G. D. BRADSHAW.

GAS BURNER.

APPLICATION FILED FEB. 3, 1915.

1,149,622.

Patented Aug. 10, 1915.

Fig. 1.

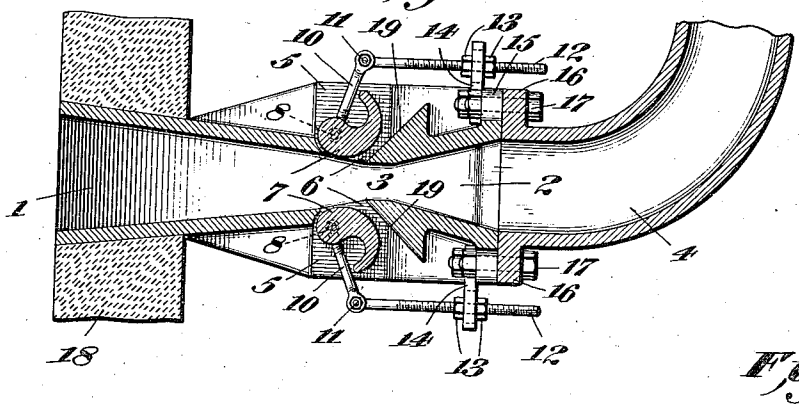


Fig. 2.

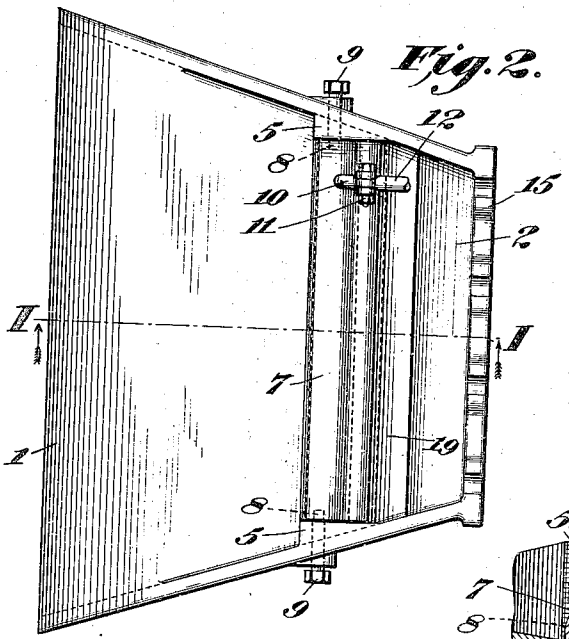


Fig. 3.

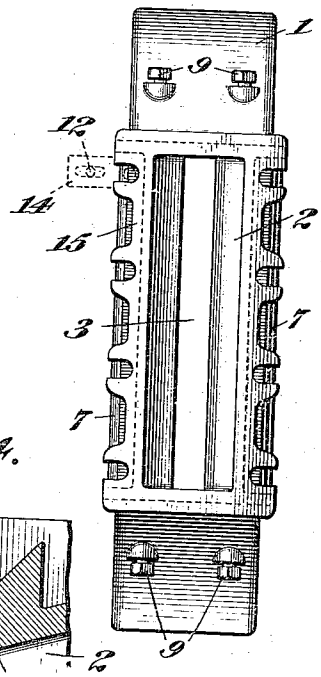
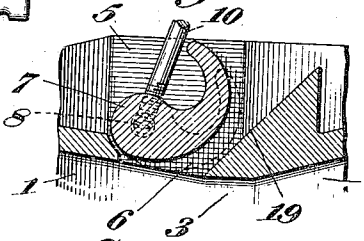


Fig. 4.



WITNESSES:

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GAS-BURNER.

1,149,622. Specification of Letters Patent. Patented Aug. 10, 1915.

Application filed February 3, 1915. Serial No. 5,894.

To all whom it may concern:

Be it known that I, GRANT D. BRADSHAW, a citizen of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, (whose post-office address is Johnstown, Pennsylvania,) have invented certain new and useful Improvements in Gas-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 a gas burner with special reference to the admixture and flow of air and gas in the same and is particularly adapted for use in connection with blast furnace gas and producer gas, although it may be used in connection with distilled coal gas or natural gas as may be readily understood.

My burner is of novel construction in that it is composed of pipes or a pipe forming a passage which is convergent from the supply pipe for a certain and predetermined distance and then becomes divergent, thereby first decreasing and then increasing its cross sectional area. At and near the junction of these two portions the burner may be of uniform cross sectional area for a short distance, although I do not confine myself to the construction including the portion of uniform section, but may combine the converging and diverging portions directly. At or near the junction of the converging and diverging portions are located openings in the pipe, to permit the introduction of air and the consequent mixing of the same with the gas to promote and insure the combustion thereof. I may also provide regulating dampers arranged to control the supply of air through the openings.

With an entrance gas pipe of substantial section connected to my apparatus, the total head will equal the static head plus the velocity head. At the outlet of my burner which ordinarily connects directly with the air or gases at substantially atmospheric pressure, the static head must of course be zero, or that of the atmosphere, while the total head, which depends, to a certain extent, on the velocity of the gases, will equal:

$$\frac{V^2}{2g}.$$

At the various points in the cross section of the pipe and gas burner with the slight variation due to the small amount of friction loss, the total heads at all cross sections must be equal.

As, in the narrower portions of the burner, the velocity of the gases is greater than in the wider portions; the velocity head in said narrow portions is greater, and as the total head remains the same, the static head in the narrow portions must be negative or less than atmospheric pressure. There is, therefore, a suction or partial vacuum at the narrow portion or throat, which partial vacuum is proportional to the square of the velocity of the gases. If the throat is opened to the air, due to the openings which I provide therein, the negative pressure will cause air to be drawn in at a velocity which is in direct proportion to the velocity of the gases within the burner. The regulation of the size of the air openings either by making them of sizes desired or by providing a damper in connection therewith, will provide a constant relation between the velocity of the gases and the air entering through said openings, which relation or ratio will be constant throughout a wide range of velocities so long as the static pressure at the outlet of the burner remains the same, namely: the atmospheric pressure when the burner is in its ordinary use.

In addition to increasing the sectional area of the burner in one direction, I may also increase its dimensions in both directions so that the issuing of the flame may be spread over the necessary area in order to contact with the boiler or other material to be heated.

It will thus be seen that a burner of this construction, when discharging a mixture of air and gas into a furnace or chamber of substantially constant pressure such as atmospheric pressure, the amount of air drawn in for any given size of air openings,

or for any given setting of the air dampers controlling said openings, will maintain a constant ratio to the quantity of gas, irrespective of any variation of this gas quantity. By this means I produce a burner of high efficiency and one in which the mixture of air and gas is automatically regulated so that the combustion is as nearly perfect at all times as is possible.

Having thus given a general description of my invention, I will now refer to the annexed sheet of drawings which form part of this specification and in which like characters and figures refer to like parts.

Figure 1 is a vertical longitudinal sectional elevation of a form of my burner adapted for use in a boiler or other furnace, also showing an inlet gas pipe connected therewith, this view being taken on the line I—I of Fig. 2. Fig. 2 is a plan view of my burner with the inlet gas pipe removed. Fig. 3 is an end elevation of the burner shown in Fig. 2. Fig. 4 is a longitudinal cross section on an enlarged scale through the throat of the burner, the air openings and the damper controlling the same.

Referring now to the characters of reference on the drawings: 1 represents the outlet portion of my burner which is shown as increasing in dimensions and cross section from the narrower or throat portion thereof, this being the diverging portion of my burner.

2 is the converging portion of my burner connected at its larger end with the gas supply pipe and with a throat or narrowing 3 at or near the point where it joins with the part 1. The gas supply pipe is indicated as 4, while 5 are bosses or enlargements on the burner adjacent to the ends of the controlling valves or dampers 7.

The air openings are indicated as 6, while the air dampers 7 are mounted on the pivots 8 and are adapted to be rotated around the same; 9 are the set screws around the pivot ends 8 of which the air valves are adapted to be rotated when desired.

10 are I-bolts secured to the dampers and provided with connecting bolts 11 by which they are pivotally secured to the I-bolts 12 which latter I-bolts are provided with adjusting nuts 13, as shown.

Brackets 14 are secured to the stationary flanges 15 of my burner as shown, by means of the bolts 17. The flange of the gas supply pipe is indicated at 16, and the brick wall of the boiler or other furnace at 18.

19 represent projections formed on the exterior of the portion 2 having inclined surfaces as shown, extending to the air openings, said projections 19 thereby serving as seats for the air valves 7, or when the valves are open, the portions 19 form one side of the entering air passages the other sides being formed by the valves 7 as illustrated.

The operation of my gas burner is as follows: Gas is supplied thereto through the gas supply pipe 4, enters into the larger end of the converging portion of the burner 2 and as it passes therethrough its velocity is increased. It then passes by the air holes 6 where, by reason of the fact that the static head at the air opening 6 is less than zero, or a partial vacuum, the air is drawn through the air openings 6, mixed with the gas and is discharged through the divergent portions of the burner, either burning or in a condition to burn.

The air valves, or dampers 7, are shown as of spiral outline so as to give an easy entrance or curved passage for the air which passes into the air openings 6, and these dampers may be regulated to give a greater or less opening, as desired, by means of the bolt 12, the adjusting nuts 13 and their connections.

Although I have shown and described my improvements in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention or as pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A gas burner having a converging entrance passage, an outlet passage continuously diverging therefrom to the outlet port, and air openings at or near the junction of the converging and diverging passages.

2. A gas burner comprising a converging inlet passage, an outlet passage continuously diverging to the outlet port, air openings near the junction of said passages and means for controlling the size of said air openings.

3. A gas burner having a converging entering passage, an outlet passage continuously diverging to the outlet port, air openings near the junction of said passages, valve seats adjacent to said openings and valves adapted to coöperate with said seats to regulate the size of said openings.

4. A gas burner having a converging inlet portion, a diverging outlet portion, air openings in and adjacent to the smaller cross section of said burner, valves of spiral cross section adapted to regulate said air openings and means for adjusting the same.

5. A gas burner having a converging entrance portion, a diverging outlet portion connected therewith, air openings adjacent to the smaller cross section of said burner, pivoted regulating valves adjacent to said

air openings, bolt connections secured to said valves, and adjusting nuts on said bolts adapted to lock the same in a predetermined position to a stationary portion of the construction.

6. A gas burner the cross section of which decreases from the inlet, then continuously increases to the outlet port, air openings in said burner adjacent to the smaller cross section thereof near the junction of said decreasing and increasing passages, rotatable valves adapted to regulate the size of said air openings and means whereby said valves may be rotated as desired and fixed in predetermined position.

7. A gas burner, the cross section of which decreases from the inlet, then continuously increases to the outlet port, air openings in said burner adjacent to the smaller cross section thereof, near the junction of said decreasing and increasing passages; dampers adjacent to said air openings and means for regulating said dampers and for holding them in predetermined position whereby the size of the openings may be adjusted.

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

GRANT D. BRADSHAW.

Witnesses:
ELMER SEAVEY,
OLIVER B. HICKOX.