Jan. 1, 1935. J. A. LOGAN 1,985,934

OIL BURNER

Filed Feb. 10, 1933

Fig. 1.

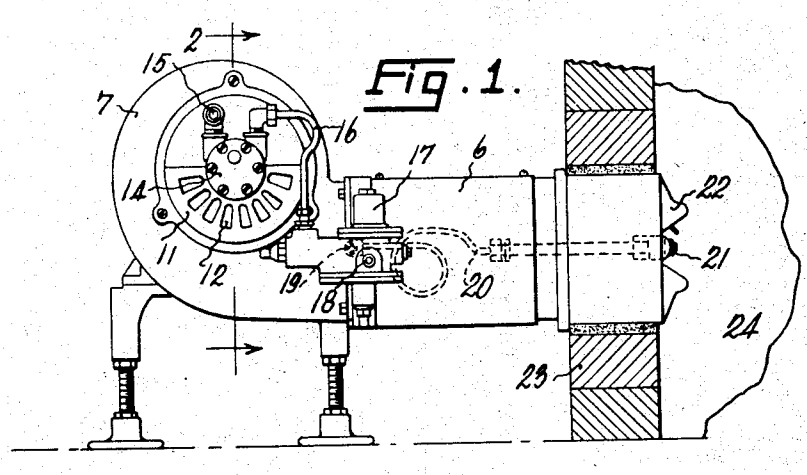


Fig. 2.

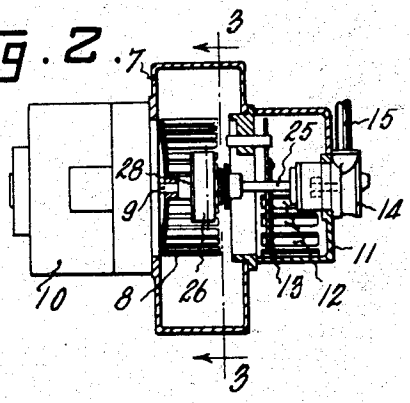


Fig. 4.

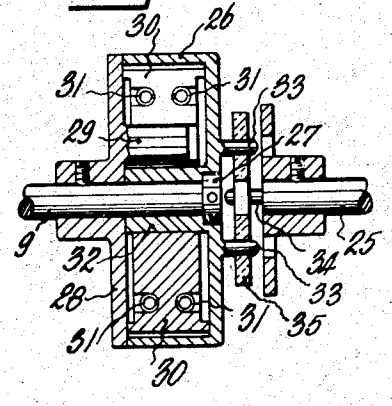
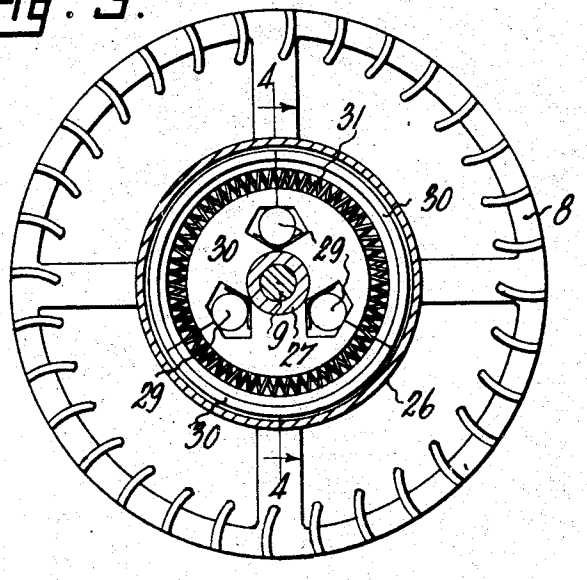


Fig. 3.



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OIL BURNER

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Application February 10, 1933, Serial No. 656,123

1 Claim. (Cl. 158—28)

This invention relates to improvements in oil burners. The invention has for its object an improvement in that type of burner in which oil is forced under heavy pressure, such for example as 80 pounds, to the nozzle of the burner by a pump which, heretofore, has been permanently coupled to the motor which drives the fan supplying air to the burner. The improvement consists in interposing in the drive between the motor and the pump a clutch which is responsive to the speed of the motor and is effective to connect the pump to the motor only after the motor has acquired considerable speed. The improvement enables the fan to build up speed very rapidly because the motor is free from the heavy load of the high pressure oil pump. Accordingly, normal air flow is established quickly and it is insured that air at the proper conditions of pressure and velocity to atomize the oil will be present at the nozzle before any oil is emitted therefrom. When the burner motor is deenergized, the pump will be quickly disconnected therefrom, and since it works under a heavy load, it will stop almost instantaneously. But the motor, being released from the major part of its load when the clutch opens to disconnect the pump, will continue in operation by the momentum of its rotor for a much longer period than it otherwise would and the fan thus coasts for a substantial time and scavenges the burner. Also, the oil flow is stopped before the air supply, wherefore there is no chance, as heretofore, for oil to be emitted at a time when there is an insufficient supply of air to properly atomize it.

Other objects will appear as the detailed description proceeds and will be pointed out in the appended claim.

The invention will be disclosed for illustrative purposes in connection with the accompanying drawing, in which:—

Fig. 1 is an elevational view of an oil burner embodying the invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2; and

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

In Fig. 1 there is shown an oil burner of the general type disclosed in U. S. Patent No. 1,832,131, granted November 17, 1931 to Hannibal A. Kunitz. It includes a tubular air conduit 6 connected to the outlet of a fan housing 7, which contains a suitable fan 8 (Fig. 2) fixed to the shaft 9 of an electric motor 10 fastened to one side of the fan housing. On the other side of the fan housing is fixed a casing 11 having openings 12 through which air is drawn in by the fan. Within casing 11 is a suitable air regulating device 13. Fixed to casing 11 is an oil pump 14 driven by motor 10. Oil is drawn into the pump through a pipe 15 and forced out through a pipe 16 to a suitable pressure regulating and by-pass valve 17, which prevents oil from passing to the burner nozzle until it is placed under a predetermined minimum pressure and allows some of the pumped oil to be by-passed around the pump, if and when the oil exceeds a predetermined maximum pressure. The by-pass outlet is marked 18 and the outlet to the burner is marked 19. The outlet 19 is connected by piping 20 to the oil nozzle 21 of the burner. The burner tube 6 has a head 22 in the outlet end thereof in which head air nozzles are provided. The nozzle 21, herein shown, is of the pressure or mechanical atomizing type. The air nozzles are or may be of the type shown in the Kunitz patent. The tube 6 passes through the wall 23 of the furnace and the air and oil nozzles deliver into the combustion chamber 24.

The burner just described is given merely by way of an illustrative example of one type of burner with which my invention may be used. The invention, however, is capable of other applications and may be used generally wherever it is desired to start the air flow in advance of the oil flow and to stop the oil flow before stopping the air flow.

For the purpose just mentioned, I provide a suitable clutch, actuated by centrifugal force, in the driving connection between the motor shaft 9 and the drive shaft 25 of pump 14. For example, a casing 26 having the general form of a brake drum, is mounted to turn freely on shaft 9, being held against axial movement between a collar 27 and a plate 28, both fixed to shaft 9. Plate 28 closes the otherwise open end of drum 26 and has fixed thereto a series, as three, of studs 29 which extend into the interior of drum 26. Mounted in the drum with freedom for radial movement are three shoes 30 which are recessed as shown to receive studs 29 and are recessed in both end faces to receive a coil spring 31 of circular formation. Spring 31 tends to hold the three shoes 29 in their innermost positions, shown in Fig. 3, in which the inner ends of the shoes abut a central hub 32 on drum 26. The drum, on its outer face, is provided with driving pins 33 which cooperate with similar but right angularly disposed driving pins 34 fixed to shaft 25, and a

flexible disc 35, in which the ends of all the pins are received to provide a flexible coupling between the drum and shaft 25.

In operation, on energization of motor 10, the fan 8 will be immediately rotated but the rotor of the oil pump will not be turned until the motor shaft 9 has acquired considerable speed. Shaft 9 drives the shoes 30 through studs 29 and plate 28 and, when a predetermined speed has been attained, the shoes 30 will be moved radially outward by centrifugal force to press against the internal periphery of the drum and force it to rotate, and with it the driving shaft 25 of pump 14. When the motor 10 is deenergized, and the speed of its armature slackens sufficiently, the springs 31 will draw shoes 30 inwardly and release drum 26 and the pump. Actually, the pump will be disconnected from the motor very shortly after the latter is deenergized because there is a heavy load on the pump which will cause the armature of the motor to rapidly slow down to the point where the clutch elements disengage. Actually the pump 14 stops almost instantaneously when the current to motor 10 is broken. After the pump is disconnected, the fan will rotate for a considerable interval because of the lack of any substantial load (such as the pump) and because of the momentum of the relatively heavy armature or rotor of the motor. Thus the air flow will be started through the tube 6 and air nozzles before the flow of oil through nozzle 21 is started. Also, after the oil flow stops, the air flow will be continued for an appreciable interval.

From the arrangement above described, there are many advantages derived which result in material improvement in the operation of the burner. Under normal conditions, in a burner of the type described operated according to prior practice, the oil begins to issue from the nozzle in atomized condition before the air has attained its maximum velocity. Although the pump and fan start simultaneously, according to prior practice, the pump builds up the proper pressure for atomizing the oil much more rapidly than the fan builds up the proper air pressure, probably because the pump is positive in its action and the fan is not. The fact, as above stated, that atomized oil issues from the nozzle before the air has attained its maximum velocity, results in producing a rich fire condition on starting, at which time a lean fire condition is wanted. Not enough air is supplied at this time to completely burn the oil. This adverse condition is further aggravated by the fact that the fan, as its first work, must push ahead a certain amount of dead air which fills the burner tube 6, the combustion chamber and stack. This delays the flow of air but not the flow of oil and increases the time lag between the initiation of the oil flow and the initiation of normal air flow at proper pressure and velocity. A rich mixture at the time of starting often results in the establishment of undesired pulsations which create noise. The mixture starts to burn but is too rich to burn completely. A series of pressure waves are set up in opposition to the fan and are transmitted through tube 6 to the fan and, impacting thereon, tend still further to delay the normal flow of air at the desired velocity and pressure. These waves, once started, tend to continue and the wave motion is sustained for some time. The wave motion results in alternate lean and rich mixtures in the combustion chamber. By the present arrangement, the fan is placed in operation first and is given time to sweep out all the dead air and establish normal air flow before the atomized oil issues from the nozzle. The opposition to establishment of proper air flow does not have a chance to get started and the former difficulties are overcome by preventing their inception because enough air is provided under proper conditions at the time of initiation of oil flow to produce the desired lean fire condition rather than the too rich condition, which tends to set in motion the pulsations that continue long after the conditions which initiated them have disappeared.

By allowing the fan time to get started and build up the desired pressure, such pressure is available as a force to oppose any explosion wave that may be produced. The explosion wave is repelled and has no chance to impact on the fan and set up the undesirable wave motion referred to. The effects of puffs or explosion waves are thus minimized and reduced to a negligible degree by the arrangement described.

When the burner is shut down, it is very desirable to have the air flow continue for a while. Any oil dripping from the nozzle will be carried forward by the air stream into the combustion chamber, whereas otherwise the oil would fall on the nozzle or parts adjacent thereto, which at that time are very hot, and become carbonized. There is a certain desirable cooling effect derived from continuing the fan in action for a while after the cessation of oil flow. Not only does the incoming cool air tend to cool the burner parts but more important still, such air flow prevents the very hot gases from the combustion chamber from backing up into the burner and delaying the cooling of the parts thereof. In the normal operation of the burner, the flame is sustained with its inner end spaced from the nozzle 21 and the continuance of air flow after the pump stops prevents the flame from backing up to the nozzle and heating the same as it did according to prior practice. The flame is sustained in spaced relation with the nozzle by the continuance of air flow after the motor is deenergized, until the flame is extinguished. Then, of course, there results a scavenging of the burner and combustion chamber,—a blowing out of all gases from these members, leaving them fresh and clean and in better condition for the next operation thereof.

The described arrangement also helps materially in securing a quick, sharp starting and stopping of the oil flow. The pressure regulating valve is intended to secure this result and does so to a certain extent but the action is improved materially by the centrifugal clutch arrangement. With the prior practice, the motor was slow in building up speed against the substantial load of the pump. With the described arrangement, the motor starts up without any load except the small load on the fan. It acquires speed very rapidly and, after the desired speed has been acquired, the clutch engages and starts the pump more quickly than heretofore. When the burner stops, the pump stops almost instantaneously with the opening of the motor circuit. A practically instantaneous stopping of oil flow results. Also on starting, the oil flow is established very quickly.

The described arrangement also offers a certain amount of protection against an excessively large drop in the voltage supplied to motor 10 during the running cycle of the burner. The electrical controls for the burner usually include electro-magnetically operated switches. These switches, if adapted for 110 volt operation would not close if the voltage dropped excessively but,

once closed, they would be held closed by a voltage much less than that necessary to close them, wherefore it is possible to have during the running cycle of the burner, a drop in voltage of such as a degree as to materially reduce the speed of the fan without causing the stopping of the burner. The air supply would be reduced but the oil supply would not be correspondingly reduced owing to the fact that the pump 14 pumps much more oil than is needed and a considerable part of the pumped oil is by-passed by valve 17. Hence, a smoky fire results but as long as there is a fire the usual burner thermostat will not cause opening of the motor circuit. Thus, with the burner described, operated according to prior practice, there is no adequate safeguard against an excessive drop in voltage occurring while the burner is in operation. The described arrangement solves the problem because an excessive drop in voltage such as would materially reduce the speed of the fan and cause the condition described, would result in the opening of the clutch and the stopping of the pump. The fire is then extinguished and the usual burner thermostat will open the motor circuit.

There is also the incidental advantage of unloading the motor on starting. A smaller motor can be used than would otherwise be possible. The invention, however, is more particularly characterized by the improved conditions affecting the operation of the burner, as above set forth.

What I claim is:

In an oil burner, a pressure-atomizing nozzle, a pump for supplying oil thereto under heavy pressure, a conduit connecting the pump and nozzle, a pressure responsive valve interposed therein and opening to allow oil to flow to the nozzle only after the pump has built up the requisite heavy pressure, a fan supplying air at low pressure, a conduit conducting such air to the nozzle to mix with the atomized oil, a motor driving the fan and pump, means connecting the fan to the motor to start and stop coincidentally therewith, and means responsive to the speed of the motor and fan operable to couple the pump to the motor only after the latter and the fan have acquired a predetermined speed sufficient to establish a flow of air in said air conduit at proper velocity and pressure to mix with the oil and operable when the motor is deenergized to disconnect the pump from the motor and fan and allow the same to continue in operation and scavenge said tube after flow of oil at said nozzle has ceased.

JOSEPH A. LOGAN.