June 1, 1943. J. DUNN 2,320,576

AIR REGISTER

Filed Nov. 29, 1941 2 Sheets-Sheet 1

Fig. 1

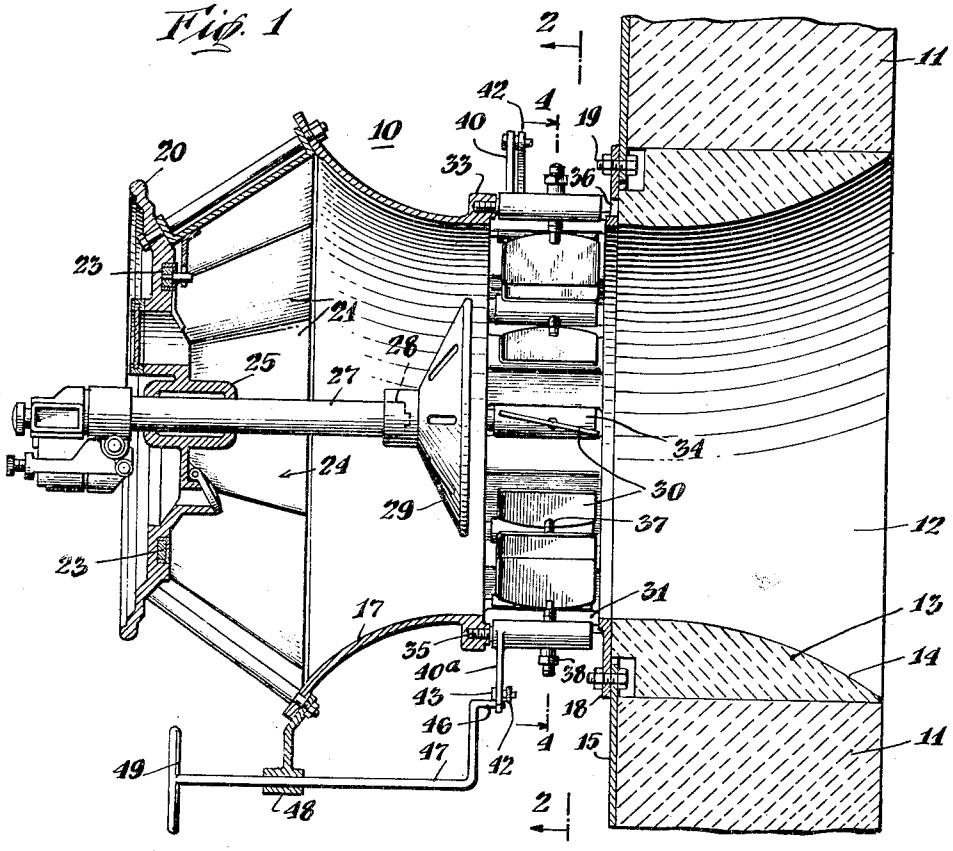


Fig. 2

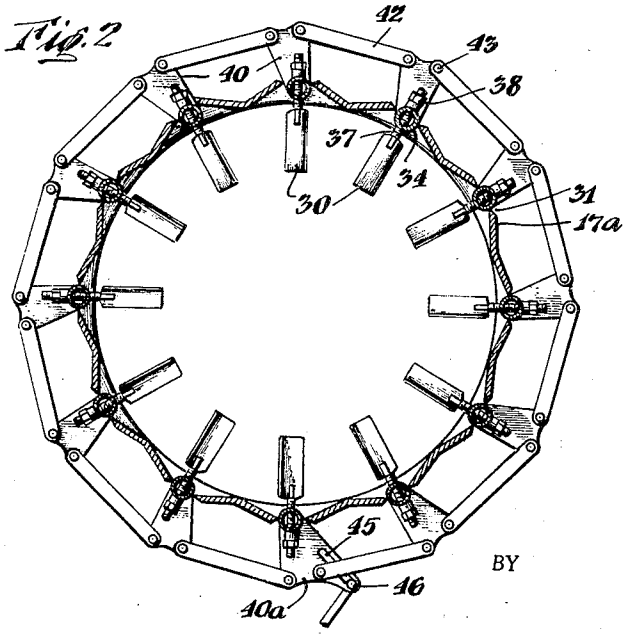
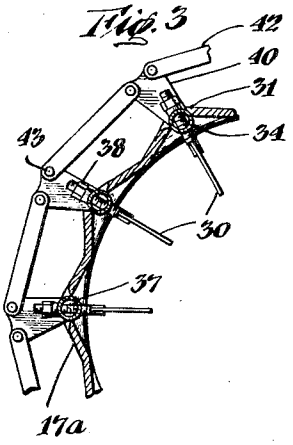


Fig. 3



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June 1, 1943. J. DUNN 2,320,576

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Filed Nov. 29, 1941 2 Sheets-Sheet 2

Fig. 4

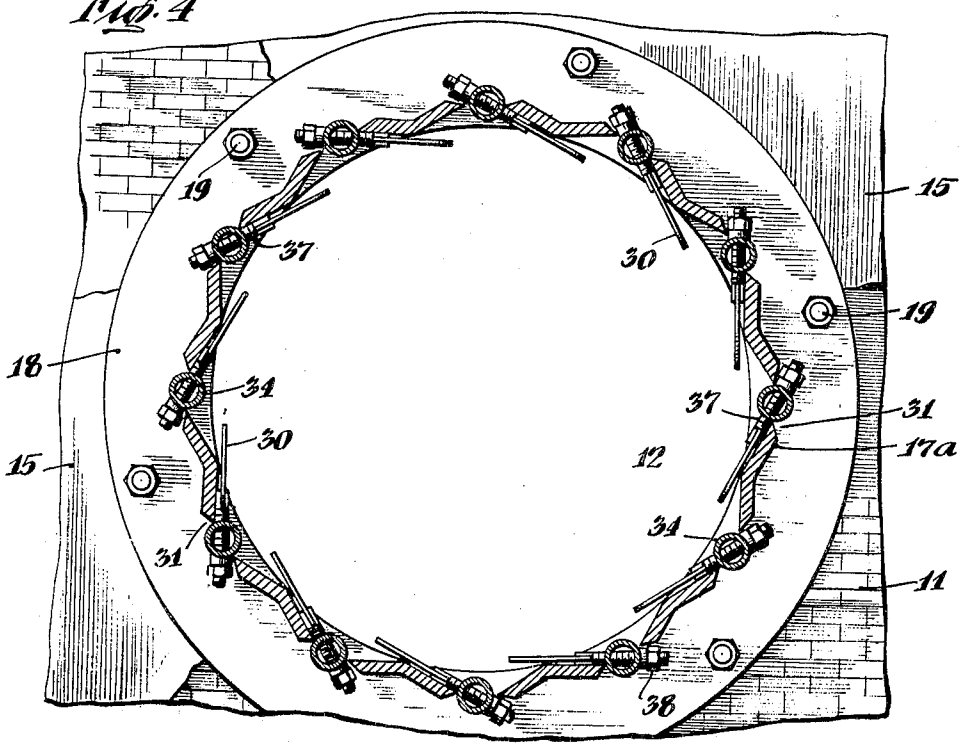


Fig. 5

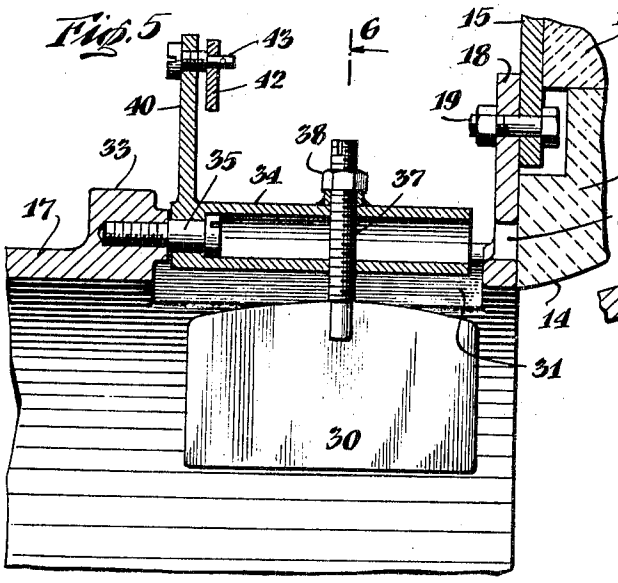
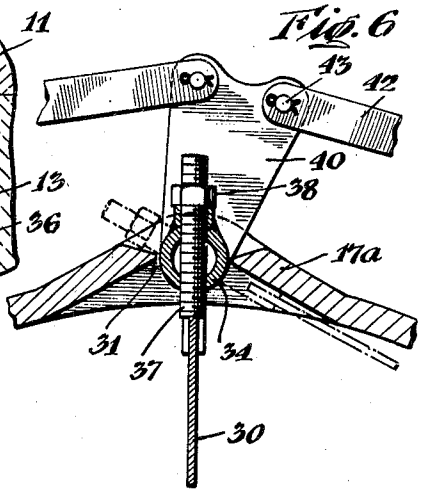


Fig. 6



6

6

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Patented June 1, 1943 2,320,576

UNITED STATES PATENT OFFICE

2,320,576

AIR REGISTER

John Dunn, Yonkers, N. Y., assignor to Peabody Engineering Corporation, New York, N. Y., a corporation of New York

Application November 29, 1941, Serial No. 420,993

9 Claims. (Cl. 158—1.5)

This invention relates to air registers for use in burners for liquid, gaseous or pulverized fuel, and is particularly applicable to air registers of the general type shown in the patent to E. H. Peabody, No. 1,527,214, which comprises a casing having circumferentially arranged doors to admit air for combustion purposes. The setting of these doors may be adjusted so as to regulate the rotation of the air delivered to the burner throat for admixture with the fuel stream.

Registers of this type are flexible in respect to their adjustment and may be used with variable capacity fuel atomizers, such as, for example, the atomizer disclosed in the patent to E. H. Peabody, No. 1,628,424, in which the capacity is varied through a wide range by controlling the fuel return from the atomizer tip.

When air registers of the type referred to above are operated under certain conditions, with the air doors throttled to produce extremely great velocity of rotation, the whirling mass of air tends to spread abnormally the cone of flame leaving the burner throat.

An object of the present invention is to provide controllable means to redirect the rotating air from the doors so as to regulate the flame spread while at the same time maintaining the flow characteristics necessary for proper combustion.

Another object is to provide a novel and improved control of the mixture of fuel and air.

Another object is to provide adjustable means which may be regulated so as to impart the desired characteristics to the air stream at the burner throat.

Another object is to provide adjustable means of the above type which may be retracted substantially out of the path of the air stream passing through the register doors when not in use.

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

In carrying out the present invention I provide a plurality of vanes or blades located between the zone of the air register doors and the flared section of the burner throat. Each vane, to control the radial flow of air, may be adjustable about an axis parallel to the axis of the burner tube and in such a manner that each may be folded back against the inner periphery of the burner tube and out of the path of the air stream when not in use. Each vane may also be adjusted about a radial axis to control the axial motion of the air stream. The vanes thus direct the rotating air, in a series of streams into the cone of fuel.

Although the novel features which are believed to be characteristic of this invention will be more particularly pointed out 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 in which a specific embodiment thereof has been set forth for purposes of illustration, and in which:

Fig. 1 is a vertical, longitudinal section through a burner embodying the present invention;

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

Fig. 3 is a fragmentary view similar to Fig. 2, but with each vane adjusted to extend paralliel to the axis.

Fig. 4 is a transverse section, taken on the line 4—4 of Fig. 1, but showing the vanes folded back out of the path of the air stream;

Fig. 5 is a detail sectional view on an enlarged scale, illustrating the mounting of the adjustable vanes; and

Fig. 6 is a transverse section taken along the line 6—6 of Fig. 5.

In the following description and in the claims certain specific terms are 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.

In the drawings the invention is shown as embodied in an air register 10, Fig. 1, forming part of a burner for liquid, gaseous or pulverized fuel. The burner is shown as associated with a front wall 11 of a furnace of any well-known construction having a burner opening 12 lined with a ring of refractory material 13 having a flared inner surface 14 forming the burner throat. A plate 15 is shown as disposed over the face of the wall 11 and may be secured in position by any suitable means, not shown.

The air register 10 comprises an annular flared throat piece 17 having a flange 18 which may be secured to the plate 15 by means of bolts 19. The register is also provided with a front plate 20, which forms a front closure therefor, and between which and the edge of throat piece 17 a plurality of circumferential air doors 21 are mounted. These air doors are adapted to be adjusted by suitable means, such as an adjusting ring 23, actuated by a control mechanism not shown, extending to the front of the plate 20, so as to control the velocity of the air supplied to the air register chamber 24. The air doors 21 are preferably positioned so as to impart a whirling motion to the air in said chamber, whereby the mass of

air rotates rapidly as it advances to the burner throat.

The front plate **20** of the register is provided with a hub **25** in which a fuel atomizer barrel **27** is supported. This atomizer barrel terminates in an atomizer tip **28** and diffuser **29** of standard construction. The atomizer may be constructed and arranged for use with liquid, gaseous or pulverized fuel and may be, for example, of the type shown in E. H. Peabody Patent No. 1,628,424.

The air register thus far described is of the type shown more in detail in Peabody Patent No. 1,527,214, and only so much thereof has been set forth herein as is necessary to an understanding of the present invention. The invention may, of course, be applied to registers and burners of various types for liquid, gaseous or pulverized fuel which may be supplied to the burner throat either peripherally or axially as shown, for example, in U. S. Patents No. 1,671,494 to C. R. Stewart, No. 1,790,395 to S. T. Warner, and No. 1,865,983 to S. T. Warner.

The various types of burners referred to above have the common characteristic that a cone of flame is produced in the burner throat and that the air register supplies air for combustion to the burner throat in a rotating turbulent mass and under conditions suitable for producing a combustible mixture with the fuel. The velocity and direction of the air flow may be controlled by adjusting the air doors **21**.

In accordance with the present invention, the air register is provided with a plurality of adjustable blades or vanes **30** which extend into the interior of the throat piece **17** adjacent the burner throat. In the embodiment illustrated, a plurality of peripherally spaced, axially extending slots or openings **31** are formed in the throat end of the throat piece **17** and the portion **17***a* (Fig. 6) of the throat piece immediately adjacent each of said openings **31** is deflected outwardly for a purpose hereinafter described.

On the outer wall of throat piece **17** there are a plurality of bosses **33**, one such boss being disposed adjacent each of the openings **31**, as shown in Figs. 1 and 5. Hollow bearing tubes **34**, which carry the vanes **30**, are rotatably mounted on the bosses **33** by suitable means shown as internal screws **35**. To facilitate assembly, the flange **18** of throat piece **17** may be provided with openings **36** (Fig. 5) permitting the insertion of a screw driver into each bearing tube for tightening the screw **35**. The tubes **34** are only slightly smaller in diameter than the width of openings **31** in throat piece **17** and thus substantially close these various openings. Each of the vanes **30** is supported by a threaded pin **37** which is threaded transversely through the associated tube **34** and is adapted to be secured in any adjusted position therein by means of a locknut **38**. By loosening the various locknuts **38** and turning the threaded pins **37**, as by means of a screw driver, the angular position of blades **30** may be varied as desired.

The bearing tubes **34** have integral arms **40** extending outwardly therefrom, each of said arms **40** being connected to the corresponding arms of the adjacent bearing tubes by means of a link **42** which is pivotally secured to the arms by pivot pins **43**. A master arm, which is numbered **40***a* in Figs. 1 and 2, is provided with an extension containing an elongated slot **45**, to which a crank **46** is connected. The crank **46** is formed as a part of a shaft **47** which extends forwardly toward the front plate **20** of the register and is rotatably mounted in a bushing **48** secured to the throat piece **17** as shown in Fig. 1. The shaft **47** may be rotated by means of a suitable handle or wheel **49**. Rotation of shaft **47** causes a corresponding arcuate movement of arm **40***a* and its associated bearing tube **34**, and vane **30**, and such pivotal movement is communicated by means of the connecting links **42** to all of the other arms **40**, thereby causing all of the vanes **30** to be angularly adjusted within the throat piece **17**. The upwardly deflected portions **17***a* of the throat piece **17** immediately surrounding the openings **31** provide clearance for the vanes **30** to be folded back against the inner periphery of the throat piece **17**, as shown in Fig. 4, substantially out of the path of the air stream flowing through the throat piece **17**.

Figs. 1 and 2 show the vanes **30** projecting radially into the body of throat piece **17**, and turned so that the flat face of each vane is disposed at an angle to a plane through the axis of the burner throat. In Fig. 3 each vane **30** is disposed parallel to the axis of the burner throat.

It will be noted that the air directing vanes **30** are mounted between the zone of the air register doors and the burner throat, in advance of the cone of flame and immediately adjacent the burner throat. It will also be noted that each vane **30** is adjustable about a bearing tube **34** having its axis parallel to the axis of the throat piece **17** and that each of said vanes is further adjustable with respect to the path of air flow about the axes of the pins **37**.

Operation

In the operation of the burner above described, fuel for combustion is supplied through the atomizer barrel **27** and is discharged from the atomizer tip **28** in the form of a cone having its apex at the tip **28**. Air for combustion is supplied into the air register chamber **24** through the peripheral doors **21** and is caused thereby to rotate or whirl within the air register chamber and to advance as a rotating air stream to the burner throat. The air doors **21** may be adjusted to control the velocity of the air and the degree of its rotation within the air register. The air quantity is controlled by varying the furnace draft or the air pressure. The whirling mass of air advances to the burner throat where it mixes with the fuel discharged from the atomizer **28** to form a combustible mixture.

As previously pointed out, with the air doors **21** set for extreme rotation, the air stream tends to cause too great a flame spread. In order to avoid this, the vanes **30** are preferably adjusted to the position shown in Figs. 1 and 2; that is, the vanes extend radially of the burner throat, but are twisted about a transverse axis.

The vanes may, of course, be angularly adjusted as desired or if not required in any particular instance they may be folded back against the inside of the burner tube as indicated in Fig. 4. The vanes may be adjusted in unison to control radial flow by operation of the handle **49**. The transverse adjustment (about the axis of the pins **37**) which may cover a range of 360° will normally remain unchanged after the vanes have once been set to produce the desired distribution.

It is to be understood that the invention is not limited to the specific type of air register disclosed herein, but may be applied to various other uses as will be apparent to a person skilled

in the art. The invention is only to be limited in accordance with the appended claims.

What is claimed is:

1. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, and a peripheral set of vanes disposed in the path of the advancing air stream and arranged to control the angle of rotation of the air at said throat opening, said vanes being mounted to be retracted out of the path of the air stream when not in use.

2. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, and a peripheral set of vanes disposed in the path of the advancing air stream and arranged to control the angle of rotation of the air at said throat opening, said vanes being angularly adjustable with respect to the axis of said register and being mounted to fold back against the inner register wall when not in use.

3. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, said casing having a set of axially extending, peripherally spaced slots adjacent said throat opening, pins rotatably mounted in said slots, and vanes carried by said pins arranged to extend radially into said chamber or to be folded back against the inner periphery of said casing.

4. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, said casing having a set of axially extended, peripherally spaced slots adjacent said throat opening, pins rotatably mounted in said slots, and vanes carried by said pins arranged to extend radially into said chamber or to be folded back against the inner periphery of said casing, said casing being bent outwardly adjacent said slots to provide clearance for said vanes to be folded back substantially out of the path of the air to said throat opening.

5. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, said casing having a set of axially extending, peripherally spaced slots adjacent said throat opening, pins rotatably mounted in said slots, and vanes carried by said pins arranged to extend radially into said chamber or to be folded back against the inner periphery of said casing, said vanes being mounted on said pins for pivotal movement about a transverse axis so as to be adjusted angularly with respect to the path of air flow to the throat opening when extended radially into said chamber.

6. A burner for liquid, gaseous or pulverized fuel comprising an air register having a chamber provided with an axial air discharge opening, a throat communicating with said discharge opening, fuel supply means for producing a cone of fuel in said throat opening, means for supplying air to said chamber constructed and arranged to cause the air to rotate therein and to advance to said throat, and a peripherally spaced set of vanes disposed in the path of air flow in said chamber in advance of said cone of fuel and arranged to direct the air in a plurality of streams, corresponding to the number of said vanes, into said cone of fuel.

7. A burner for liquid, gaseous or pulverized fuel comprising an air register having a chamber provided with an axial air discharge opening, a throat communicating with said discharge opening, fuel supply means for producing a cone of fuel in said throat opening, means for supplying air to said chamber constructed and arranged to cause the air to rotate therein and to advance to said throat, a peripherally spaced set of vanes disposed in the path of air flow in said chamber in advance of said cone of fuel and arranged to direct the air in a plurality of streams, corresponding to the number of said vanes, into said cone of fuel, means mounting said vanes for pivotal movement about axes parallel to the burner axis so as to be folded back against the inner surface of said register, and means interconnecting said vanes for adjustment about said axes in unison.

8. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, a set of vanes disposed in the path of the advancing air stream and arranged to control the angle of rotation of the air at said throat opening, said vanes being angularly adjustable with respect to the axis of said register and being mounted to fold back against the inner register wall when not in use, and control mechanism for said vanes comprising an operating mechanism connected to actuate one of said vanes and links interconnecting adjacent vanes for causing all of said vanes to operate in unison.

9. An air register comprising a casing forming an air chamber having an axial air discharge throat opening, means to supply air to said chamber and to cause the air to rotate in said chamber and to advance toward said throat opening, a peripheral set of vanes disposed in the path of the advancing air stream and arranged to control the angle of rotation of the air at said throat opening, said vanes being pivotally supported at their outer edges, and control mechanism for said vanes comprising an operating member connected to actuate one of said vanes, outwardly projecting ears on each of said vanes and links interconnecting the ears of adjacent vanes for causing all of said vanes to operate in unison.

JOHN DUNN.