Jan. 22, 1929. 1,699,654

C. H. DOOLEY

OIL BURNER

Filed June 24, 1926 3 Sheets-Sheet 1

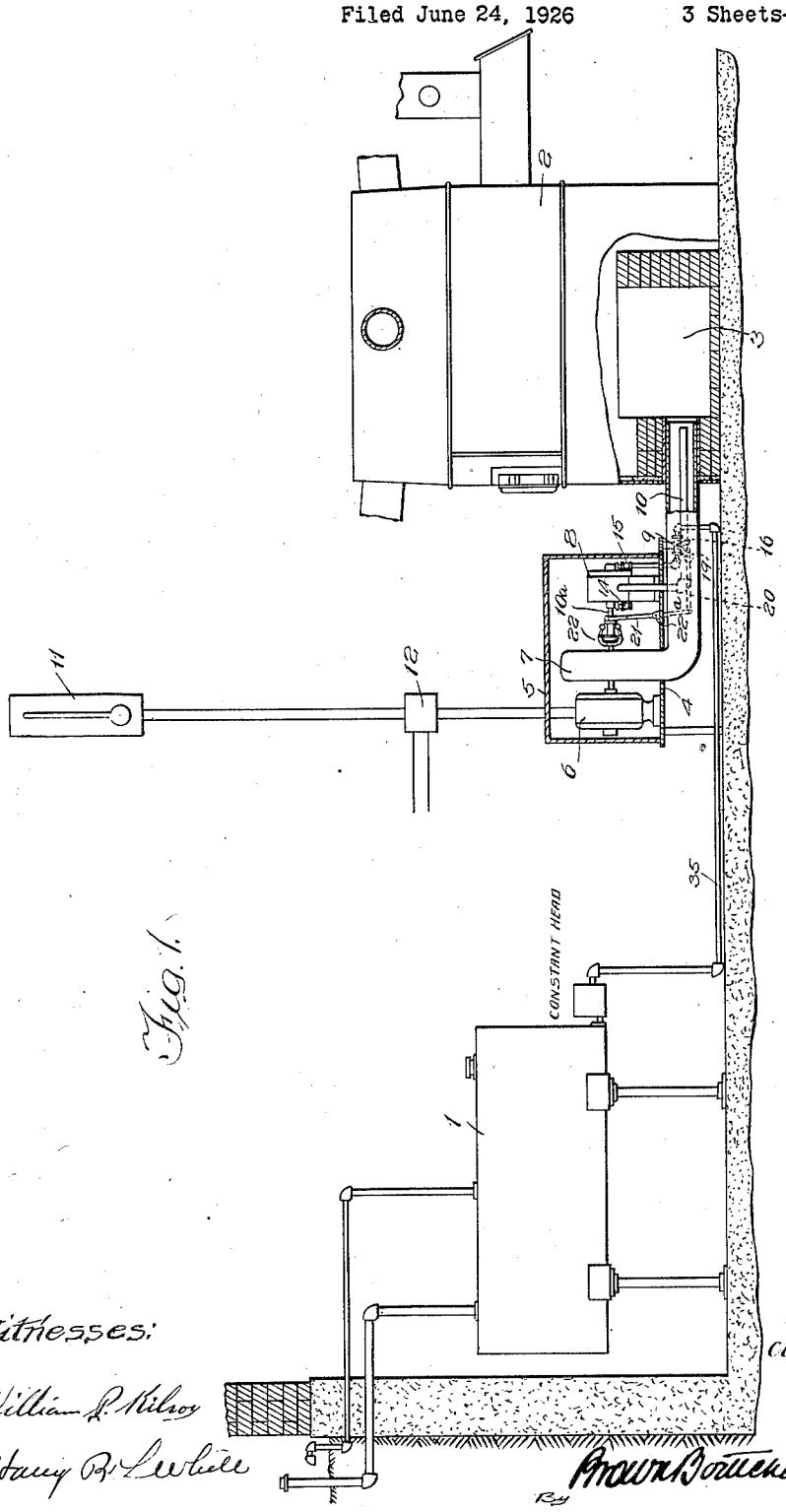

Fig. 1.

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Fig. 2.

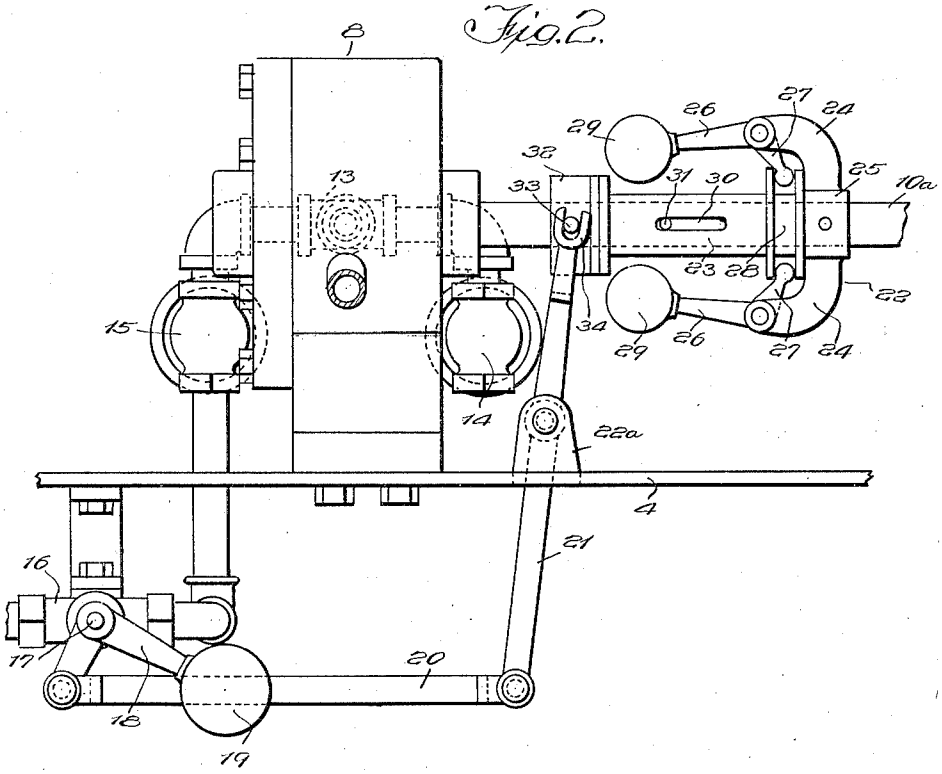
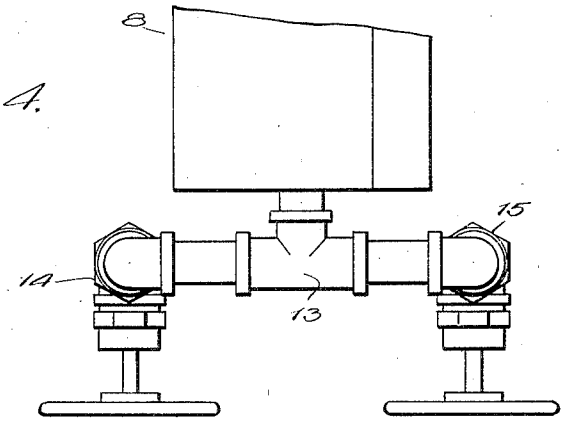


Fig. 4.



Witnesses:
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Fig. 3.

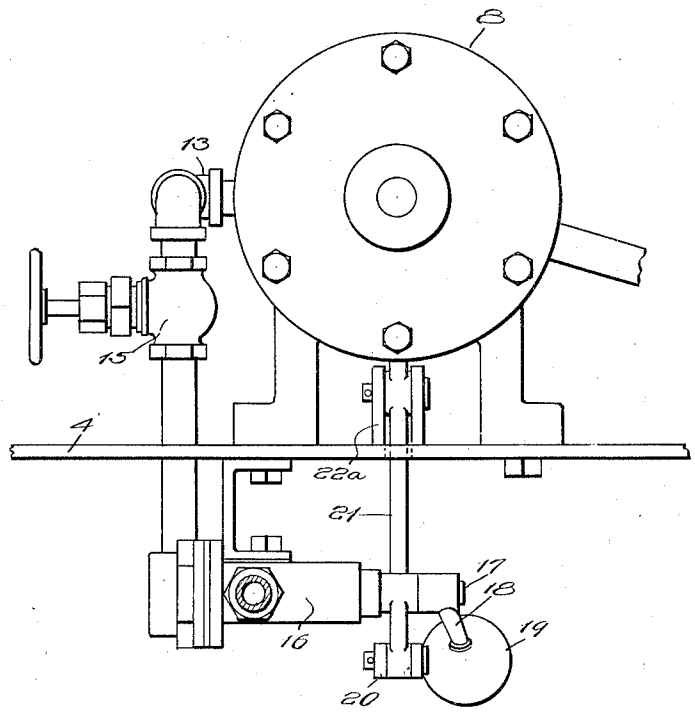


Fig. 5.

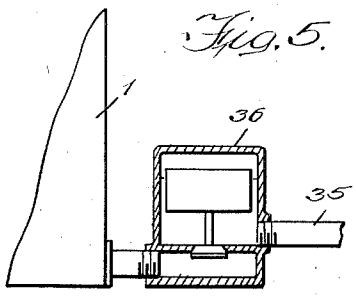
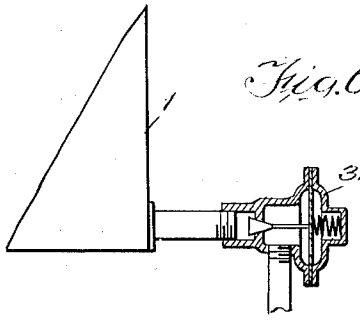


Fig. 6.



Witnesses:
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Patented Jan. 22, 1929. 1,699,654

UNITED STATES PATENT OFFICE.

CLARENCE H. DOOLEY, OF ROCK ISLAND, ILLINOIS, ASSIGNOR TO BETTENDORF OIL BURNER COMPANY, OF BETTENDORF, IOWA, A CORPORATION OF DELAWARE.

OIL BURNER.

Application filed June 24, 1926. Serial No. 118,157.

This invention relates to oil burners and particularly to those having a gravity feed and it aims to provide a means for automatically cutting off or on such feed in accordance with the requirements for fuel by automatically stopping the feed when the blower stops, and for automatically cutting the feed in again when the blower starts.

While I refer to gravity feed as an example of the manner for supplying the fuel under suitable head to the point where it is metered out and mixed with air it is to be understood that the invention is applicable to any type of feed where the oil is supplied under pressure to the burner.

Oil burners which have been in general use heretofore particularly for the heating of homes have been of two general types. One type in which the oil is pumped to the burner or atomizer requires more or less expensive apparatus and is comparatively complex. The other type is the gravity feed type in which the oil is fed to the burner by gravity and as heretofore constructed usually includes a float valve or the like for controlling such feed. Due to the unreliability of the float valve or the other valves used heretofore in the gravity feed type of burner such burners have been more or less objectionable. The float valve sticks at times and is otherwise subject to leakage resulting in flooding and faulty operation. This invention accordingly contemplates the provision of an oil burner in which a gravity feed is provided together with a means for positively and automatically cutting off the feed of oil to the burner when the air supply is cut off, such air supply being essential to combustion. My invention also contemplates positively and automatically cutting the gravity feed in again when the air supply is started up.

My invention is suitable for use in burners employing a float valve. The cut off valve is inserted in series in the feed line in advance of the float valve and then even if the float does leak, flooding will not result. However, since the burner can still flood during operation when the valve is open I dispense wholly with the float valve at this point and employ instead a metering orifice at the burner for controlling the rate of flow under a given head which I keep substantially constant by a pressure regulator or the like, and then cut the supply off or on by the speed controlled valve hereafter described.

In order to carry out my invention I employ a system which includes a motor driven blower, an atomizer which, for the sake of convenience and simplicity, I mount on the motor and blower shaft, an oil reservoir connected either through a constant level means or a constant pressure means so as to provide a gravity feed of substantially constant head to said atomizer, and an automatic cut-out valve interposed between said means and said atomizer. A centrifugal element somewhat like a governor is mounted on the blower shaft and is operatively connected through suitable crank and lever mechanism to the cut-out valve for opening or closing the same in accordance with the requirements for fuel. The test of whether fuel is required is the critical speed of the blower shaft. The governor is adapted to close the cut-out valve whenever the speed of the blower is below a certain critical value and to open said valve when the speed of the blower is above the critical value. In the preferred form of my invention I employ a constant speed type driving motor such as an induction motor for alternating current or a shunt motor on direct current.

In addition to the foregoing I employ the usual thermostatic control over the electric motor which drives the blower, and in addition I employ the usual automatic means for shutting down the electric blower if the fire does not come on properly or in case the fire goes out. These are features well known in the art and I need not disclose them in detail.

Other advantageous features of my invention will be apparent from the specification and claims when taken in connection with the accompanying drawings, wherein,

Figure 1 is a side elevational view partly in section of an oil burning system embodying my invention;

Figure 2 is an enlarged detail fragmentary side elevational view with parts omitted showing the atomizer and centrifugal governor both mounted on the blower shaft and the automatic cut-out valve and connection therefore to said governor;

Figure 3 is a similar view taken from the left of Figure 2;

Figure 4 is a fragmentary view taken from the top of Figure 2 showing the oil and air connection to the atomizer;

Figure 5 is an enlarged fragmentary view partly in section showing a constant level means for insuring a constant head of pressure at the automatic control valve; and

Figure 6 is a similar view showing an alternative form of means for insuring a constant pressure of oil at the automatic supply valve, this view showing a constant pressure regulator.

Referring to the drawings more particularly numeral 1 represents an oil tank situated in the basement of an ordinary residence and connected through suitable pipes to the outside of the residence for keeping said tank supplied with oil. A heater 2 is also mounted in the basement and is connected in the usual manner to the various rooms of the residence or other building to supply the same with heat. The lower portion of the heater 2 is provided with a furnace chamber 3 lined with furnace fire-brick. Outside of the chamber 3 there is provided a platform 4 on which is mounted a casing 5. Within the casing 5 on the platform 4 there is mounted an electric motor 6, a blower 7 and a pump 8 of the eccentric vane type, well known in the art and having a positive action. The motor 6 is an induction motor such as is usually used for this purpose and having a normal full load speed of about 1,750 to 1,800 R. P. M. The discharge from the blower 7 communicates with one end of a horizontal pipe 9, the other end of which extends into the wall of the chamber 3 and communicating with said chamber. The motor 6, the blower 7 and the pump 8 are all mounted on the same shaft 10^a. The usual thermostat 11 is provided in one of the rooms of the building and is connected to a suitable control 12 for controlling the motor 6 in accordance with the temperature in the residence.

The eccentric vane pump 8 acts as an atomizer for the oil. The intake of the pump 8 communicates through a T connection 13 to an air supply valve 14 and an oil supply valve 15. These valves 14 and 15 comprise regulable orifices for controlling the flow of air and oil to secure the desired consistency of oil emulsion before the same is discharged into the main air stream, as will be set forth later. The valves 14 and 15 may be provided with suitable indices or stops for ease in securing a desired setting. The valve 14 may be connected either to the atmosphere or the discharge from the blower 7. As shown in Figures 2 and 3 the valve 15 is connected to the delivery of an automatic cut-out valve 16 supported beneath the platform 4. The valve 16 is provided with a pivotally operable valve stem 17 on which is mounted a bell crank 18 having a weight 19 mounted upon the outer end of one of the arms of said crank. The weight 19 is normally supported by the crank 18 in a manner to cause said weight to normally act to close the valve 16. The other end of the crank 18 is connected through a link 20 to the lower end of a lever 21. The lever 21 extends upwardly through the platform 4 and is pivotally supported on a bracket 22^a secured thereon. A centrifugal governor 22 is mounted on the shaft 10^a and is operatively connected to the upper end of the lever 21 for causing the same to open the valve 16 through the link 20 and the crank 18, when the shaft of the motor and blower reaches a certain critical speed which may be and preferably is substantially full load speed. The governor 22 is not a governor in the usual sense of the word, that is it does not hold an intermediate position for each intermediate speed. When the fly balls 29 start to move out they go all the way fully opening the valve 16. Likewise, when the weight 19 overcomes the outward force of the balls 29, the balls 29 move inwardly fully closing the valve 16.

The governor 22 consists of a pair of arms 24 opposite to each other and integrally mounted on a collar 25 pinned to the shaft 10^a. As viewed in Fig. 2, the outer ends of the arms 24 extend toward the left and have pivoted thereon bell cranks 26 having inwardly extending arms 27, the ends of which fit in a groove 28 formed by suitable collars on the end of a sleeve 23 which is slidable on the shaft 10^a to the left of the collar 25. The other arms of the bell crank levers 26 have mounted thereon weighted balls 29. The sleeve 23 is provided with a longitudinal slot 30 in which extends a pin 31 connected to the shaft 10^a. The pin 31 in the slot 30 acts to limit the movement of the sleeve 23 to the left as will be apparent hereinafter. The weight 19 not only holds the valve closed but also holds the sleeve 23 to the right with the end thereof abutting the collar 25. It forms the load upon the governor 22 to determine and control its action. No springs are needed. A collar 32 is loosely mounted on the shaft 10^a to the left of the sleeve 23 and is connected through laterally extending pins 33 on said collar and bifurcated members 34 at the upper end of the lever 21 to said lever. The collar 32 is thereby held non-rotatively upon shaft 10^a. An anti-friction collar may be disposed between the end of sleeve 23 and the collar 32.

The inlet of the valve 16 is connected through a suitable pipe 35 to a constant level means preferably mounted adjacent the bottom of the tank 1 and communicating therewith. The constant level means may consist of a float valve 36 interposed between the valve 16 and the tank 1 or, as shown in Figure 6, such means may consist of a pressure regulator 37 of the usual type, so interposed. The function of this element is to maintain a predetermined head upon the

orifice in valve 15 so as to secure a regulated flow.

Any suitable means may be provided for automatically shutting down the motor 6 in the event that ignition does not take place or any disorder of the system requires the same to be stopped.

In the operation of the device, the motor 6 is started causing the shaft 10^a to rotate and the blower 7 and pump 8 to operate. The blower 7 will immediately commence to discharge air through the pipe 9 into the chamber 3. The pump 8, although it begins to operate mechanically as soon as the shaft 10^a rotates, does not begin to function as an atomizer until the governor 22 has caused the valve 16 to open sufficiently to permit some oil to enter said pump. This the governor 22 does normally very quickly as the motor comes up to full speed. Upon the rotation of the shaft 10^a at sufficient speed, the weights 29 suddenly move out away from said shaft and cause the sleeve 23 to move to the left, as viewed in Figure 2, resulting in full opening of the valve 16. Since the blower 7 is so designed that it provides substantially full delivery of air at the critical speed at which the governor operates, a sufficient amount of air to obtain perfect combustion is assured.

The pump 8 is not employed for the purpose of drawing the fuel. Its function is to take the fuel as delivered by the gravity head through the metering orifice which the valve 15 provides and churn it up with air through the orifice in valve 14 to form an air-oil emulsion and discharge it through the pipe 10 from whence it is delivered into the main air flow created by blower 7 through its delivery pipe into the firebox 3.

Due to the fact that the motor 6 is an induction motor or like constant speed type and therefore adapted to run at its designed speed or not at all, the governor 22 is preferably adapted to close the cut-off valve when the motor drops below the critical assigned speed say to 1,600 R. P. M. and to open said valve when said motor reaches its critical assigned speed. In a motor of the constant speed type the full load speed is a fixed and definite value. The governor is set to operate at a small margin below that. Assuming normal voltage the motor upon starting will quickly pass the assigned critical speed or it will not run at all. If the voltage on the line is so low as to drop the corresponding full load speed below said assigned critical speed the oil valve 16 will not be opened at all. This is highly advantageous as it prevents burning of fuel with an insufficient air supply which as is well known will produce smoke and may do serious damage.

The fan or blower is so co-ordinated that above the assigned critical speed it will give the proper air delivery. Hence my burner will not discharge oil until the proper air delivery is established.

The fan or blower 7 is in reality an inertia type machine and the governor 22 likewise is an inertia type device which however does not respond at all until a predetermined velocity is reached.

I am aware that changes may be made and details of construction varied without departing from the principles of this invention and I do not intend to be limited to the details shown and described.

I claim:—

1. In combination, a rotary fuel atomizing pump, a fuel supply pipe leading to the intake of said pump, a manually regulable metering valve in said pipe adjacent said intake, a source of liquid fuel under gravity head for maintaining fuel under suitable pressure at said metering valve, a rotary shut-off valve in said pipe, said pipe comprising a vertical portion between said shut-off valve and the intake of the pump to trap liquid fuel when the shut-off valve is closed, a blower for air connected to the shaft of the fuel pump, the discharge of the fuel pump being directed into the blast of air discharged by the blower, and means controlled by the speed of the pump for opening and closing said shut-off valve.

2. In combination, a base plate, a fuel atomizer pump mounted on said base plate, said pump having an inlet, a shaft for said pump, a fuel supply pipe lying below said base plate, a rotary shut-off valve in said pipe, said pipe extending to the intake of the atomizer pump through a vertical portion to trap liquid fuel when the shut-off valve is closed, a metering valve in said pipe adjacent the said intake to control the rate of fuel flow, a fly ball governor arm carried by the shaft of the pump, a lever pivoted on said base plate and connected at its upper end to said fly ball arm and to said shut-off valve at its lower end, and means connected to the rotary shut-off valve for closing said valve and for holding the governor arm towards the shaft.

3. In a burner, a gravity head oil supply means, an atomizer, connected to receive oil directly from the supply means, a blower, a constant speed type motor for driving the atomizer and blower, said atomizer having a metering orifice for air and a metering orifice for oil, a cut-off for oil between the supply means and the atomizer, a speed responsive element driven synchronously with the atomizer and blower and connected to said cut-off, and means to prevent operation of said element until the blower has reached the speed at which it gives the requisite air delivery.

4. In combination, a horizontally extending frame plate, a rotary oil and air mixing pump mounted on top of said plate, said

pump having an operating shaft extending longitudinally of said plate, a rotary shut-off valve mounted on the bottom of said plate and having a horizontal stem extending transversely of the pump shaft, an operating arm on said stem, a fuel feed pipe leading from a source of liquid fuel to the valve, said valve having a connection extending from it to the pump at a point above the frame plate, a fly-ball arm connected to the shaft for rotation with the same, a sleeve on the shaft connected to the arm and adapted to be actuated thereby, a lever connected to the sleeve and extending to a point below the frame plate, a pivot for the lever on said frame plate, a link connecting the lower end of the lever to the aforesaid operating arm, and a weighted arm on said valve stem for closing the valve and for holding the fly-ball arm toward its shaft.

5. In a burner of the class described, the combination of a pump for mixing oil and air and delivering the same to a nozzle, a drive shaft therefor, a source of fuel under gravity head, a pipe leading from said source directly to said pump, an automatic shut-off valve controlled by the rotation of the shaft above a certain speed to permit opening and below a certain speed to permit closing, said valve being disposed below said pump in the pipe, the connecting pipe between said valve and said pump comprising a vertical portion opening at its upper end into the pump, said pump having a constantly open atmospheric inlet opening into the same in common with the upper end of the vertical portion of said pipe, said pipe including the vertical portion being always filled with oil and able to deliver oil to the pump continuously as soon as the shut-off valve is opened.

In witness whereof, I hereunto subscribe my name this 17th day of June, 1926.

CLARENCE H. DOOLEY.