

April 13, 1948.

A. W. ANDERSON

2,439,554

AIR REGISTER

Filed July 25, 1945

2 Sheets-Sheet 1

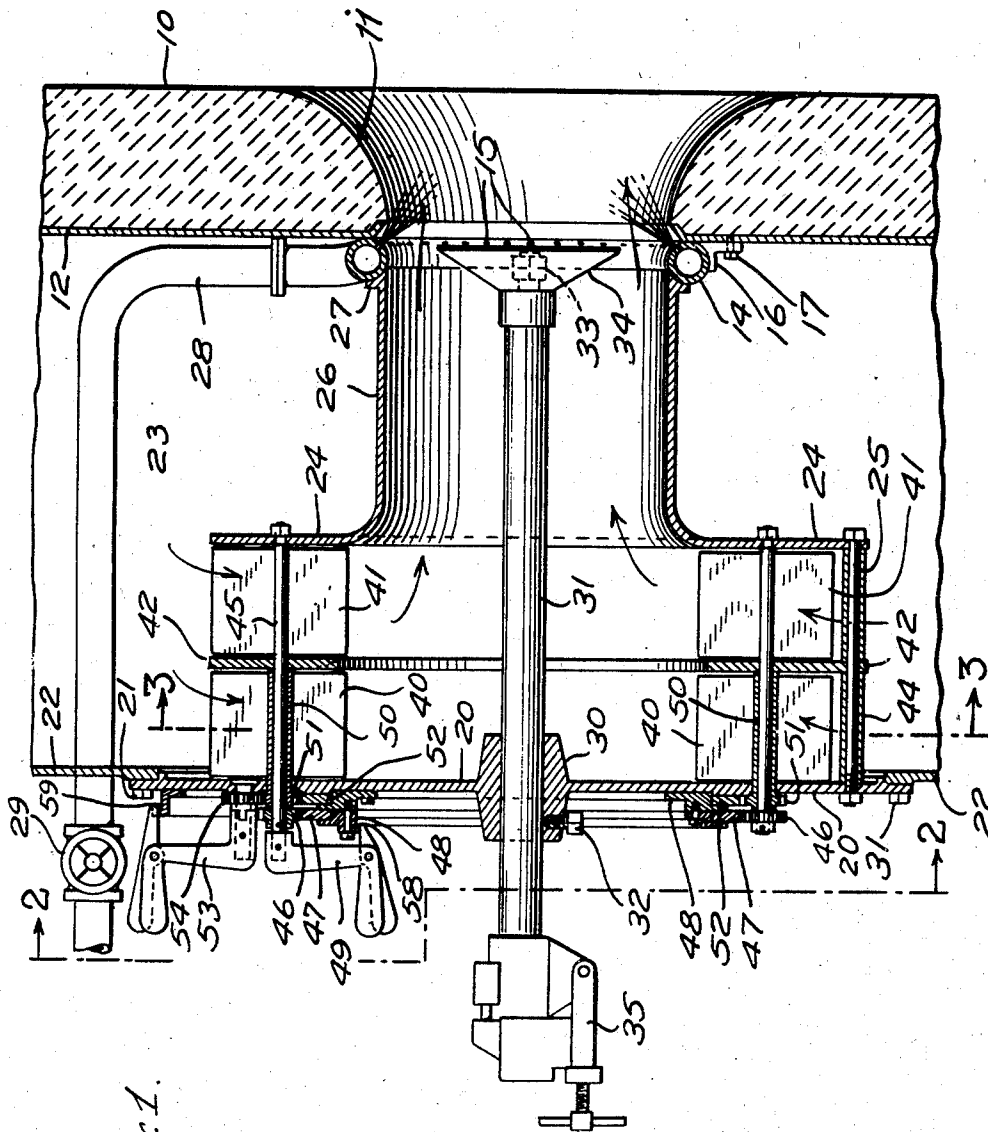


Fig. 1.

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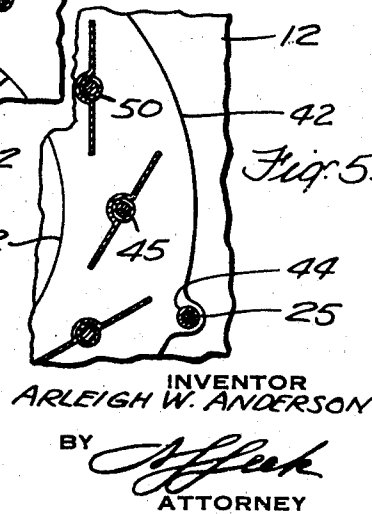
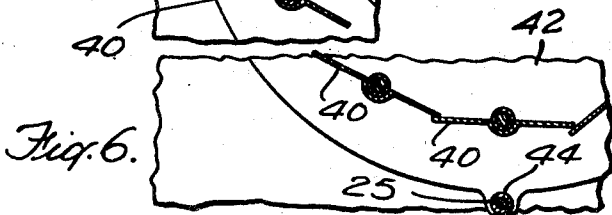
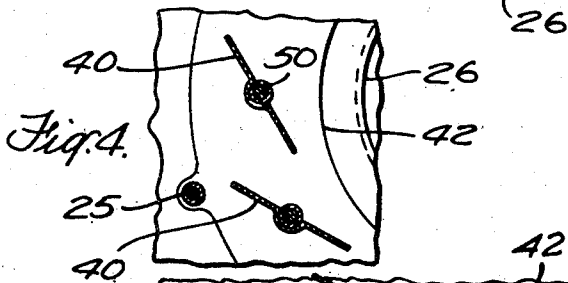
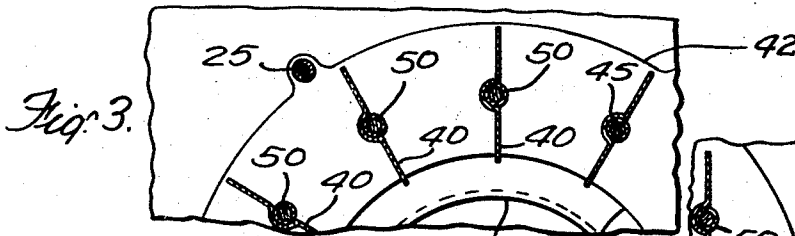
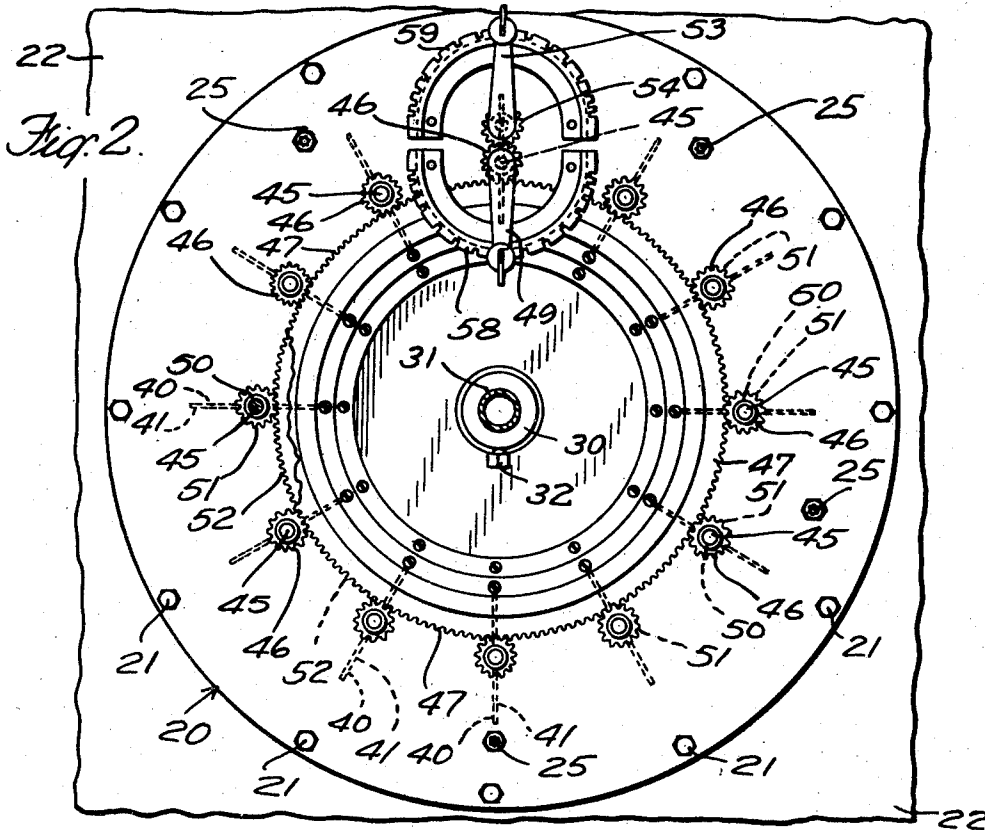
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AIR REGISTER

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,439,554

AIR REGISTER

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12 Claims. (Cl. 158-1.5)

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This invention relates to air registers or the like and more particularly to an air register for use in a burner of the general type disclosed in E. H. Peabody Patent 1,628,424, dated May 10, 1927, for Apparatus and method for burning liquid fuel.

The air register may take the form of a casing having peripheral doors through which air for combustion is admitted. The doors control the direction and speed of the air and are adjusted to cause the same to form a rotating mass of air within the air register having a speed and rotation giving a degree of turbulence best adapted to promote the mixture of air and fuel for combustion.

An object of the present invention is to provide, in an air register, novel and improved means for independently controlling the direction of rotation and the speed of air flow so as to obtain any desired degree of turbulence.

In accordance with the present invention, the above and other related objects are accomplished by providing a plurality of independently controlled sets of peripheral air doors which are arranged adjacent each other and are in parallel with respect to the air flow. Both sets of doors are mounted for substantially 180° rotation with an overlap for completely closing off the air flow in each closed position. In this way either a clockwise or a counter-clockwise rotation may be imparted to the air passing through either set of doors and the speed and direction of air flow through each set may be accurately controlled.

If, for example, the burner is to be operated at a very low capacity, one set of doors may be completely closed so that all of the air for combustion passes through the second set of doors. On the other hand, when operated at maximum capacity, both sets of doors may be utilized for air flow if desired. In this way the air admission area may be varied without changing the angular setting of the doors.

By this arrangement it is also possible to maintain a predetermined speed of air flow which is independent of the direction of rotation of the air, because both the direction of rotation and the speed represent a composite effect of the two sets of doors. For example, if both sets of doors are open to their maximum position, that is, are extended radially, a fixed quantity of air passing therethrough would have minimum speed and would enter the burner without rotation in either direction. On the other hand, if one set of doors is adjusted to a minimum opening for air rotation in a clockwise direction and the other set of doors

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is adjusted to a minimum opening in counter-clockwise direction, air would pass at a high velocity through both sets of doors. However, the opposed rotation of the air passing through the two sets of doors would tend to neutralize the rotational effect of the mass of air within the register and would maintain an air flow within the register without substantial rotation, the net result being to increase the speed of air flow without changing the resultant rotation. Obviously, intermediate adjustment could be made to obtain substantially a continuous range of adjustment from minimum to maximum speed without substantial change in the resultant rotation of the air within the register.

The two sets of doors may also be set to produce two layers of air rotating either in the same or in opposite directions. The layer which first contacts the fuel may thus have different characteristics from the other layer which may represent tertiary air combining with the fuel nearer the burner throat.

It will be obvious that by a suitable adjustment of the two sets of doors any desired combination of speed and degree of rotation may be obtained.

The nature of the invention will be better understood by referring to the following description, taken in connection with the accompanying drawings in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a longitudinal section of a burner embodying the present invention;

Fig. 2 is a transverse section taken on the line 2-2 of Fig. 1 showing the arrangement of front plate and adjusting means; and

Figs. 3, 4, 5 and 6 are partial transverse sections taken on the line 3-3 of Fig. 1 showing the air register doors in different positions.

Referring to the drawings more in detail, the invention is shown as applied to a burner for a furnace having a combustion chamber provided with a wall 10 of the usual refractory material and an opening 11 forming the burner throat. A wall plate 12 is positioned over the refractory wall 10 and to this plate is secured a fuel ring 14 extending around the burner throat 11 and having openings 15 through which fuel may be admitted to the throat. The fuel ring 14 may be attached by means of brackets 16 which may be secured by bolts 17 to the wall plate 12.

The air register is shown as having a front plate 20 secured by bolts 21 to a plate 22 which is spaced from the wall plate 12 to form a plenum chamber 23 therebetween in which air is supplied

under pressure to the register. The register is provided with a back plate 24 which is secured to and spaced from the front plate 20 by spacing bolts 25 and is provided with a cylindrical extension 26 of any desired length terminating in a flange 27 which is positioned adjacent the fuel ring 14, but is not secured thereto. Fuel is supplied to the fuel ring 14 by means of an inlet duct 28 which extends through the plate 22 to the front of the register and is provided with a control valve 29.

In certain embodiments, such as, for example, an air register for use at atmospheric pressure, the register may be supported from the plate 12 in which event the plate 22 may be omitted.

The register front plate 20 is shown as provided with a hub 30 in which an atomizer barrel 31 is mounted and is secured by means of a set screw 32. The atomizer barrel is provided with a diffuser 34 and an atomizer tip 33 which is arranged to direct a stream of finely divided fuel into the burner throat. The atomizer barrel 31 also carries a coupling means 35 containing a fuel connection not shown.

The atomizer barrel, if for liquid fuel, may be of the type disclosed more in detail in the Peabody patent above identified and may comprise, for example, means for supplying fuel under pressure to the atomizer tip and for discharging the same in a finely divided 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 fuel return line as more fully described in said patent. Other fuel supply means may be used for burning various types of gaseous, liquid or pulverized fuel, as shown, for example, in S. T. Warner Patent 1,790,395, dated Jan. 27, 1931, for Fuel burner and J. Dunn, Patent 2,320,575, dated June 1, 1943, for Fuel burner.

For controlling the velocity of the air supply from the plenum chamber 23 to the interior of the air register two sets of air doors 40 and 41 respectively are provided. These doors 40 and 41 are mounted side by side between the front plate 20 and the back plate 24 of the register and are separated by a division plate or shroud ring 42. The spacing bolts 25 are shown as provided with spacing sleeves 44 to space and support the plates 24 and 42.

The doors 41 are mounted on shafts 45 which extend through the front plate 20 and the back plate 24 and are provided at their forward ends with pinions 46 meshing with an annular rack 47 which is rotatable in brackets 48 attached to the front plate 20 to cause all of the doors to be adjusted in unison. An adjusting handle 49 is attached to one of the shafts 45 for controlling this adjustment.

Doors 40 are rigidly mounted on sleeves 50 which rotate on the shafts 45. Sleeves 50 extend through the front plate 20 and carry pinions 51 which mesh with an annular rack 52, likewise carried in the brackets 48 so that adjustment of all of the doors 40 in unison may be obtained. An adjusting handle 53 is provided with a pinion 54 meshing with one of the pinions 51 for controlling the adjustment of the doors 40.

The handles 49 and 53 cooperate with indicator and locking plates 58 and 59 respectively for locking the respective sets of doors in their adjusted positions. In the form shown the plates 58 and 59 are provided with locking notches which are spaced more closely as the doors approach their

closed positions so that a finer adjustment may be obtained. Preferably the spacing is such that equal percentage changes in area are effected at the different operating positions. It is also to be noted that counter-clockwise rotation is obtained through both sets of doors when both handles 49 and 53 are moved to the left of the vertical center line and clockwise rotation is obtained when the handles are moved to the right of this center line as viewed in Fig. 2.

Other means may be used for actuating the doors in unison such as connecting links as shown in Dunn Patent 2,320,576, dated June 1, 1943, for Air register.

In some instances individual adjustment of each door may be desired in which event the annular racks 47 and 52 may be omitted and separate adjusting handles and quadrants may be provided for the individual doors.

In the embodiment shown all of the doors 40 and 41 are substantially flat as shown in Fig. 3 and are mounted symmetrically on the respective sleeves 50 or shafts 45 so that they overlap and form a substantially continuous wall when adjusted to closed position in either direction. The doors are made with symmetrical surfaces on the two sides of the axis of rotation so that the inner peripheral wall formed thereby when closed and the shape of the air passages therebetween when open will be the same regardless of which side of the door is adjusted to face the interior of the register.

Operation

In the normal operation of the burner liquid or other fuel is supplied to the atomizer barrel 31 and gaseous fuel is supplied through the duct 28 to the throat ring 14. If only gaseous fuel is to be burned the atomizer barrel 31 may be retracted.

With the burner in operation suitable adjustment is made of the two sets of doors 40 and 41 by means of the control handles 49 and 53. As pointed out above, by suitable adjustment of the two sets of doors any desired combination of air speed and air rotation within the burner may be obtained. The two sets of doors may be adjusted to cause the air passing therethrough to rotate in the same direction or in opposite directions and in various degrees according to the operating requirements in each instance.

While two sets of adjacent parallel doors have been shown for purposes of illustration, it is obvious that additional sets may be provided as conditions require; also that the direction of rotation of the air may be reversed when required without taking the burner out of operation.

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

What is claimed is:

1. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180°, and means for adjusting said doors to obtain any desired

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angularity thereof, so as to control both the direction of rotation and the speed of air passing therethrough.

2. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180° and overlapping when closed in either direction, and means for adjusting said doors to obtain any desired angularity thereof, so as to control both the direction of rotation and the speed of air passing therethrough.

3. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180° and overlapping when closed in either direction and individual means for adjusting all the doors of each set in unison for obtaining any desired angularity, so as to control both the direction of rotation and the speed of air passing therebetween.

4. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being substantially flat and being mounted for rotation through approximately 180° and overlapping when closed in either direction and means for adjusting said doors to obtain any desired angularity thereof, so as to control both the direction of rotation and the speed of air passing therethrough.

5. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being substantially flat and being mounted for rotation through approximately 180° and overlapping when closed in either direction and individual means for adjusting the doors of each set in unison for obtaining any desired angularity, so as to control both the direction of rotation and the speed of air passing therebetween.

6. An air register for a fuel burner comprising a register front plate and a register back plate, a division plate therebetween forming two parallel annular air passages into said register, a set of air doors mounted between said front plate and said division plate and a second set of air doors mounted between said division plate and said back plate, each of said doors being mounted for rotation through substantially 180° and overlapping when closed in either direction to form a closed peripheral wall for said register, and separate control means for each of said sets of doors for individually controlling the degree and direction of rotation of air passing therethrough, the opposed surfaces of each of said doors being similarly shaped so that the same angularity of air flow may be obtained with both counter-clockwise and clockwise adjustments.

7. An air register for a fuel burner comprising

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a register front plate and a register back plate, a division plate therebetween forming two parallel annular air passages into said register, a set of air doors mounted between said front plate and said division plate and a second set of air doors mounted between said division plate and said back plate, each of said doors being mounted for rotation through substantially 180° and overlapping when closed in either direction to form a closed peripheral wall for said register, and separate control means for each of said sets of doors for individually controlling the degree and direction of rotation of air passing therethrough, the opposed surfaces of each of said doors being flat so that the same angularity of air flow may be obtained with both counter-clockwise and clockwise adjustments.

8. An air register for a fuel burner comprising a register front plate, a register back plate and a burner throat, a division plate between said front and back plates forming therewith two parallel annular air passages into said register, a set of air doors mounted between said front plate and said division plate and a second set of air doors mounted between said division plate and said back plate, each of said doors being mounted for rotation through substantially 180° and overlapping when closed in either direction to form a closed peripheral wall for said register, and separate control means for each of said sets of doors for individually controlling the degree and direction of rotation of air passing therethrough, the opposed surfaces of each of said doors being similarly shaped so that the same angularity of air flow may be obtained with both counter-clockwise and clockwise adjustments, and an axial extension cooperating with said back plate to form an axial air delivery passage for delivering air for combustion from said register to said burner throat.

9. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180°, means connecting the doors of each set for adjustment in unison and adjusting handles connected to actuate each set of doors, said handles having a central position and being arranged to produce rotation of the air in the same direction in response to movement of each handle to the same side of said central position.

10. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180°, means connecting the doors of each set for adjustment in unison, and adjusting handles connected to actuate each set of doors, and a locking rack for each handle provided with positioning notches spaced more closely as the doors approach closed position so as to effect substantially equal percentage changes in air flow area.

11. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral

air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180°, racks and pinions connecting the doors of each set for adjustment in unison and adjusting handles connected to actuate said racks.

12. In a burner having a throat and fuel supply means for introducing fuel to said throat for combustion, an air register supplying air for combustion to the fuel in said throat comprising a plurality of axially spaced sets of peripheral air doors for admitting air to the periphery of said register, said doors being mounted for rotation through approximately 180°, racks and pinions connecting the doors of each set for adjustment in unison and adjusting handles connected to actuate said racks, said handles having a central position and being arranged for adjustment of the doors in the same direction in response to movement of the handles to the same side of said central position.

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