

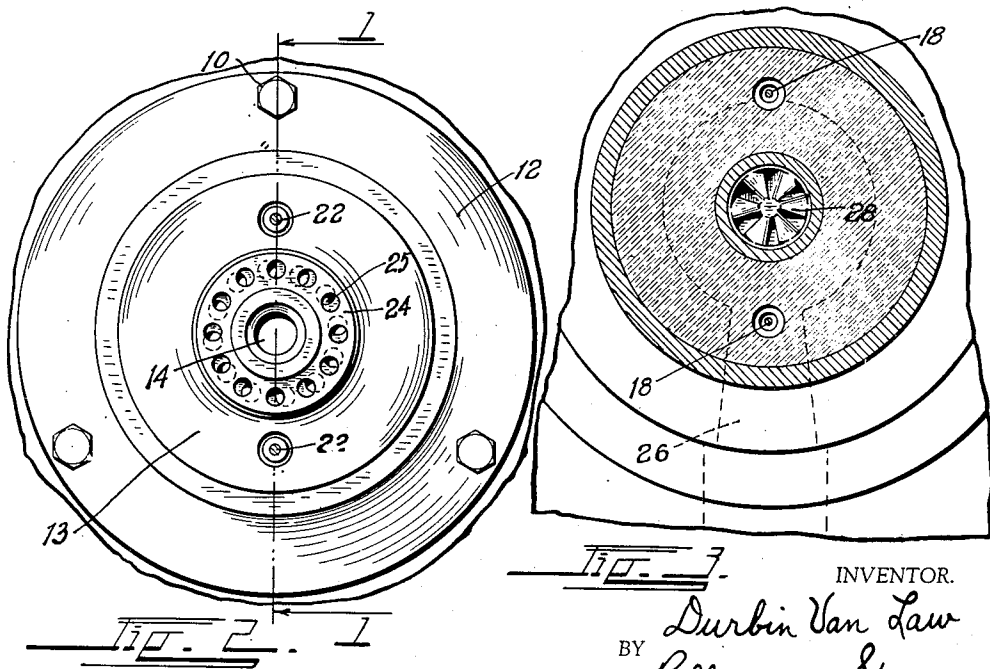
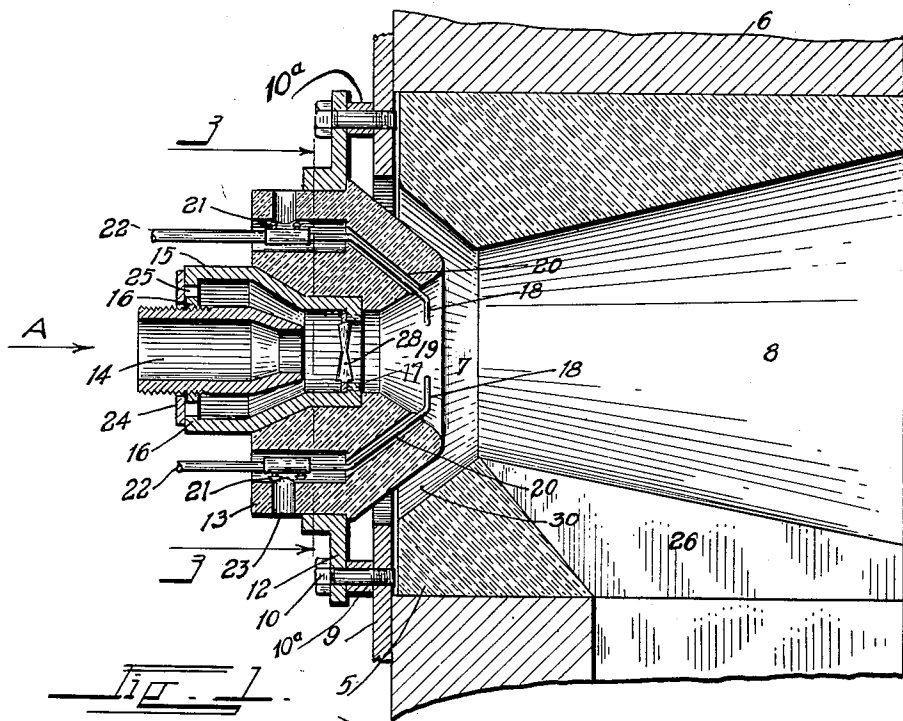
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BURNER

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BURNER

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This invention relates to apparatus for burning powdered fuel, and an object of the invention is to provide a burner particularly adapted for use in connection with small furnaces by the production of a short flame.

Another object of the invention resides in the provision of an igniter in association with the burner, for the initial ignition of fuel in a fuel-carrying air-current prior to its entering the furnace.

Another object is to provide a burner, the component parts of which are durable and heat-resisting, and assembled in a simple arrangement which permits of ready adjustments and replacement of parts.

Still another object is to provide a burner-unit having in association with a heat-resisting tip, an igniter for fuel in a fuel-carrying air-current fed to the tip, means to reduce the velocity of the air-current in the tip, and means for admitting auxiliary air to the igniter.

Further objects are to be found in details of construction and in novel and useful arrangements and combinations of parts as will be fully set forth in the course of the following description.

In the drawing, in which similar reference characters designate corresponding parts throughout the views,

Figure 1 represents a sectional elevation of a burner-system in accordance with the present invention,

Figure 2, a face-view of the burner, looking in the direction of the arrow "A" in Figure 1; and

Figure 3, a section taken on the line 3—3, Figure 1.

Referring further to the drawing, a preliminary combustion chamber 5 is fitted and secured in an opening of the furnace wall 6. The preliminary combustion chamber which is made of heat-resisting material, such as fire-brick, has an opening flaring in opposite directions from a transverse plane nearest the outer surface of the wall.

The shorter conical portion 7 of the opening provides a housing for the body-part or tip of a burner-unit while the inner and longer conical portion 8 functions for the ignition and diffusion of fuel in fuel-carrying currents before they pass into the furnace.

A face-plate 9 fastened upon the outer surface of the furnace-wall, has an opening corresponding in size with that of the preliminary combustion chamber at the extreme outer end thereof and fastened to the face-plate by means of stud-

bolts 10, is a flanged ring 12 in which the before-mentioned tip or body-member of the burner-unit is supported.

The body-member or burner tip consists of a block 13 of terra cotta or other vitreous clay product, positioned rearwardly of the preliminary combustion chamber, i. e., on the opposite side thereof from the interior of the furnace, and having a central passage into which the powdered fuel is fed by an axially disposed nozzle 14. The nozzle communicates with a conduit connected with a source of fuel-supply and it has a constricted throat within the passage of the tip. The nozzle is supported in a shell 15 which is fitted and secured interiorly of the block and extends beyond the outer end thereof. The shell has at its exterior end, an inwardly ranged flange 16, interiorly threaded to receive the nozzle which has an exterior screw thread co-operating with the other. By these means, the position of the nozzle inside the body-member of the burner may be lengthwise adjusted, in accordance with differing conditions.

At the end of the shell inside the tip 13, is an inwardly extending flange 17 for the support of a whirler 28, which may consist of a fixed disk having radial, angularly bent vanes, between which the fuel-carrying currents must pass to enter the furnace. The whirler functions as a means for reducing the velocity of the air currents and additionally as an element to effect an intimate intermixture of the fuel and the air.

The passage of the body-member 13, at the inner end thereof, flares outwardly from the whirler for the expansion of the currents, and it is desirable that the flare of the said passage be substantially in line with that of the inner portion of the opening 8 of the preliminary combustion chamber. The faces of the terra cotta block other than those engaged by the metal parts 12 and 15, are preferably glazed to better resist the detrimental influence of the heat of the furnace.

In the flaring inner end of the passage of the burner tip, are two electrodes 18 spaced apart to form a spark-gap 19. The electrodes extend through openings 20 in the block, which at the outer portion of the same are enlarged to contain terminal blocks 21 by which the electrodes are connected to the leads 22 of a conveniently located source of electricity.

The electrodes are made of heat-resisting wire, such as chromium nickel, and they are by means of the leads, connected with a source of high tension electric current of perhaps from 10,000 to 55

12,000 volts, a small standard transformer being included in the circuit.

The wires and the terminal blocks are cemented in the holes of the block, by means of suitable fillers and the binding-screws of the terminal blocks are accessible from the outside of the tip through transverse openings 23. The flanged outer end of the shell 15 has a series of holes 25 for the admission of auxiliary air to the passage of the burner-block, and the volume of this auxiliary air is controlled by a rotary damper 24 having holes to register with those of the flange.

The preliminary combustion chamber has at its underside a slot 26 registering with an opening 6a in the furnace wall for the discharge of ashes and other solid products of combustion.

Having thus described the invention, its operation and the advantages derived therein, will be apparent.

Air currents carrying pulverized fuel produced in a suitable grinding mill, are forcibly fed to the burner, through the nozzle and thence pass through the whirler past the igniter, into the inner flaring portion 8 of the preliminary combustion chamber. The whirler, the outward flare of the passage of the burner-tip in which the igniter is disposed, and the outward flare of the inner portion 8 of the preliminary combustion chamber, cooperate in reducing the velocity of the air currents, it being an important desideratum of the invention to, by these means, produce the short flame essential in small furnaces such as those used in residential heating-systems.

The heat-resisting burner-tip provides for the disposition of the electrodes with perfect insulation and it forms a conical diffuser and expander for the air currents as stated hereinbefore. The whirler by imparting a spinning motion to the air currents likewise effects the expansion and consequent reduction in velocity of the same.

The velocity of the air currents entering the furnace is by the above-described means reduced to a degree just sufficient to keep the coal-particles in suspension. Initially, the volatile hydrocarbons of the coal are ignited by the spark produced in the gap 19 between the electrodes 18, it being understood that the air by which the coal is carried, contains sufficient oxygen to ignite said volatile constituents.

Subsequently, the heat produced by ignition of the volatile hydrocarbons, ignites and burns the fixed carbons, usually with the assistance of the auxiliary supply of air drawn into the burner through the damper-controlled openings 25 in the flanges of the shell, and the space 30 between the burner tip and the preliminary combustion chamber.

At this time, the spark between the electrodes may be discontinued by breaking the circuit in a suitable switch, it being obvious that after the fuel has once been ignited, the heat of the ignited parts thereof, is sufficient to support continued combustion.

In this manner, the fuel held in suspension by the air-currents, is put in a state of combustion in the preliminary combustion chamber and before it enters the furnace proper, thereby differentiating the present method from others in which ignition and subsequent combustion of the fuel takes place in the combustion chamber of the furnace above a burner.

It is an important feature of the present invention that the velocity of the fuel-carrying air currents is reduced so as to closely approach the

critical point between the forces of suspension and gravitation to which the fuel is subject during its movement into the furnace, or in other words, that the velocity of the air-currents entering the furnace, is just sufficient to maintain the fuel in suspension, thereby producing the short flame which, as stated hereinbefore, adapts the invention particularly for use in furnaces of limited dimensions.

The position of the nozzle with relation to the whirler is readily adjusted by turning the latter in the screw-threaded opening of the shell and by the use of interchangeable nozzles of different throat openings, the velocity and the volume of the air-currents entering the burner through the nozzle are further regulated.

The velocity of the air currents in the burner should be enough to insure the maximum effect of the whirler, in entering the currents into the preliminary combustion chamber at a low velocity and in a whirling motion, it being apparent that the preliminary combustion chamber provides the area of preliminary combustion as stated hereinbefore, prior to a substantially complete combustion of the fixed carbons of the fuel in the furnace.

The burner-tip is spaced from the preliminary combustion chamber, as shown at 30, for cooling purposes and incidentally for the controllable supply of auxiliary air to the preliminary combustion chamber as may be required to support combustion, it being understood that the width of the space may be varied by changing the thickness of washers 18a between the parts 12 and 9.

What I claim and desire to secure by Letters Patent is:

1. A burner system for furnaces, comprising a nozzle, a chamber to receive and spread fuel-carrying air-currents discharging from the nozzle, a preliminary combustion chamber communicating with the first-mentioned chamber, a whirler separating the chambers and providing a passage therebetween, the preliminary combustion chamber providing an expansion space for fuel-carrying currents entering therein, means for igniting fuel in the latter chamber, and means for the supply of additional air to said chamber to aid combustion and to effect the passage through of the ignited material for delivery to the furnace at a reduced velocity.

2. In a burner unit for furnaces, a burner tip comprising a body of refractory material having a passage for fuel-carrying air currents, and having in its wall around said passage, openings for the placement of electrodes in opposed relation to each other within the passage to provide a spark-gap, the openings being enlarged at their outer ends to contain terminal blocks at the ends of the electrodes, and the enlargements having lateral entrances affording access to the terminal blocks.

3. A furnace having a wall, a hollow block of refractory material in an opening of said wall providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air-currents into the flaring passage of the burner tip, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber and means between the flaring passage and the preliminary combustion chamber for supplying atmospheric air to the preliminary combustion chamber.

4. A furnace having a wall, a hollow block of refractory material in an opening of said wall providing an inwardly flaring preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air currents into the flaring passage of the burner tip, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber.

5. A furnace having a wall, a hollow block of refractory material in an opening of said wall providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air-currents into the flaring passage of the burner tip, a whirler to impart a whirling motion to the air-currents entering the flaring passage, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber.

6. A furnace having a wall, a hollow block of refractory material in an opening of said wall providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air-currents into the flaring passage of the burner tip, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber, there being an entrance for secondary air into the preliminary combustion chamber.

7. A furnace having a wall, a hollow block of refractory material in an opening of said wall, providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air-currents into the flaring passage of the burner tip, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber, there being an

entrance for secondary air into the preliminary combustion chamber, around the burner tip.

8. A furnace having a wall, a hollow block of refractory material in an opening of said wall, providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air currents into the flaring passage of the burner tip including a shell provided with an inlet for air, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber.

9. A furnace having a wall, a hollow block of refractory material in an opening of said wall, providing a preliminary combustion chamber, a burner tip having an inwardly flaring passage, rearwardly of and in communication with said preliminary combustion chamber, a nozzle for the introduction of fuel-carrying air-currents into the flaring passage of the burner tip including a shell provided with an inlet for air, a whirler in the shell to impart a whirling motion to the air-currents, and means for igniting fuel in said air-currents, within the flaring passage, prior to their entrance into the preliminary combustion chamber.

10. The combination with a furnace, of a preliminary combustion chamber, having an opening therethrough, the walls of which flare in opposite directions from a transverse plane through the burner to provide a portion flaring toward the exterior of the furnace and a portion flaring to the interior thereof, a hollow burner tip positioned in the exterior flaring portion, in spaced relation to the walls thereof, whereby to provide an inlet for atmospheric air between the tip and said walls, the interior hollow portion of said burner tip being flared in the general direction of the flare of the walls of said interior flaring portion, means to direct fuel-carrying currents into the flaring portion of the burner tip, and means in the burner tip to ignite incoming fuel carried by said currents, prior to the passage thereof through the preliminary combustion chamber, whereby said fuel will be delivered to the furnace in a state of combustion.

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