E. BIRKHOLZ.

GAS BURNER.

APPLICATION FILED SEPT. 21, 1914.

1,165,835. Patented Dec. 28, 1915.

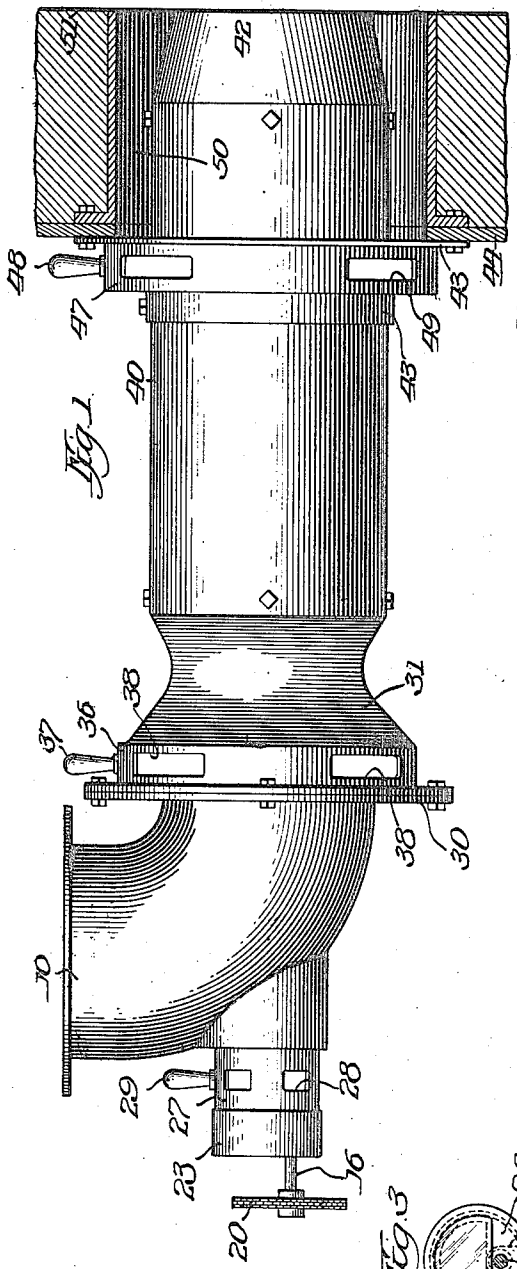


Fig. 1.

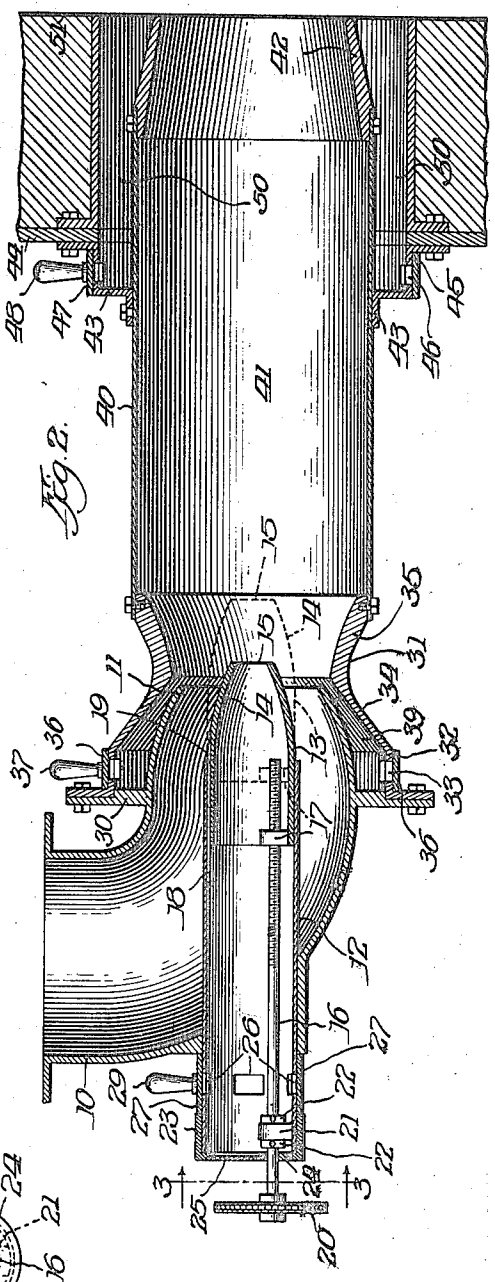


Fig. 2.

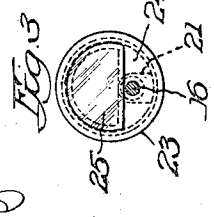


Fig. 3.

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UNITED STATES PATENT OFFICE.

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GAS-BURNER.

1,165,835. Specification of Letters Patent. Patented Dec. 28, 1915.

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To all whom it may concern:

Be it known that I, ERNEST BIRKHOLZ, a subject of the Emperor of Germany, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Burners, of which the following is a specification.

My invention relates to gas burners, and refers particularly, although not exclusively, to burners of relatively large size for use in connection with the burning of blast furnace gas, producer gas, coke oven gas, and the like.

My burner is particularly useful in connection with the heating of blast furnace stoves, boilers, foundry ladles, crucibles, and for other purposes where a relatively large amount of heat is required.

I have tested many styles of gas burners which have heretofore been used for the purposes which I have enumerated above, but a great disadvantage residing in such burners has been that owing to their construction an intimate mixture of gas and air in proper proportions has not taken place prior to the actual burning of the gas. The result of this improper and only partial mixture of gas and air has been that the combustion of the gas has been relatively slow, causing a long flame with comparatively low temperature.

It is the object of my invention to provide a burner in which the air and gas are intimately mixed with each other before reaching the zone of combustion, while at the same time the relative proportions of gas and air are accurately controlled to give the desired results.

My burner, built according to the principles which will be described more in detail hereafter, by reason of the intimate mixture of gas and air in proper proportions causes a quick combustion with a short flame of intense heat. When used in connection with a boiler, for example, this rapid combustion also results in complete combustion, since if the combustion is not rapid the gas and air become rapidly cooled when brought into contact with the boiler tubes, and the gas is no longer capable of being completely oxidized.

I have found that by the use of my improved burner coal dust and the like which may be mixed with the gas are completely burned, since the zone of combustion does not reach the boiler tubes and a deposit of dust on the latter is prevented. By actual experiments I have demonstrated that as high as 88% of the heat units in the gas is communicated to the water in a boiler, whereas by the use of many other types of burners which I have tested not higher than 50 to 55% of the heat units in the gas is thus utilized.

A further object of my invention is to so construct the burner that the combustion of the gas may be readily observed at all times.

These and other advantages of my invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 represents a side elevation of my burner as applied to a boiler (the wall of the latter being shown in section); Fig. 2 is a vertical longitudinal section of the burner shown in Fig. 1; and Fig. 3 is a fragmentary section and end elevation on the line 3—3 of Fig. 2.

The gas inlet pipe 10 is preferably bent, and at its inner end 11 is of constricted sectional area in order to form a throttle. The air tube 12 enters the gas tube 10 through a wall thereof at substantially a right-angle to the plane of the inner end 11 and terminates at its inner end near the throttled end 11 of the gas tube 10. The air tube 12 has at its inner end the gas valve 13, which fits snugly within the air tube 12 and has an inner end 14 of gradually decreasing diameter, this end 14 being provided with the air inlet opening 15. The gas valve 13 has threaded engagement with the regulating rod 16 by means of the lug 17. The air tube 12 is provided with the keyway 18, which engages the groove 19 in the gas valve 13.

The adjusting rod 16 has the wheel 20 at its outer end, and is supported by the bearing lug 21 formed integral with the air tube 12. The collars 22 are anchored to the regulating rod 16 on each side of the bearing lug 21. It will be evident that on rotation of the adjusting rod 16 the gas valve 13 is moved inwardly or outwardly, as the case may be, and is thus readily adjusted to a desired position. I prefer to make the wheel 20 in the form of a sprocket wheel so that a number of such sprocket wheels of a plurality of burners may be connected by a chain and operated simultaneously if desired. As the gas valve 13 is moved in-

wardly (for example, to the position indicated in dotted lines in Fig. 2), the flow of gas through the throttled end 11 of the gas tube 10 is decreased, whereas if the gas valve 13 is moved outwardly the flow of such gas is increased. The outer end of the air tube 12 is closed by the cap 23, through an aperture of which the adjusting rod 16 passes. The end wall 24 of the cap 23 contains the window 25, of glass or similar transparent material, through which an operator may watch the entire operation of the burner. This is a point of great advantage.

Toward its outer end the air tube 12 is provided with the apertures 26. Encircling this portion of the air tube 12 is the ring valve 27 having therein the apertures 28 which may be brought in register with the apertures 26 by turning the valve 27 by means of the handle 29. The amount of primary air admitted to the air tube 12 may thus be readily regulated by the ring valve 27.

Fastened to the flange 30 of the gas tube 10 is a casting, indicated as a whole by 31, this casting comprising three portions: first, the air inlet portion 32, which is provided with apertures 33; second, the converging portion 34; and, third, the diverging portion 35. The diverging portion 35 is preferably of the same length as the end portion 14 of the gas valve 13 and has a curved inner surface, for reasons that will be explained hereafter. Exterior to the air inlet portion 32 of the casting 31 is the ring valve 36 having the handle 37, this ring valve 36 having apertures 38 which may be brought into register with the apertures 33 of the gas inlet portion 32 of the casting 31. It will be evident that by rotation of the ring valve 36 the amount of air passing through the apertures 38 and 33 into the air passage 39 located between the outer surface of the gas tube 10 and the inner surface of the portions 32 and 34 of the casting 31 may be accurately regulated.

In constructing my burner the throttled end 11 of the gas inlet tube 10 is located slightly exterior to the point of junction between the portions 34 and 35 of the casting 31. Attached to the exterior surface of the inner end of the portion 35 of the casting 31 is the metal inclosing wall 40, within which is thereby formed a mixing chamber 41 continuous with the interior of the diverging portion 35 of the casting 31. Fitted to the inner end of the inclosing wall 40 is the slightly converging combustion nozzle 42. The circular support 43 is fastened to the wall 40 and to the wall 44 of a boiler or the like, and is provided with an air inlet portion 45 spaced outwardly from the wall 40 of the mixing chamber 41, and has therein a series of apertures 46 controlled by the ring valve 47 having the handle 48 and provided with apertures 49. An annular air passage 50 is provided around the inner end of the mixing chamber 41 and the combustion nozzle 42, this air passage extending from the support 43 to the inner end of the combustion nozzle 42, which is preferably located in the same plane with the inner surface 51 of the wall of the boiler or the like with which the burner is designed to be used.

Having thus described the construction of my improved burner, the operation of the same may now be readily understood: From a suitable source of supply gas enters the outer end of the gas inlet tube 10 and thence passes through the throttled end 11 of said tube into the mixing chamber 41. On account of the fact that the thermal units in gas vary according to the pressure, temperature and analysis of said gas, it is necessary in order to obtain the desired heat units on combustion that the amount of gas admitted to the mixing chamber for subsequent combustion should be varied correspondingly, and this result is accomplished by suitable adjustment of the gas valve 13 (effected by rotating the wheel 20), so that the amount of gas thus admitted may be increased or decreased, as desired. As the gas passes through the throttled end 11 of the gas inlet tube 10 and then past the inner end of the gas valve 13, air is drawn through the air tube 12 and through the aperture 15 in the end of the gas valve 13. On account of the shape of the throttled end of the gas inlet tube 11 and of the inner end of the gas valve 13 the gas is first directed toward the central axis of the mixing chamber 41, and then, on account of the fact that this mixing chamber is of greater diameter than the diameter of the throttled end 11 of the gas inlet pipe 10, the gas expands and tends to go toward the wall 40 of the mixing chamber. In order that this latter action may not be interrupted, the inner surface of the diverging portion 35 of the casting 31 is preferably in the shape of a gradual curve. The air, being introduced into the central portion of the gas, intimately mixes therewith. If the proportion of primary air thus introduced through the air tube 12 is not correct owing to varying conditions, the air may be increased or decreased by regulation of the ring valve 27. As the amount of gas admitted to the mixing chamber 41 is decreased by moving the gas valve 13 inwardly, the amount of air drawn through the air tube 12 is automatically decreased on account of the fact that the inner end of the gas valve 13 has been moved into a plane in which the diameter of the diverging portion 35 of the casting 31 has increased, thereby decreasing the velocity of the gas passing the opening 15 of the gas valve 13. In order to keep the proportion of gas and

air constant, I preferably construct the converging portion 14 of the gas valve 13 of the same length as the diverging portion 35 of the casting 31 and the portion 14 decreases in diameter at substantially the same rate that the portion 35 increases. Additional primary air is introduced through the apertures 33 and 38, the amount of such air being regulated by the position of the ring valve 36. This additional primary air after passing through the apertures just mentioned passes through the annular air passage 39, and being directed toward the central axis of the mixing chamber 41 it becomes intimately mixed with the gas, which, as pointed out above, is first directed toward the central axis of the mixing chamber, and then on expanding tends to move toward the wall 40 of the mixing chamber. By thus introducing a portion of the primary air into the central portion of the gas through the air tube 12 and the gas valve 13 and the balance of the primary air through the annular air passage 39 around the periphery of the gas inlet tube, it will be evident that a very thorough mixture of gas and air takes place. This mixed gas and air during their passage through the mixing chamber 41 become completely mixed with each other, and this mixture finally passes out to the combustion chamber through the restricted combustion nozzle 42. The object of restricting the combustion nozzle 42 is to slightly increase the velocity of the mixture of gas and air so that backfire may be effectually prevented.

Secondary air is introduced around the combustion nozzle 42 by proper regulation of the ring valve 47, this secondary air being first introduced through the apertures 46 and 49. This secondary air is for the purpose of supplying sufficient air to render the combustion complete. On account of the fact that the primary air is drawn into the burner entirely by the suction effect of the gas, it will be evident that the amount of primary air is necessarily limited on account of the fact that the more air thus introduced the slower will be the expulsion of the gas and air mixture from the combustion nozzle, with the consequent greater danger of firing back. A second objection to the introduction of too much primary air with the gas is that the mixture is thus rendered more inflammable, with consequent increased danger of firing back. By introducing the requisite amount of air to insure complete combustion in the form of secondary air, in the manner which I have described, all danger of firing back is avoided, while at the same time rapid and complete combustion results.

It will be apparent to those skilled in the art that many changes could be made in the detailed construction of the various parts which I have described without departing from the spirit or scope of my invention, as defined in the appended claims.

What I claim is:

1. In a gas burner, the combination of a gas tube, an air tube projecting into said gas tube, a window in the outer end of said air tube, and a ring valve encircling said air tube exterior to said gas tube for controlling the amount of air admitted to said air tube.

2. In a gas burner, the combination of a gas tube having a constricted inner end, an air tube passing into said gas tube and having its outer end projecting therefrom, a ring valve for controlling the amount of air admitted to said air tube, a window in the outer end of said air tube, an annular air passage around the constricted end of said gas tube, a ring valve for controlling the entrance of air into said air passage, and a mixing chamber communicating with said gas and air tubes and with said annular air passage.

3. In a gas burner, the combination of a curved gas tube, an air tube projecting into said gas tube at substantially a right-angle to the plane of the inner end of said gas tube, means for controlling the entrance of air into said air tube, a valve-controlled annular air passage around the inner end of said gas tube, a mixing chamber communicating with said gas and air tubes and with said annular passage, and a valve-controlled passage around the periphery of the inner portion of said mixing chamber.

4. In a gas burner, the combination of a gas tube, an air tube passing into said gas tube and having its outer end projecting therefrom, a ring valve for controlling the amount of air admitted to said air tube, a window in the outer end of said air tube, an annular air passage around the inner end of said gas tube, and a valve for controlling the entrance of air into said air passage.

5. In a gas burner, the combination of a gas tube having a converging inner end, an air tube projecting into said gas tube, a casing having its interior communicating with said gas tube and having a portion of gradually increasing diameter extending from substantially the plane of the inner end of said gas tube, and an annular passage for introducing additional air into said casing at its portion of minimum diameter.

6. In a gas burner, the combination of a gas tube having a converging inner end, an air tube projecting into said gas tube, an open-ended tube valve carried by the inner end of said air tube at the inner end of said gas tube, and means for actuating said valve, whereby the amount of gas passing through said gas tube may be regulated.

7. In a gas burner, the combination of a gas tube having a converging inner end, an air tube projecting into said gas tube, an open-ended tube valve carried by the inner

end of said air tube at the inner end of said gas tube, means for actuating said valve, whereby the amount of gas passing through said gas tube may be regulated, and a diverging casing having its interior communicating with said gas tube and its portion of minimum diameter substantially in the plane of the inner end of said gas tube.

In witness whereof, I hereunto subscribe my name this 17th day of September, A. D., 1914.

ERNEST BIRKHOLZ.

Witnesses:
HENRY M. HUXLEY,
L. E. HANNEN.