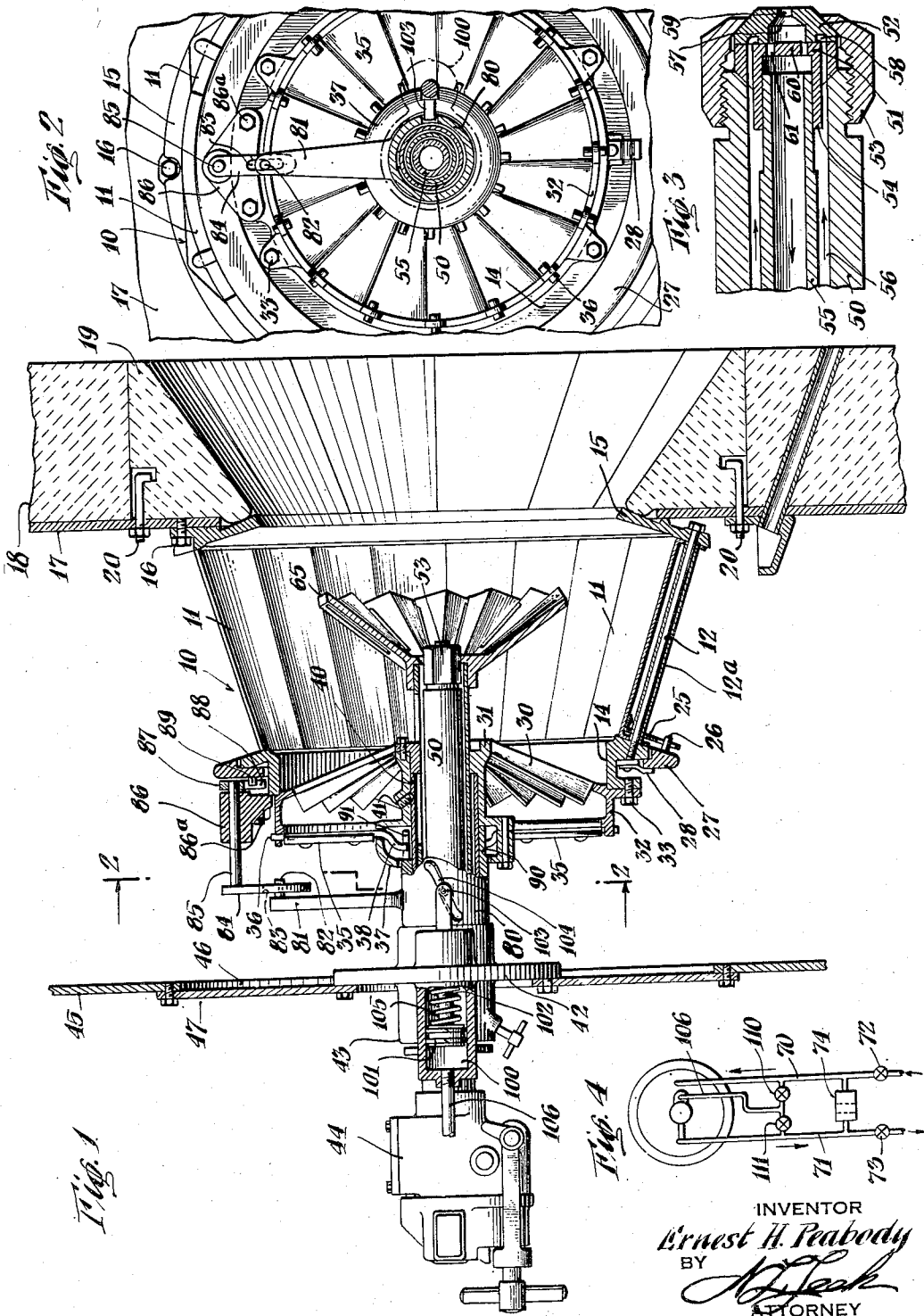


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AIR REGISTER CONTROL

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1 Claim. (Cl. 158—1)

This invention relates to fuel burners and more particularly to burners of the type having fuel supply means for liquid, gaseous or pulverized fuel and an air register supplying air for combustion purposes.

The invention may be applied, for example, to variable capacity atomizing burners of the type commonly known as the "Peabody wide range burner." This type of burner, in general, comprises an atomizer for liquid fuel, having a whirling chamber in which the fuel is caused to rotate rapidly to set up centrifugal forces which break up or atomize the fuel as it is released from the atomizer tip. In one embodiment the capacity is controlled by withdrawing a selected return portion of the fuel from the whirling chamber or other appropriate part of the atomizer. By varying the pressure in the return line the quantity of fuel atomized may be adjusted as desired. Such a burner and controls therefor is shown and described more in detail in U. S. Patent to E. H. Peabody, No. 1,628,424, dated May 10, 1927.

A further development is shown in U. S. Patent to Graham et al., No. 1,824,952, dated Sept. 29, 1931, which describes a system for maintaining a controlled pressure drop across the tangential slots supplying fuel to the whirling chamber so as to improve the operating characteristics of the burner at various loads. In this embodiment the pressure in both the supply and return lines varies as a function of the operating capacity of the atomizer. The Graham et al. patent points out that the operating capacity of the burner is dependent upon the oil pressure in the tip and that the form of the spray is dependent upon the centrifugal force produced by the rapid whirling motion of the oil in the whirling chamber. The latter factor is dependent upon the velocity of the oil entering the tip which is determined by the pressure drop across the tangential slots. In the Graham system, the pressure drop across the slots is maintained substantially constant by a control of the pressure differential between the supply and return lines. The pressure in the whirling chamber being dependent upon the pressure in the return line accordingly varies as a function of the pressures in both the return and supply lines. The pressure in either of these lines accordingly constitutes a measure of the operating capacity of the burner.

The air register, as shown in Patent 1,628,424 above mentioned, may be provided with a peripheral set of adjustable air doors which are pivotally mounted for adjustment in unison so as to vary the quantity, velocity and direction of the

air. A further embodiment of air register construction is shown in application Serial No. 196,878 for Fuel burners, filed March 19, 1938, in which a set of radial dampers are provided to admit controlled quantities of air around the axis of the burner to be combined with the rotating mass of air admitted through the peripheral doors and to improve the combustion characteristics.

It has been found that for most efficient operation the quantity velocity and direction of air supplied to the burner through the air register should bear a definite relationship to the operating capacity of the atomizer and the present invention accordingly has for an object to provide novel and improved means for adjusting the air register to fulfill these conditions.

Another object is to provide means responsive to the fuel consumption of the burner to control the air supply.

Another object is to provide means responsive to changes in pressure in either the fuel supply line or the fuel return line to actuate the air register doors.

Another object is to provide, in a mechanism of the above type, means to adjust the air doors as a predetermined function of the operating capacity of the burner.

A further object is to provide automatic means for effecting the above adjustments.

A still further object is to provide remote controlled means for adjusting the air doors of an air register.

Another object is to provide a burner of the type above indicated, having novel and improved operating characteristics and details of construction.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are believed to be characteristic of this invention will be more particularly pointed out in the claim appended hereto, the invention itself will be better understood by referring to the following description, taken in connection with the accompanying drawing, in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawing:

Fig. 1 is a longitudinal section through a burner constructed in accordance with the present invention.

Fig. 2 is a transverse section taken along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged partial sectional view of

one form of atomizer which may be embodied in the burner of Figs. 1 and 2, and

Fig. 4 is a diagrammatic view showing typical control lines.

In the following description and in the claims certain specific terms are used for convenience in referring to the various details of the invention. It is to be understood, however, that these terms are to be given as broad an interpretation as the state of the art will permit.

Referring to the drawing more in detail, the invention is shown, for purposes of illustration only, as applied to an air register of the type described in application Serial No. 196,878 referred to above.

The construction comprises, in general, an air register 10 having a plurality of air doors 11 arranged peripherally thereof and journaled on spacing sleeves 12a which are secured by rods 12 between a front ring 14 and an annular back plate 15. The back plate 15 is secured, as by bolts 16, to a plate 17. This plate 17 is secured to or mounted adjacent a refractory wall 18 forming the front wall of the furnace. A ring of refractory blocks 19, forming the burner throat, may be secured in the wall 18, as by bolts 20.

Each air door 11 is provided with a slotted arm 25 engaging a pin 26 mounted in an adjusting ring 27. The adjusting ring 27 is journaled on the front ring 14 and may be held in position by suitable means, such as clips 28. The air register is shown as provided with a front cover comprising vanes 30 rigidly mounted between a hub 31 and a peripheral ring 32, which is secured by suitable means such as by bolts 33, to the front ring 14. The vanes 30 may be inclined to impart a rotating motion to the air passing axially therebetween into the burner throat. For controlling the quantity of air passing between the vanes 30, there is shown a plurality of dampers 35 which are pivotally mounted on rods 36, supported at their outer ends by the ring 32 and at their inner ends by a flange 37 carried by the hub 31. The inner ends of the rods 36 are shown as bent to provide adjusting levers 38 by which the pivotal position of the dampers is controlled. A sleeve 40 is mounted within the hub 31 and suitably secured as by a set screw 41. This sleeve is rigidly attached by suitable means to a front plate 42, having a hub 43. A baffle 45 may be mounted in spaced relationship to the wall 18 so as to form a wind box through which air is supplied to the air register. This baffle 45 may be provided with an opening 46 of sufficient size to permit the entire burner to be removed therethrough and which is normally closed by a plate 47 extending between the baffle 45 and the front plate 42 of the burner.

An atomizer barrel 50 is slidably mounted within the sleeve 40. This atomizer barrel carries an atomizer and a housing 44 containing the fuel connections. The atomizer may be of the wide range type, as set forth more in detail in the Patent No. 1,628,424 referred to above and may comprise a plug 51 (Fig. 3) communicating with a tip 52 which is held in position by a cap 53, threaded on the barrel 50. The plug 51 may be provided with a central flange 54 which fits over a return pipe 55 concentric with the burner barrel 50, and spaced therefrom to provide an annular supply passage 56. The tip 52 is provided with a chamber 57 communicating with the supply passage 56 by tangential passages 58 which are arranged to supply the fuel tangentially to the chamber 57 whereby the fuel is caused to whirl rapidly therein. The chamber 57 is tapered

forwardly to a discharge orifice 59. The plug 51 is provided with a front wall 60 having return passages 61 therein communicating with the chamber 57 and with the interior of the return pipe 55.

In operation, the fuel supplied through the passage 56 is caused to whirl in the chamber 57 to set up a centrifugal force such that when released from the orifice 59 atomization takes place. A controlled quantity of the fuel is withdrawn through the passages 61 and is returned through the return pipe 55. The amount so returned controls the operating capacity of the nozzle as more fully set forth in the Patent No. 1,628,424, above referred to. In some instances the fuel return may be omitted and the operating capacity controlled by suitable variation of the fuel supply pressure.

The burner barrel 50 also carries a diffuser 65 which controls the passage of air to the burner throat and provides for the desired mixture thereof with the atomized fuel.

The fuel may be supplied through a line 70, Fig. 4, to the passage 56, Fig. 3, and may be withdrawn from the pipe 55 by means of a return line 71, suitable regulating means being provided, such as valves 72 and 73, to control the fluid pressure in said lines. In an arrangement of this character, the fluid pressure in the supply line 70, for example, may be held constant and the operating capacity of the burner may be controlled by regulating the valve 73 in the return line 71, thereby varying the pressure in the return line and the quantity of fuel which is withdrawn from the atomizer tip, or the return line may be omitted or the fuel return pressure may be held constant, in which case the operating capacity may be controlled by varying the fuel supply pressure.

In certain instances it may be desirable to maintain a substantially constant pressure difference between the supply and return lines. This may be accomplished by the provision of a valve 74 of the type described more in detail in Patent No. 1,824,952, referred to above, which varies the pressure in the supply line 70 in accordance with variations in pressure of the return line 71 or vice versa. In this system the operating capacity may be adjusted by controlling either the valve 72 or the valve 73.

The construction thus far described is set forth more in detail in the patents and application above referred to. Consequently, only so much thereof has been set forth herein as is necessary to an understanding of the present invention.

The invention is not limited to the specific burner construction described above for purposes of illustration, but may be applied to any burner for liquid, gaseous or pulverized fuel or combinations thereof, such as those shown in U. S. Patents 1,671,494 to C. R. Stewart, dated May 29, 1928, 1,790,395 to S. T. Warner, dated Jan. 27, 1931, and 1,865,983 to S. T. Warner, dated July 5, 1932. In the above burners the gas may also be admitted peripherally if desired. The term "atomizer," as used herein, is intended to include any of the above types of burner.

The present invention utilizes the variable fuel flow to control the position of the air doors 11 and of the dampers 35. In the embodiment shown, this is accomplished by providing a sleeve 80 which is rotatably mounted on the sleeve 40 and carries an arm 81 provided with a pin 82 engaging a slot 83 in an arm 84 which is secured to a shaft 85. The shaft 85 is journaled

in a block 86 attached by suitable means, such as bolts 86a, to the front ring 14 and carries at its free end a lever 87 provided with a slot 88, in which a pin 89 is seated. The pin 89 is carried by the ring 27, the arrangement being such that rotation of the sleeve 80 causes a corresponding rotation of the ring 27, thereby, through the pins 26 and arms 25, actuating the air doors 11. The sleeve 80 is also provided with a hub 90 having a plurality of axial slots 91 which engage the levers 38 so that rotation of the sleeve 80 causes rocking movement of the levers 38 and thereby controls the position of the dampers 35. This particular operating linkage may, of course, be varied as desired to obtain unitary adjustment of the air doors and dampers or independent adjustment may be provided. A specific embodiment has been shown for illustration only.

For actuating the sleeve 80 there is provided a fluid pressure motor, such as a cylinder 100 having a piston 101 therein attached to a piston rod 102 which extends rearwardly from said cylinder and carries a pin 103 which engages a helical slot 104 in the sleeve 80. The piston 101 is held forwardly by a spring 105 seated within the cylinder 100. Fluid pressure is supplied to the cylinder 100 by a pipe 106 for the purpose of controlling the position of the piston 101, which, in turn, by means of the pin 103 and the slot 104, controls the rotational position of the sleeve 80 and thereby effects adjustment of the air doors 11 and of the dampers 35. The pin and slot may be replaced by a cam connection or by other linkage means to effect adjustment of the sleeve by the operation of the fluid pressure motor and the cylinder may be mounted transversely to the burner axis if desired. Furthermore, other types of fluid pressure motors, such as a diaphragm motor or expansible bellows, may be employed.

The pipe 106 may be connected to the supply line 70 and the return line 71 through valves 110 and 111 respectively, so that communication can be established with either of said lines by suitable actuation of said valves. The arrangement is such that an increase in pressure in the fuel supply or fuel return line, as the case may be, which represents an increase in the operating capacity of the atomizer, causes a corresponding increase in the fluid pressure supplied to the cylinder 100 and thereby actuates the air doors 11 and dampers 35 in a direction to increase the supply of air. The pipe 106 may be connected to only one of the lines 70 and 71, in which event the valves 110 and 111 may be omitted.

It is to be understood that the shape of the slot 104 and the relationship thereof to the piston rod 102 is such that the variation in air supply corresponds to the variation in requirements at the various operating capacities of the burner. This may, for example, represent a straight line variation with the quantity of air varying directly as the quantity of fuel burned. The shape of the slot 104 must, however, take into consideration the relationship between the

fuel pressure and the operating capacity and also the relationship between the annular position of the sleeve 80 and the quantity of air supplied through the air register.

It will be understood that the present invention is not limited to this specific construction of air register and burner. The air doors may be arranged in the form of a cylinder or in certain instances may be arranged radially. In certain instances the dampers 35 and vanes 30 may be omitted provided the atomizer is so positioned with respect to the air doors that the proper mixture of air for combination purposes is thus obtained. Suitable manual adjustment means, such as a handle (not shown), may be provided for manually setting or adjusting the air doors and dampers as may be required. The invention may be applied to any desired type of air register wherein a variable air flow is required. Such air register may or may not be incorporated in a burner.

It is also to be understood that the fluid pressure for actuating the piston 101 may be obtained from either the supply line or the return line in a constant differential system, or may be obtained from the return line in a system operating at a substantially constant supply pressure and a variable return pressure, or from the supply line in a system operating at constant return pressure or in a non-return system. In certain instances the fluid pressure supply to the cylinder 100 may be taken from an independent source and may be controlled manually.

Although a specific embodiment of the invention has been shown and described for purposes of illustration, it is to be understood that various changes and modifications may be made therein as will readily appear to a person skilled in the art. The invention is only to be limited in accordance with the following claim.

What is claimed is:

A fuel burner comprising an atomizer of the variable return type having a tip provided with a whirling chamber having a discharge orifice, tangential slots to supply fuel to said chamber, a supply conduit to supply fuel to said slots, a return conduit connected to withdraw fuel from said tip, means for maintaining a controlled pressure differential between said conduits, means for adjusting the fuel pressure in one of said conduits to thereby vary the operating capacity of the burner, an air register having adjusting means to control the quantity, velocity and direction of air supplied to said burner for combustion purposes, and pressure responsive means actuated by the fuel pressure in one of said conduits to effect a corresponding adjustment of said register adjusting means so as to maintain a predetermined relationship between the operating capacity of the atomizer and the quantity, velocity and direction of the air supplied thereto.

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