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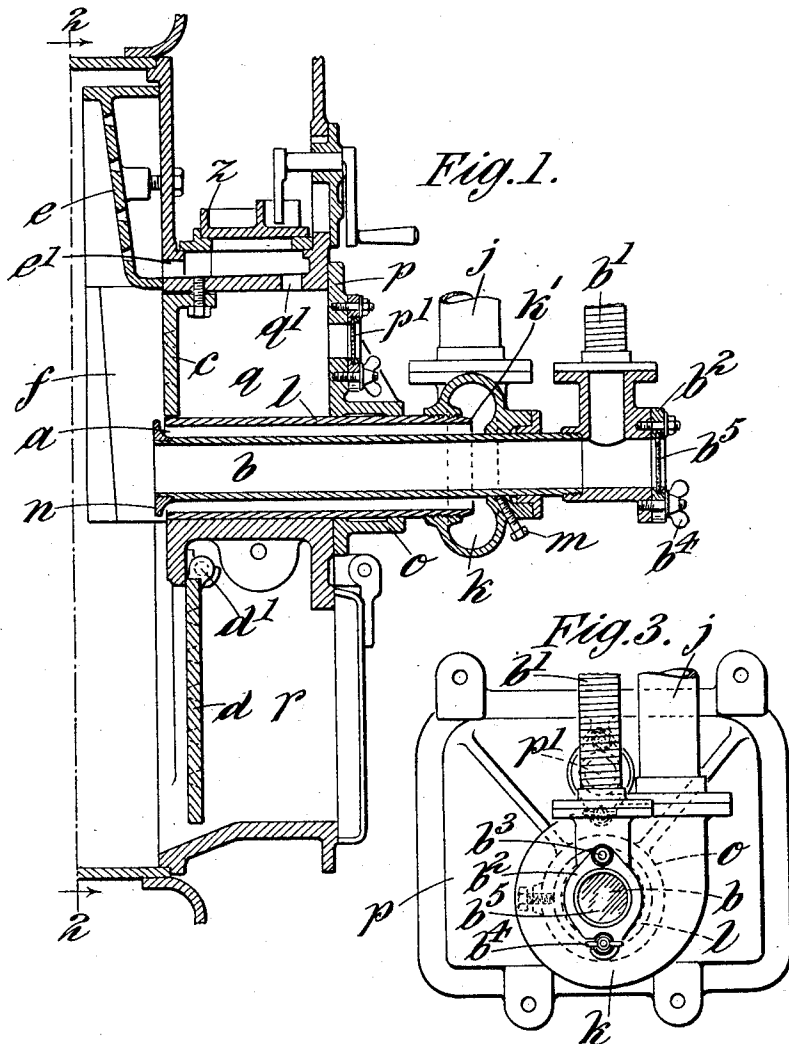
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MEANS FOR THE COMBUSTION OF PULVERIZED FUEL

Filed March 18, 1929

2 Sheets-Sheet 1



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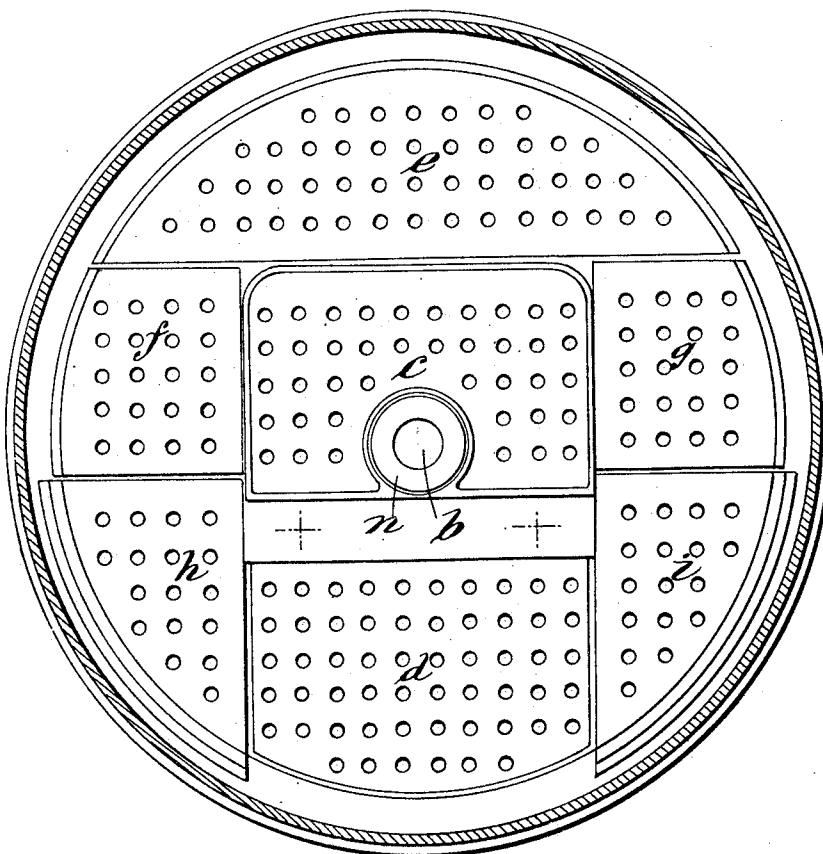
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Fig. 2.



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UNITED STATES PATENT OFFICE

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MEANS FOR THE COMBUSTION OF PULVERIZED FUEL

Application filed March 18, 1929, Serial No. 347,755, and in Great Britain April 13, 1928.

This invention relates to improvements in the combustion of pulverized fuel and means therefor, has particular reference to burners suitable for heating steam boilers and has for its object the more complete combustion of the fuel than has been possible heretofore, said combustion being effected by simpler and more reliable apparatus than has hitherto been used for this purpose.

The invention consists in the arrangement within a stream of pulverized fuel and its carrying fluid, of a core in the form of a stream of air, and about said stream of pulverized fuel and its carrying fluid of an envelope in the form of a stream of air, means being provided for constituting said streams and for proportioning the volumes and velocities of the various streams relative the one to the other so as to ensure effective intermingling of the fuel with the requisite amount of air for complete combustion in the combustion chamber.

In the drawings:—

Figure 1 is a longitudinal section of an improved structure adapted to operate in accordance with this invention, said structure being arranged with a Howden forced draught furnace front so as to constitute a burner;

Figure 2 is a sectional end elevation of the structure illustrated in Figure 1 taken on the line 2—2 of that figure and looking in the direction of the arrow; and

Figure 3 is an external end elevation of the parts associated with the Howden front in Figures 1 and 2.

From the drawings, it will be seen that the invention is carried into practical effect by discharging through the furnace front into the combustion chamber the pulverized fuel and its carrying air as a tubular stream from an annular conduit *a*, the stream of air forming the core being delivered through the tube *b* whilst the air forming the envelope is delivered through the perforated plates *c*, *d*, *e*, *f*, *g*, *h*, and *i* as described hereinafter.

The tube *b* is supplied with air from the Howden or other preheater associated with the furnace front through the flexible tube *b*¹ and the end of the tube *b* external to the fur-

nace is provided with a cover plate *b*² pivotally mounted on a stud *b*³, in order that during lighting up operations the plate *b*² may be swung out of the way and a suitable torch be introduced into the tube *b*. The cover plate *b*² is maintained in closed position by means of the finger operable nut *b*⁴, and is provided with a window *b*⁵ to enable the colour and nature of the flame to be observed whilst the burner is in operation.

In order that the pulverized fuel shall be evenly distributed in the carrying fluid and the mixture shall be evenly supplied to the annular conduit *a*, the fuel and its carrying fluid are tangentially introduced from the supply conduit *j* into a chamber *k* adapted to produce a whirling stream from which chamber the mixture is centrally discharged into the annular conduit *a* between the tube *b* and a tube *l* attached to the whirl chamber *k*.

To enable the most desirable admixture between the fuel and its carrying air to be obtained and to adjust the quantity delivered to the annular conduit *a*, the whirl chamber *k* is provided with a lip *k*¹ about its discharge orifice, said lip *k*¹ projecting into the whirl chamber *k* such distance as will ensure that the required conditions are complied with.

A deflector *n* is mounted upon the end of the tube *b* remote from the cover plate *b*², said deflector cooperating with the adjacent end of the tube *l*. The tube *b* is slidably mounted in the whirl chamber *k* and tube *l* so that the deflector *n* can be displaced longitudinally relatively to the end of the tube *l* as required, the said tube *b* being secured in the most satisfactory position by means of a screw *m*.

The above recited structure is mounted within a tubular extension *o* on a plate *p* which can be substituted for the ordinary fire door of the furnace front to which the burner is to be applied.

As illustrated the plate *p* has a window *p*¹ provided to enable the colour and nature of the flame to be observed during operation of the furnace.

In the form of construction illustrated in Figure 1 the structure is applied to an ordi-

nary Howden forced draught furnace front for a boiler the said structure being located in the aperture through which firing with solid fuel is normally effected and to produce the envelope of air for the annular stream use is made of the Howden draught arrangements to supply air to the firing hole *q* and also to the ash pit *r*.

The supplementary plate *c* distributes the air supplied to the firing hole *q* through the port *q*¹ under control of the valve *z*, the supplementary plates *d*, *h* and *i* distribute the air supplied to the ash pit *r* under the control of the side valves usually employed with Howden forced draught fronts, the ordinary known perforated plate *e* distributes the air supplied through the port *e*¹ under the control of the valve *z* and the ordinary known perforated plates *f* and *g* distribute the air supplied to them through ports and under the control of the valve *z*.

The deflector *n* cooperates with the adjacent end of the tube *l* to deflect the annular stream of fuel and air issuing from the conduit *a* directly into the path of the air issuing from the perforations in the plates *c*, *d*, *e*, *f*, *g*, *h*, and *i*.

In order that the deposit formed during operation of the burner may be removed through the ash pit *r* in the ordinary way the plate *d* may be hung upon hooks *d*¹ so as to permit of its deflection or removal as required during cleaning operation.

The perforations in the plates *e*, *f* and *g* are of such size as will pass the requisite amount of air to promote complete combustion of the fuel introduced. Otherwise the parts *e*, *f* and *g* are similar to the equivalent parts usually used with coal fired Howden forced draught furnace fronts.

Obviously, the proportions of air supplied during combustion vary with the fuel employed and the conditions under which combustion takes place. It has been found that with a burner having a two inch connection to the central tube *b* satisfactory results can be obtained when 400 pounds of pulverized North country steam coal are fed per hour through the annular conduit *a* together with about 1,750 pounds of air at a temperature of about 140° F., about 380 pounds of air at a temperature of about 200° F. through the tube *b* and about 3,250 pounds of air through the plates *c*, *d*, *e*, *f*, *g*, *h* and *i* at a temperature of about 350° F. inasmuch as this air is heated by the plates.

Those skilled in the art will recognize that some variations of considerable magnitude may be required to operate such a burner satisfactorily, such alterations being determined in the ordinary way such as by the CO₂ meter or the appearance of the effluent from the funnel. To enable the required variations in proportions to be obtained means of ordinary form are provided for regulating the quanti-

ty of fuel, the amount and temperature of the carrying fluid therefor and the amount and temperature of the air passing through the burner.

As illustrated, the Howden front is shown now with the usual regulating valve *z* but for purposes of clearness the side valves provided to control the flow of air to the ash pit are omitted and such valves as may be employed to control the flow of air to the central tube *b* and the combustible mixture through the tube *j* are also omitted.

We claim:—

1. An improved burner for air borne pulverized fuel having in combination a combustion chamber, a furnace front comprising a front wall and a perforated rear wall spaced therefrom, a main tube carried by said front penetrating said walls, a central tube in said main tube leaving an annular passage about said central tube, a whirl chamber located externally of said combustion chamber and carrying said central tube and adapted and arranged to deliver a whirling stream of air to said annular passage, a deflector on the free end of the central tube within the combustion chamber, means for supplying air to the space between said walls, means for supplying air to the central tube and means for supplying air borne pulverized fuel to the said whirl chamber.

2. An improved burner for air borne pulverized fuel, as claimed in claim 1, said central tube being adjustable along the longitudinal axis of the main tube to vary the position of the deflector and means for securing the central tube in any position to which it may be thus adjusted.

3. An improved burner for air borne pulverized fuel, as claimed in claim 1, including a lip interiorly arranged about the discharge orifice of the said whirl chamber.

4. An improved burner for air borne pulverized fuel, as claimed in claim 1, including a displaceable cover upon the end of said central tube remote from the combustion chamber.

5. An improved burner for air borne pulverized fuel, as claimed in claim 1, in which the said central tube is adjustable with respect to the whirl chamber, whereby the deflector may be adjusted relatively to the end of the said annular passage.

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