July 27, 1943. R. C. VROOM 2,325,443

AIR REGISTER

Filed April 13, 1942 2 Sheets-Sheet 1

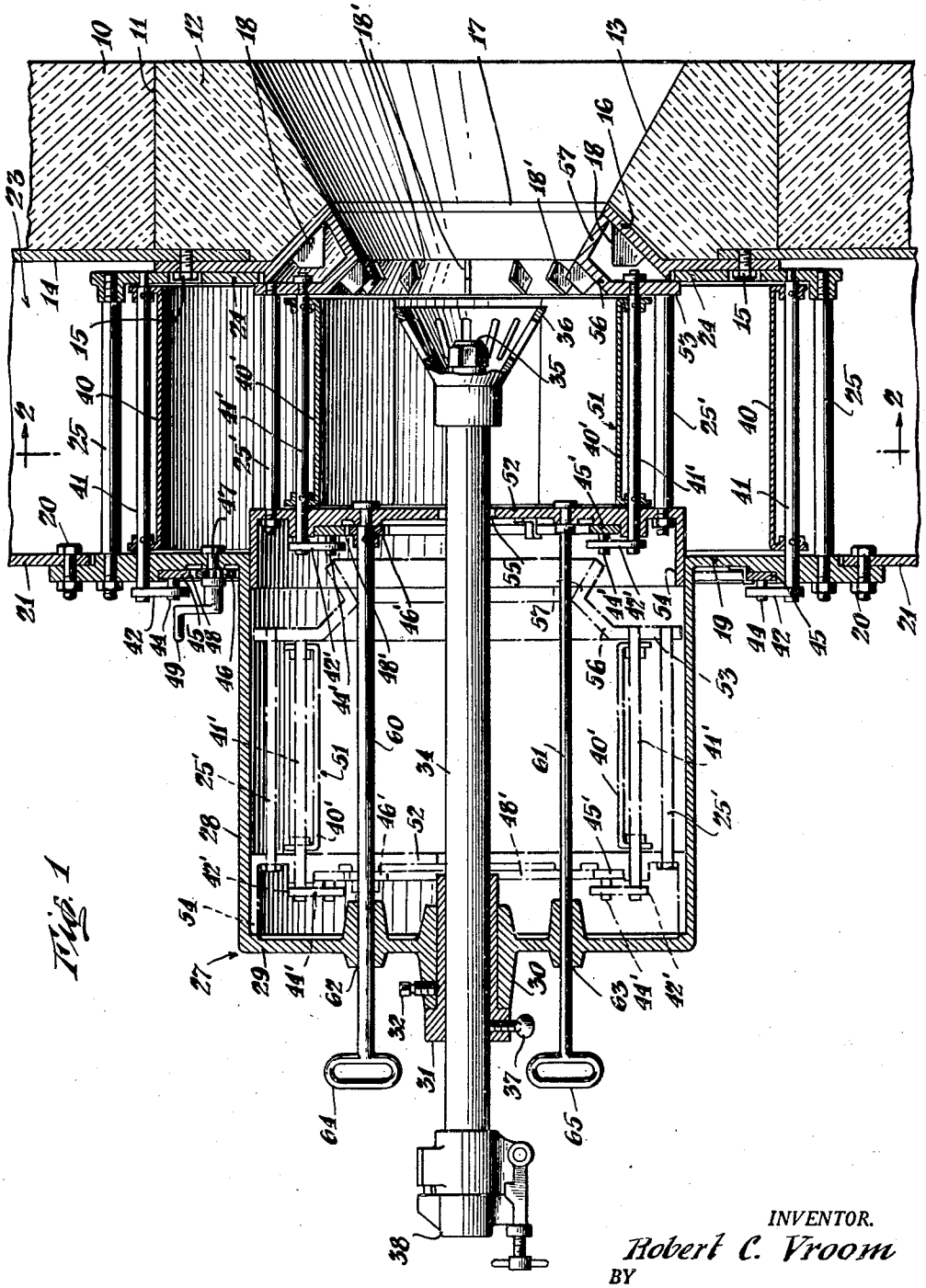


Fig. 1

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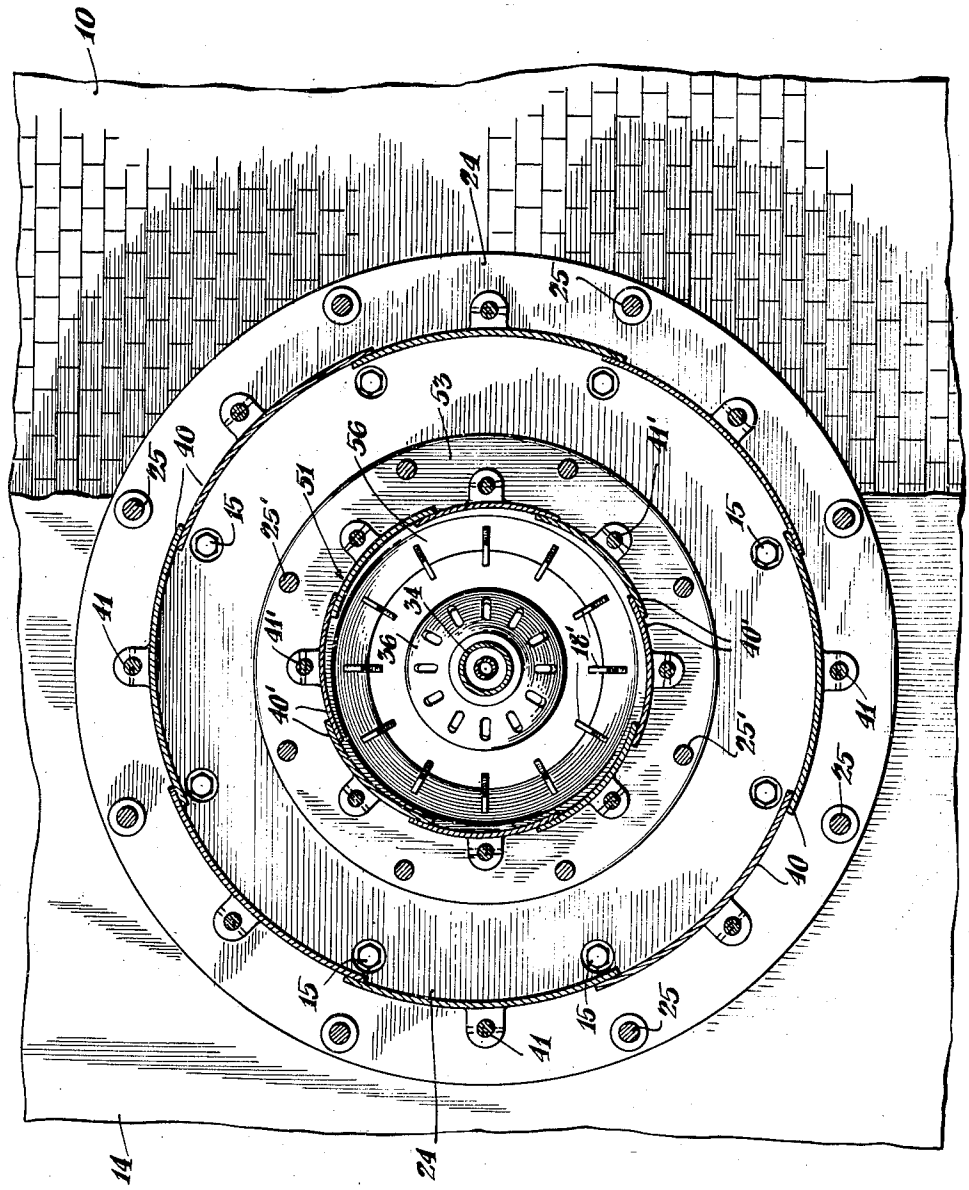


Fig. 2

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2,325,443

UNITED STATES PATENT OFFICE

2,325,443

AIR REGISTER

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10 Claims. (Cl. 158—1.5)

This invention relates to air registers or the like and more particularly to an air register for use in a fuel burner of the general type disclosed in Vroom Patent No. 2,210,476, dated Aug. 6, 1940.

In a burner of this type, an air register is provided which may take the form of a casing having peripheral doors through which air for combustion is admitted. The doors control the direction and velocity of the air and cause the same to form a rotating mass of air within the air register having a degree of turbulence and a velocity of rotation adapted to promote the mixture of air and fuel for combustion.

It is an object of the present invention to provide a new and improved means for controlling the velocity of air supplied through a system of the above type.

Another object of the invention is to provide, in a burner of the above type, means for controlling the velocity of the air at the burner throat.

Another object is to provide, in a burner of the above type, a plurality of air registers arranged in series with adjustable means to regulate the passage of air through said registers to the burner throat.

Another object is to provide a multiple air register for burners of the above type having novel and improved details of construction and characteristics of operation.

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 are pointed out more particularly in the claims appended hereto, the invention itself may be better understood by referring to the following description, taken in connection with the accompanying drawings forming a part thereof in which a specific embodiment of the invention has been set forth for purposes of illustration.

In the drawings,

Fig. 1 is a longitudinal sectional view of a burner embodying the present invention; and

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

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

Referring to the drawings more in detail, the invention is shown as applied to a burner for a furnace having a front wall 10 of the usual refractory material and an opening 11 in which is positioned a ring of refractory blocks 12 having flared inner surfaces 13 forming the burner throat. A plate 14 is positioned over the front wall 10, and to this plate there is secured, as by bolts 15, an annular flanged part 16 having an opening 17 registering with the burner throat. Suitable vanes 18 may be disposed about the sloping surface of part 16 for controlling the direction of air flow at the burner throat.

The burner is shown as comprising a main air register having a front plate 19 secured, as by bolts 20, to a plate 21 which is spaced from the plate 14 to form a plenum chamber 23 in which air is supplied under pressure to the register. A back plate 24 is secured to the front plate 19 by suitable means, such as stay bolts 25. The back plate 24 bears against a surface of part 16 for effecting an air seal. In certain embodiments, such as, for example, an air register for use at atmospheric pressure, the register may be supported by securing the back plate 24 to the plate 14 in which event the plate 21 may be omitted.

Extending outwardly from the front plate 19 is a housing 27 which, in the embodiment illustrated, comprises a cylindrical side wall 28 closed by a front plate or wall 29. The front wall 29 of housing 28 is provided with a hub 30 in which a sleeve 31 is secured by suitable means such as a set screw 32. Atomizer barrel 34 having an atomizer tip 35 and a diffuser 36 may be mounted within the sleeve 31 and secured in position by a set screw 37. The tip 35 and diffuser 36 are arranged to direct a stream of finely divided fuel into the burner throat. The atomizer barrel 34 may also carry a coupling member 38 containing the fuel connections, not shown.

The atomizer barrel may be of the type disclosed more in detail in the Peabody Patent No. 1,628,424, dated May 10, 1927, and may comprise, for example, means for supplying fuel under pressure to the atomizer tip and for discharging the same in a fine cone-shaped spray. The operating capacity may be varied by varying the supply pressure or by returning a portion of the fuel from the atomizer tip to the fuel pump and controlling the pressure in the return line, as more fully described in the said patent. Other fuel supply means may be used for burning various types of gaseous, liquid or pulverized fuel as shown, for example, in Warner Patents Nos. 1,790,395, dated Jan. 27, 1931, and 1,865,983, dated July 5, 1932.

For controlling the velocity of air to the burner, the main register is provided with a plurality of peripherally spaced air doors 40 which are curved to form the peripheral wall of an air register chamber. The doors 40 are individually actuated by means of hinge bolts 41 which are secured individually to said doors and are journaled in the back plate 24 and front plate 19 as shown in Fig. 1. Each hinge bolt 41 extends through the front plate 19 and carries a lug 42 having a slot engaged by a pin 44. The pins 44 cooperating with the various lugs 42 are carried upon a ring 45 which is rotatably mounted on the front plate 19. Suitable means may be provided for operating the ring 45, shown for example, as a pinion 46 carried on a shaft 47 and engaging a rack 48 on said ring. The shaft 47 may be operated by suitable means such as a handle 49. The arrangement is such that actuation of the ring 45 causes pivotal movement of the lugs 42 and swings the doors 40 angularly about the axes of the hinge bolts 41 so as to adjust the openings between said doors. In certain instances individual adjusting means may be provided so as to permit individual adjustment of each door.

For the purpose of controlling the velocity of air to the burner throat at very low capacities, the present invention provides a relatively small auxiliary air register 51 which, when not in use, is enclosed within the housing 27, and which when required may be moved as a unit into registry with the burner throat, as will now be described. In the embodiment of the invention shown here for purposes of illustration, the auxiliary air register 51 is similar in construction to the main air register previously described. Accordingly, in order to simplify the description, the corresponding parts of the auxiliary air register 51 will be designated by the same reference numerals, but with primes affixed thereto.

The auxiliary air register 51 has a front plate 52 and a rear plate 53. The front plate 52 has a wide peripheral flange 54 which is guided inside the cylindrical wall 28, and contains an axial opening 55 through which the atomizer barrel 34 extends. The back plate 53 of the auxiliary air register 51 has a converging annular wall 56 upon which the vanes 18' are mounted, and a diverging or flaring annular wall 57 which is adapted to register with the flared surface 13 of the burner throat. The other structural elements of the auxiliary air register 51, specifically the stay bolts 25', air doors 40', hinge bolts 41', lugs 42', pins 44', ring 45', pinion 46', and rack 48', are similar to the correspondingly numbered elements of the main air register.

Axial movement of the auxiliary air register 51 into and out of the housing 28 is effected by a pair of elongated rods 60 and 61 which are journaled in the front plate 52 of auxiliary register 51 and extend through openings 62 and 63 in the front wall 29 of housing 27, the rods being provided with suitable handles 64 and 65, respectively. The pinion 46' cooperating with rack 48' of auxiliary air register 51 is secured to the rod 60, hence rotation of rod 60 by means of its handle 64 causes pivotal movement of the lugs 42' and swings the doors 40' about the rods 41' so as to adjust the openings between said doors, in a manner similar to the adjustment of the air doors 40 of the main register by means of handle 49 described above. Fig. 1 shows in full lines the auxiliary air register 51 seated in operative position within the main air register, with the outer flared wall 57 of the auxiliary register in registry with the flared surface 13 of the burner throat; while in the dotted line position shown in Fig. 1, the auxiliary air register 51 is withdrawn within the confines of the housing 27.

Operation

When the burner is to be operated at maximum capacity, the auxiliary air register 51 is withdrawn into the confines of the housing 27, which is the position illustrated in dotted lines in Fig. 1, and under such conditions the auxiliary register 51 plays no part in the operation of the burner. In operating the burner under such conditions, the atomizer is set by suitable means for the required load, and the air doors 40 are adjusted by means of the handle 49 to cause the air to enter the main register with the desired direction and velocity to set up a whirling motion within the register adapted to produce an efficient mixture of air and fuel at the burner throat. Pressure in the plenum chamber 23 may also be varied so as to effect the desired air flow.

When it is desired to operate the burner at very low capacity, the auxiliary air register 51 is moved axially from within the housing 27, by grasping handles 64 and 65 and forcing the rods 60 and 61 toward the right as viewed in Fig. 1, until the auxiliary register 51 is seated wholly within the main register, with its flared surface 57 in registry with the burner throat as shown in full lines in Fig. 1. The air doors 40' of the auxiliary register are then adjusted by rotating the handle 64 to cause the air to enter the register with the desired direction and velocity to set up a whirling motion within the auxiliary register adapted to produce the desired mixture of air and fuel at the burner throat 13. When the auxiliary air register 51 is thus utilized, the air doors 40 of the main register are opened wide to admit freely the desired flow of air from the plenum chamber to the auxiliary register.

The auxiliary air register 51, when utilized in the manner described above, not only maintains the velocity of the air to the burner throat at reduced capacities by reason of the reduced size of the auxiliary air doors 40', but likewise reduces the effective throat area to an extent commensurate with the reduced air flow. Under such conditions, by properly adjusting the main air doors 40 as well as the auxiliary air doors 40', the capacity of the burner may be varied accurately over an extremely wide range while maintaining desired register and throat velocities.

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

What is claimed is:

1. In a burner having a throat and fuel supply means adapted to introduce fuel for combustion, a main air register comprising a wall having adjustable air inlet openings therein, an auxiliary air register within said main air register, said auxiliary air register comprising a wall having adjustable air inlet ports therein and arranged to receive air through said ports from said main air register and to control the flow thereof to said burner throat, said auxiliary air register having

means to reduce the effective area of said burner throat.

2. In a burner having fuel supply means adapted to introduce fuel for combustion, a main air register comprising a set of air doors overlapping when closed to form the peripheral wall of an air register chamber and being adjustable to regulate the supply of air to said chamber, and an auxiliary air register within said main air register chamber, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable to receive and regulate the supply of air from said main air register.

3. In a burner having a throat and fuel supply means adapted to introduce fuel for combustion, a main air register comprising a set of air doors overlapping when closed to form the peripheral wall of an air register chamber and being adjustable to regulate the supply of air to said chamber, an auxiliary air register within said main air register chamber, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable to receive and regulate the supply of air from said main air register, said auxiliary register having means to reduce the effective area of said burner throat.

4. In a burner having a throat and an atomizer for introducing finely divided fuel for combustion, a main air register comprising front and back walls and a set of air doors overlapping when closed to form with said walls an air register chamber and being adjustable angularly to control the air flow therethrough, a housing on the front wall of said main air register opening into said chamber, and an auxiliary air register movably mounted in said housing and adapted to be moved axially into said chamber, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable to control the air flow therethrough.

5. In a burner having a throat and an atomizer for introducing finely divided fuel for combustion, a main air register comprising front and back walls and a set of peripheral air doors overlapping when closed to form with said walls an air register chamber and being adjustable to control the air flow therethrough, a housing on the front wall of said main air register opening into said chamber, an auxiliary air register movably mounted in said housing and adapted to be moved axially into said chamber, said auxiliary air register likewise comprising a set of peripheral air doors overlapping when closed and adjustable to control the air flow therethrough, and means on said auxiliary air register cooperating with said burner throat to reduce the effective throat area when said auxiliary air register is in operative position in said chamber.

6. In a burner having a flared throat and an atomizer for introducing finely divided fuel for combustion, a main air register comprising front and back walls and a set of peripheral air doors overlapping when closed to form with said walls an air register chamber and being adjustable angularly to control the air flow therethrough, a housing on the front wall of said main air register opening into said chamber, an auxiliary air register movably mounted in said housing and adapted to be moved axially into said chamber, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable to control the air flow therethrough, and a flared annular back plate on said auxiliary air register adapted to cooperate with said flared burner throat to reduce the effective throat area when said auxiliary air register is in operative position in said chamber.

7. A burner comprising a throat, an atomizer barrel and means including an atomizer tip and diffuser for introducing finely divided fuel for combustion, a main air register comprising front and back walls and a set of peripheral air doors cooperating therewith, said doors overlapping when closed to form with said walls an air register chamber and being adjustable angularly to control the air flow therethrough, a cylindrical housing on the front wall of said main air register opening into said chamber, an auxiliary air register movably mounted in said housing and adapted to be moved axially of said atomizer barrel into said chamber, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable angularly to control the air flow therethrough, a flared annular throat plate on said auxiliary air register adapted to cooperate with said burner throat to reduce the effective throat area, and means for moving said auxiliary air register into and out of operative position.

8. A burner comprising a throat, an atomizer barrel and means including an atomizer tip and diffuser for introducing finely divided fuel for combustion, a main air register for supplying air to said burner comprising front and back walls and a set of peripheral air doors cooperating therewith, said doors overlapping when closed to form with said walls an air register chamber and being adjustable angularly to control the air flow therethrough, a cylindrical housing on the front wall of said main air register opening into said chamber, an auxiliary air register movably mounted in said housing, said auxiliary air register likewise comprising a set of air doors overlapping when closed and adjustable to control the air flow therethrough, a flared annular throat plate on said auxiliary air register adapted to cooperate with said burner throat to reduce the effective throat area, means including a rod extending outwardly through said housing for advancing said auxiliary air register into operative position and for retracting said auxiliary register into said housing, and means controlled by said rod for adjusting the doors of said auxiliary air register.

9. In a burner having a throat and fuel supply means adapted to introduce fuel for combustion, an air register comprising walls forming an air register chamber communicating with said throat, said walls having a peripheral set of adjustable air inlet openings therein to control the air flow into said chamber, an auxiliary air register having a second set of peripheral adjustable air inlet openings of smaller area than the first mentioned set, means mounting said auxiliary air register for adjustable positioning within said chamber with said second set of openings interposed in the path of air flow from said first set of openings to said throat for controlling the air flow to said throat at lower operating capacities and for retraction out of the path of air flow in said chamber to permit control by said first openings at higher capacities.

10. In a burner having a throat and fuel supply means adapted to introduce fuel for combustion, an air register comprising walls forming an air register chamber communicating with said throat, said walls having a set of adjustable air inlet openings therein to control the air flow into said chamber, an auxiliary air register hav-

ing a second set of adjustable air inlet openings of smaller area than the first mentioned set, means mounting said auxiliary air register for adjustable positioning within said chamber with said second set of openings interposed in the path of air flow from said first set of openings to said throat for controlling the air flow to said throat at lower operating capacities and for retraction out of the path of air flow in said chamber to permit control by said first openings at higher capacities, and a throat piece movable with said auxiliary air register to cooperate with said throat to reduce the effective area thereof when said auxiliary air register is in the first named position for operating at lower capacities and retractable with said auxiliary air register for operation at higher capacities.

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