C into the burner.

Each appliance is operated independently of each other utilizing a single air compressor and oil pump. The appliances need not all be at the same level because containers C maintain a separate oil supply at a constant level for each burner. If the appliances are all located at the same level there need be no more than one constant level valve. The purpose of this valve is to maintain an oil level just below the level of the burner nozzle so that the air feed to the burner will lift the oil into the burner as required. Thus, there is no gravity feed of oil, and no danger of overflow.

The burner of FIGURES 2–4 includes the nozzle **5** at its front, and also primary air supply **6** and oil supply **7**. The nozzle shown is of the type depicted in FIGURE 1 of Biber et al. Canadian Patent 650,549, issued October 16, 1962 and assigned to Gulf Research & Development Company. The spark is provided by electrodes **8** in the ring **9** which is of high thermal shock-resistant porcelain of a high dielectric value. The cap **10** is not necessary, but if used secondary air is forced into it through conduit **11**. This air from the conduit **11** and the primary air entering at **6** may be supplied from the same source. If the cap **10** is omitted secondary air is drawn from the atmosphere into the burner as will be described. The secondary air may enter through openings **13**, but preferably passes through openings **14** into the flame guide **12** which is open at the front and back and the mixture of oil and air passes through the flame guide without obstruction. It passes between the flame guide and the wall of the conversion chamber **17** through openings **16**.

The oil from the nozzle **5** is ignited by a spark drawn from the electrodes **8**. They are positioned in a recess **19** below the central opening **20** in the porcelain ring **9**, away from the oil particles suspended in the air and gas stream passing into the flame guide **12**. By locating the electrodes in the recess, carbon is prevented from depositing on them. A current of air passing through the inlet **23** blows the spark from between the electrodes into the main stream of the combustible oil and air mixture and maintains the flame.

The ring **9** is flanked by steel clamping rings **25** which are held to the ring **9** by two bolts and thus support the burner assembly. The mixture of oil and air leaving the nozzle **5** passes through a hole in the center of metal screen **26**, and prevents any flash-back through openings **14** of the flame that is produced.

The restriction in the Venturi flue **27**, maintains a balanced pressure within the conversion chamber **17**. The following description is illustrative and the invention is not limited thereto: In a burner measuring 3⅜ inches from the nozzle front to the Venturi throat **27**, with a flame guide **12**, 1½ inches in diameter and 1½ inches long, with 225 holes per square inch, each .045 inch in diameter, surrounded by a conversion chamber **17**, 3 inches in diameter and 1⅜ inches long, the opening in the Venturi 27 being ¾ inch in diameter, an oil input between .22 gallon per hour and .50 gallon per hour can be maintained with different orifice openings in the nozzle. With a larger Venturi throat, the oil input can be increased beyond .50 gallon per hour. The higher the oil input, the greater the amount of air required to aspirate it, and this greater volume of air decreases the temperature within the conversion chamber. Because of the increased gallons per hour of firing rate resulting from the use of a larger nozzle, the flow of gases through the restriction in Venturi 27 is of much greater volume and lower temperature than when a smaller nozzle is used. At the exit of these gases from the final burner chamber 28, the greater volume of gases tends to lower the temperature of the flame at the flame deflector 29 and creates a larger circular flame spread beyond the edges of the flame deflector 29.

The turbulent flow of the gases through the flue 27 prevents the deposit of aspirated oil, etc. within the conversion chamber, all of which is removed from the chamber and out through the Venturi by the gas stream. The conversion chamber and its contents quickly reach terminal temperature and balanced operating conditions throughout the system are attained.

The final burner chamber 28 is an upshot burner. It is located at the end of the flue. The cylindrical screen flame guide 28′ directs the flame up through the middle of the chamber 28 against the bottom of the flame deflector 29 supported by rods attached to chamber 28. Secondary air flows up through the bottom of chamber 28, if perforated, and/or down through the edge of screen 30 to feed this flame.

The flame front is located just in front of the hole in the screen 26. The restriction in the Venturi flue 27 retards the exit of gases so that a pressure balance is built up within the conversion chamber 17.

Two methods of operation are possible. The flow of oil and air may be so regulated that there is sufficient air in the chamber 17 to cause combustion of all or substantially all of the oil. In that event the walls of the chamber become very heated and the gases created pass through the Venturi flue 27. These hot gases pass on up through the chamber against the bottom of the flame deflector 29, or, alternatively, against some other surface to be heated. The outlet from the conversion chamber 17 can be cut off just beyond the restriction or it can be connected with burners of different types.

According to another method of operation, when the amount of air introduced into the chamber 17 is restricted the gases passing through the Venturi 27 are starved. In that event combustion will take place in and beyond the chamber 28 with additional air drawn through perforations in the bottom of this chamber or down through the edge of screen 30, or supplied by other means. Conversion chamber 17 turns the burning aspirated mixture into gases enabling more of the properties to be burnt at the flame means than has been formerly possible.

The restriction in Venturi 27 and the location of the nozzle 5 determine the position of the flame front. Between the flame front and the restriction in Venturi 27 the flow of the gases is turbulent and no carbon collects within this chamber. As the gases are driven up from the conversion chamber 17 into chamber 28 and up against the bottom of the deflector or other surface, the turbulent flow is continued in chamber 28 to prevent deposition of any solid matter in the gases. The screen 30 permits additional air to flow over the outer wall of the chamber 28 and down into the chamber where, if the gases are starved as they pass through the restriction in Venturi 27, further combustion occurs. The screen 30 also is a sound suppressor.

At the start of firing and prior to terminal temperatures being reached in the conversion chamber, there is an initial flash of fire going through restriction 27 and impinging on deflector plate 29. Upon reaching terminal temperature, conversion chamber 17 converts the oil-air spray coming from the nozzle into gases, and because of restriction 27 the gases, due to a lack of supporting air extinguish the flame from that point to final burner chamber 28 where the gases are again supported by enough atmospheric air and reignited by the initial flame already established. On a failure of the flame at chamber 28 an unsafe condition is created because of conversion chamber 17 continuing to manufacture gases. A flame sensor (FS in FIGURE 1), either bimetallic or electronic, responds and through electrical means shuts down the air supply to the burner, thus eliminating oil flow. If there is but a single burner in the system, the flame sensor acts directly on the air pump; if there are a plurality of burners, the flame sensors act on solenoid valves, such as indicated by letters S in FIGURE 1. The control by each flame sensor is of the usual type and does not interfere with normal operation of the burners.

After the heat of the gases has been used for the desired purpose, the spent gases are passed through a flue or other means into the atmosphere.

The pump

The preferred oil-air pump shown in FIGURES 5–10 includes a generally cylindrical housing 56 closed by a front end plate 53 and back end plate 81. Within the housing is a rotary air compressor and an oil pump designed to lift the oil from the storage tank through the pump and supply it to the burner or burners. The air compressor is composed of an air rotor 43 within an eccentric air-compression chamber 68 (FIGURE 9) of which the housing forms the outer wall 66. The oil pump includes a non-rotating stator 80 fastened to the back plate 81 by screws 92 and an eccentric oil chamber 82 (FIGURE 10) formed by a pump-cavity bushing 90 recessed in that surface of the air rotor 43 which faces the back plate.

The bushing 90 is driven by the air rotor 43 by means of fixed driving pin 83 located partly in the rotor and partly in the bushing. The bushing is pressed to the back plate by an annular pressure sealing spring (usually about a 5-pound spring) 101 located between the bushing and the air rotor. This spring presses the bushing away from the rotor and seals it to the back plate. The O-ring 91 in a groove in the outer diameter of the bushing forms a seal between the bushing and the air rotor, preventing oil from leaking between the bushing and the rotor and thence over the face of the end plate 81 into the air chamber 68. Thus the bushing serves not only as an eccentric oil pump cavity but also serves as a stationary seal at the O-ring 91 and also a rotating seal at the interface between the bushing and end plate 81, and because of spring 101, both seals are self adjusting. Both seals are preferably designed to withstand as much as a 10-foot oil head. Capillary action lubricates the interface between the bushing 90 and the back plate 81 and also the surface of the main bearing 84 contacted by the air rotor 43. No lubrication is necessary for the air compressor, because no surface of the air rotor 43 is in sealing contact with any adjacent surface of the compressor and friction is lessened between the air rotor and the roller pistons because of the air cushion between them, as will be explained in what follows.

The drive shaft 45 which passes through the outer pump bearing 51 drives the air rotor 43 by means of coupling 49 at the front of the air rotor. There are two pins 48 on the front of the air rotor 43 which extend into coupling 49, and two similar pins (not shown) evenly spaced therefrom, on bushing 46 which extend into the coupling 49. These cause the rotor to turn with the drive shaft 45. This coupling is of Teflon or like material so that the operation is quieter than if there were metal-to-metal contact. The outer pump bearing 51 is positioned inwardly by means of three adjustment screws **107** in the front end plate **53** so that the bearing **51** registers on air rotor **43** and maintains a clearance between the end plate **53** and a surface of the rotor adjacent to it. The bushing **46** acts as a coupling between drive shaft **45** and air rotor drive pins **48**. O-ring **50** acts as a stationary air seal. The drive shaft is rotated by any suitable power means, but preferably by an electric motor which may be a shaded pole motor or a split phase motor, the former being preferable from an economic standpoint.

The main bearing **84** is press-fitted into the oil pump stator **80** and extends into the recess **94** in the back plate **81**. The other end of the bearing terminates within the air rotor, and near its front to give adequate support for the rotor. The air rotor **43** rotates about this bearing, carrying the bushing **90** with it. Thus, there is no drive shaft for the oil pump. The oil-pump cavity is bounded on the front by the air rotor and at the back by the back plate. The cavity **68** of the air pump is bounded on the front and back by the front and back plates **53** and **81**.

Two roller pistons **67** within oppositely disposed roller cavities **71** (FIGURE 9) in the air rotor are cushioned against the wall **66** of the air cavity.

A cyclindrical air-cushion duct **70** (FIGURE 9) in the forward wall of each roller piston cavity **71** connects the air chamber **68** with the cavity, so that the air under each roller piston within the cavity is pressurized and the lift created assists centrifugal force in propelling the roller pistons toward chamber wall **66**. The pressure lift created by the passage of compressed air through duct **70** eliminates much of the vibration and heat which would otherwise be created by the roller pistons. The roller pistons are adapted to move in and out of their respective cavities with minimum touching of the cavity walls, and this movement depends upon the differential in the air pressure in front and in back of the rollers. The operation of the air rotor is relatively noiseless because (1) on starting the pump, the contact between the roller pistons **67** and the wall **66** of the air chamber is rolling contact, and (2) as the compressor operation continues and air under pressure is forced into the roller piston cavities **71** through ducts **70** behind the roller pistons, the pressure floats said pistons in air, so that as they are reciprocated in and out of their respective cavities they make little, if any, contact with the cavity walls.

The capaciy of the air compressor is made adjustable so that the same pump can be used for installations requiring more or less air, depending upon the number of appliances or the like which are to be supplied with air. The air enters the compressor through the silencer **40**, passes through the conduit **102** into the air chamber **68**, and then passes out through the conduit **105** to the manifold through the connection **41**. The small conduit **62** connects with one end of the return passage **60** (FIGURE 8) cut into the wall of the housing **56**, or, if preferred, in the face of the back plate, and the other end connects with the air intake **102** through the small conduit **61**. The amount of air recirculated through this return is controlled by the adjustment screw **63**. Proper adjustment of this screw by factory or field adjustment keeps the compressor from operating at maximum capacity unless necessary.

The flat pumping vane **95** of the oil pump moves in and out of the oil stator **80**, being pressed out by the purposely weak drive spring **96** (FIGURE 10). Further pressure needed to seal the outer edge of the vane **95** against the inner surface of the wall **93** of bushing **90** is provided by oil returned from the oil chamber through a small opening **103** between the oil outlet **99** in the stator **80** and the inner end of the vane cavity **104** (FIGURE 9) in the stator. As the air rotor rotates it rotates the bushing **90** in the oil chamber and this causes reciprocation of the vane **95** in the vane cavity, creating suction which lifts oil from storage to the pump through oil inlet **98** and forcing it out through outlet **99**. In this pump the stator is stationary so that one edge of the vane slides against the stationary end plate, minimizing frictional wear.

Thus, as the bushing is rotated about the stator, oil is lifted into the pump through inlet **98** and expelled through outlet **99** by movement of the vane **95** adjacent the inner wall **93** of the bushing. Simultaneously, air is drawn through the muffler **40** into the air chamber **68** through conduit **102** and expelled under a pressure of several pounds through the outlet **105** which connects with a manifold if a manifold is used. Operating at only 1000 revolutions per minute, a lift equivalent at 30 inches of mercury is possible.

As best shown in FIGURE 6, the oil in entering the oil pump and also in leaving the oil pump, travels through the stator. Heat generated in the air compressor is transmitted through the air rotor and oil bushing to oil in the oil cavity, and thence to the stator, so that the circulating oil continuously cools the air rotor and prevents it from heating to an undesirable temperature.

The main bearing **84** is not connected to the drive shaft. Consequently, a very low torque is required to put the pump in operation.

To equalize the thrust developed by forcing the air and oil into their respective outlets, these outlets are advantageously located opposite one another, as in FIGURE 5, where the air outlet **105** (to which the manifold connection **83** may be attached) is opposite the oil outlet **99**.

Alternative pump structure

The pump **110** of FIGURES 11 to 13 includes a relatively large air compartment **111** and a relatively small oil compartment **112**. The drive shaft **113** extends from a motor directly into the pump.

The eccentric air compartment **111** includes the concentric rotor **115** with an air inlet **116**. The exhaust is not shown but it is opposite the inlet. As the shaft drives the rotor in the direction indicated by the arrow in FIGURE 11, air is drawn into the chamber **111** by the roller pistons **119** and is forced out through the exhaust.

There is no partition between the open-ended compartments **111** and **112**. The side of the rotor **115** seals off the open end of the compartment **112**. The end **120** of the shaft **113** passes through the oil compartment **112** which is eccentric with respect to the center of the shaft. Oil is supplied to the compartment **112** by the feed line **122** and is exhausted through the outlet **123**. The sliding valve vane **125** (FIGURE 13) is made in two parts, separated by the spring **126** which continually forces each of the parts against the cylindrical wall of the compartment **112**. The vane **125** shifts back and forth as its edges traverse the eccentric cylindrical wall of the chamber. This pumps the oil into and out of the compartment **112**.

Thus, as the shaft **113** rotates it pumps air and oil simultaneously through the respective compartments **111** and **112**.

FIGURES 14 and 15 show an alternative arrangement for the oil pump. The shaft **130** with rotor attached supplies air from the compartment **131** in the manner described. Oil is supplied from the compartment **132**. This compartment is cylindrical but eccentric with respect to the center of the shaft **130**. Fitted over the end of the shaft is a flexible plastic impeller. It comprises the annular member **135** and the fan blades **136**. As the fan is rotated within the chamber, the centrifugal force and the resilience of the impeller throw the blades out into continuous contact with the cylindrical outer surface of the chamber **132** except when the use of oil is diminished, in which case as pressure is built up within the chamber **132** the blades are flexed and rotate with their ends out of contact with the cylindrical surface, creating a balanced condition (a built-in by-pass). Because of the eccentricity of the impeller as the blades rotate, they are fixed over flat while in the area in which the shaft **130** is nearest the circumferential wall of the chamber **132**. The oil is drawn in through the inlet **138** and expelled through the outlet **139**.

In a still further modification, illustrated in FIGURE 16, the oil pump is provided with roller pistons **142** which operate in the same manner as the roller pistons **119** in the air blower. The centrifugal force produced by rotation of the rotor **144** throws these pistons against the outer wall of the oil chamber **145** and thus pumps the oil through this chamber as the rotor rotates.

Oil is fed to any one of the various burners from a suitable supply source, preferably by drawing it up from a supply of constant level such as the device C of FIGURE 1 in which a constant level is maintained. If fed by gravity, a proper feed rate will be maintained.

If desired, a film of oil between the vanes in the air pump and the wall of the air chamber tends to produce a seal which increases the efficiency of the pump. O-rings or other seals regulate this capillary flow of oil.

Referring back to FIGURE 1, it is seen that this burner system is designed particularly for home use, especially in a home with a number of appliances to be heated by oil. Any type of flame spreader may be used with the burner. It need not be directed up, but may be directed horizontally or at any angle. By use of the air manifold only a single pump is required for several appliances.

In a pump of the type shown in FIGURES 5–10, with an inside volume measuring about 4 inches in diameter and 1.5 inches deep, with the rotor operating at 1000 r.p.m. it is possible to pump thirty gallons (or 120 liters) of oil per hour with sufficient air to aspirate this in a plurality of burners. The pressure of the oil at the outlet of the pump is relatively low, but when the oil exit from the pump is closed the pressure may build up to 60 to 70 pounds, but soon returns to working pressure when the exit is opened.

Modifications in the structures shown are possible within the scope of the invention. For instance, the oil and air pumps and the burners used in the system described may be quite different from those specifically described.

The invention is covered in the claim which follows.

What we claim is:

In combination, (1) at least two of the following units of different types of equipment each of said units having a different firing rate, namely, a furnace, an incinerator, a clothes drier and a water heater, and (2) an oil burner system which includes a burner in each of said two units, each burner containing one nozzle and each independently operable, which system includes an air compressor and means for feeding the nozzles with compressed air therefrom and close to each nozzle a device which (a) provides a supply of oil at all times adequate for burner requirements, and (b) is operable by virtue of vacuum produced by air flowing through the nozzle to cause oil to flow through the device into the nozzle, and a flame sensor in association with each burner and in operative relation with flame therein which prevents the supply of air to that burner in the event of flame failure.

References Cited by the Examiner

UNITED STATES PATENTS

1,512,132	10/1924	Pfahl	158—36
1,679,830	8/1928	Lang	158—73

FOREIGN PATENTS

525,509	5/1921	Germany.
164,777	1/1934	Switzerland.

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