United States Patent

Morck, Jr.

[15] **3,692,460**

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[54] **INDUSTRIAL BURNER**

[72] Inventor: **Charles W. Morck, Jr.**, Philadelphia, Pa.

[73] Assignee: **Selas Corporation of America**, Dresher, Pa.

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[52] **U.S. Cl.**.....**431/348**

[51] **Int. Cl.**.....**F23d 15/04**

[58] **Field of Search**.....431/348, 173

[56] **References Cited**

UNITED STATES PATENTS

3,050,112	8/1962	Saunders et al. 431/348
3,076,498	2/1963	Williams et al. 431/348
3,262,484	9/1966	Hess .....431/348 X

Primary Examiner—Edward G. Favors

Attorney—Wellford Mason

[57] **ABSTRACT**

The invention is directed to an industrial burner that will operate, without change of parts, with any fuel gas and with a wide turndown range.

7 Claims, 6 Drawing Figures

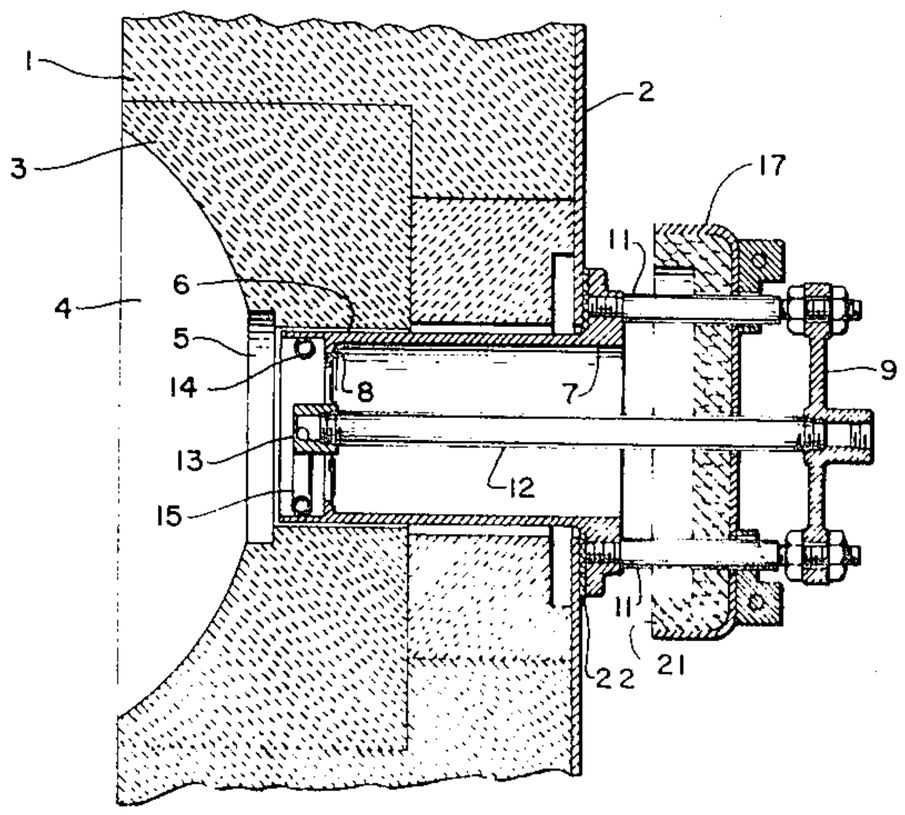


FIG. 1

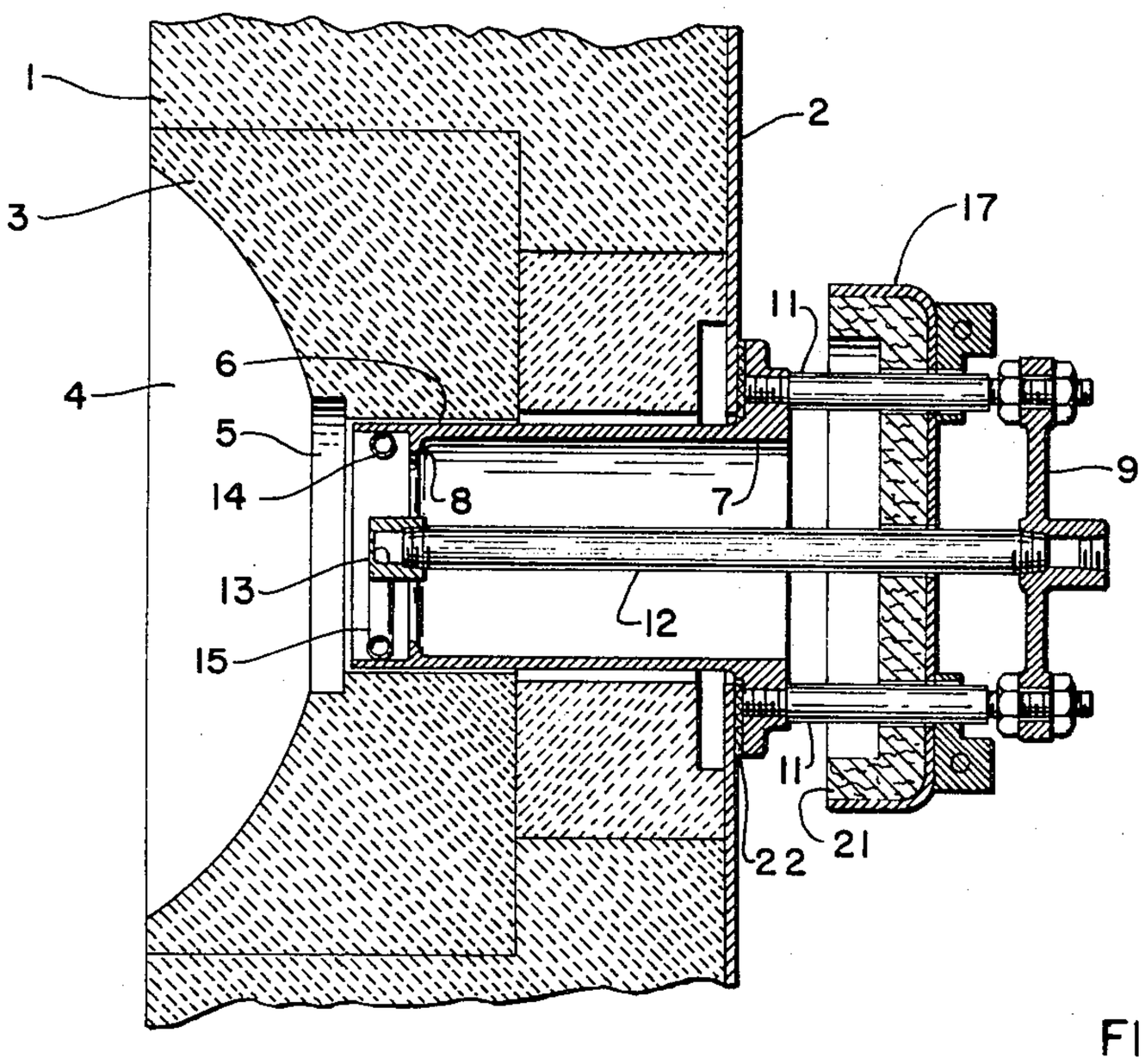


FIG. 3

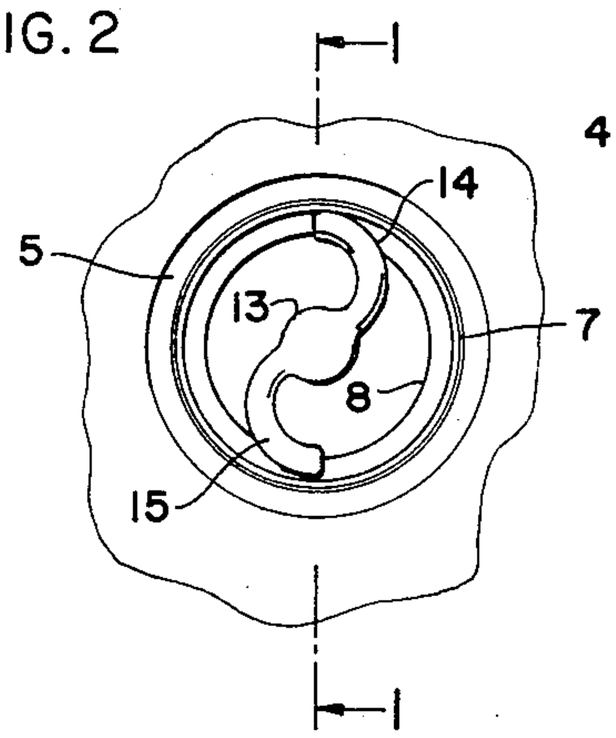
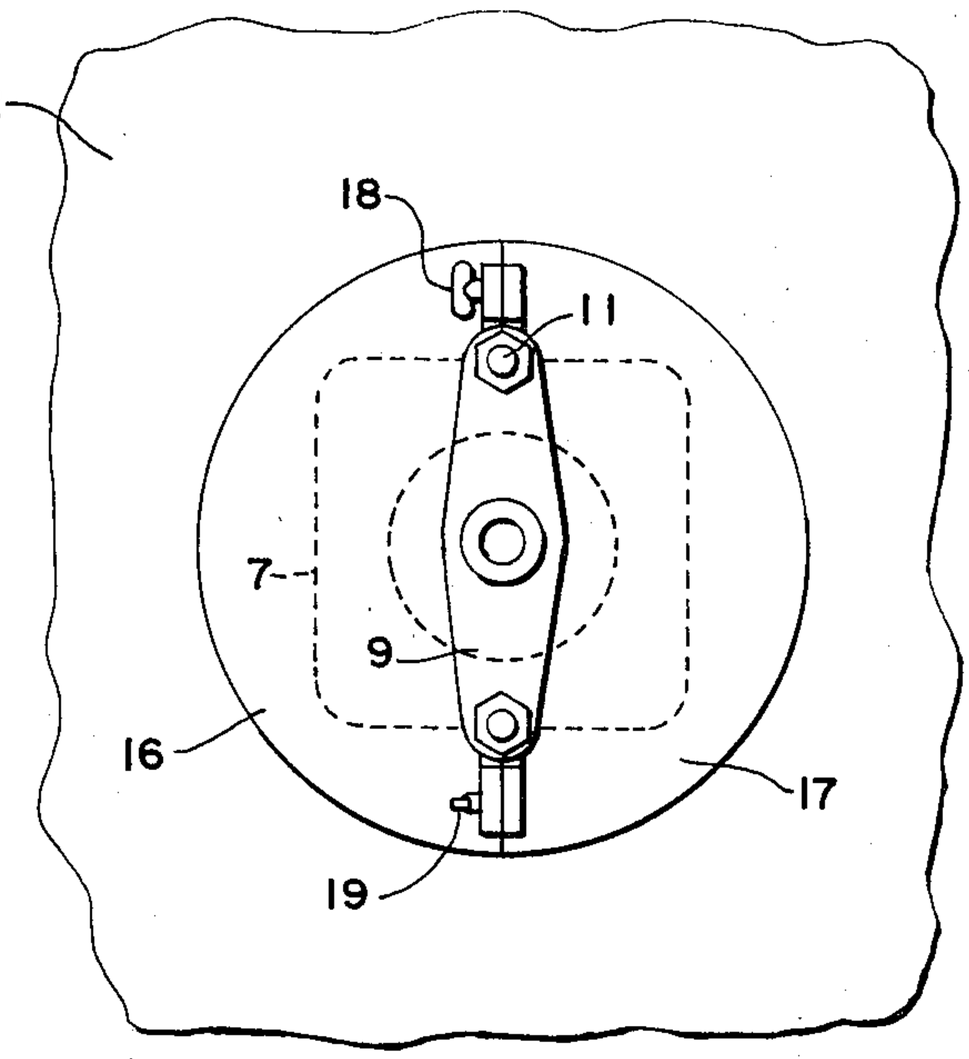


FIG. 2



INVENTOR.

CHARLES W. MORCK JR.

BY E. W. Smason

FIG. 4

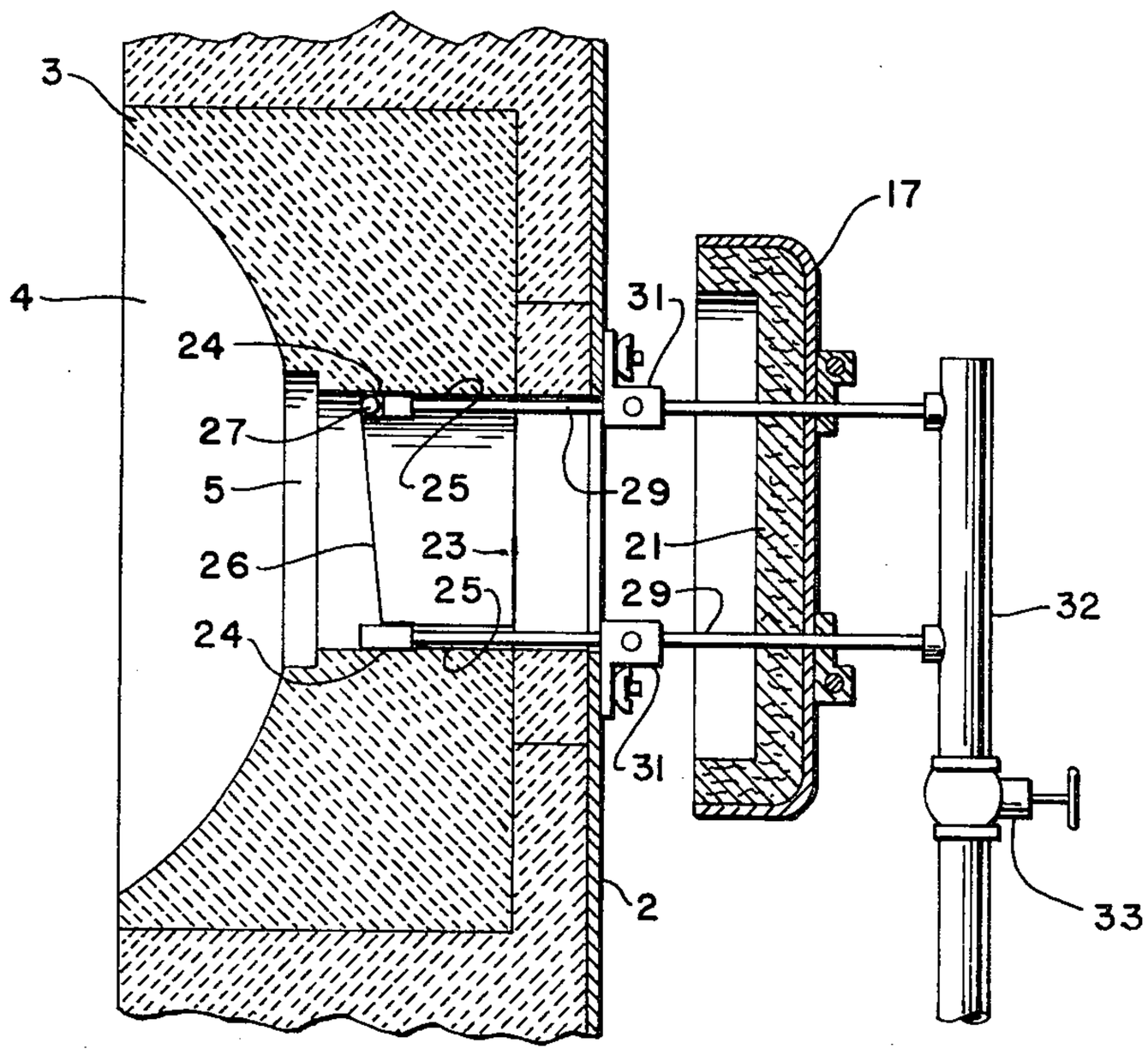


FIG. 5

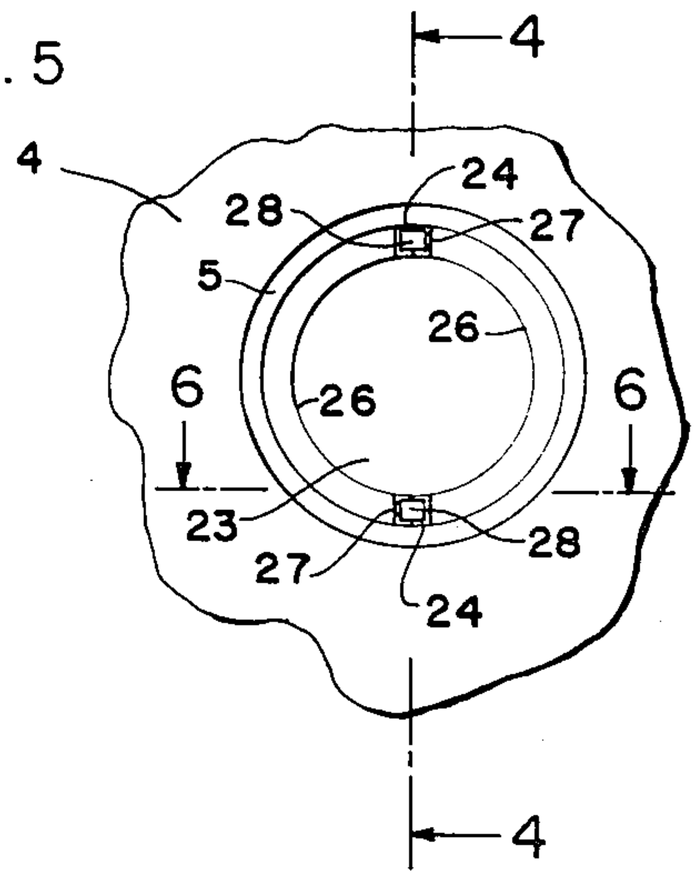
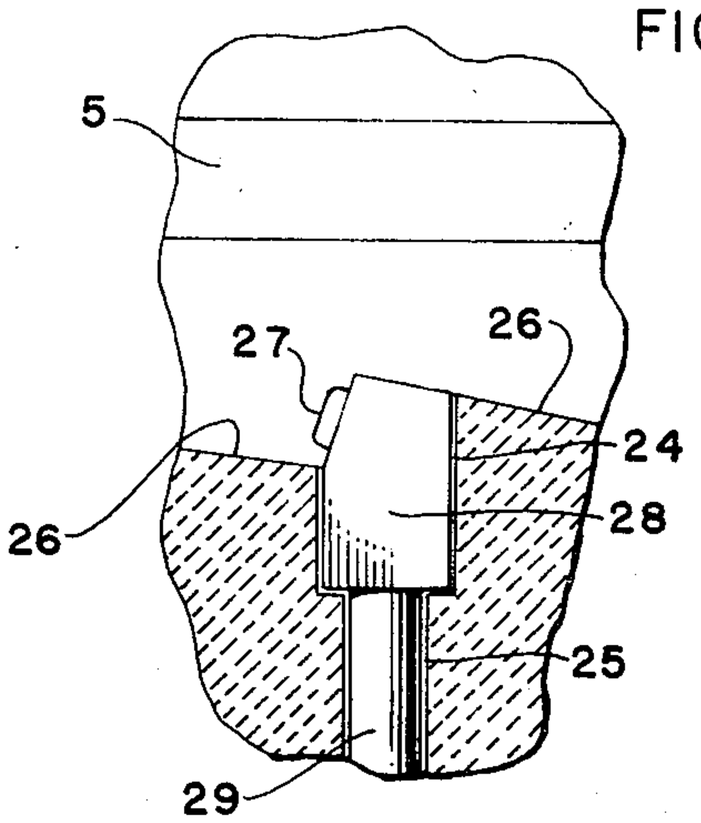


FIG. 6



INVENTOR.

CHARLES W. MORCK JR.

BY E. W. Morck

INDUSTRIAL BURNER

SUMMARY OF THE INVENTION

The present invention relates to industrial burners capable of using various types of fuel gas through a wide range of heat release.

One common form of industrial burner is the inspirator burner. With this type, fuel gas under pressure is discharged through a spud into the throat of a venturi. The gas aspirates and mixes with the air to form a combustible mixture that is discharged into a furnace to be burned. One disadvantage of these burners is that different gases and different capacities of the burner require that the spud be changed. Another disadvantage is that pure hydrogen or a high hydrogen gas cannot be used as fuel because the high flame propagation rate of hydrogen will cause the burner to backfire so that combustion will take place in the burner.

It is an object of the present invention to provide a burner that will overcome the above-mentioned defects. It is a further object of the invention to provide a burner having a large turndown range.

The burner of the invention comprises a cylindrical tube inserted in a furnace wall with one end terminating substantially at the base of a cup-shaped depression formed in the face of the furnace wall. Fuel gas is discharged in a tangential direction in the tube at a location near the base of the cup. Air is drawn through the tube to mix with the gas and burn along the face of the cup. Since the gas and air do not mix until they are actually entering the cup, where combustion is supposed to take place, there can be no backfiring regardless of the type of fuel used. The air required for combustion comes through the tube and is controlled by a shutter on the outer end of the tube and the furnace draft.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

IN THE DRAWINGS

FIG. 1 is a section view of the burner on line 1—1 of FIG. 2.

FIG. 2 is a front view from the left of FIG. 1.

FIG. 3 is a back view from the right of FIG. 1.

FIG. 4 is a section view on line 4—4 of FIG. 5 of a modified form of burner.

FIG. 5 is a front view from the left of FIG. 4, and

FIG. 6 is a view on line 6—6 of FIG. 5.

DETAILED DESCRIPTION

Referring to the drawings, there is shown a portion of a furnace wall 1 constructed with refractory in the usual manner and having a metal plate 2 to back up the refractory. A burner block 3 is located in the wall. This block has a cup-shaped depression 4 facing the interior of the furnace with a recess 5 at its base. An axial opening 6 extends from the base of the recess through the block and the refractory of the furnace to the outside of

the furnace wall. The burner includes a cylindrical tube 7 that is inserted in the opening 6. As shown in the drawings, the left end of the tube terminates adjacent to the base of recess 5 and the tube is fastened in position by means of bolts extending through a flange on its rear end. A gasket 22 is provided between the flange and the metal plate 2 in order to prevent infiltration of air around the tube. It is noted that this tube has formed on its inner surface, adjacent to the front end, an annular ridge 8 for a purpose to be described.

A gas tube supporting yoke 9 is attached to the rear of the furnace wall and is spaced from this wall and the flange of tube 7 by means of spacers 11. This yoke has a central opening that is axially aligned with the tube and has threaded into the opening a gas pipe 12 which extends forwardly through the center of tube 7. A fuel gas supply pipe, not shown, is connected to the other side of the yoke. The front end of gas pipe 12 has a gas distributing member 13 attached to it, which member is provided with curved tubular arms 14 and 15 that terminate adjacent to the inner surface of tube 7 in front of ridge 8, with the ends of the tubes pointing in a tangential direction substantially perpendicular to the axis. Gas is discharged into the burner through pipe 12 and the arms 14 and 15. For this purpose the ends of arms 14 and 15 are formed as jets or, if desired, they can be provided with small spuds similar to the type that are used on inspirator burners.

Air for combustion is introduced into the furnace to be mixed with the fuel gas through the center of tube 7. The volume of air is controlled by a shutter which includes two semicircular members 16 and 17 which are provided with cutout portions to surround the spacers 11 and gas pipe 12. These two members forming the shutter are held together by means of thumb screws 18 and 19 which extend through lips as shown in the drawing. The shutter when placed in position can be slid toward or away from the rear of the furnace wall in order to adjust the size of the opening through which air flows. It is noted that the two portions of the shutter are formed of metal which is lined with a fiberous material 21 such as a glass fiber mat. This material also acts as a sound absorber when the burner is in operation.

In the operation of the burner, gas under pressure is supplied through pipe 12. The pressure of the gas will vary with the capacity at which the burner is to be operated. High velocity swirling jets of fuel gas issuing from arms 14 and 15 create a central low-pressure region which sucks air through tube 7. The spinning gas mixes with the air, the mixture ignites and is thrown by centrifugal force onto the surface of cup 4 where it moves across the cup and out onto the furnace wall, thus heating the cup surface and the adjacent portions of the wall to incandescence. Ridge 8 in tube 7 insures that the swirling gas jets will flow only in the direction of the cup and furnace interior.

Recess 5, at the base of the cup, helps to anchor the flame and improve the gas-air mixing by creating a local turbulence. At normal capacity, a low furnace draft is required to augment the vortex action of the spinning gas in supplying enough air for complete combustion. Since draft requirements vary with capacity, some adjustment of the air shutter 16, 17 is necessary to obtain excess air, if desired, at any given capacity.

The burner will perform on any fuel from pure hydrogen to pure natural gas. Since natural gas requires about four times the amount of air that hydrogen does to burn stoichiometrically, it is necessary to have a higher furnace draught the greater the percentage of natural gas being used in or as the fuel. The capacity of the burner can be varied by varying the pressure of the fuel gas supply through a relatively wide range without changing the size of tubes 14 and 15.

In the embodiment of the invention, shown in FIGS. 4–6, the block 3 is the same as that previously described except for the center opening therein. The block, instead of having a separate tube 7 in the center opening 6, is formed with its equivalent in the shape of a smaller diameter cylindrical portion 23 extending from the back toward recess 5. This smaller diameter portion has two recesses 24 which are diametrically opposed to each other at its front edge. Each recess 24 is connected by a groove 25 to the rear end of the block. The front edge of the small section 23 is formed by shoulder 26 that corresponds to ridge 8. The shoulder extends in a slightly helical direction from each of the recesses 24 so that one side of each recess is higher than the other, as is shown in FIG. 6.

Fuel is supplied to the burner tangentially, as in the previously described embodiment. In this case, however, there are provided spuds 27 which extend from tips 28 that are received in the recesses 24. Each tip is supplied by a gas tube 29. These tubes are received in slots 25 and extend backwardly beyond the furnace wall and are held in position by clamps 31 attached to the metal backing 2 of the furnace. These tubes, in turn, are connected to a fuel supply pipe 32 that is provided with a fuel valve 33. In this case also there is provided a shutter similar to that previously described except that the shutter does not have a center opening since there is no center fuel pipe in this embodiment.

The operation of the burner is identical with that previously described. In this case fuel under pressure is discharged in a tangential direction from spuds 27. Fuel is guided forwardly in an axial direction by the edges 26 of the smaller portion 23 in addition to its swirling movement. Fuel flowing radially across cup 4 creates a low pressure area that draws air through the center opening of the block to mix with the fuel in a manner previously described.

It will be seen that both embodiments of the burner have fuel introduced in a center opening in a tangential direction substantially perpendicular to the burner axis. Air is drawn through the same opening to mix with the fuel gas as they move into the furnace chamber along the surface of cup 4 and the furnace wall. A ridge or shoulder is provided to insure that the fuel moves forwardly into the cup of the burner so that it will spread evenly over the cup to heat the cup to incandescence during its operation. The burner has relatively few and simple parts that are easily manufactured. Once the burner has been assembled there is nothing to get out of order.

While in accordance with the provisions of the Statutes I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. In an industrial burner, a burner block adapted to be inserted in a furnace wall, said block being formed with a cup-shaped depression in one face and having an opening extending from the base of the cup to an opposite face of the block, a cylindrical member received in said opening with one end located substantially at the base of said cup and the other end extending outwardly, means forming an annular ridge on the interior of said member adjacent to said first mentioned end, fuel gas supply means including a pair of tubes, the discharge ends of said tubes terminating at substantially diametrically opposed points at the interior surface of said member between said ridge and said first mentioned end, said discharge ends discharging fuel gas in the same direction tangentially to the interior surface of said member and substantially perpendicular to its axis.

2. The combination of claim 1 in which said cup-shaped depression is provided with an annular recess at its base.

3. The combination of claim 1 in which said fuel gas supply means includes a supply pipe extending axially of said cylindrical member and said tubes are mounted on and supplied by said pipe.

4. The combination of claim 1 including a shutter of a diameter larger than said opening in said cup, and means to mount said shutter coaxially of the end of said opening away from said depression and for movement toward and from said opening.

5. The combination of claim 4 in which said shutter is lined with a sound absorbing material.

6. The combination of claim 1 in which said cylindrical member is separate from said block and is attached to the furnace wall with which the burner is used.

7. The combination of claim 1 in which said cylindrical member is a reduced diameter portion in the opening of said block, axially extending grooves located at diametrically opposite portions of said member, the fuel gas supply means including tubes received in said grooves and means forming discharge openings on the ends of said tubes, the end of said reduced portion adjacent to said depression forming said ridge.

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