Feb. 26, 1946. J. A. LOGAN 2,395,487

OIL BURNER

Filed May 3, 1944

Fig. 1.

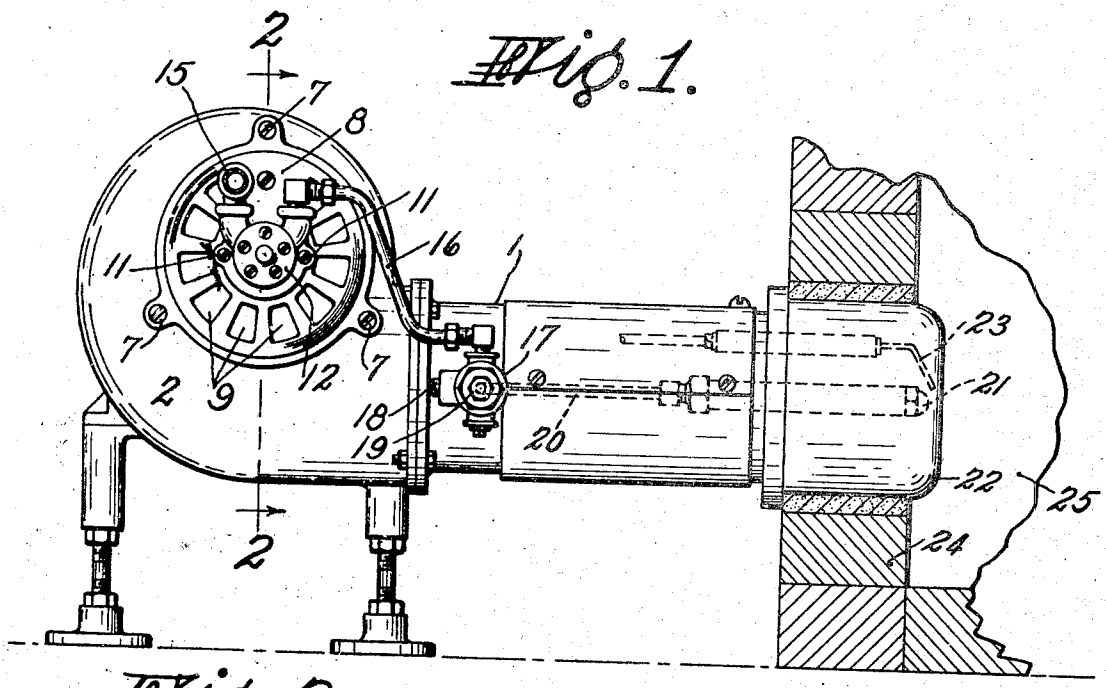


Fig. 2.

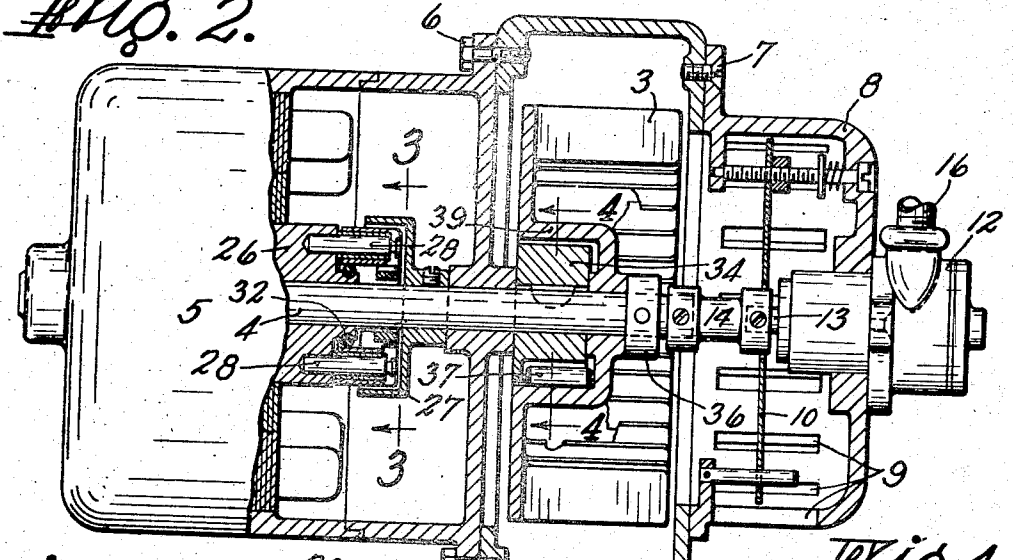


Fig. 3.

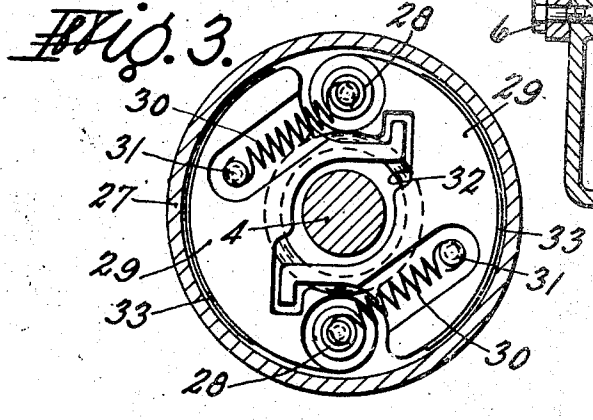
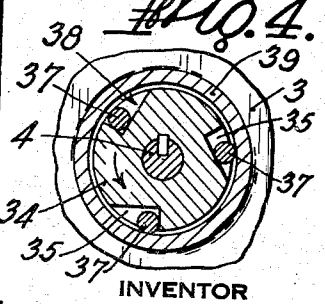


Fig. 4.



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OIL BURNER

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Application May 3, 1944, Serial No. 533,889

1 Claim. (Cl. 158—28)

This invention relates to improvements in the so-called gun type oil burners, such as are adapted for use in residential heating and are started and stopped many times each day during the heating season.

In burners of this type, wherein the oil pump and air-supplying fan start and stop simultaneously with the motor, combustion conditions are very poor during the starting and stopping intervals. The conditions existing during such intervals vary widely from those which exist during the intervening and normal running intervals. The oil and air mixture, during the starting and stopping intervals, is over rich and the mixture burns with a smoky flame, sooting up the boiler. To offset this trouble to some extent, the common practice is to adjust the air valve of the burner to admit considerable more air than would be required for the conditions existing during the normal running intervals. Accordingly, combustion is less efficient during the normal running intervals and the cost of operation is greater than it should be.

This invention is directed generally to the provision of means whereby the combustion in a burner of the type described may be materially improved and its cost of operation materially lowered, very important advantages in these times of oil rationing and also important at other times.

This invention is related to my prior invention, disclosed in U.S. Patent No. 1,985,934, dated January 1, 1935, in that it has to do with securing a quick, sharp starting and a quick, sharp stopping of the oil flow after the motor of the burner has been energized and deenergized, respectively. The burner of said patent involves a speed-responsive coupling. It is interposed between the motor-driven air-supplying fan and the oil-supplying pump of the burner. The arrangement effects a starting of the fan before the pump on energization of the burner motor and a stopping of the pump before the fan on deenergization of the burner motor.

The present invention has for an object to provide a burner structure which may be manufactured at less cost than the burner of said prior patent and which will nevertheless perform much of the important work of the prior burner to the end of securing substantially improved combustion conditions and resulting economy in operation.

The invention also has for an object the provision of means whereby existing burners may be altered at relatively low cost to substantially improve the operation and lower the operating cost.

Like the burner of my prior patent a speed-responsive coupling is employed but it is arranged differently so that the fan and pump are simultaneously coupled to and uncoupled from the burner motor. This arrangement enables a substantial reduction in manufacturing cost. One can use a standard form of electric motor which has the speed-responsive coupling built into it. Such a motor may be had at only a slight advance in cost over the ordinary motor, such as is shown in my prior patent, and can be applied to any burner at much less cost than would be necessary to apply the coupling in the manner of my prior patent. Particularly, for the business of converting existing burners, the present invention offers a simple and relatively inexpensive solution. No cutting and fitting of parts in the field is required as would be necessary to secure the arrangement of my prior patent. The result can be secured simply by replacing the motor of the burner to be converted with a motor having the speed-responsive coupling built into it. And this can be done quickly and inexpensively.

These objects will best be understood as the detailed description proceeds and they will be pointed out in the appended claim.

The invention will be disclosed with reference to the accompanying drawing, in which:

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

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

Figs. 3 and 4 are fragmentary sectional views taken on the lines 3—3 and 4—4, respectively, of Fig. 2.

Fig. 1 of the drawing, there is shown a so-called gun type oil burner. It includes a tubular air conduit 1, connected to the outlet of a fan housing 2, which contains a suitable fan 3, mounted on the shaft 4 of an electric motor 5. This motor is secured, as by screws 6, to one side of the fan housing 2. Fixed to the other side of this housing, as by screws 7, is a casing 8, having openings 9 through which air is drawn in by the fan. Within this casing 8 is a suitable air valve 10. Fixed to casing 8, as by screws 11, is an oil pump 12 having a shaft 13, which is connected to the shaft 4 by flexible coupling 14 of any suitable form. Oil is supplied to pump 12 through a pipe 15 and forced out through a pipe 16 to a suitable pressure-regulating and by-pass valve 17. This valve prevents

oil from passing to the burner nozzle until it has been placed under a predetermined minimum pressure, say for example, 100 pounds per square inch, and it allows some of the oil to be by-passed around the pump when the oil exceeds a predetermined maximum pressure, say 125 pounds per square inch. The by-pass outlet is marked 18. The burner outlet is marked 19 and it is connected by piping 20 to the oil nozzle 21 of the burner. This nozzle is of the pressure-atomizing type adapted to emit a conical spray of atomized oil in fog-like form. A suitable air director 22 is provided on the outlet end of tube 1 to direct air toward the spray of atomized oil. Ignition electrodes 23 are provided to ignite the oil and air mixture. The tube 1 enters through the wall 24 of a combustion chamber 25 in the usual manner.

The burner, above described, is given by way of illustrative example. It shows merely one suitable form of gun-type burner with which the invention may be used. However, it will be clear that the invention may equally well be used with various other forms of burner of the same general type.

Referring now to Figs. 2 to 4, the electric motor is of a type which embodies within its housing a speed-responsive coupling. Its shaft 4 is not permanently fixed to its rotor 26 but is connected thereto only by means of the speed-responsive coupling. The shaft 4 has fixed thereto a drum 27, opening toward the rotor 26. The latter has fixed thereto in diametrically opposed relation two studs 28 which pivotally support weight segments 29. A spring 30 connects a pin 31 on each segment 29 to the nearest pivot stud 28. These springs tend to draw the segments toward one another and hold them in their inner positions in which they abut a bumper 32 in the form of a torus ring of rubber or the like. The segments have suitable facings 33 to engage the internal periphery of drum 27, when the segments are thrown outwardly by centrifugal force. With the coupling described, the motor shaft 4 and the fan 3 and oil pump 12 will not immediately turn when the motor is energized. They will remain idle until the motor has acquired considerable speed, when the coupling elements will engage and pick up the fan and pump and set them rapidly in motion.

Preferably, the fan 3 is driven from shaft 4 through a suitable overrunning clutch which allows the fan to continue in motion by its own momentum after the oil pump has stopped. When the motor is deenergized, shaft 4 will quickly stop because of the relatively heavy load of the oil pump. This would cause sudden stoppage of the fan except for the clutch described which enables the fan to coast in free-wheeling fashion for a substantial interval after the motor has stopped. Any suitable form of clutch may be used for this purpose. One suitable example is shown in Fig. 4. A cylindrical member 34 with notches 35 in its periphery is keyed to shaft 4. The fan has a cup-shaped opening to receive the member 34. The hub of the fan is loose on shaft 4 and is held from endwise movement between the adjacent end face of member 34 and a collar 36 fixed to the shaft. Rolls 37 are received one in each notch 34. As the member 34 turns in a counterclockwise direction as viewed in Fig. 4, the rolls 37 will become wedged between the wall 38 of each notch and the circumferential wall 39 of the fan. Accordingly, the fan will then be driven. When shaft 4 stops, the wall 39 may freely turn in a counterclockwise direction because the rolls will be moved into the deep ends of the notches 34.

On energization of the motor 5, the latter starts up without any external load and thereby gets up to speed very rapidly. As the motor nears its maximum speed, the speed-responsive coupling connects shaft 4 to rotor 26 with the result that the fan and pump are picked up at high speed and in an instant reach full speed. Proper atomizing pressure for the oil and proper air flow are quickly secured. The slow building up of oil pressure and the even slower building up of proper air flow, such as would occur if the motor had to start up with both fan and pump coupled to it are avoided. By letting the motor attain its speed first and then coupling on the load, the pump and fan reach proper speed in a much shorter interval. So also, on deenergization of the motor, the load is uncoupled almost immediately. The coupling functions on the first slackening in speed of the motor. And on uncoupling, the oil pump almost immediately stops because of the heavy load on it. The pump will not turn more than two or three revolutions after it is uncoupled. Oil pressure drops very rapidly and the burner cut-off valve soon closes. A quick, sharp starting and stopping of the oil flow is thus secured.

Without the use of a speed-responsive coupling, the pump will slow down gradually. The pump, being designed for a capacity far in excess of the requirements of the burner nozzle can force oil through the nozzle at atomizing pressure even at materially reduced speeds. And the nozzle cut-off valve will not close until the oil pressure has reached the minimum in the selected range (usually twenty pounds at least) of pressures. The burner can slow down to half speed or more before the cut-off valve will close. And even after this valve is closed, it may thereafter open intermittently and emit spurts of oil. This is caused by the building up of pressure which occurs soon after the valve closed. A subsequent opening of the valve relieves this pressure, whereupon the valve again closes, only to later open if and when the pressure builds up again. Thus, there will not be a quick, sharp cut-off of oil during the stopping interval of the burner. Oil is emitted after proper air flow has ceased and the overrich mixture burns with a sooty flame. To offset this trouble to some extent the air valve of the burner is usually set to admit more excess air than would be needed during the intervals of operation when conditions are normal. This causes a reduction in the efficiency of the burner as will be indicated by a low percentage of CO_2. With the quick sharp cut-off of oil, as secured by the use of this invention, the burner can be adjusted for substantially less air and thus a substantial improvement in combustion will result, as will be indicated by a substantially higher percentage of CO_2.

On stopping, if the overrunning clutch is used, as is preferable, the fan will continue in operation after the pump has stopped and the air tube 1 will be scavenged. The cooling effect of continuing the air flow after cessation of combustion can be had and the hot gases in the combustion chamber are held by the air flow from backing up into the air tube and heating up the nozzle. The conditions during the stopping interval are usually worse than during the starting interval

in the ordinary burner and the use of the free-wheeling fan continues the supply of air when it is most needed.

The invention is particularly useful in the work of converting existing burners for the purpose of providing materially improved combustion conditions and securing more economical operation. It is of course, desired to do this at as low a cost as possible. Motors, already equipped with the speed-responsive couplings, may be secured in quantities at low cost from the motor manufacturers. A motor of this type may be substituted for the old motor. Then, the old motor may be returned to the manufacturer for rebuilding and a substantial credit secured so that the net cost of the new motor is relatively small. But it is more important to avoid so far as possible, any cutting and fitting or machine work of any sort in the field all of which is expensive. It is not necessary to cut the motor shaft or the pump shaft in order to make room for the speed-responsive coupling as would be the case if the teachings of my prior patent were followed. The coupling is already in place in the motor and all that is involved is the easy substitution of one motor for another.

The invention thus provides a means whereby combustion may be materially improved in existing burners by substituting for their motors, motors having the speed-responsive couplings. The starting and stopping intervals are shortened. The conditions, causing smoky combustion during such intervals and necessitating the admission of excess air and thereby causing less efficient combustion, are improved by the quick sharp starting and cutting off of the oil flow.

What I claim is:

In an oil burner, a pressure-atomizing nozzle, a pump for supplying oil thereto under high pressure, a conduit connecting the pump and nozzle, a pressure-responsive valve interposed in said conduit and opening to allow oil to flow to the nozzle only after the pump has built up the requisite high pressure, a fan supplying air at low pressure, a conduit conducting such air to the nozzle to mix with the atomized oil, a motor for driving the fan and pump and including a speed-responsive coupling operable to connect the fan and pump to the motor only after the latter has acquired a predetermined speed and to disconnect the fan and pump from the motor whenever the speed of the latter falls below said speed, and an overrunning clutch through which the fan is driven and which is operable to allow the fan to continue in operation by its momentum after the oil pump has stopped.

JOSEPH A. LOGAN.