June 22, 1926. 1,589,735

F. A. BAYNES

MIXER

Filed April 5, 1919

Fig. 1.

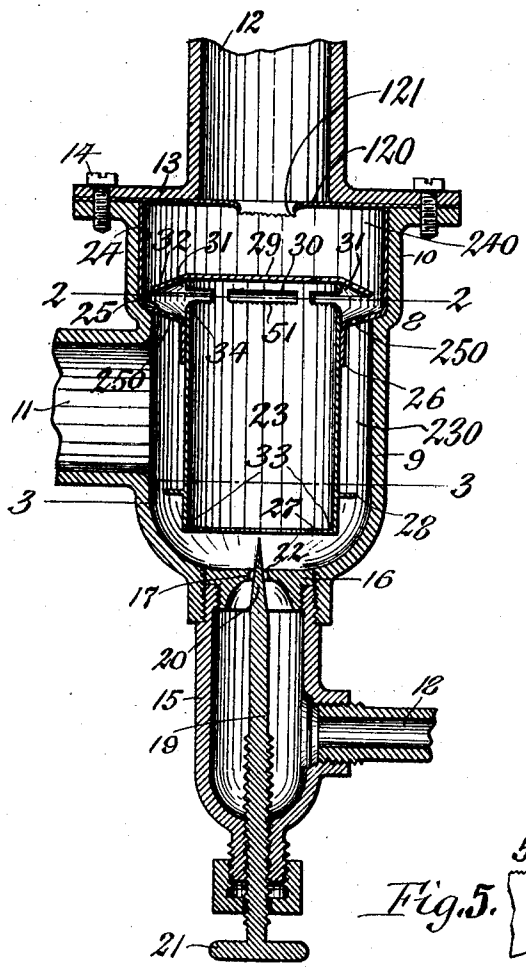


Fig. 2.

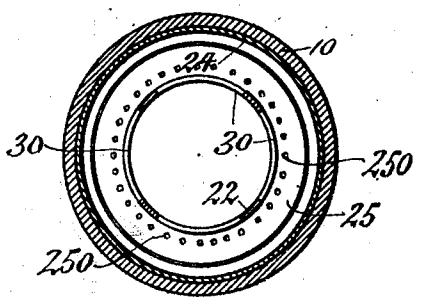
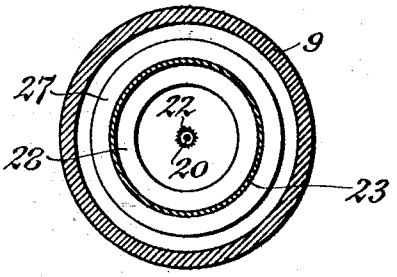


Fig. 3.



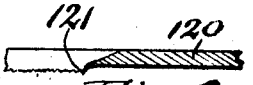
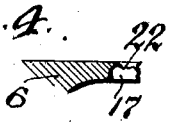


Fig. 6.

Fig. 5.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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MIXER.

Application filed April 5, 1919. Serial No. 287,770.

This invention relates to a mixer for preparing fuel oils and gas for intensified and concentrated combustion.

It is the object of this invention to provide a mixer for producing an improved combustible mixture readily and economically and of uniform quality and efficiency.

In the accompanying drawings:

Figure 1 is a vertical section of one form of mixer in which the fluid is drawn by suction through the apparatus and which is suitable for producing a gaseous mixture intended more particularly for power purposes. Figures 2 and 3 are horizontal sections taken on the correspondingly-numbered lines in Fig. 1. Figures 4, 5, and 6 are fragmentary enlarged views showing the outlet edges of the valve, the mixing tube and expansion chamber exaggerated.

Similar characters of reference indicate corresponding parts throughout the several views.

Referring to the construction shown in Figs. 1-3 the numeral 8 represents the hollow or tubular body of a mixer the lower part 9 of which is of camparatively small diameter while the upper part 10 thereof is of relatively large diameter. Into the side of the small lower part of this body an air inlet pipe or conduit 11 leads from any suitable source and into the lower end of this body a combustible fuel or fluid is supplied by means of a valve which may be of any suitable construction. From the top of this body the mixture of air and gas is carried off to the place of consumption by means of a delivery conduit 12 which connects with a head 13 secured to the upper or outlet end of the body by means of screws 14 as shown in Fig. 1, or by any other suitable means.

The valve for controlling the supply of gas or fuel to the lower end of the mixer body may be variously constructed but that which is shown in the drawings, as an example of one suitable for this purpose, comprises a hollow valve body 15 which is connected by means of a screw joint at its upper end with the lower end of the mixer body, a head or disk 16 secured by a screw joint into the upper end of the valve body and provided centrally with a gas exit or port 17 which is arranged axially in line with the mixer body, a gas supply pipe 18 opening into the side of the valve body, a valve stem or spindle 19 arranged lengthwise in the valve body and provided at its upper end with an upwardly-tapering needle-valve 20 which is movable axially relatively to the gas port while its lower part is connected by a screw joint with the valve body and its lower end is provided with a handle 21 Upon turning the valve stem in one direction or the other, its needle valve is projected more or less into the gas part 17 and thereby regulates the amount of gas which is to be supplied to the mixer body to form a combustible mixture with the air entering through the air supply pipe 11.

The gas port 17 is preferably so constructed that its wall is parallel or nearly so relative to the axis of this port and the tapering needle valve 20 is adapted to be moved into engagement with the lower edge of this port or to be moved more or less away from the same for either stopping or regulating the flow of gas through this port. This valve however at no time comes in contact with the upper corner of this port, which edge is preferably so constructed that it is sharp or keen, and of jagged or wire edge form, as shown at 22 in Figs. 1, 3 and 4, and extending slightly into the gas column so that this edge produces a scraping or combing effect on the gas, thereby putting the gas in the best condition for thoroughly mixing the same uniformly and intimately with air.

The means which are arranged within the mixer body for producing a thoroughly intimate and uniform mixture of the air and gas may be varied as to details of construction, but as shown in Figs. 1, 2 and 3, the same are preferably organized as follows:

23 represents a mixing tube or mixing chamber which is preferably of tubular form and arranged lengthwise within the lower small part of the mixer body, this tube being of smaller diameter than the adjacent part of the mixer body and also terminating short of the lower end of this body, so as to form an intervening space 230 between the mixing tube and this body.

24 represents the wall of an upper expansion or spreading chamber 240 which is of larger diameter or cross sectional area than the mixing tube and which fits against the bore of the upper enlarged part 10 of

the mixer body, so that the upper end of this chamber opens into the outlet of the mixer. At its lower end the cylindrical wall of the expansion chamber is provided with an inwardly-projecting bottom 25 which is provided with a downwardly-projecting sleeve or neck 26 engaging with the periphery of the mixing tube 23 at a distance from the upper end of the latter. The lower end of this tube is open and provided with an inwardly-projecting annular flange 27, and on its periphery adjacent to its lower end this tube is provided with an external annular flange 28 which is arranged between the air inlet 11 and the lower end of the mixing tube. At its upper end this tube is closed by a head 29 and between its upper end and the bottom of the expansion or spreading chamber wall this tube is provided with a mixture outlet port which is preferably constructed in the form of a plurality of slots 30 arranged in an annular row, as shown in Figs. 1 and 2. Projecting laterally from the upper end of the mixing tube toward the wall 24 of the expansion chamber is an annular upwardly-tapering or conical flange 32 which together with the adjacent uppermost part of this tube forms an annular pocket 31 surounding the mixture outlet of this tube.

As the gas issues from the orifice 17 of the valve chamber in the form of a jet it enters the mixing tube and at the same time the air passes from the air inlet 11 downwardly through the lower small part of the mixer body, and thence upwardly into the mixing tube wherein the same becomes entrained in the gas jet. As the air descends in the lower part of the mixer body the same passes around the lower external flange of the mixing tube whereby the same is distributed uniformly and evenly in all directions around the lower inlet end of the mixing tube so that when the air enters the mixing tube the uniform mingling of the same with the gas therein is promoted.

As the body of air and gaseous fuel or vapor enters the lower end of the mixing tube, the same is constricted by reason of the lower internal flange 27 of the mixing tube, but after the air and fuel have passed this internal flange, the same expands suddenly upon entering the mixing tube, which is of larger diameter than the opening formed within this flange. The intermingling of the air and fuel is promoted by reason of the pocket 33 which is formed in the lower inner corner of the mixing tube, which pocket tends to stretch the mixture by reason of the pulling or vacuum effect which this pocket produces so as to separate the gas particles and allow air to fill the voids between them. By constricting the lower end of the mixing tube by means of the internal flange 27 the gas and air are prevented from coming immediately into contact with the bore of the mixing tube, and thereby reducing the wall friction so that a reduced resistance is offered to the velocity of the air and fuel as the same passes through the mixing tube but instead permits such passage to occur with greater velocity on account of its lack of wall friction depending upon the suction to which the air and gas are subjected while producing the combustible mixture. The mixture is then drawn by the suction of the apparatus in all directions on radiating lines from the center of the mixing tube through the outlet slot 30, tending to form a vacuum in the upper and central parts of the mixing tube, said vacuum being nearly equal in suction to that which is exerted to form it, and thus operates to retard the flow of the mixture. The lower edge of each opening or slot 30 is preferably made sharp but jagged or saw toothed, as shown in Figs. 1 and 5 which causes the stream of gas when drawn over the same at a high speed by the suction of the engine to be scraped or combed and finely divided and thus effect a more intimate and uniform mingling of the ingredients of the gas and improve the combustibility of the same.

The velocity of the gas increases in proportion to the restriction in the cross sectional area of the conduit which carries the gas and is very great during the passage of the gas past the sharp, jagged edged slots which divert the gas particles in all directions as they enter the pockets 31 of the expansion chamber.

As the mixture passes from the enlarged expansion chamber or space 240 to the delivery tube 12 the same passes around an annular flange 120 projecting inwardly from a place adjacent to the junction of this chamber and tube, thereby holding the gaseous mixture away from the bore of this tube and preventing undue wall friction of the gas against the same. This flange is preferably clamped between the body 8 and the tube 12 and its inner edge 121 is preferably of sharp or keen and jagged or wire edge form, as shown in Figs. 1 and 6, so the same operates to scrape, comb, fracture and displace the gas particles and cause the air entrained in the same to be intimately commingled therewith, so as to produce increased heat units from the combustible mixture.

As the mixture is drawn through the outlet slots 30 of the mixing tube to the circular outlet at the periphery of the flange 32, the mixture travels radially in all directions on account of the formation of the channels, the location of the suction and the form of the slots 30, and the same travels on radiating lines from the outlet of the mixing tube to the periphery of the flange 32.

Therefore the gas particles are further apart at the periphery of the flange 32 than in the mixing tube. The air is supplied at this expansion place preferably through numerous small orifices 250 arranged in an annular row in the flange 25 concentric with the outlet slots 30 of the mixing tube. The mixture passes from the circular outlet at the periphery of flange 32 through the expansion chamber and into and through the conduit 12 to the place of combustion.

In this mixer the column of gaseous mixtures is controlled without loss of energy, in fact the velocity of the mixture is greatly increased and absorbs heat as the same passes from the mixing tube into the enlarged expanson chamber, and at the same time more air is entrained in the gas which has the effect of greatly improving the combustibility of the mixture.

I claim as my invention:

1. A mixer comprising a conduit for combustible gaseous elements having a reduced mixing chamber, an enlarged spreading chamber which communicates with said mixing chamber, and a spreader arranged in the conduit between the mixing and spreading chambers thereof and operating to spread the stream of gaseous elements as the same passes from the mixing chamber into the spreading chamber, the inlet end of said mixing chamber being provided with an inwardly projecting flange.

2. A mixer comprising a conduit for combustible gaseous elements having a reduced mixing chamber, an enlarged spreading chamber which communicates with said mixing chamber,—a spreader arranged in the conduit between the mixing and spreading chambers thereof and operating to spread the stream of gaseous elements as the same passes from the mixing chamber into the spreading chamber, that end of the wall of the mixing chamber furthest away from the spreading chamber being provided with external and internal flanges, and an annular air inlet chamber surrounding said mixing chamber.

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