

G. S. BARROWS.
GAS BURNER.
APPLICATION FILED SEPT. 27, 1917.

1,290,878.

Patented Jan. 14, 1919.

Fig. 1.

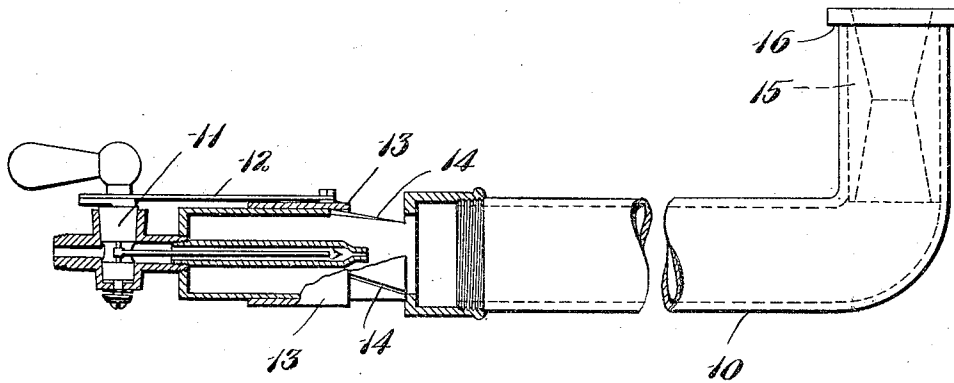


Fig. 2.

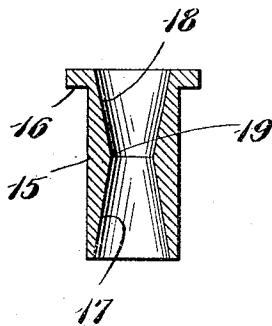
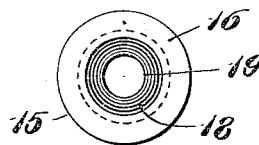


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE S. BARROWS, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO GENERAL FIRE EXTINGUISHER COMPANY, OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF NEW YORK.

GAS-BURNER.

1,290,878.

Specification of Letters Patent.

Patented Jan. 14, 1919.

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To all whom it may concern:

Be it known that I, GEORGE S. BARROWS, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Gas-Burners, of which the following is a specification.

This invention relates to improvements in gas burners. More particularly it relates to means for producing an economical flame, and for permitting reduction of the size of flame, and rate of burning gas, with safety from the danger of "flash back" which with certain kinds of economical burners becomes greater owing to increased proportion of air as the flow of gas is reduced. It is particularly useful in connection with installations where economy is deemed important and where automatic regulating appliances are provided for the mixture when the flame is low. Incidentally it relates to those types of burners in which a part of the air required for combustion, known as "primary air," is mixed with the gas at some point in the pipe or chamber before the place of combustion is reached. It is often desirable to take as much as is practicable of the total quantity of air as primary air. The proportion that can be safely taken is limited, for the rapidity of combustion of the gas may be greater than the rate of flow of the gas and primary air toward the burner, and when this condition occurs the flame will reach back from the burner into the mixing tube to the point where gas and air are first mixed. This phenomenon is known as a "flash-back" and is most liable to occur when the gas is flowing slowly to the burner. The invention relates to means for providing a burner large enough and of suitable shape to be free from the risk of being stopped with dust or other foreign matter, and still not so large as to permit the flame to flash back, and particularly to attain these objects with the added possibility of safely turning the flame down low. Burners having truncated conical surfaces for the form of the burner orifice are already known and operate with certain advantages. It has been found however, that in such cases the flame is not subject to definite control as to the shape which it takes, and that irregularities

which cannot be foretold develop in the shape of such flame as more or less gas mixture flows to the burner. The flame may set in one direction when the gas pressure is high or when the gas is fully turned on, and set in another direction when the pressure becomes lower, or the gas is turned down. Incidentally it appears that eddy currents are present which tend to prevent homogeneity of the mixture, and which as a result render the combustion less efficient for heating or cooking purposes, *i. e.* less heat is produced per unit of gas used, and more carbon may be deposited on adjacent surfaces, as on utensils being heated.

The invention consists in the extremely simple device of smoothing the interior cone of the tip of the burner. This cone referred to is the surface along the interior approach to the point of maximum contraction in the discharge passage and is a little way back in the passage from the flame and the place where the secondary air first has access to the mixture of gas and primary air. Hitherto burners of the shape described have been made as castings with a surface made by a core in the mold. The invention consists further in making this part of the burner in two pieces, both of which may be of the same kind of metal, the one fitting removably into the other, and arranging the conical approach to the point of maximum contraction in the removable piece. By this device the said approaching portion of the passage can be gotten at to be machined to a smooth condition. The construction of such a burner tip with a burner having automatic means to regulate the inflow of primary air according to the quantity of gas admitted has especial utility. In the accompanying drawings, which show an embodiment of the invention:

Figure 1 is a side elevation of a burner,

Fig. 2 is a vertical section through the middle of the improved tip.

Fig. 3 is a plan of the same.

Referring to the drawings,—10 represents the body portion of a burner being a pipe whose interior is the chamber in which the gas and primary air are mixed. Said gas enters through a cock 11 which is suitably connected, as by a rod, 12, with a sliding

gate 13 that moves over the opening 14 through which the primary air enters. Thus the air opening is varied in size somewhat according to the rate of gas flow. The burner has a detachable tip 15 whose outer wall preferably cylindrical is adapted to be inserted into the end of a pipe or chamber which conducts the gas mixture instead of being integral therewith as has hitherto been customary. At 16 a flange is provided to form the face of the tip and to serve on its under side as a seat for the tip in the burner body. The interior face of the wall of the tip is formed of two truncated cylindrical surfaces 17 and 18 converging respectively toward each other from the top and bottom of the tip and thereby forming a comparatively restricted opening at the point of intersection, as indicated at 19. These interior surfaces are machined smooth so as to present an even surface to the passage of gas. Heretofore the interior of the end portion of the burner, below the point 19 has been left unfinished. The development of the present invention has shown that the slight roughness inhering in such a surface as is made by the process of casting has been sufficient to interfere with the free and even flow of mixture to the point of combustion. It appears from the results that it is the eddy currents set up in the mixture by flowing over this wall at some distance from the flame which causes the mixture, when it reaches the free air outside, to be deflected from its proper direction so that, in previous constructions it issues at the mouth of the burner in an irregular manner. As a result the flame from a burner so arranged is irregular, and particularly, it is not concentric with the mouth of the burner. The irregular issue of the gas and air mixture results in an unequal mixture with the secondary air at different parts of the flame so that at certain points of the flame there is insufficient air to support good combustion, fuel is wasted and carbon may be deposited. This former practice is both uneconomical and dirty. The present invention eliminates this unnecessary waste of fuel and provides a clean flame.

The object of the constricted opening 19 is to confine the gas mixture into a small and rapid stream at that point. The flash-back is not as liable to take place because the velocity of the mixture toward the flame is higher than elsewhere on the tube. When the gas is turned down the flame will reach back into the burner until it stops at a point where the velocity of the gas mixture is greater than the rate of flame propagation. This constricted opening is made as small as practical to prevent flash-back and yet not cut down the delivery of gas below the maximum amount which the burner is designed

to consume. The smallness of the area has rendered impossible the smoothing of the interior conical surface, hitherto, even if it had been known that its smoothing produces the improved results stated. By making the tip of the burner in two pieces, one of them separable from the other, the smoothing of the interior becomes possible.

When a burner is provided with a device, such as that illustrated, by which the inflow of primary air is cut down when the inflow of gas is reduced, the velocity of flow of mixture at the constricted opening 19 is further reduced by the reduced quantity of passing air. The balance of relations is so close that the elimination of eddy currents resulting from the invention makes a sufficient difference in the gas and air mixture at and just before the flame that a "flash-back" is prevented under conditions of mixture and small magnitudes of flow which formerly permitted it.

I claim as my invention:

1. A burner comprising a mixing chamber, with means for inlet of gas and of primary air; and with a combustion orifice which is too large for the running back of the flame through it in to the chamber to be prevented under working conditions by the mere proximity of its heat-abstracting metal walls; and means tending to prevent such running back, comprising the provision of a high degree of superficial smoothness on its walls approaching the orifice, whereby the resulting flow of the mixture adjacent keeps the flame out.

2. A burner comprising a mixing chamber, with means for inlet of gas and of primary air; and with a combustion orifice which is too large for the running back of the flame through it into the chamber to be prevented under working conditions by the mere proximity of its heat-abstracting metal walls; the said orifice being formed in cast metal whose walls approaching the orifice are polished, whereby the said running back is prevented.

3. A burner, having inlets for gas and for primary air; a regulating controller therefor whereby the said inlets open and close together, thereby materially reducing the rate of flow of mixture when the gas supply is reduced; a mixing chamber extending from them and having a discharge orifice which is too large to prevent running back of flame into the chamber at normal reduced rates of flow; and means to prevent such running back comprising the provision of a smooth surface on the walls of the chamber approaching the place of smallest cross section near the orifice, whereby the flow of mixture passing through the said place of smallest cross section is rendered uniform.

4. A burner, comprising a cast metal mixing chamber having means for inlet of gas

and of primary air combined with a short
tube separate from the material of the cham-
ber, set into it, and constituting its discharge
orifice; said discharge orifice being of circu-
lar cross section adapted to pass the whole
5 of the mixture, too large to prevent flash-
back by abstraction of heat through its walls,
and having a constricted portion and walls
converging thereto with smooth surface in
the direction of flow whereby the flow of the 10
mixture keeps the flame out.

Signed by me at Boston, Massachusetts,
this 25th day of September, 1917.

GEORGE S. BARROWS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."