A. F. T. WOLFF.

GAS BURNER FOR HOT BLAST STOVES.

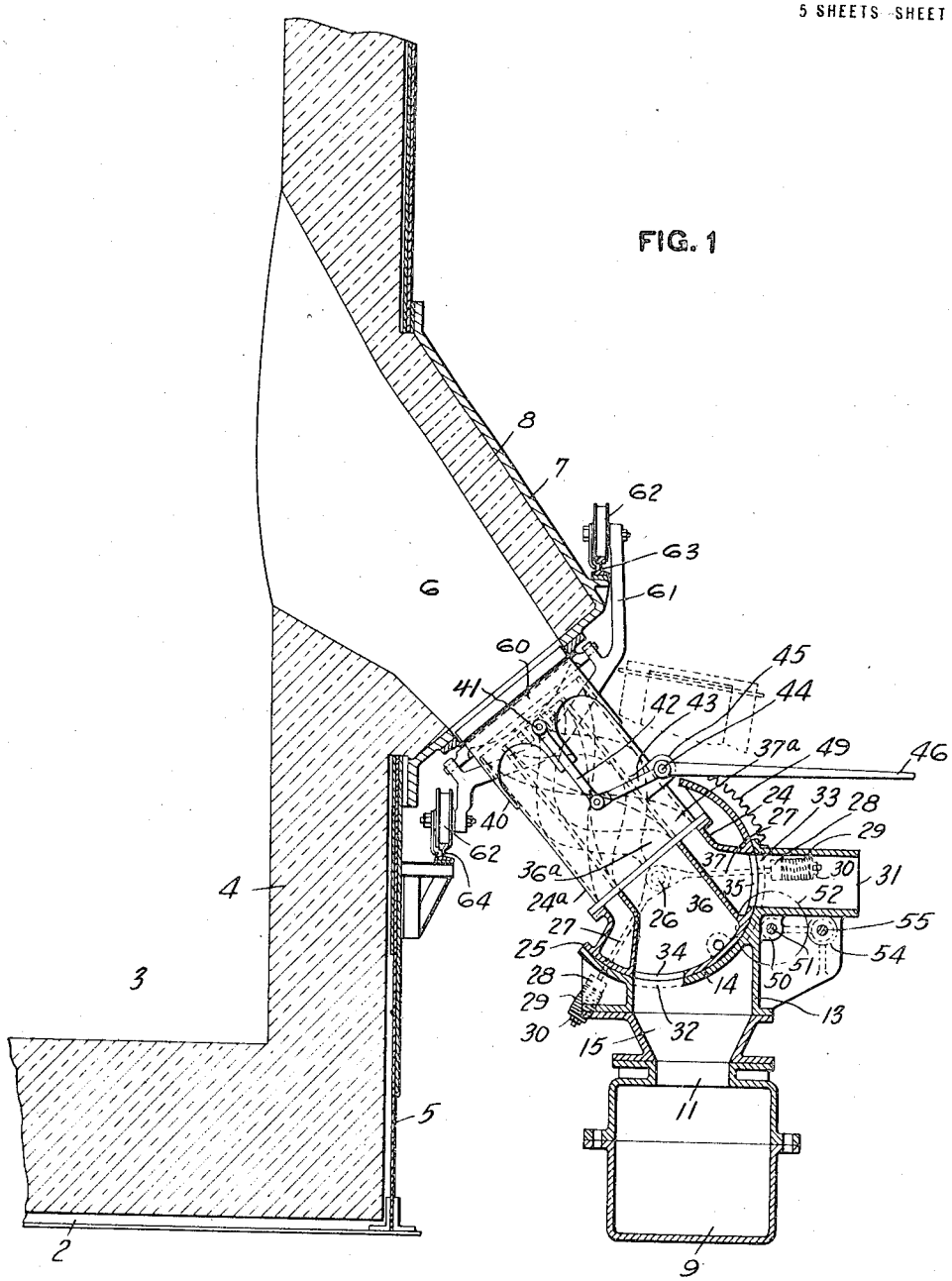
APPLICATION FILED MAY 21, 1918.

1,283,010.

Patented Oct. 29, 1918.

5 SHEETS-SHEET 1.

FIG. 1



WITNESSES

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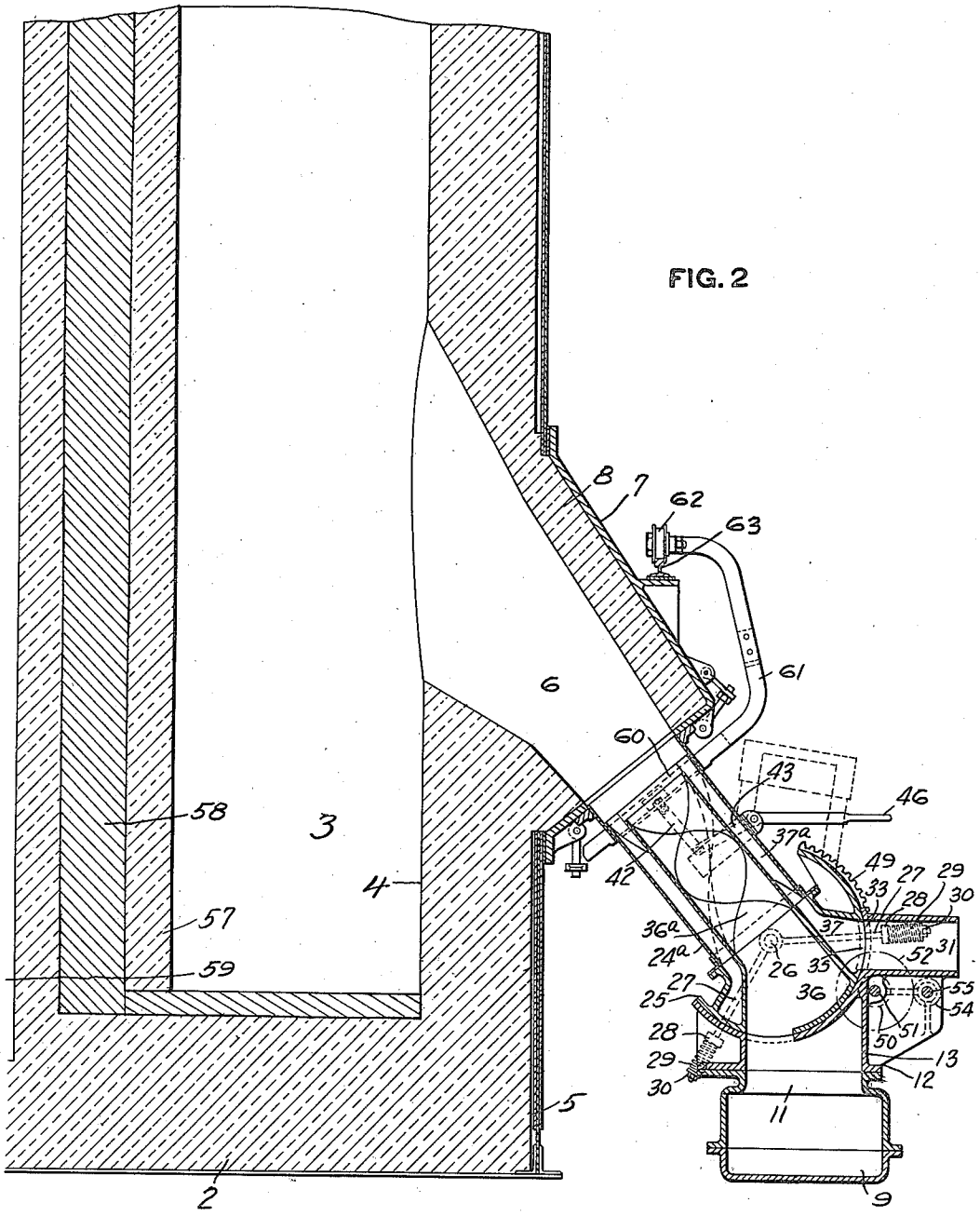
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5 SHEETS—SHEET 2.

FIG. 2



WITNESSES

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5 SHEETS—SHEET 3.

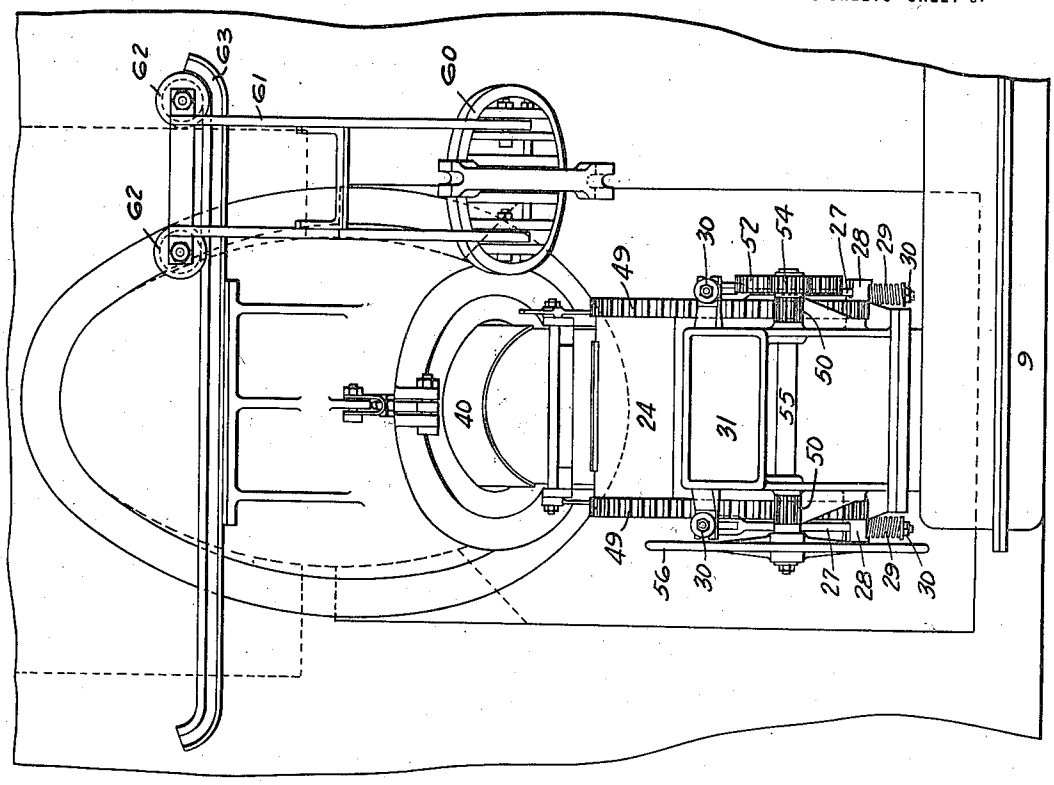


FIG. 4

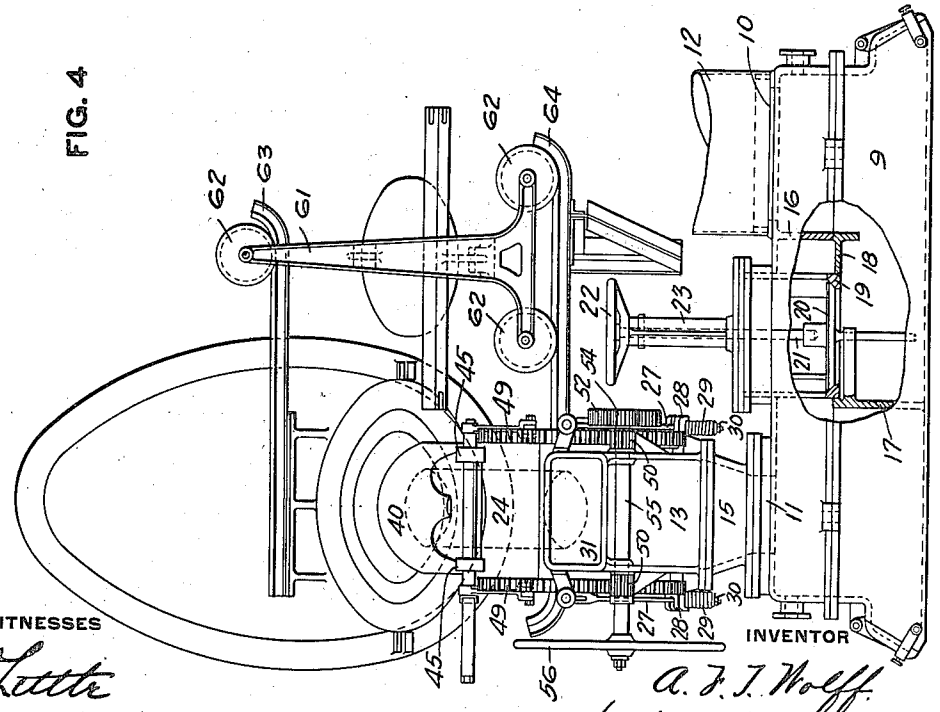


FIG. 3

WITNESSES

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5 SHEETS—SHEET 4.

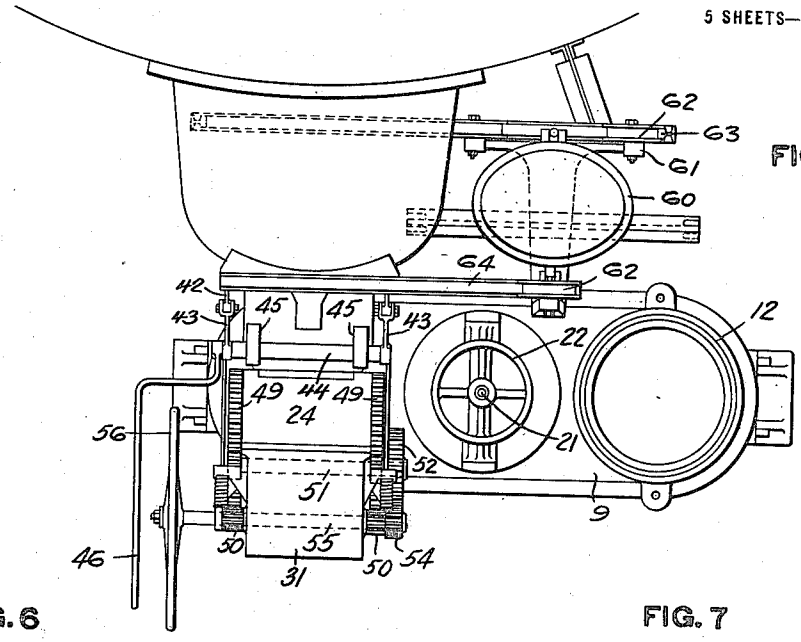


FIG. 5

FIG. 6

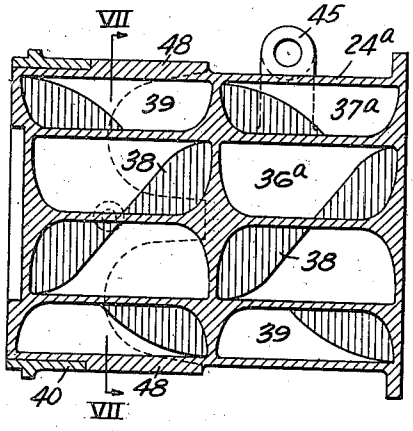
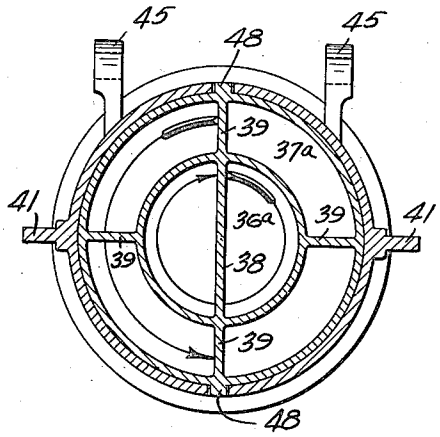


FIG. 7



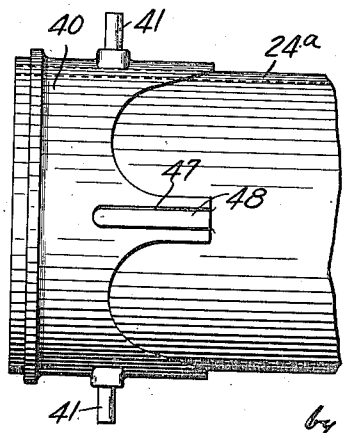


FIG. 8

WITNESSES

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5 SHEETS—SHEET 5.

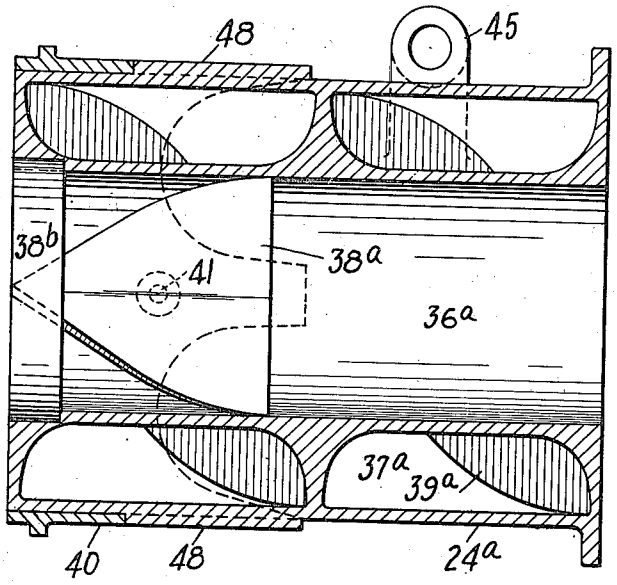


FIG. 9

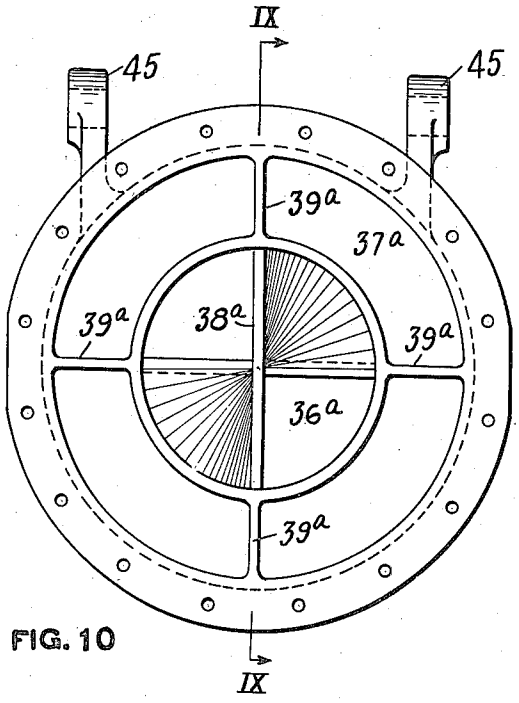
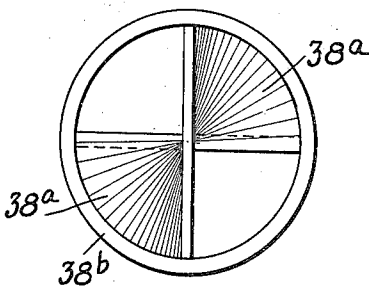


FIG. 10

FIG. 12



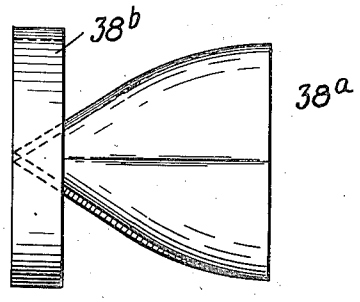


FIG. 11

WITNESSES

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UNITED STATES PATENT OFFICE.

ARTHUR F. T. WOLFF, OF SWISSVALE, PENNSYLVANIA.

GAS-BURNER FOR HOT-BLAST STOVES.

1,283,010. Specification of Letters Patent. Patented Oct. 29, 1918.

Application filed May 21, 1918. Serial No. 235,873.

To all whom it may concern:

Be it known that I, ARTHUR F. T. WOLFF, a citizen of the United States, and resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Burners for Hot-Blast Stoves, of which the following is a specification.

My invention relates to the construction and arrangement of gas burners, and more particularly of gas burners for hot blast stoves used in burning blast furnace gases.

One object of my invention is to provide a gas burner having improved means whereby the combustible gas and air, or a mixture of gas and air, is conducted and discharged into the combustion chamber of a hot blast stove.

Another object of the invention is to provide a proclivous gas burner for hot blast stoves constructed and arranged to deliver the gas and air, or mixture of gas and air, into the vertical combustion chamber of the hot blast stove at an oblique angle.

Another object of the invention is to provide a gas burner having a rocking or oscillating burner barrel arranged to swing about a horizontal axis in moving the burner barrel into and out of operative position, and having novel means whereby the supply of air and gas to the burner barrel is regulated and controlled.

Another object of the invention is the provision in a gas burner for hot blast stoves of novel means for lengthening the life of the refractory wall of the gas burner combustion chamber.

A further object of the invention is the provision of a gas burner having a swinging burner barrel and having novel means for yieldingly holding the gas burner barrel in position on the saddle or seat for supporting the swinging burner barrel.

A still further object of my invention is the provision of a gas burner having a gas burner barrel and having a novel arrangement of double walls and helical vanes within the barrel whereby the gas and air are caused to flow in gyral paths and are intimately mixed at the discharge end of the burner barrel.

A still further object of my invention is the provision of a gas burner having the novel constructions, arrangements, and combination of parts shown in the drawing, to be more fully described hereinafter and specifically pointed out in the appended claims.

Referring now to the drawings forming part of this specification, Figure 1 is a sectional side elevation showing the lower end or bottom of a hot blast stove having an obliquely inclined inlet opening leading upwardly and inwardly into the vertical combustion chamber within the stove and having a swinging gas burner constructed and arranged for use therewith in accordance with my invention.

Fig. 2 is a similar sectional side elevation showing a modified form of oscillating gas burner constructed in accordance with this invention.

Fig. 3 is a front elevation, partly in section, of the apparatus shown in Fig. 1.

Fig. 4 is a front elevation showing the apparatus of Fig. 2.

Fig. 5 is a plan showing the gas burner construction of Figs. 1 and 3.

Fig. 6 is a longitudinal section of the mixing end of the gas burner barrel forming a novel feature of my invention.

Fig. 7 is a transverse section of the same, the section being taken on the line VII—VII of Fig. 6.

Fig. 8 is a partial plan of the gas burner shown in Figs. 6 and 7, showing details in the construction and arrangement of the sliding sleeve on the forward or discharge end of the swinging burner barrel.

Fig. 9 is a longitudinal section of the mixing end of the burner barrel, similar to that of Fig. 6, showing a modification in the construction of the vane used in the gas chamber of the barrel, the section being taken on the line IX—IX of Fig. 10.

Fig. 10 is an end elevation of the burner barrel of Fig. 9.

Fig. 11 is a plan showing details in the construction of the vane of Figs. 9 and 10.

Fig. 12 is an end elevation of the vane of Fig. 11.

In the accompanying drawings the numeral 2 designates a hot blast stove having a vertical, side combustion chamber 3. The stove is provided with the usual refractory lining 4 which is erected within the metallic shell or casing 5 of the stove in the usual and well known manner. Adjacent to the lower end of the combustion chamber 3 is the inlet 6 through which the mixture of gas and air enters the combustion chamber

from the gas burner. As will be seen by reference to Figs. 1 and 2, this inlet 6 is inclined upwardly and inwardly and extends lengthwise at an oblique angle so that the mixture of gas and air is delivered into the lengthwise vertical combustion chamber 3 at an oblique angle, or on a line approaching the vertical. The angularly extending inlet 6 is formed by the metal branch or connection 7 which is riveted or otherwise securely fastened to the stove shell 5 and is provided with a refractory lining 8 bonded into the stove lining 4.

Positioned below and in front of the entrance end of the combustion chamber inlet 6 is a gas box 9 conveniently made in longitudinally divided sections and having a gas inlet 10 and gas outlet 11 on its upper side at opposite ends of the box. The gas box inlet 10 is connected by a vertical branch flue 12 to an overhead gas supply main (not shown). The outlet 11 on the box 9, which is flanged on one end, opens into the hollow barrel supporting saddle 13 secured upon the flange of the outlet 11 and the curved flange 14 on the upper end of the saddle 13 forms a seat for the rear end of the oscillating gas burner barrel 24.

In the construction shown by Figs. 1 and 3 the saddle 13 is connected to the flange of the outlet 11 by a short flanged pipe or "dutchman" 15. In that shown by Figs. 2 and 4 the flange on the lower end of the saddle 13 rests directly upon the flange on the upper end of the gas box outlet 11.

The interior of the gas box 9, as shown, has vertical partitions 16 and 17 connected by a horizontal partition 18 so as to separate the gas box into two compartments (see Fig. 3), the opening in the horizontal partition 18 having a removable valve seat 19 enabling the gases to pass through the opening in the seat 19 from one compartment to the other of the gas box 9 when the disk valve 20 is in lifted position. The valve 20 which, when necessary, shuts off the gas supply from the compartment at the outlet end of the gas box, has a vertical stem 21 extending upwardly through a suitable stuffing box and gland, having a threaded upper end in operative engagement with the hand wheel 22, the hand wheel being rotatably supported by the yoke 23 which is fastened to the upper side of the gas box.

Pivotally secured by its rear end to the saddle 13 is the sectional burner barrel 24. The rear end of the barrel 24, which is hollow, has a curved flange 25 which is seated upon the curved flange 14 of the saddle 13, and has trunnions 26, 26, to which one end of the eye-bolts 27 are pivotally secured. The screw threaded outer ends of the eye-bolts 27 project through holes in the lugs 28 on the saddle 13 and helical springs 29, which are adjustably held by nuts 30 on the bolts 27, yieldingly maintain the flange 25 on the rear end of one section of the oscillating burner barrel in sliding engagement with the curved flange 14 of the saddle 13. The amount of compression on the springs 29 is adjusted by turning the nuts 30 on the bolts 27, so as to keep the flanges 25, 14, in engagement when the burner barrel 24 is swinging into and out of position relative to the inlet 6 on the hot blast stove, as well as when it is stationary.

The hollow saddle 13 also has an air conduit 31, formed integrally thereon, as shown, through which the air to be mixed with the gases enters the burner barrel 24. This air conduit 31 may be open to the atmosphere, as shown in the drawings, and in such case the air is drawn into the gas burner by the suction or draft of the stove stack. When required the conduit 31 may be connected to a pressure blower or fan, or to an air blast main or other source of compressed air in order to supply air under a regulated pressure to the gas burner.

The saddle 13 has restricted openings 32 and 33 in its curved flange 14 through which the gases and air separately enter the rear end of the burner barrel 24 from the saddle 13, these openings 32 and 33 registering with similar openings 34 and 35 in the curved face or flange 25 on the rear end of the hollow burner barrel 24. The openings 32 and 34 when in register connect the central chamber 36 of the burner barrel with the interior of the hollow saddle 13 and the openings 33 and 35 connect the conduit 31 on the saddle 13 with the annular air chamber 37 of the burner barrel.

When the burner barrel 24 is swung upwardly out of the angular position shown, (the position for delivering air and gas to the combustion chamber in the stove,) the rear end of the curved flange 25 on the burner barrel will close the openings 32 and 33 in the saddle flange 14 and shut off the supply of gas and air to the burner barrel.

Secured to the flange on the discharge end of the rear section of the burner barrel 24 is a front section or extension 24^a which also has a central gas chamber 36^a and annular air chamber 37^a, these chambers being continuations of the chambers 36 and 37. The central or gas chamber 36^a is provided with a helical vane or plurality of helical vanes 38 and the annular air chamber 37^a has a series of four helical vanes 39 which impart a gyral motion to the gas and the air in the passage thereof through the chambers 36^a and 37^a. The vane or vanes 38 will be of the opposite hand or pitch to the vanes 39 so as to give the gas a whirling motion in one direction and the air in the other or opposite direction in passing through the barrel extension 24^a and cause an intimate mixture of the gas and air as

they combine at the discharge end of the extension 24a.

In the burner barrel extension or nozzle 24a of Figs. 1 to 8, a single vane 38 is shown in the gas chamber 36a, which makes one complete turn in the length thereof, in a clockwise direction, and the air chamber 37a has a series of four vanes 39 which make one-half turn in the length thereon, in a counter-clockwise direction. The arrows in Fig. 7 indicate the direction in which the vanes turn, the vanes 38 and 39 being formed integrally on the extension 24a.

In the extension 24a of Figs. 9 and 10, 11 and 12, the air chamber 37a has a series of four integrally formed vanes 39a which, like those in the air chamber 37a of Figs. 1 to 8, make one-half turn in the length thereof.

The vane 38a in the gas chamber 36a of the nozzle or burner barrel extension 24a of Figs. 9 and 10, which is made separate from the barrel extension so as to be removable, is somewhat shorter than the vane 38 and also is arranged to make one-half turn in the length thereof, as is clearly shown in Figs. 11 and 12. This removable vane 38a, as will be best seen in Figs. 11 and 12, has a retaining ring 38b on one end by which it is located within the gas chamber 37a, the edges of the curved vanes fitting neatly within the gas chamber. Making the vane 38a removable permits of the gas chamber 37a and vane 38a to be thoroughly cleaned when the use of dirty gas has resulted in the deposition of flue dust or other finely divided solids on the surfaces of the chamber and vane, and also enables vanes of varying pitch to be used so as to change the angle of the vane in the gas chamber with respect to that or those in the air chamber 37a.

Positioned on the front or discharge end of the burner barrel extension 24a is a sliding sleeve 40 having trunnions 41, 41 by which it is connected to one end of the links 42, 42. The other ends of the links 42 connect to the outer ends of lever arms 43 which are keyed or otherwise fastened to a rock shaft 44, the shaft being mounted in the lugs or bearings 45 on the burner barrel extension. A hand lever 46 is fastened to the rock shaft to form means for reciprocating the sleeve 40 on the burner barrel extension in moving the sleeve into and out of operative position with respect to the outer end of the inlet 6 leading to the stove combustion chamber 3. The sleeve 40 is provided with a slot or groove 47 (Fig. 8) which embraces the sides of a lug 48 on the outer face of the burner barrel extension 24a and coacts therewith to prevent rotation while permitting lengthwise movement of the sleeve on the burner barrel extension.

The opposite sides of the curved rear end of the section 24 of the burner barrel are provided with gear teeth 49, 49, which mesh with the teeth of the spur pinions 50, 50, on the ends of the shaft 51, and the spur gear 52 on one end of the shaft 51 meshes with the pinion 54 on one end of the hand wheel shaft 55. The shaft 55 is provided with a hand wheel 56 to manually turn the shafts 55 and 51, which are rotatably mounted on the saddle 13, and, through the reducing gearing, oscillate or rock the swinging burner barrel on the saddle 13 in moving the gas burner into and out of its operative position.

Blast furnace gases usually contain a considerable quantity of finely divided solids. These heated solids when impinged against the side wall of the combustion chamber as they are in supplying gas to the combustion chamber, are burned onto the surface of the wall and build up so as to form lumps thereon which must be removed at frequent intervals. In removing the so-formed lumps the refractory wall becomes damaged, frequently to such an extent as to necessitate immediate repairs, or rebuilding.

To avoid such necessity I have provided a false wall 57 in the combustion chamber which is built within the chamber but is not bonded to the partition wall 58 separating the combustion chamber 3 from the chamber 59 containing the stove checker work. (See Fig. 2). It will be readily seen that the provision of the loosely built false wall 57 in this manner enables the wall to be easily and quickly removed and replaced as often as necessary and desirable at a minimum expense, and without disturbing or injuring the bonded lining 58.

The outer end of the gas inlet 6 to the stove combustion chamber 3, which is closed when the stove is in use to heat the cold blast, has the usual closing door 60. This door, as shown in Fig. 1, is supported upon a trolley 61 having track wheels 62, 62, which run upon the track rails 63, 64. The track rails are secured to the shell 5 of the stove and the shell 7 of the stove gas inlet 6, so as to form a convenient means for pushing the door 60 into and out of position in front of the inlet 6, the usual provision being made for bolting the door 60 in closing position on the inlet 6.

In the apparatus shown in Fig. 1, two track rails 63 and 64 are used with wheels 62 on the upper and lower ends of the trolley 61. In the construction shown in Fig. 2 a single track rail 63 is employed and the trolley 61 is suspended from this track rail. The door 60 is pivotally secured to the trolley 61 of both Fig. 1 and Fig. 2.

The operation of my improved gas burner will be readily understood. When the stove is to be put "on gas," *i. e.*, to be heated by burning blast furnace gases in the combustion chamber, the door 60 on the inlet 6 is

detached from the inlet and is then pushed sidewise from in front of the inlet by moving the trolley 61 on the trolley track rails. The burner barrel is then swung downwardly into position in line with the inlet 6 leading to the stove combustion chamber 3 by turning the hand wheel 56. The sleeve 40 is then moved lengthwise on the burner barrel extension 24ª by means of the hand lever 46 to bring its forward end into operative engagement with the inlet 6. In swinging the burner barrel on the saddle 13 from the positions indicated by dotted lines in Figs. 1 and 2 into the position shown by full lines, the openings 32 and 34, and openings 33 and 35 are caused to register. The hand wheel 22 is then turned to open the valve 20 and admit gas to the discharge end of the gas box 9 and into the burner barrel. Before moving the sleeve 40 forwardly into discharging position a flame or other suitable means will be provided in the inlet 6 for igniting the mixture of gas and air as it emerges from the sleeve 40 and enters the inlet 6 leading to the combustion chamber.

The burning gases are delivered into the combustion chamber at an oblique angle to the horizontal and at an angle which approaches the vertical. This is of very great advantage in that gases are not delivered at right angles to the length of the combustion chamber, but are discharged upwardly within the combustion chamber.

When the stove has become heated and is to be put "on air" the valve 22 in the gas box is closed, and the sleeve 40 is moved backwardly from its advanced position on the burner barrel. The burner barrel is then swung on the saddle 13 into the position indicated by dotted lines in Figs. 1 and 2, so as to permit of the closing door 60 being moved into position to be fastened to the outer end of the inlet to the stove combustion chamber. After the door 60 is bolted in position the cold blast is caused to travel under pressure through the stove to be heated in its passage therethrough in the usual known manner, and the gas burner remains in its inoperative position until again required for use in heating the stove when it is again moved into heating position in the manner which has been described.

The advantages of my invention will be apparent to those skilled in the art. The provision of an obliquely inclined gas burner on the vertical combustion chamber enables the mixture of gas and air to be delivered into the combustion chamber in a line approaching the vertical and avoids the difficulties and disadvantages caused by the gases impinging directly against the combustion chamber wall and present in gas burners discharging horizontally into the vertical combustion chamber of the stoves. The apparatus is simple and is easily kept in repair. The provision of a swinging or oscillating burner barrel enables a compact construction to be used and reduces the amount of movement necessary in swinging the burner into and out of operative position. My improved gas burner is applicable for use on existing stoves as well as on new stoves.

The use of the loosely built false wall in the combustion chamber enables repairs to be easily and quickly made at the point of impingement of the burning gases on the refractory lining of the combustion chamber and greatly lengthens the life of the apparatus.

Modifications in the construction and arrangement of the parts may be made without departing from my invention as defined in the appended claims.

I claim:—

1. In a gas burner for hot blast stoves, the combination of a hot blast stove having a combustion chamber therein, said combustion chamber having a proclivous inlet, and a gas burner having a discharge nozzle movable into and out of alinement with said inlet and arranged to discharge gas and air into said combustion chamber through the said inlet.

2. In a gas burner for hot blast stoves, the combination of a hot blast stove having a combustion chamber therein, said combustion chamber having a proclivous inlet, a gas burner having a swinging discharge nozzle movable into and out of alinement with said inlet and arranged to discharge gas and air into said combustion chamber through the said inlet, and means for actuating said nozzle.

3. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, and means for swinging said barrel into and out of alinement with the inclined inlet to said combustion chamber.

4. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, a sliding sleeve on the discharge end of said burner barrel, and means for reciprocating the sleeve on the burner barrel.

5. In a gas burner for hot blast stoves, the combination with a hot blast stove hav-

ing a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, said burner barrel having double walls forming a central gas nozzle and annular air nozzle, and gas and air chambers in said saddle connecting with the nozzles in said burner barrel.

6. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a pivoted burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, said burner barrel having double walls forming a central gas nozzle and annular air nozzle, a spiral vane in each of said nozzles, and gas and air chambers in said saddle connecting with the nozzles in said burner barrel.

7. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, said burner barrel having double walls forming a central gas nozzle and annular air nozzle, oppositely pitched spiral vanes in said nozzles, and gas and air chambers in said saddle connecting with the nozzles in said burner barrel.

8. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, said burner barrel having double walls forming a central gas nozzle and annular air nozzle, oppositely pitched spiral vanes in said nozzles, the vanes of said annular nozzle being of less pitch than the vanes in said central nozzle, and gas and air chambers in said saddle connecting with the nozzles in said burner barrel.

9. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, and means for yieldingly holding said swinging burner barrel in position on said saddle.

10. In a gas burner for hot blast stoves, the combination with a hot blast stove having a vertical combustion chamber, said chamber having an inlet at the lower end thereof and said inlet being inclined lengthwise at an oblique angle, of a gas burner having a swinging burner barrel, a saddle on which said barrel is pivoted, means for swinging said barrel into and out of alinement with said inclined inlet, and spring loaded eye-bolts for yieldingly holding the burner barrel in position on said saddle.

11. In a gas burner for hot blast stoves, the combination with a stove having a vertical combustion chamber, said chamber having a proclivous inlet, of a gas burner having a pivoted burner barrel arranged to swing into and out of alinement with said inlet, and means for swinging said burner barrel.

12. In a gas burner for hot blast stoves, the combination with a stove having a vertical combustion chamber, said chamber having a proclivous inlet, of a gas burner having a pivoted burner barrel arranged to swing into and out of alinement with said inlet, means for swinging said burner barrel, a sliding sleeve on the discharge end of said burner barrel, and means for reciprocating said sleeve on the burner barrel.

13. In a gas burner for hot blast stoves, the combination of a hot blast stove having a vertical combustion chamber therein, said combustion chamber having a proclivous inlet, a gas burner having a discharge nozzle movable into and out of alinement with said inlet and arranged to discharge gas and air into said combustion chamber through the said inlet, and a helical vane removably secured in said nozzle.

14. In a gas burner, a combustion chamber and a gas burner barrel movable into and out of operative position relative to said combustion chamber, said barrel having double walls forming a central gas nozzle and annular air nozzle, and helical vanes in said nozzles, at least one of said vanes being detachably secured in the nozzle.

In testimony whereof, I have hereunto set my hand.

ARTHUR F. T. WOLFF.