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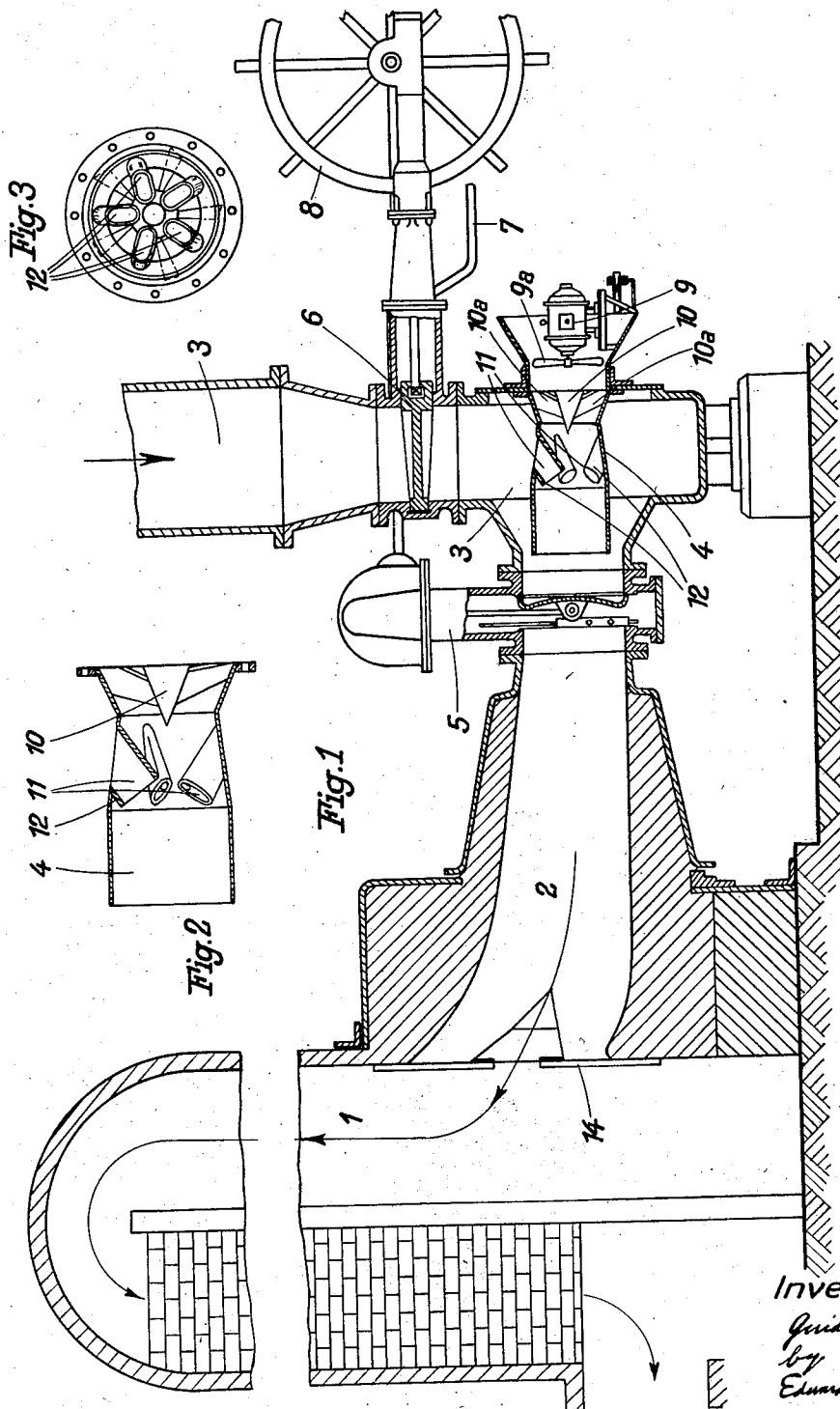
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1,963,009

HIGH POWER GAS HEATING APPARATUS

Filed Dec. 8, 1930

2 Sheets-Sheet 1



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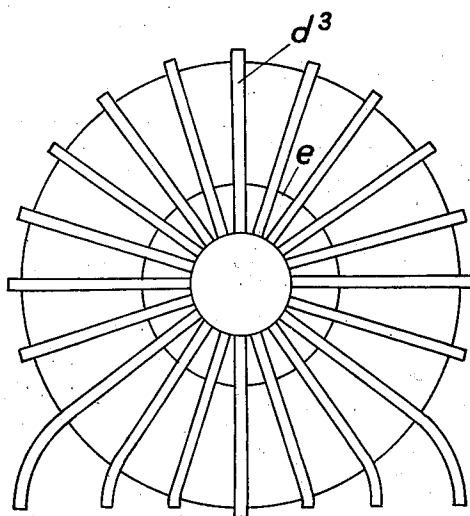
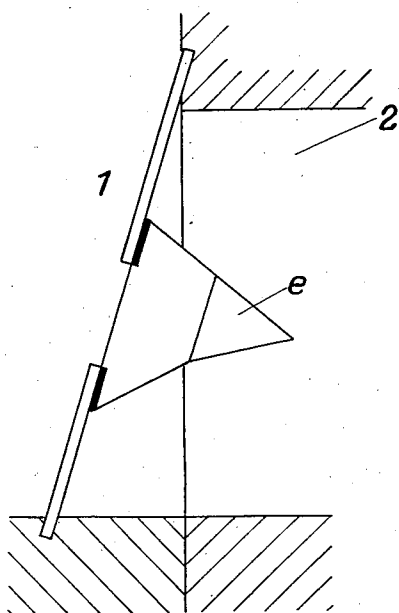
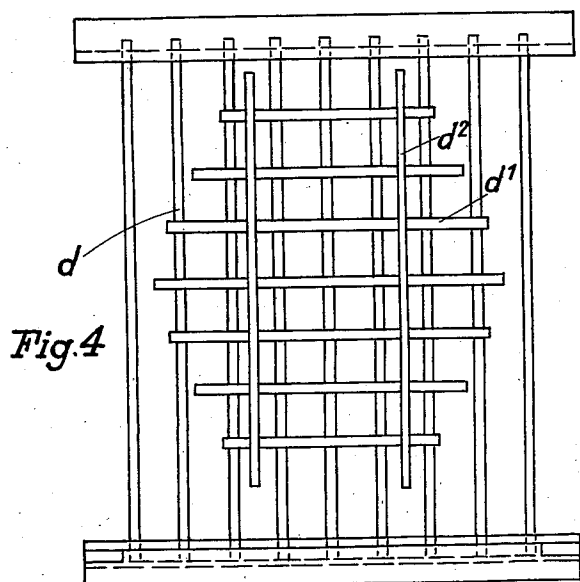
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HIGH POWER GAS HEATING APPARATUS

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UNITED STATES PATENT OFFICE

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HIGH-POWER GAS HEATING APPARATUS

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In Germany December 9, 1929

10 Claims. (Cl. 158—109)

This invention relates to high-power gas heating apparatus and more particularly to high-power gas burners for the well-known Cowper apparatus of blast furnaces, for example. Cowper apparatus in use today for blast furnaces are very high-powered and require as much as 2000 or even more cubic meters of gas per hour. Such large quantities of gas can be fed or supplied only where the gas is blown into the combustion shaft of the Cowper under much higher pressure than heretofore. This, however, presents the serious difficulty that the gas and air mixture, by reason of the high pressure used, acquires much too great a velocity relative to the igniting speed of the gas mixture. As a result the flame cannot ignite quietly adhering to the opening of the gas and air mixture supply conduit in the combustion shaft, but continuously breaks or is torn away from said opening, thus giving rise to the popping or sputtering of the flame so injurious to the operation of the apparatus.

The invention has for its object, among other things, to overcome this difficulty by providing for a much more intimate admixture of the gases with the air, whereby the igniting speed of the gases is materially increased, and also preferably by providing a suitable impediment or impediments in front of the opening of the supply or feed conduit of the gas-air mixture into the combustion shaft. The gas-air mixture breaks against said impediments, in the lee of which there is thus formed a zone, or zones, of lower velocity, lower than the speed of ignition. Furthermore, behind the impediments the flow or stream of the gas-air mixture rapidly spreads over a materially greater cross-sectional area. The mean speed of flow thus drops below the igniting speed, allowing the flame to ignite quietly in the lee of the impediments. A quiet flame filling the combustion shaft is thus secured without the impediments diminishing in any degree the amount of the air and gas mixture supplied.

The invention and its aims and objects will be best understood from the following description, taken in connection with the accompanying drawings of one embodiment of the invention herein described and shown for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 shows a Cowper of conventional construction with an illustrative embodiment of the invention, partly in section;

Fig. 2 is a longitudinal sectional elevation of the air conduit, with the inserted gas pipes;

Fig. 3 is an end view of the construction shown in Fig. 2, viewed from the right of the latter figure;

Fig. 4 is an illustrative embodiment of an impediment in accordance with the invention;

Fig. 5 is a further illustrative embodiment of an impediment in accordance with the invention;

Fig. 6 shows a part of the combustion shaft with the impediment illustrated in Fig. 5.

The intimate mixture of the gas with the combustion air may be secured in various ways and by various means, without departing from the spirit of the invention. In the Cowpers commonly used today the combustion air conduit and the gas conduit are surrounded one by the other at their opening into the mixing chamber in such manner that one conduit opens into the other in form of a suction jet. In the case of Cowper burners of this type the mixture of gas and combustion air can be secured in the simplest way by providing openings in the inside conduit through which the medium flowing through the outer conduit is sucked by the action of the medium flowing through the inner conduit. Parts of the gases flowing through the outer conduit thus penetrate into the innermost core of the inner gas conduit, thus producing a much more intimate mixture than it was possible to produce heretofore.

Referring to the drawings, the gas mixture supply conduit 2 opens into the combustion shaft 1 of the Cowper. The combustion gas is sucked through the gas conduit 3. The air supply conduit 4 is inserted in the usual manner within the gas conduit 3. The combustion air is supplied under pressure by a fan 9a driven by a motor 9 (see Fig. 1). To change over the Cowper from the heating period to the draft period there are used, as usual, quickly operable slide dampers 5 and 6, the former of which closes off the Cowper from the gas and air mixture, whereas the slide 6 serves to shut off the gas conduit itself.

For the operation of said slide dampers 5 and 6 there are provided a crank 7 and a hand wheel 8.

The parts described in the above paragraph are of conventional and well known construction and need not be more fully described.

I will now describe means for securing the

more intimate mixture of the combustion gases. In the illustrative embodiment of the invention said means comprises ports 11 provided in the wall of the inner conduit 4, which in the illustrative embodiment of the invention supplies the combustion air. In said ports 11 are provided forwardly inclined pipes 12 which are preferably welded in place. The current of combustion air driven through the air supply conduit 4 by operation of the fan 9a sucks the gas from the conduit 3 through said pipes 12 directly forwardly towards the centre of the combustion air stream, said gas thus penetrating to the innermost core of said combustion air stream. An extremely intimate mixture of the gas with the combustion air is thus secured. For the better distribution of the stream of combustion air within its conduit a spreading cone 10, having guiding surfaces 10a, may be provided. The mixture of gas and air then flows through the gas mixture supply conduit 2 into the combustion shaft of the Cowper.

While the ports 11 of the air supply conduit, by effecting a much more intimate mixture of the gas with the combustion air, materially increase or raise the igniting speed of the mixture, the velocity of the flow of the gas and air mixture still exceeds said igniting speed, so that a quiet flame does not yet form adhering to the opening of the supply conduit 2 into the combustion shaft 1. Means are accordingly provided in accordance with the invention for this purpose, said means in the illustrative embodiment of the invention comprising impediments as already set forth. Said impediments may conveniently take the form of a grid. In the illustrative form of grid shown in Fig. 4 said grid comprises a plurality of vertical rods *d* spaced apart preferably a distance greater than the width of the rods. Said rods may be of any suitable material, preferably of iron, and their spacing from each other may be equal to a multiple of their width. Under some conditions it is preferable to provide a second grid situated centrally of the grid *d*, said second grid consisting of a plurality of rods *d1*, *d2*, disposed at right angles. Said second grid covers the central portion of the first grid.

In the lee of the grid rods there are formed regions of lower velocity of flow of the gas and air mixture, in which the flame can ignite. By means of the grid the air and gas mixture is relatively quickly distributed over a wider cross-sectional area, so that within a short distance at the rear of the grid the mean velocity of flow of the air and gas mixture will be below the igniting speed of said gas mixture, so that the flame that ignites against the grid rods *d* will burn quietly without being torn away therefrom.

In the illustrative embodiment of the grid shown in Figs. 5 and 6, the grid rods *d3* radiate from a common central point and are preferably held together at their inner ends by a dispersion cone *e* having its apex directed towards the centre of the flow in the gas mixture supply conduit 2. Said dispersion cone effects a still better and wider dispersion of the mixture of gas and air over a greater cross-sectional area within the combustion shaft 1.

I am aware that my invention may be embodied in other specific forms without departing from the spirit or essential attributes of said invention, 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. In apparatus of the class described, in combination, a combustion shaft; a gas supply tube therefor; an air supply tube extending into said gas tube; a conduit opening at its inner end into said combustion shaft, and through its outer end receiving a mixture of gas and air from said gas and air supply tubes; and a grid within said combustion shaft and extending transversely of the inner opening of said conduit, said grid being of relatively large mesh so as not to impair materially the volume of flow of the gas and air mixture to the combustion shaft.

2. In apparatus of the class described, in combination, a combustion shaft; a gas and air mixture conduit opening at its inner end into said combustion shaft; a gas supply tube and an air supply tube concentrically positioned for injecting a mixture of gas and air into said conduit through its outer end; means to force air from atmosphere through said air tube; and a grid extending transversely of the opening between the inner end of said conduit and said combustion shaft, said grid being of relatively large mesh so as not to impair materially the volume of flow of the gas and air mixture to the combustion shaft.

3. In apparatus of the class described, in combination, a combustion shaft; a gas supply conduit therefor; an air supply conduit for said combustion shaft; means cooperating with said conduits intimately to mix the gas and air supplied thereby in their passage to said combustion shaft; and means presenting upon one side areas of impact to the gas and air mixture flowing to the combustion shaft and upon the opposite side areas of adhesion for the flame, when said mixture is ignited, said areas being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to the combustion shaft.

4. In apparatus of the class described, in combination, a combustion shaft; a gas supply conduit therefor; an air supply conduit for said combustion shaft; means cooperating with said conduits intimately to mix the gas and air supplied thereby, in their passage to said combustion shaft; and a grid extending transversely of the flow of the gas and air mixture at its entrance into said combustion shaft, said grid being of relatively large mesh so as not to impair materially the volume of flow of the gas and air mixture to said combustion shaft.

5. In apparatus of the class described, in combination, a combustion shaft; a gas supply conduit therefor; an air supply conduit for said combustion shaft; means cooperating with said conduits intimately to mix the gas and air supplied thereby in their passage to said combustion shaft; and means presenting upon one side areas of impact to the gas and air mixture flowing to the combustion shaft and upon the opposite side areas of adhesion for the flame when said mixture is ignited, said areas being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to the combustion shaft, said means provided with a dispersion cone.

6. In apparatus of the class described, in combination, a combustion shaft; a conduit open-

- ing at its inner end into said combustion shaft; means comprising gas and air supply tubes at the outer end of said conduit to inject a mixture of gas and air through said conduit into
 5 said combustion shaft; and means adjacent the inner end of said conduit and presenting upon one side areas of impact to the gas and air mixture flowing to the combustion shaft and upon the opposite side areas of adhesion for
 10 the flame when said mixture is ignited, said areas being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to said combustion shaft.
7. In apparatus of the class described, in combination, a combustion shaft; gas and air supply
 15 tubes for injecting a mixture of gas and air into said combustion shaft; and means spaced from the discharge openings of said tubes in the direction of said combustion shaft and presenting
 20 areas of impact to the gas and air mixture flowing with high velocity to said combustion shaft to form in the lee of said areas, zones of reduced velocity in which the mixture can ignite without the flame being torn away by the high
 25 velocity flow of said mixture, said areas being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to said combustion shaft.
8. In apparatus of the class described, in combination, a combustion shaft; gas and air supply
 30 tubes for injecting a mixture of gas and air into said combustion shaft; and a grid spaced from the discharge openings of said tubes in the direction of said combustion shaft, the grid members being spaced apart sufficiently not to impair
 35 materially the volume of flow of the gas and air mixture to said combustion shaft and being of a cross section to form in the lee of said members zones of reduced velocity in which the gas and air mixture can ignite without the flame being torn away by the high velocity of the
 80 flow of said mixture.
9. In apparatus of the class described, in combination, a combustion shaft; a conduit opening at its inner end into said combustion shaft; means comprising gas and air supply tubes at the
 85 outer end of said conduit to inject a mixture of gas and air through said conduit into said combustion shaft; and a grid comprising a plurality of superposed intersecting bars, said bars being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to said combustion shaft, said grid being positioned across the opening of said conduit into said shaft.
10. In apparatus of the class described, in
 95 combination, a combustion shaft; means to inject a mixture of gas and air into said combustion shaft; and means disposed in a plane transversely of the flow of said gas and air mixture and presenting areas of impact to said gas
 100 and air mixture as it flows with high velocity to said combustion shaft, to form in the lee of said areas zones of reduced velocity in which said gas and air mixture can ignite without the flame being torn away by the high velocity of
 105 the flow of said mixture, said areas being spaced apart sufficiently not to impair materially the volume of flow of said gas and air mixture to said combustion shaft.
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