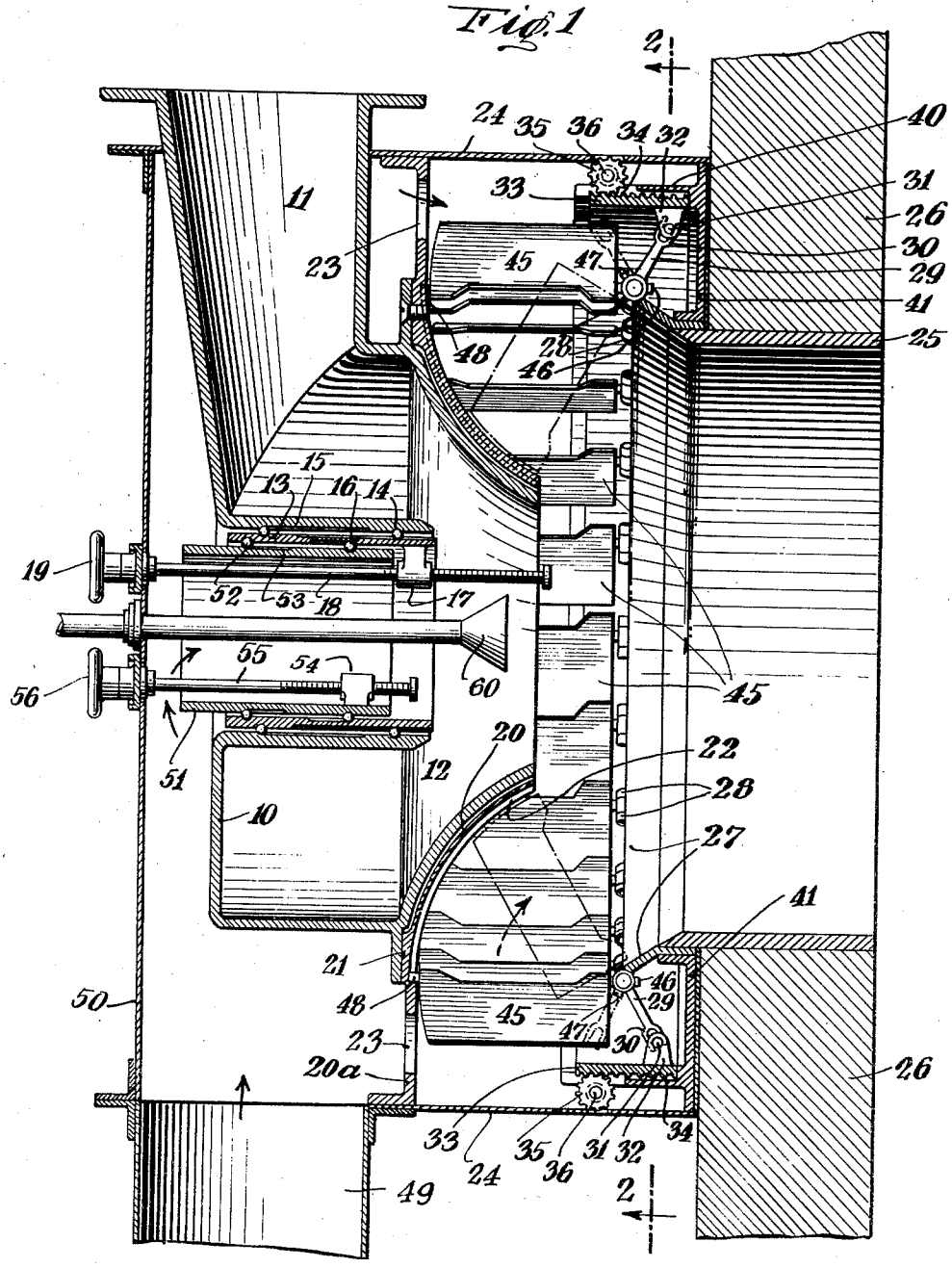
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BURNER

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Fig. 1



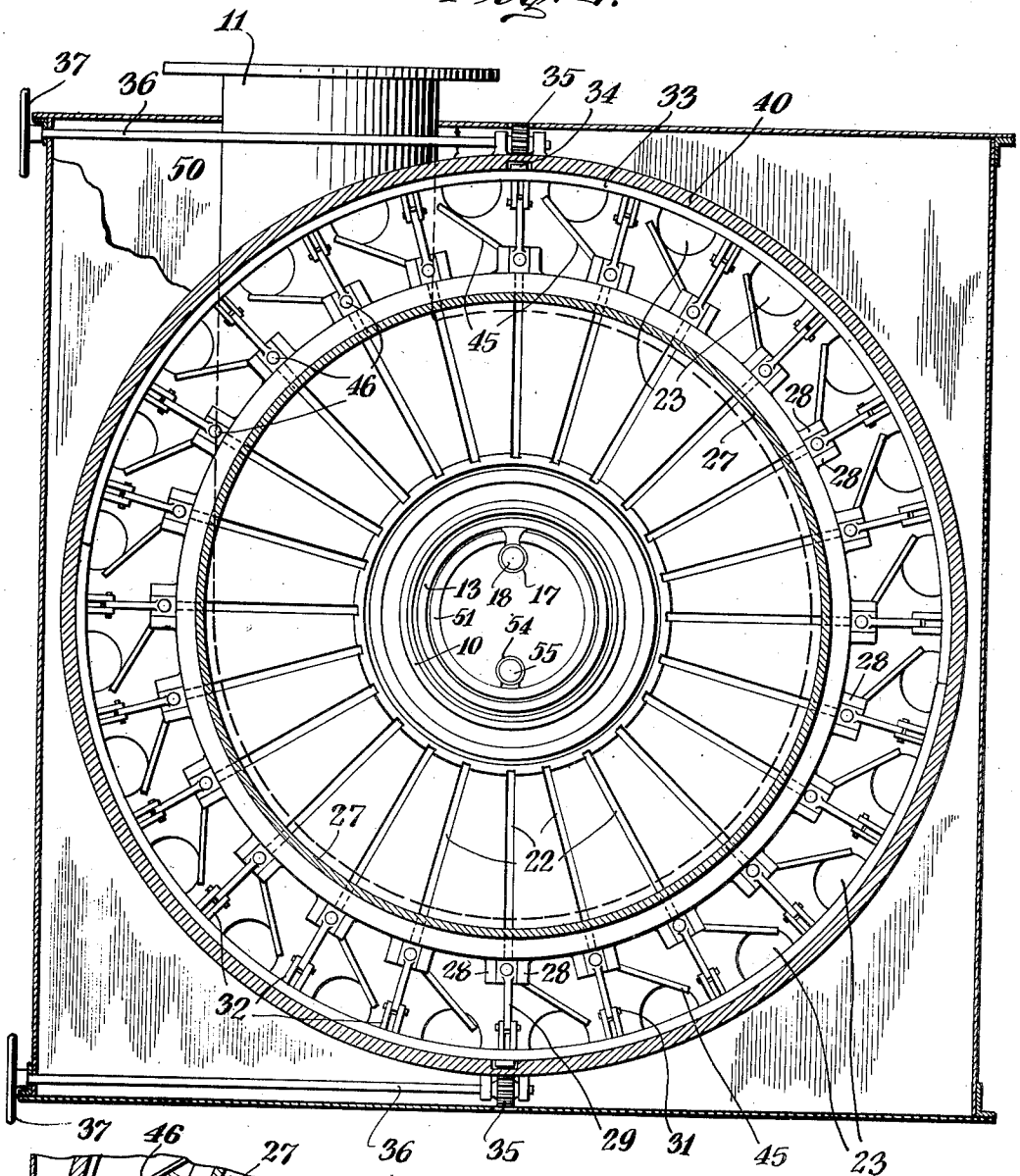
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Fig. 2.



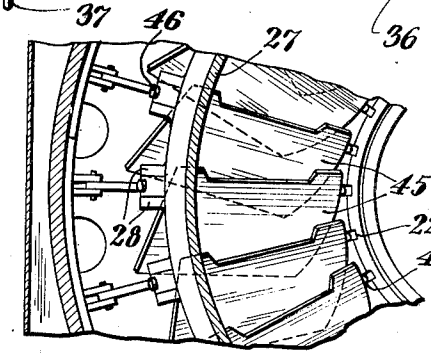


Fig. 3.

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BURNER

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Application March 21, 1930, Serial No. 437,851

24 Claims. (Cl. 158—1.5)

This invention relates to apparatus for supplying a combustible mixture to a furnace. It is particularly applicable to a burner for supplying fuel such as pulverized coal and air to the furnace of a steam boiler.

The invention particularly provides a burner having means therein incorporated for securing an intimate mixture of air and fuel, and for controlling the relative quantities and distribution thereof. Means is provided for introducing the pulverized fuel axially of the burner in the form of a rotating mass, and applying air for combustion both axially and externally thereof. The external air is applied in a tangential direction invariable controlled quantities. The arrangement is such as to produce a turbulence which assures that intimate mixture of fuel and air which is required for proper combustion. This is accomplished by providing a fuel housing having an annular discharge opening and causing rotary movement of the fuel prior to discharge therefrom. The main air supply is arranged externally of the fuel stream between vanes which are inclined to apply the air to the fuel in a general tangential direction with respect to the fuel stream. The vanes are pivoted about axes tangential to the annular discharge opening for controlling the effective opening without materially altering the direction of the air. A controlled central opening is also provided to afford an axial space which may be used for air supply or for an auxiliary burner or for cleaning, inspection or repair.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a vertical section taken showing a burner constructed in accordance with the present invention; Fig. 2 is a section taken on the line 2—2 of Fig. 1; and Fig. 3 is a detail view showing the air vanes in closed position.

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to the drawings more in detail, the burner is shown as formed with a hollow, annular fuel supply housing 10 having a supply duct 11 and arranged to admit fuel to the housing in a tangential direction whereby the fuel is caused to rotate and to be discharged axially through annular port 12. For controlling the amount of fuel thus discharged, a cylindrical damper 13 is mounted axially of housing 10 as by bearings 14 seated in recesses 15 and 16 formed in said housing and in said damper, respectively so that the damper 13 is spaced from the housing 10 in order to provide an annular air passage between the damper and the housing, the inlet end of which is in communication with the air casing, hereinafter described. Said damper is provided with a threaded lug 17 which cooperates with rod 18 for controlling the axial position thereof. Said rod extends through the air casing, hereinafter described, and has affixed thereto a handwheel 19 by which adjustment is effected. The recesses 15 and 16 provide stops for controlling the extent of movement of the damper.

The outer wall of housing 10 adjacent part 12 is of arcuate cross section and receives a liner 20 of similar shape which forms one wall of the external air passage. Liner 20 is secured to casing 10 as by screws or rivets passing through flange 21 and is provided with a radially extending section 20a having a plurality of air ports 23 therein. Liner 20 is also provided with radial slots 22 which guide the air vanes to be described, and is supported by wall 24 forming a part of the air casing, which is carried by the furnace wall in any convenient manner.

The furnace supply channel comprises a cylindrical pipe 25 which is imbedded in the brick work 26 of the furnace wall. Secured to this pipe is a ring 27 having lugs 28, Fig. 2, formed thereon to which arms 29 are pivoted for movement about axes tangential to ring 27 and located in the locus of the centers of the arcuate sections of liner 20. Said arms are provided with forked ends 30 which engage pins 31 carried on extensions 32 which are secured to slidable ring 33. For ease of construction, said ring is divided peripherally into two parts, each of which is provided with a rack 34 cooperating with a pinion 35 by which the position of said ring may be varied. Said pinion is mounted on a shaft 36 which extends to the outside of the air casing and carries a hand adjusting wheel. Ring 33 is slidably held in flange 40 which is formed on

annular member 41, carried by ring 27 adjacent the furnace brick work 26.

A plurality of vanes 45 are pivotally mounted in the annular air port formed between pivot arms 29 and liner 20 by being carried in arms 29 by pins 46 which extend into suitable bores in said arms and are engaged by set screws 47. The annular air port has sector shaped radial plane sections. Vanes 45 are also provided with pins 48 which slide in recesses 22 in liner 20 as the arms are rotated about said tangential axes. The inclination of said vanes may be adjusted by rotating pins 46 in arms 29 after which they may be secured as by set screws 47. The setting of the vanes in this respect determines the maximum effective air passage.

The air casing comprises walls 24 and 50 which, as shown, enclose the fuel housing 10. An air supply pipe 49 is mounted on any convenient part of said casing as on the lower wall 24. Air for combustion is supplied to the furnace from the air casing between vanes 45 and at the axis of annular housing 10 through port 12. For controlling the latter portion of the air a cylindrical damper 51 is slidably mounted within damper 13 as by bearings 52 cooperating with grooves 53 therein which space the dampers apart so as to provide an annular air passage between the dampers which communicates at its inlet end with the air casing. Said damper is provided with a threaded lug 54 engaged by rod 55 which extends through wall 50 and carries hand wheel 56 by which adjustment thereof may be effected. An auxiliary burner 60 extends through wall 50 axially of housing 10 and may be used for burning auxiliary fuel such as gas or oil or for lighting the main burner. The amount of air applied to the main burner between vanes 45 is controlled by pivotally adjusting said vanes about the tangential pivots of rods 29. For this purpose hand wheel 37 is operated, thereby causing axial movement of ring 33 and pivotal movement of arms 29 which are connected thereto. With any given angular position of vanes 45 in arms 29 the maximum opening will be obtained when the axis of the vanes extends approximately parallel to the axis of the burner as shown in full lines in Fig. 1. When the vanes are pivoted to the dotted position of Fig. 1 about the tangential pivots the opening therebetween is reduced in size and may be substantially closed by the overlapping vanes, as shown in Fig. 3. No adjustment of vanes 45 in arms 29 is required after they have been set to the desired opening and direction. Consequently, when vanes 45 have once been set at the desired angle they may be secured by set screws 47 and will thereafter require no further adjustment.

The pulverized fuel is caused to whirl in housing 10 and to be discharged axially into the burners. The bulk of the air for combustion is applied between the vanes 45 and is introduced in a substantially tangential direction due to the inclined setting of the said vanes. The quantity of fuel is controlled by operating handwheel 19 which varies the position of cylindrical damper 13 and the amount of tangential air may be controlled by operating vanes 45 in the manner above described.

The above described arrangement permits the direction of the external air to be controlled by properly setting the inclination of vanes 45 and permits the volume of air to be controlled without changing the setting or varying the direction of air flow. It is to be noted that movement of the vanes about the tangential pivots opens and closes the effective opening but does not appreciably affect the direction of air flow. The air is accordingly always applied in a tangential direction and causes turbulence of the fuel mixture which permits efficient combustion.

A further quantity of air for combustion is supplied from the air casing through the axis of housing 10 or through the port 12. The quantity of air supplied in this manner is controlled by damper 51 which is longitudinally movable in response to handwheel 56. It is to be noted that the tangential and axial air may be independently adjusted and that the quantity of fuel may also be adjusted during the operation of the burner. Furthermore, the axial air may be entirely cut off by bringing damper 51 into engagement with casing 50.

In the above described burner, the center is left unobstructed, whereby access thereto is facilitated for purposes of cleaning or adjusting and whereby the operation of the burner may be observed. Furthermore, the auxiliary fuel burner 60 may be utilized whenever desired or may be removed to afford an unobstructed view of the interior. The mounting of vanes 45 is such that a maximum variation in effective range of opening is obtained with a minimum movement and without materially altering the direction of air supply, which is determined by the inclined position of the vanes with respect to arms 29. The annular passageways provided between the dampers 13 and 51 and between the damper 51 and the fuel housing 10, permit the passage of air therethrough and thereby prevent the accumulation of coal dust or other matter between the dampers and between the damper 51 and the casing. As clearly shown in the drawings, the inlet ends of these passageways are in open communication with the air casing so that so long as air is supplied to the burner, air will be forced through the passages referred to.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What I claim is:

1. In a burner for pulverized fuel, means for introducing said fuel, means for introducing air for combustion comprising an annular air port, a plurality of vanes mounted in said port, and means for rotating said vanes about axes tangential to said annular air port.

2. In a burner for pulverized fuel, means for introducing said fuel, means for introducing air for combustion comprising an annular air port, a plurality of vanes mounted in said port, means for independently adjusting said vanes about longitudinal axes thereof and means for simultaneously pivoting said vanes about axes normal thereto.

3. In a burner for pulverized fuel, means for introducing said fuel, means for introducing air for combustion comprising an annular air port, a plurality of vanes mounted in said port, said vanes being inclined to radii of said port whereby air is discharged in a general tangential direction and means for pivoting said vanes about axes tangential to said port for varying the effective opening therebetween.

4. In a burner for pulverized fuel, an annular

housing, means for discharging fuel in a stream axially thereof, means for supplying air for combustion tangentially to said fuel stream and externally thereto, means for supplying further quantities of air axially of said housing and independent means for adjusting the quantities of air supplied axially and tangentially.

5. In a burner for pulverized fuel, an annular air port, a plurality of vanes peripherally disposed in said port, means for independently adjusting said vanes about longitudinal axes thereof for varying the maximum effective port passage and the angle of discharge of air, and means for rotating each of said vanes about an axis normal to the longitudinal axis thereof for varying the effective passages between the vanes.

6. In a burner for pulverized fuel, a burner inlet, a ring surrounding said inlet, a plurality of arms pivotally mounted on said ring about axes tangential to said ring, and a vane carried in each of said arms adapted to pivot about an axis normal to the axis of said arm.

7. In a burner for pulverized fuel, an annular air port, a ring coaxial therewith, a plurality of arms pivoted on said ring about axes tangential thereto and a vane carried by each of said arms.

8. In a burner for pulverized fuel, an annular air port, a ring coaxial therewith, a plurality of arms pivoted on said ring about axes tangential thereto and a vane carried by each of said arms, and means for pivotally adjusting said vanes in said arms to vary the direction of said air supply.

9. In a burner for pulverized fuel, an annular air port, a ring coaxial therewith, a plurality of arms pivoted on said ring about axes tangential thereto and a vane carried by each of said arms, means for pivotally adjusting said vanes in said arms to vary the direction of said air supply, and means for simultaneously causing pivotal movement of said arms to vary the effective opening of said port.

10. In a burner, an annular air port, a plurality of vanes mounted therein and adapted to control the direction of air flow and means for moving said vanes in planes axial with respect to said annular air port for varying the effective opening therebetween.

11. In a burner, an annular air port, a plurality of vanes peripherally spaced therein and each having a position of axial extent, means for adjusting the inclination of said vanes with respect to radii of said port for controlling the direction of supply of air and means for varying the effective radial distance of said vanes from the center of said port for varying the effective opening therebetween.

12. In a burner, an annular air port, a plurality of vanes peripherally spaced therein and each having a position of axial extent, means for adjusting the inclination of said vanes with respect to radii of said part for controlling the direction of supply of air and means for causing pivotal movement of each of said vanes about an axis tangential to said annular port to vary the effective opening therebetween.

13. In a burner for pulverized fuel, an annular air port, a ring coaxial therewith, a plurality of arms pivoted on said ring about axes tangential thereto and a vane carried by each of said arms, means for pivotally adjusting said vanes in said arms to vary the direction of said air supply, and means for simultaneously causing pivotal movement of said arms to vary the effective opening of said port comprising an annular member movable axially of said port and operatively connected to each of said arms.

14. A pulverized fuel burner comprising a hollow annular fuel housing, an annular air inlet surrounding said housing, an air inlet axially of said housing and a cylindrical damper for controlling the size of said last named inlet.

15. A pulverized fuel burner comprising a hollow annular fuel housing, means associated therewith for discharging fuel as a rotating mass and means for applying air for combustion about the periphery of said mass in a direction which produces further rotation and causes turbulence, movable vanes for controlling the quantity of air applied and a cylindrical damper for controlling the quantity of fuel discharged.

16. A burner comprising a hollow annular fuel housing having means for discharging pulverized fuel as a rotating mass, an air casing surrounding said housing and having an annular air port and a plurality of peripherally spaced vanes mounted in said port for controlling the volume and direction of air passed therethrough.

17. In a burner for pulverized fuel, a fuel supply housing and an annular air port associated therewith, said annular air port having sector shaped radial plane sections and vanes mounted therein and pivoted for movement about centers of the sectors.

18. In a burner for pulverized fuel, an annular fuel housing having an annular outlet port for discharging fuel axially thereof, an annular air port around said annular outlet port and a cylindrical damper mounted concentric with said annular outlet port for varying the effective size thereof.

19. In a burner for pulverized fuel, an annular housing having an annular opening, said housing defining a cylindrical passageway, a cylindrical sleeve movably mounted in said passageway, means for moving said sleeve to vary the effective size of said annular opening and said sleeve being spaced a relatively small distance from said housing.

20. In a burner for pulverized fuel, an annular fuel housing having an annular discharge opening, said housing defining a cylindrical passageway, an air casing connected with said passageway, a cylindrical sleeve movably mounted in and spaced from said passageway, means for moving said sleeve to vary the effective size of said annular discharge opening, and means comprising a second cylindrical sleeve movably mounted within and spaced from the first mentioned sleeve for regulating the flow of air from the air casing through the central passageway, the spaces between the sleeves and between the first mentioned sleeve and the passageway permitting the passage of air between said sleeves and between the first mentioned sleeve and said housing.

21. In a burner for pulverized fuel, an annular housing having an annular opening, said housing defining a cylindrical passageway, a cylindrical sleeve mounted in said passageway, bearing members between said sleeve and said housing, said bearing members spacing the sleeve from the housing and means for moving said sleeve to vary the effective size of said annular opening.

22. In a burner for pulverized fuel, an annular housing having an annular discharge opening, said housing defining a cylindrical passageway, an air casing connected with said passageway, a first cylindrical sleeve mounted in said passageway, a second cylindrical sleeve mounted in said

first sleeve, bearing members between said sleeves and between said first sleeve and said housing, said bearing members spacing said sleeves from each other and said first sleeve from said housing, means for moving said first sleeve to vary the effective size of annular discharge opening, and means for moving said second sleeve to regulate the admission of air from the air casing through said passageway, the spaces between the sleeves and between the first sleeve and the housing permitting the flow of air between said sleeves and between said first sleeve and said housing.

23. In a burner for pulverized fuel, an air casing, an annular fuel housing located within said casing and having an annular outlet, a plurality of vanes arranged peripherally around said outlet, said housing defining a cylindrical passageway extending from said air casing to a point adjacent the outlet, a cylindrical sleeve movably mounted in said passsageway, bearing members between said sleeve and said housing spacing the sleeve from the housing, the space thus formed being in communication with said air casing and means for moving said sleeve to vary the effective size of said annular outlet.

24. In a burner for pulverized fuel, an air casing, an annular fuel housing located within said casing and having an annular outlet, a plurality of vanes arranged peripherally around said outlet, said housing defining a cylindrical passageway extending from said air casing to a point adjacent the outlet, a first cylindrical sleeve movably mounted in said passageway, a second cylindrical sleeve movably mounted in said first sleeve, bearing members between said sleeves and between said first sleeve and said housing which space the sleeves from each other and space said first sleeve from said housing, the spaces thus formed being in communication with said air casing, means for moving said first sleeve to vary the effective size of said annular outlet and means for moving said second sleeve to regulate passage of air through said cylindrical passageway.

MARTIN FRISCH.