W. W. CASE.

BURNER.

APPLICATION FILED MAY 28, 1909.

950,996.

Patented Mar. 1, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

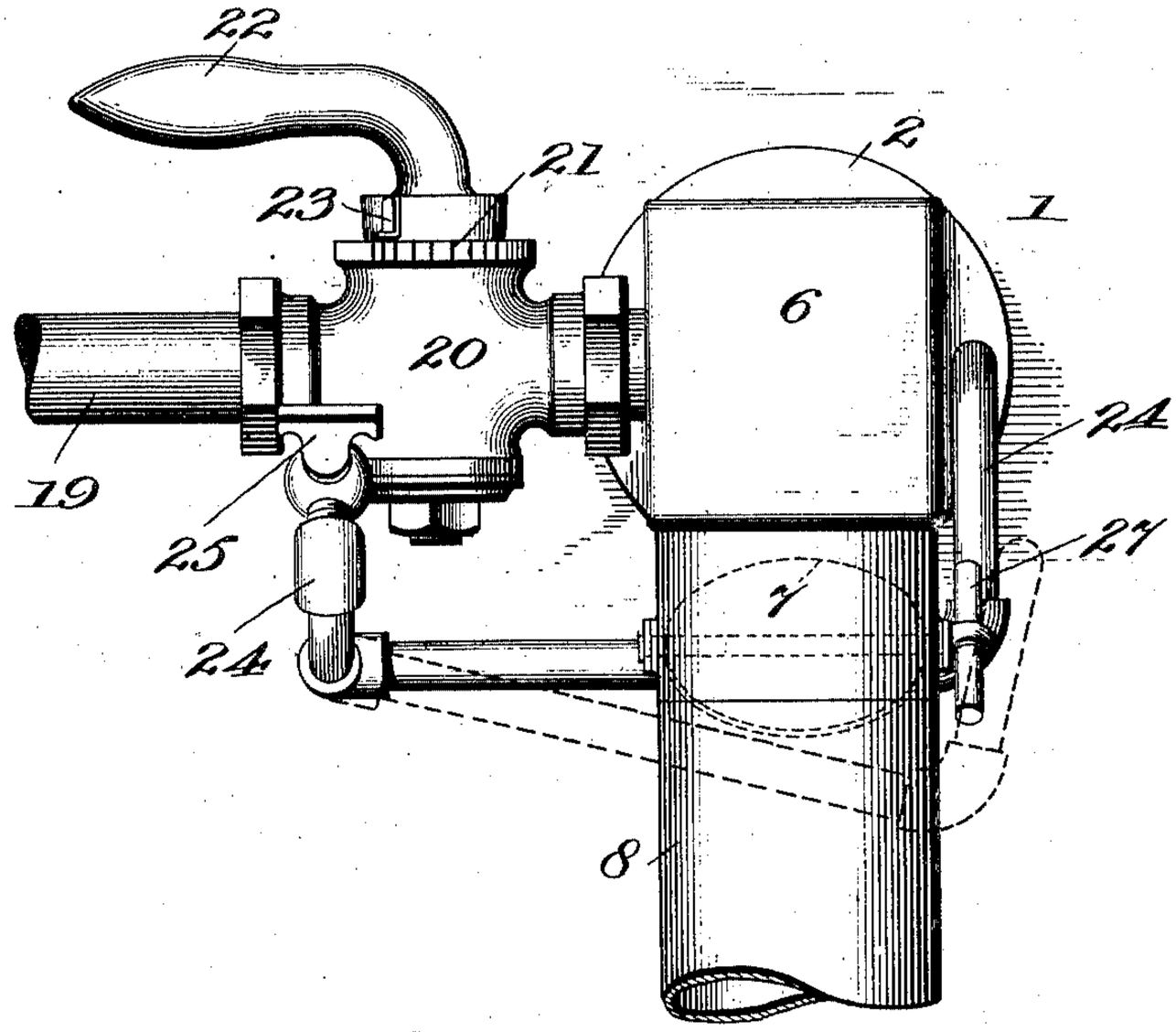


Fig. 2.

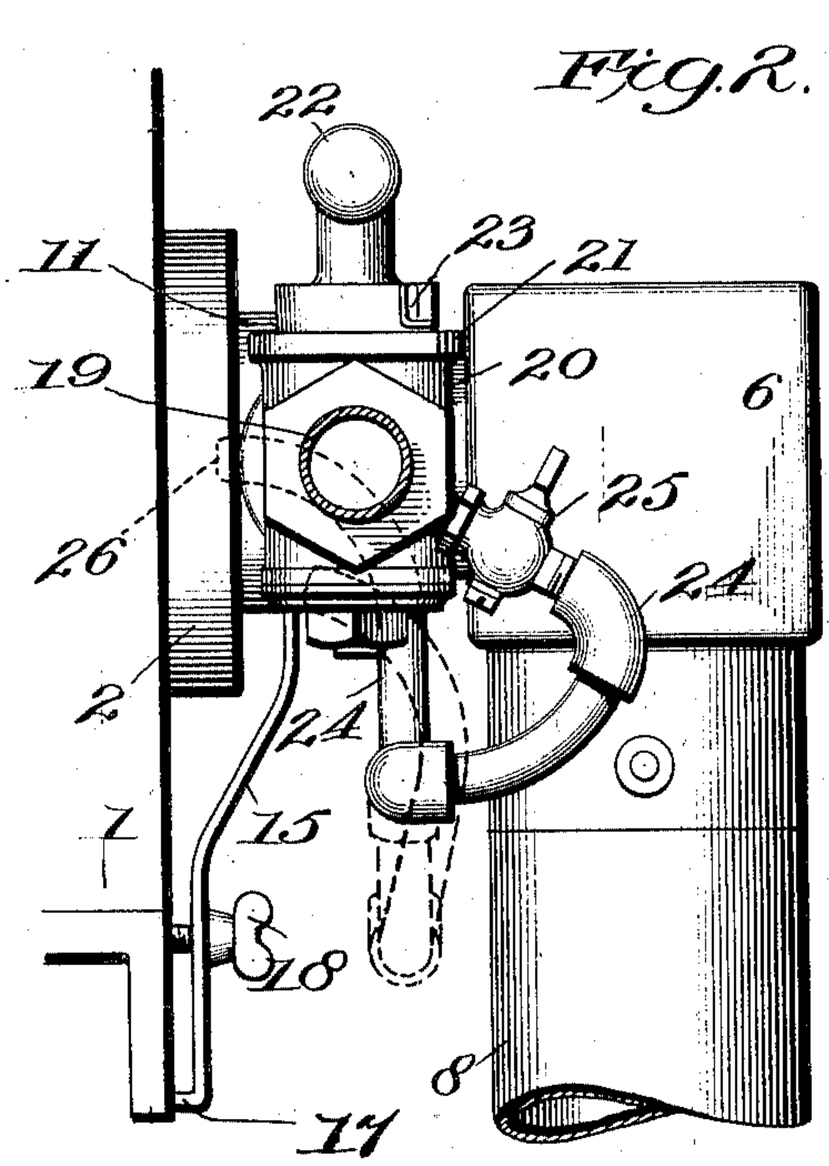
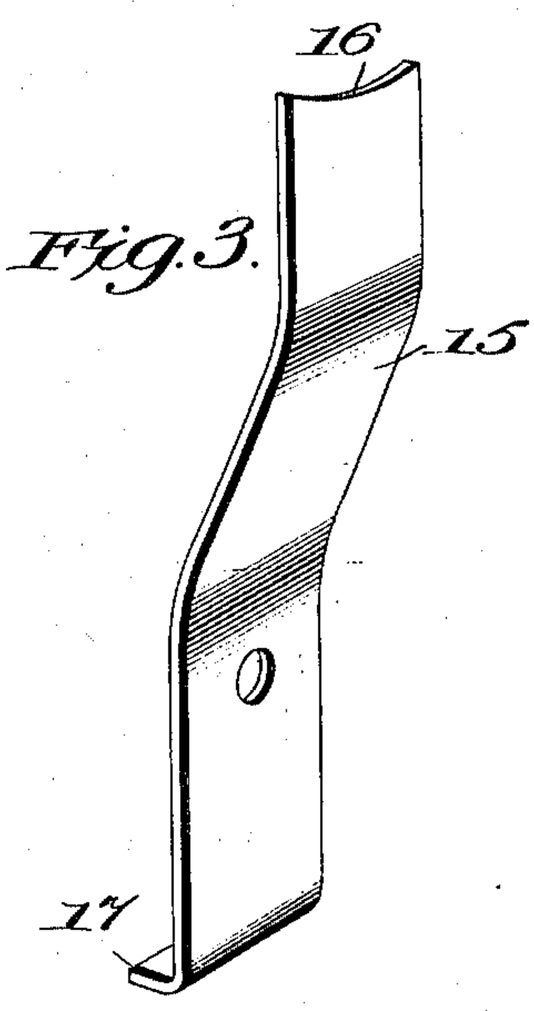


Fig. 3.



Witnesses

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W. W. CASE.

BURNER.

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2 SHEETS—SHEET 2.

Fig. 4.

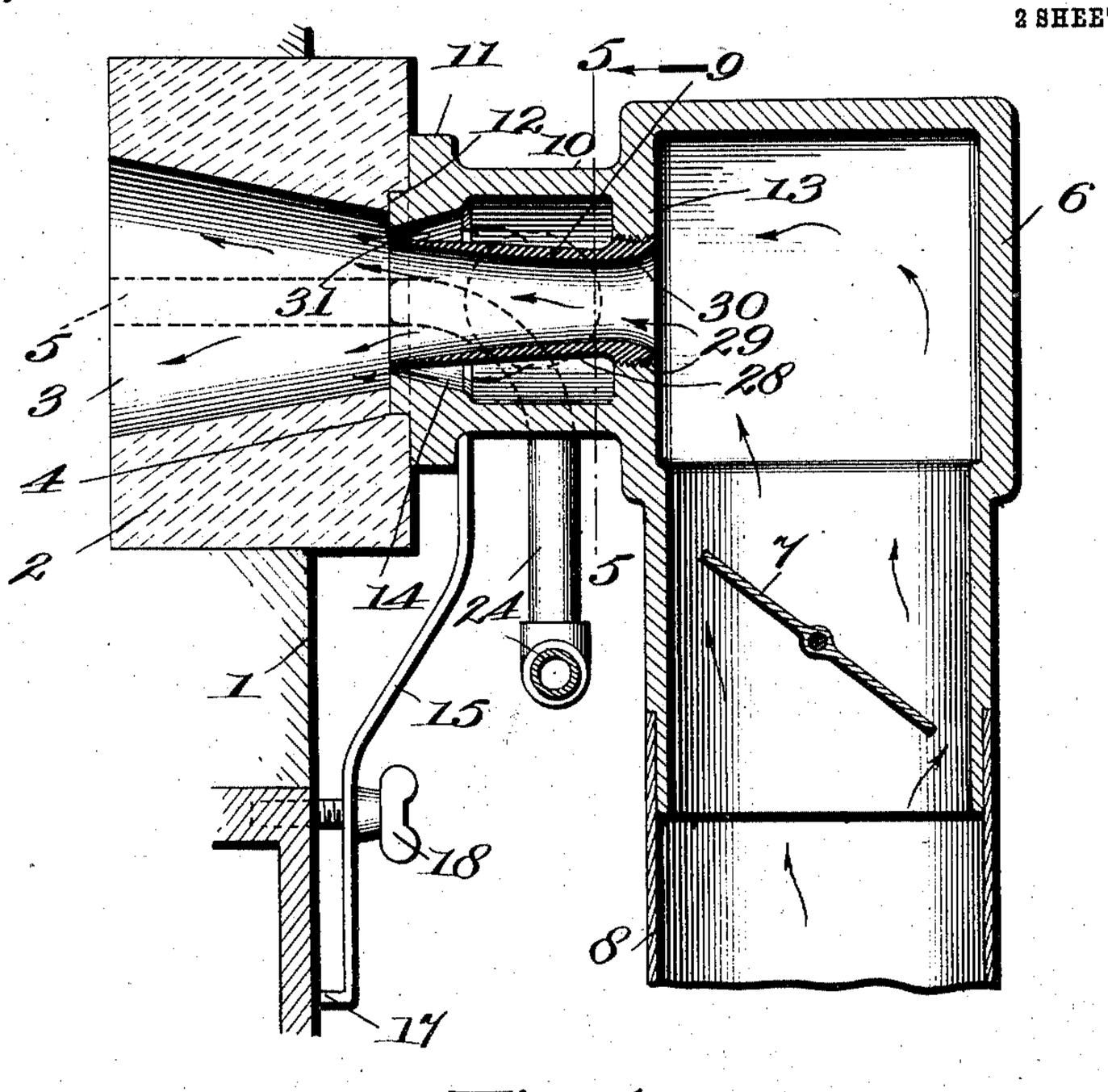


Fig. 5.

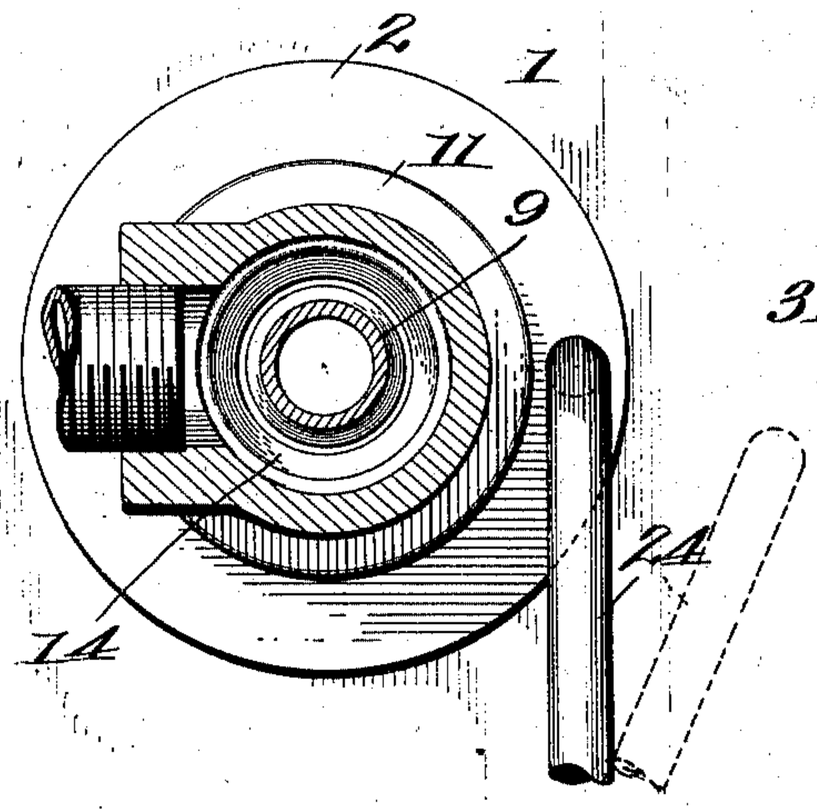
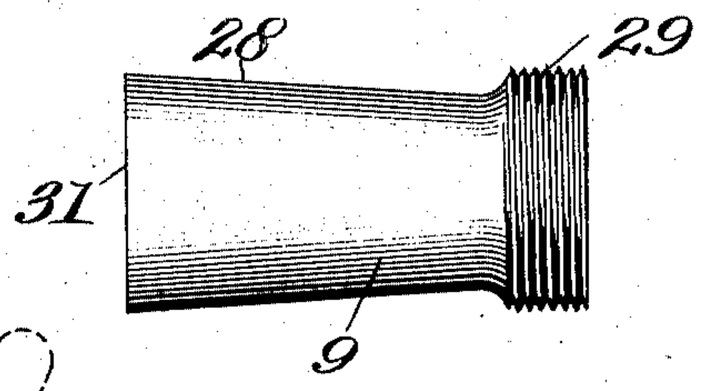


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

WILLIS W. CASE, OF DENVER, COLORADO, ASSIGNOR TO THE DENVER FIRE CLAY CO., OF DENVER, COLORADO, A CORPORATION OF COLORADO.

BURNER.

950,996. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed May 28, 1909. Serial No. 499,053.

To all whom it may concern:

Be it known that I, WILLIS W. CASE, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Burners; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in burners, more especially designed to be used in connection with assay furnaces, such as shown in my former patents Nos. 798,949 and 798,950, dated September 5, 1905, although it is not restricted to such use.

The object of my invention is to produce a non-smoking very hot flame with the use of a comparatively small quantity of gas and a very low air pressure, less than one ounce, and equal to about one inch water pressure.

With this object in view, my invention consists in the construction and combinations of parts as hereinafter described and claimed.

In the accompanying drawings—Figure 1 is an end view of my improved burner, the air supply pipe being broken off. Fig. 2 is a similar view, taken on an adjacent side, and showing the gas supply pipe in section. Fig. 3 is a perspective view of one of the supporting brackets. Fig. 4 is a longitudinal section of my improved burner, also showing in section a part of an assay furnace, showing the burner in position. Fig. 5 is a cross section, taken on the line 5—5 of Fig. 4, and Fig. 6 is a side elevation of the air delivery nozzle.

1 represents part of a wall to an assay furnace, or other furnace perforated to receive a block of fire clay 2. This block or boss 2 acts as an efficient protection to the part of the burner next the furnace and especially to the knife edge 31 of the nozzle 9, hereinafter described. This block is provided with an inwardly-flaring aperture 3, and has a portion of its face cut away to receive the end of the burner, as indicated at 4, and is also provided with a perforation 5, through which the gas from the pilot light is allowed to enter the furnace.

6 represents a casing preferably cast in cubical form, and hollow, in which is mounted a swinging valve 7, to vary the amount of air passing therethrough, and which is connected to an air pipe 8, which leads from a blower of any desired type driven by a small electrical motor of about one-twentieth of a horsepower, the blowing devices not being shown. The casing 6 is perforated on one side, the perforation being screw-threaded, and in this perforation is mounted the air delivery nozzle 9, shown in section in Fig. 4, and in side elevation in Fig. 6. On the same side of the casing 6 as the nozzle 9 and surrounding the same is provided an extension 10, preferably circular in form, having on its end an enlarged circular portion 11, cut away so as to form a small circular portion 12, which fits into the perforation in the face of the fire clay block 2. The extension 10 is hollow, as shown, and is separated from the part 6 by a partition 13, perforated for the reception of the air nozzle 9. The central part of the extension 10 is substantially cylindrical in shape, but in the parts 11 and 12 a beveled opening 14 is provided, the delivery part thereof being the smallest.

15 represents a bracket for holding the burner in position against the block 2. As shown in Fig. 3, the upper end is cut away, as shown at 16, to fit around the curved part 10, just outside the part 11, and at its lower end it is provided with a lip 17, fitting against the furnace stand, to which it is attached by a thumb screw 18.

Connected to the extension 10, and about centrally thereof, is a gas supply pipe 19, having therein a valve casing 20, in which is mounted a valve of any desired type, and provided on its top with a graduated scale 21.

22 represents the handle of the valve, which is located in the part 20, and the valve head is provided with a projection 23, which projects out over the scale 21, to indicate to the operator just how much gas is being used.

Connected to the valve casing is a smaller pilot gas pipe 24, provided with a cock, which is operated by the handle 25. The pipe 24 is made up of several fittings arranged at various angles, finally terminating in an end 26, which is adapted to be moved opposite the perforation 5 in the block 2, as indicated in Fig. 4. The parts of this pipe, where they are joined together, are so jointed that they can be moved in several different planes, so that the end 26 of the pilot pipe may be removed from the hole 5, so that the operator may look into the furnace and reg-

ulate the supply of air and gas, to produce a blue flame, the greatest amount of heat and perfect combustion, and so that, after the gas issuing from the end 26 has been ignited, the lighted flame may then be introduced a short distance into the opening 5, where it will be sucked through by the rush of air and gas passing through the flaring opening 3, thus igniting the mixed stream of air and gas inside the furnace.

27 represents the handle for operating the valve 7.

One very important feature of my invention is the air nozzle 9, and it was only after long experimentation that I was enabled to hit upon this exact form, which is a perfect success. On the outside, this part 9 is provided with a frusto-conical portion 28, terminating in an enlarged screw-threaded head 29, which engages the screw-threads in the opening of the partition 13, the parts being preferably so arranged that when the nozzle 9 is screwed home, as indicated in Fig. 4, the inner end will be just flush with the inner edge of the part 12, although this is not absolutely necessary.

The shape of the inside of the air nozzle 9 is very important. At the point 30, as shown in Fig. 4, and where it connects with the casing 6, the nozzle is gradually contracted inwardly, forming the well-known *vena contracta*, which has been established by long experiment and calculation to offer the least resistance to the flow of a fluid. The interior of the nozzle, which is in the extension 10, is flared outwardly, as shown in Fig. 4, but is not exactly in the form of a frustum of a cone, the passage in the nozzle expanding outwardly by a gentle curve greater than that of the frustum of a cone, the walls of this part of the nozzle being thickest near the head 30 and gradually diminishing in thickness to the delivery end 31, where it is reduced practically to a knife edge.

By making the delivery orifice of the part 10 tapered inwardly and by having the part 9 curved as shown, and terminating in a knife edge and connecting with a large air pipe, I find it possible to use a very small air pressure, which is a great desideratum in assay furnaces, and by this arrangement I am enabled to produce a very hot flame with perfect combustion. This is due to the fact that in applicant's burner a large volume of air under low pressure comes into close interior contact with a thin cylindrical film of gas without the mixing and swirling that results from the use of a thick-edged nozzle.

I am aware, of course, that it is old to provide burners using a mixture of air and gas, and I make no broad claim to such a burner, as my invention resides in the specific arrangement and dimensioning of parts.

I claim:—

1. In a burner, the combination of a hollow casing, an air pipe of comparatively large section connected therewith, said casing being provided with a hollow extension, the end of which is adapted to be placed in proximity to a furnace, a valved gas pipe entering said extension, and an air delivery nozzle connected to said casing and passing through said extension, said nozzle being conical on its outside and having on its interior a passage forming a *vena contracta*, said passage extending outwardly on a gentle curve, the walls of said nozzle being thickest at the head and diminishing gradually to a knife edge at the other end, whereby a comparatively large volume of air under low pressure is brought into contact with a thin cylindrical film of gas, substantially as described.

2. In a burner, the combination of a hollow casing, an air pipe connected therewith, said casing being provided with a hollow extension, the end of which is tapered inwardly and adapted to be placed in proximity to a furnace, a valved gas pipe entering said extension, and an air delivery nozzle connected to said casing and passing through said extension, said nozzle having a conical outside provided with a screw-threaded head, and having on its interior a passage forming a *vena contracta*, said passage expanding outwardly on a gentle curve, the walls of said nozzle being thickest at the head and diminishing gradually to a knife edge at the other end, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

WILLIS W. CASE.

Witnesses:

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FRANCIS S. MAGUIRE.