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TEMPERATURE RESPONSIVE APPARATUS FOR OPERATING AN OIL BURNING SYSTEM

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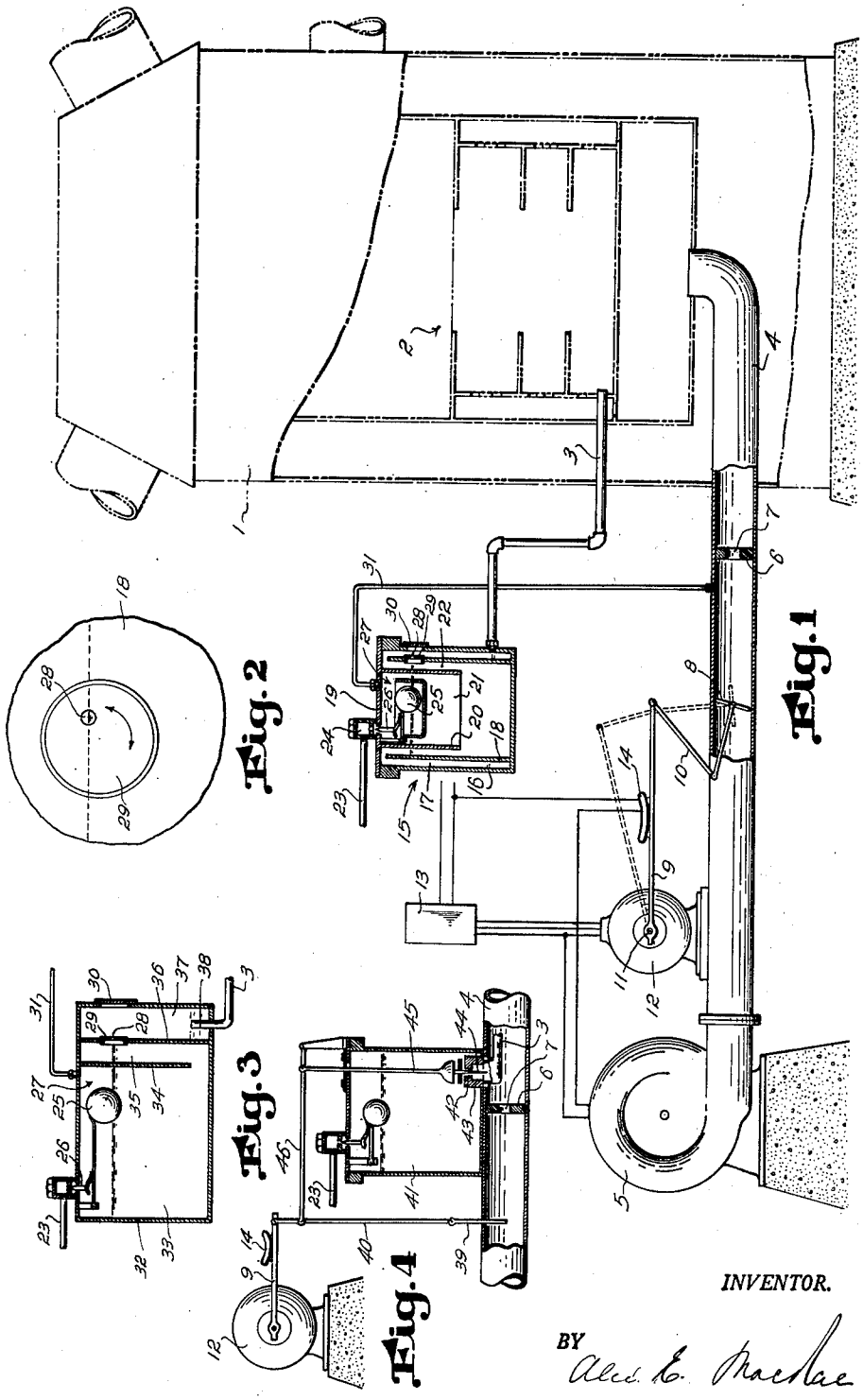

Fig. 1

Fig. 2

Fig. 3

Fig. 4

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TEMPERATURE RESPONSIVE APPARATUS FOR OPERATING AN OIL BURNING SYSTEM

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2 Claims. (Cl. 158—28)

This invention relates to oil burning systems.

In conventional oil heating units for domestic and like service, intermittent operation of the burner occurs, under thermostatic control, to provide the required quantity of heat. The rate of feed of fuel oil and air to the burner is chosen to provide a mixture which will insure most efficient combustion under all operating conditions. While the proportion of oil and air in the mixture may be adjusted from time to time, it remains constant for any one operating period or until further manual adjustment is made.

It is a primary object of the present invention to provide a method and means of operating an oil burning heating system in which continuous adjustment of the combustion mixture is effected to provide substantially increased operating efficiency.

Another object is to provide an oil burning heating system which may be operated in a continuous manner to provide a more satisfactory heat supply with decreased fuel consumption.

To this end, the invention contemplates the provision of a heating system wherein continuous and automatic adjustment of the combustion mixture in response to heat requirements is effected and wherein continuous operation of the oil burning unit may be carried out.

Other objects, advantages and details of the invention will become apparent as this description proceeds with particular reference to the accompanying drawing, in which

Figure 1 is a diagrammatic elevation, partly in section, of a system in accordance with the invention,

Figure 2 is a side elevation of an oil orifice plug,

Figure 3 is a sectional elevation of a modified form of oil metering device, and

Figure 4 is a sectional elevation of a modified form of an air and oil feed control device.

Referring to Figure 1, 1 is a furnace of standard construction containing an oil burner 2 of conventional type having an oil feed conduit 3 and an air feed pipe 4.

The air feed pipe 4 is connected to a fan 5 arranged to supply air under low pressure to the pipe 4. The fan need not, and preferably does not develop a pressure of more than approximately .02 pounds per square inch above atmospheric. A partition 6 having an axial aperture 7 is provided in pipe 4 to constrict the air flow just prior to its entrance to the burner and thus cause a slight build-up in air pressure in the pipe anteriorly of the partition.

Also mounted in the pipe 4 anteriorly of the partition is a damper or air check valve 8 which is arranged to be moved into open or closed position by means of an arm 9 one end of which is connected to the damper through linkage 10. The other end of arm 9 is fixed to a shaft 11 arranged to be driven slowly by a motor 12. The arm 9 is swingable upwardly through a small arc, as indicated in the drawing, in response to rotation of the shaft, to open the damper. Movement of the arm downwardly will close the damper, as shown.

Energization of the motor 12 to place the damper in any

desired position of adjustment is effected through a thermostat 13 adapted to be placed in the space to be heated.

Mounted on arm 9 is a mercury or like switch 14 connected to the fan 5 and arranged to energize the fan when the damper 8 has reached a predetermined partially open position, the fan being adapted to continue operating so long as the damper remains open and until the damper returns to closed or almost closed position.

An oil metering device 15 is provided and comprises a cylindrical container or tank 16 having an annular compartment 17 adjacent its outer wall formed by a cylindrical wall 18 extending from the bottom wall of the tank to a level slightly spaced below the top of the tank. A top closure 19 is provided for the tank and suspended therefrom is a cylindrical wall 20 concentrically arranged in spaced relation to wall 18. Wall 20 extends downwardly into the tank to approximately the midsection thereof. Wall 20 forms an inner cylindrical compartment 21 and an annular compartment 22 between it and wall 18.

Oil is fed to compartment 21 through conduit 23 and a suitable constant level maintaining mechanism including a casing 24, float 25, and float actuated valve 26. It will be apparent that the oil is free to flow into compartment 22 through the open bottom of compartment 21. An adjustable level oil outlet orifice 28 is provided in wall 18, such orifice being preferably located in off-center relation in a circular plate 29 rotatably mounted in wall 18. Referring to Fig. 2, it will be apparent that the level of orifice 28 may be adjusted simply by rotating plate 29, which is accessible through the wall of tank 16 by means of a removable plug 30.

Oil flows through orifice 28 into compartment 17 from whence it is fed to the burner 2 through feed conduit 3, which is connected to compartment 17 slightly above the bottom level thereof.

The space above the oil level, indicated at 27, in compartment 21 is in communication with the interior of air feed pipe 4 just anterior to partition 6 by means of a conduit 31. Thus, a pressure will be applied to the surface of oil in compartment 21 directly proportional to the pressure difference developed across the air aperture 7 in the air stream.

In operation, it is preferably proposed that a fuel mixture will be continuously supplied to burner 2 for continuous combustion therein. To this end, damper 8, in the lower or "at rest" position of arm 9, will be slightly open to permit a small quantity of air at atmospheric pressure (fan 5 not being in operation) to bleed past the damper. The oil level in compartment 21, being under atmospheric pressure, will be approximately the same as that in compartment 22, orifice 28 being adjusted to permit at such level a restricted flow of oil into compartment 17. A correspondingly restricted flow of oil will flow through conduit 3 to burner 2. The relatively small quantity of fuel mixture thus supplied to the burner will result in the production of a very low flame therein and consequently a very low degree of heat in the space to be heated.

However, when additional heat is required in the space to be heated, thermostat 13 is actuated to energize motor 12. Arm 9 will then be slowly swung upwardly to a new position, depending upon the position of thermostat 13, and will impart opening movement to the damper 8. As arm 9 moves upwardly from its "at rest" position, mercury switch 14 will energize the motor of fan 5 and place the latter in operation. Air under pressure is then forced past the damper 8 and through the aperture 7 to the burner 2. A pressure difference is then developed across the air aperture 7 which acts upon the oil surface

in compartment 21 through conduit 31. This pressure raises the oil level in compartment 22 and an increased flow of oil through orifice 28 occurs in direct proportion to the pressure developed at the upstream face of the air aperture partition 6. Flow of oil through feed conduit 3 to the burner thus occurs at a rate in direct proportion to such pressure.

It will thus be apparent that the air and oil are both metered in a constant proportion, since the same pressure difference across aperture 7 causes the increased flow of both air and oil. With the proper choice of oil orifice and air aperture sizes, air and oil will be supplied in a combustible ratio regardless of the quantity supplied. It will also be apparent that the quantity of oil and air in the combustible ratio is varied in proportion to the position of the control damper 8, and thus by the thermostat and the heat requirements of the space to be heated.

It will be observed that the system described lends itself particularly to the preferred continuous operation of the burner. Such continuous operation has many advantages. The temperature of the space to be heated is maintained substantially uniform, with result greater comfort. Continuous combustion varying from a predetermined very low rate to a higher rate as required is much more economical than intermittent combustion at a high rate. The chimney and fuel pipe remain warm at all times and there is no variable pull by the chimney to remove heat from the furnace and basement. The combustion mixture may be readily adjusted to provide substantially the exact amount of air required to burn the oil present, and thus there is no excess air to be heated and carry heat energy up the chimney, as is the case in standard systems. Substantially only the products of combustion are discharged through the chimney in the present system.

Figure 3 illustrates a modified form of oil metering device which comprises a rectangular tank 32 having a main compartment 33, to which oil is fed through conduit 23 to maintain a constant level of oil therein by mechanism, similar to that shown in Figure 1. A baffle 34 extends from the top wall of tank 32 to a point adjacent but spaced above the bottom wall of the tank. Baffle 34, together with a transverse partition 36 in the tank forms a narrow compartment 35 in communication with compartment 33 through the space below baffle 34. The oil metering orifice 28 is provided in plate 29 in partition 36. Partition 36 forms with the end wall of the tank a compartment 37 into which oil flows through orifice 28 and from which it flows through conduit 3 to burner 2. In this instance, conduit 3 has an inlet portion 38 extending through the bottom wall of compartment 37 to a level spaced slightly above such bottom wall. The conduit 31 is in communication with the space above the oil level in compartment 33. The device described operates in the same manner as does device 15. Pressure on the oil in compartment 33 will raise the level of oil in compartment 35 and cause an increased flow of oil through orifice 28 into compartment 37 from which an increased flow will occur through conduit 31.

Figure 4 illustrates another modification of oil and air metering device, wherein a damper 39, controlling the flow of air through pipe 4 on the upstream side of air aperture partition 6, is suspended from the swingable arm 9 of motor 12 by means of a link 40. An oil tank 41 is supplied with oil through conduit 23 to maintain a constant level of oil therein by mechanism similar to that shown in Figure 1. A metered flow of oil flows from tank 41 into conduit 3 through an orifice 42 in a plug 43

in the bottom wall of the tank. Flow of oil through orifice 42 is controlled by a tapered stem 44 extending axially through the orifice and carried by a rod 45 suspended from a link 46. Link 46 is pivotally connected to link 40 for simultaneous upward and downward movement therewith. It will be apparent therefore, that the rate of oil feed from tank 41 into conduit 23 will be in direct proportion to the rate of air flow through air pipe 4 as permitted by damper 39. The value and constancy of the air and fuel ratio will depend on the size of orifice 42 and the size and taper of the tapered stem 44.

I claim:

1. In a furnace having an oil burner, an air supply pipe leading to said burner, a fan for forcing air through said pipe to the burner, means forming an air metering orifice in said pipe exteriorly of the furnace and forming an air aperture in said pipe of reduced diameter and relative to the internal diameter of said pipe to constrict the flow of air therethrough, a damper on the upstream side of said constriction and controlling flow of air through said pipe and aperture to said burner, said damper being partially open in its normal at rest position, linkage normally holding said damper in said position, a reversible motor means connected to said linkage for actuating said linkage to impart slow opening or closing movement to said damper, a power circuit for operating said motor, a thermostat in said circuit and arranged to close said circuit to operate the motor in one direction or the other in response to heat requirements, circuit means including a normally open switch controlling operation of said fan, said switch being connected to said linkage and being closable in response to actuation of said linkage by said motor to place said fan in operation, and an oil metering device comprising a tank, a wall dividing said tank into a main compartment and an auxiliary compartment latterly thereof and communicating therewith adjacent its lower end, an oil feed conduit leading to said main compartment, a valve in said oil feed conduit to control flow of oil therethrough, float mechanism in said main compartment controlling said valve, said wall having a metering oil flow orifice therein leading from said main compartment to said auxiliary compartment, an air conduit leading from said air supply pipe at a point between said constriction, and said damper to said main compartment adjacent the top thereof to permit application of the air pressure in said pipe to the surface of oil in said main compartment thereby to raise the level of oil above the oil metering orifice to control rate of oil flow through said oil metering orifice, and an oil supply line leading from said auxiliary compartment to said burner.

2. A furnace as defined in claim 1, including means for adjusting the level of said oil metering orifice in said wall comprising a circular plate rotatably mounted in said wall, said oil metering orifice being located in said plate in off-center relation thereto.

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