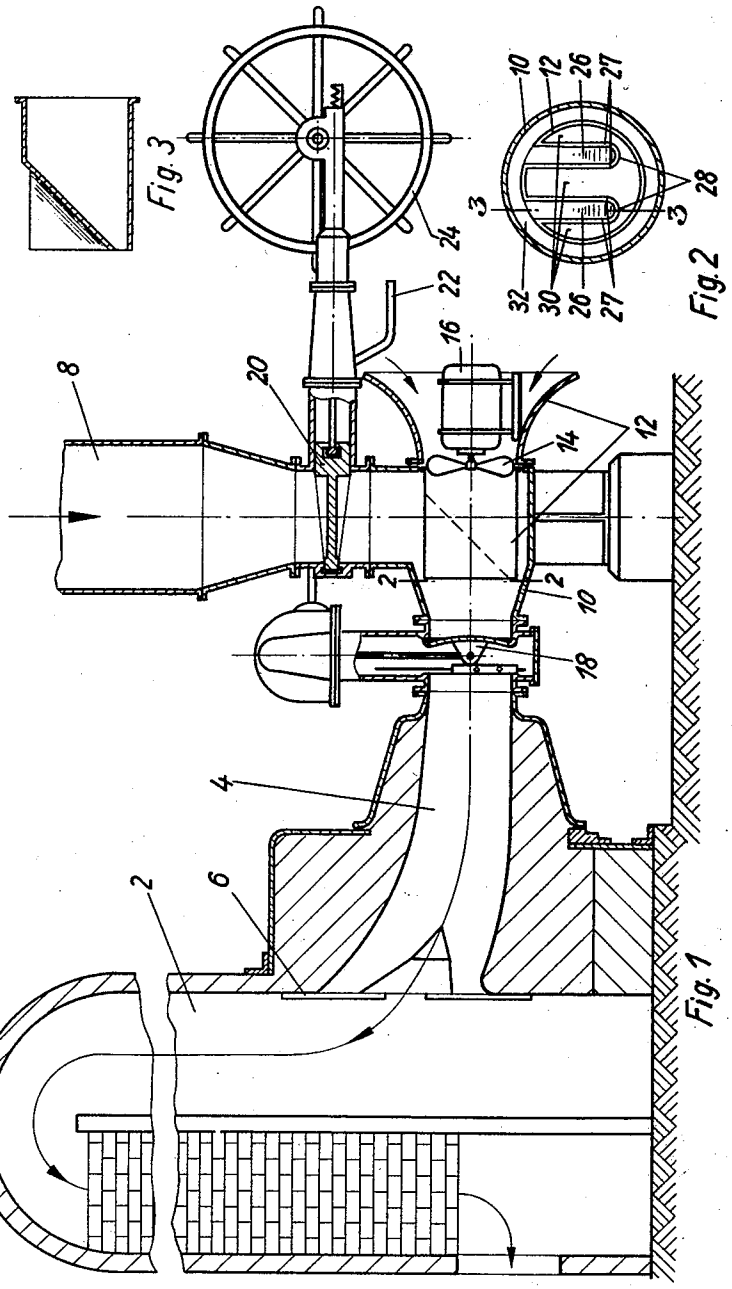
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ART OF MIXING GAS AND AIR FOR HIGH POWER BURNERS

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ART OF MIXING GAS AND AIR FOR HIGH-POWER BURNERS

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5 Claims. (Cl. 158—109)

This invention relates to the art of mixing gas and air for burners of high capacity, such as the burners of high power blast furnaces, for example, in which the burners are adapted to handle 24,000 cubic meters or more of gas per hour. This requires that the mixture of gas and air be fed to the burner under high velocity, with the result that, with methods and apparatus as heretofore used, the gas mixture enters the combustion shaft or chamber with a velocity which materially exceeds the speed of ignition of the mixture. This causes irregular explosive ignition, flare backs, popping of the flame and other objectionable and disturbing phenomena, all exceedingly deterimental to a smooth and efficient operation.

One of the objects of the present invention is to eliminate these undesirable phenomena by providing such a thorough, intimate and homogeneous mixture of the gas and air that its speed of ignition is raised practically to the highest theoretically attainable, so that on entering the combustion chamber the ignited flame will adhere to the edges of the mixing chamber, or to a suitable obstruction, such as a grid for example if such be provided, and will burn with a perfectly quiet flame.

The invention and its aims and objects will be best understood from the following description, taken in connection with the accompanying drawing of one illustrative embodiment of the invention and its mode of operation, the true scope of the invention being more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 shows one illustrative embodiment of the invention in its application to Cowper apparatus, said figure being a vertical longitudinal section of said apparatus;

Fig. 2 is a front elevation of the air supply tube, the gas supply tube being shown in vertical cross-section on line 2—2 of Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 2.

Referring to Fig. 1, the combustion shaft of the Cowper apparatus is shown at 2, into which opens a mixing chamber 4. Across the opening of said mixing chamber into said combustion shaft, a suitable obstruction, such as a grid 6 or the like may be provided, through which the inflammable mixture of gas and air enters said combustion shaft at high velocity and is ignited. Two conduits or tubes, the one surrounding the other, serve to supply, the one gas the other air to form the necessary combustion mixture. Herein gas will preferably be supplied through the outer of said two conduits, said gas supply conduit being shown at 8 and being provided with a tapered or constricted lateral extension 10 rectangularly disposed relative to said conduit and opening into said chamber 4. Air for combustion is herein preferably supplied through the inner conduit 12 extending through the wall of said gas conduit 8, the part of said air conduit exterior to said gas conduit being preferably bell-shaped to facilitate the air supply and the part of said air supply conduit within said gas supply conduit being co-axial with said tapered or constricted lateral extension 10 and preferably terminating within said tapered or constricted portion for increased suction. A fan 14 driven by any suitable means, a motor 16 for example, may be provided in said conduit 12 to produce the necessary air pressure. Quickly operable slide dampers 18 and 20 may be provided, the former for closing off the cowper from the gas and air mixture and the latter to shut off the gas conduit itself. These slide dampers 18 and 20 may be operated by a crank 22 and hand wheel 24, respectively.

The parts so far described, with the exception of said mixing chamber 4, which herein is relatively extended, and of that part of the air supply conduit within the gas supply conduit, which will be more fully described, may and preferably will be substantially the same as the corresponding parts described in my co-pending application Serial No. 500,969 filed December 8, 1930, to which reference may be had for a more detailed description thereof.

Various expedients have heretofore been used in attempts to secure a satisfactory admixture of gas and air. Generally two co-axial tubes are used the one to supply gas and the other air, the inner tube being provided with a plurality of circumferentially disposed restricted ports through which gas from the gas supply tube can be drawn into the air supply tube by suction. The ports referred to in the inner tube have sometimes been made in the form of spiral passages, by the rotary action thus imparted to the gas and air currents, to secure a better admixture; or adjacent jets of gas and air have been projected against a foraminous plate or screen upon the opposite side of which the mixture is intended to ignite. All such expedients, however, have failed to secure a sufficiently thorough mixture of gas and air and they greatly reduce the velocity of the feed of the combustion mixture by the great resistance they offer to the flow of gas and air so that they are en-

tirely unsuited for use in high power plants, for which my invention is more particularly intended, plants having a capacity of approximately 24000 cubic meters or more of gas per hour, since the velocity of the gas and air supply must be kept up to said capacity, which would require altogether too great an increase in the pressure used.

I have found that all the above mentioned and other objections may be overcome and a thorough, uniform and homogeneous gas and air mixture secured by my invention which provides novel means to supply the gas and air in alternate layers to said relatively extended mixing chamber 4 in such manner that no material retardation or resistance to the free flow of the gas and air mixture to the combustion shaft shall occur, the gas and air being thus more readily intimately mixed within said chamber 4 from which it passes into the combustion shaft as a thoroughly uniform and homogeneous mixture.

Referring now to the drawing, said means for forming alternate layers of gas and air herein comprises one or more pocket like recesses or chambers 26 provided in that part of the air supply conduit 12 located within the gas supply conduit 8. In the illustrative embodiment of the invention herein described two such pockets 26 are provided having substantially parallel side walls 27, their bottom walls 28 being preferably directed upwardly from the front ends of said pockets, where they open toward the chamber 4, to where said pockets open through the lateral wall of said conduit 12 into the conduit 8. Said pockets at the discharge end of said tube 12 preferably extend substantially throughout the entire width of said tube 12. It will be apparent that, within the scope of the invention, the number of said pockets 26 may be varied correspondingly to vary the number of alternate layers of air and gas, as may be desirable or expedient.

It will be seen that by the above described arrangement the suction action of the stream of air flowing through conduit 12 sucks gas from said conduit 8 into said pockets 26 so that the stream of gas and air on its way to the chamber 4 is divided within the tube 12 into alternate layers of gas and air, herein two layers of gas sucked into the two pockets 26 and three layers 30 of air, said alternate layers of gas and air being enclosed within an outer ring 32 of gas sucked in between the inner end of said tube 12 and said constricted portion 10 of the lateral extension of the conduit 8. As the alternate layers of gas and air leaving the tube 12 are relatively thin there quickly results an exceedingly thorough and intimate admixture of gas and air within said mixing chamber 4 to the very core of the stream, and the latter enters the combustion shaft 2 as a homogeneous mixture throughout. On entering said shaft 2, said gas and air mixture therefore possesses a speed of ignition, i. e. ignites with a rapidity, only slightly if at all less than the velocity of the flow of said stream, so that the flame can affix itself to the edges of the opening of said chamber 4 into said shaft or to the grid 6, if a grid be used, to which it adheres, burning quietly without sputtering or other objectionable or detrimental phenomena.

I am aware that my invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. Apparatus of the class described comprising, in combination, a relatively extended mixing chamber adapted to open into a combustion shaft or chamber; means to deliver gas and air to said mixing chamber; and means communicating with said gas and air delivery means and opening into said mixing chamber to divide said gas and air delivered by said gas and air delivery means into layers of gas alterating with layers of air within said means and enclosed in an encircling layer of gas.

2. Apparatus of the class described comprising, in combination, a mixing chamber; a conduit communicating with said mixing chamber and having a portion adjacent said mixing chamber tapered toward the latter; a second conduit within said first-named conduit and having one end within the tapered portion of said first-named conduit, said two conduits communicating the one with the gas and the other with the air supply of said apparatus; and means comprising spaced substantially parallel pockets provided in said second conduit and opening on the one hand through the lateral wall and on the other hand through the discharge end of said second conduit, to form, within said means, gas layers alternating with air layers.

3. Apparatus of the class described comprising, in combination, a mixing chamber; two conduits, one within the other, communicating with said mixing chamber and also communicating the one with the gas and the other with the air supply for said apparatus; and means comprising spaced substantially parallel pockets provided in said inner conduit and opening on the one hand through the lateral wall and on the other hand through the discharge end of said inner conduit, to form within said means gas layers alternating with air layers.

4. Apparatus of the class described comprising, in combination, a gas and air mixing chambe · an air supply conduit; a gas supply conduit coaxial therewith; and means comprising spaced pockets and intermediate spaces, said pockets communicating with one of said conduits and said spaces with the other, both said pockets and said spaces opening into said mixing chamber.

5. Apparatus of the class described comprising, in combination, a gas and air mixing chamber; a gas supply conduit; an air supply conduit coaxial therewith; and means comprising partitions forming chambers opening into said mixing chamber and communicating alternately with said gas supply conduit and said air supply conduit to divide the air and gas into gas layers alternating with air layers within said means.

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