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FURNACE

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Fig. 1

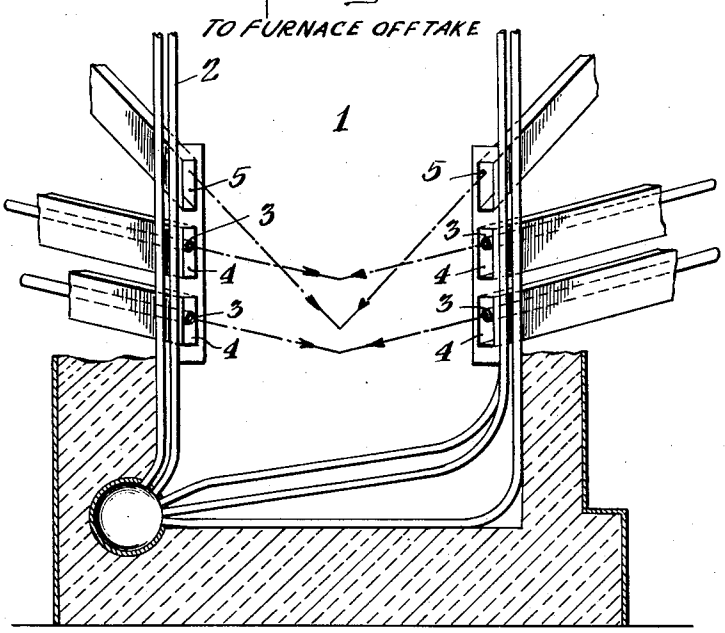
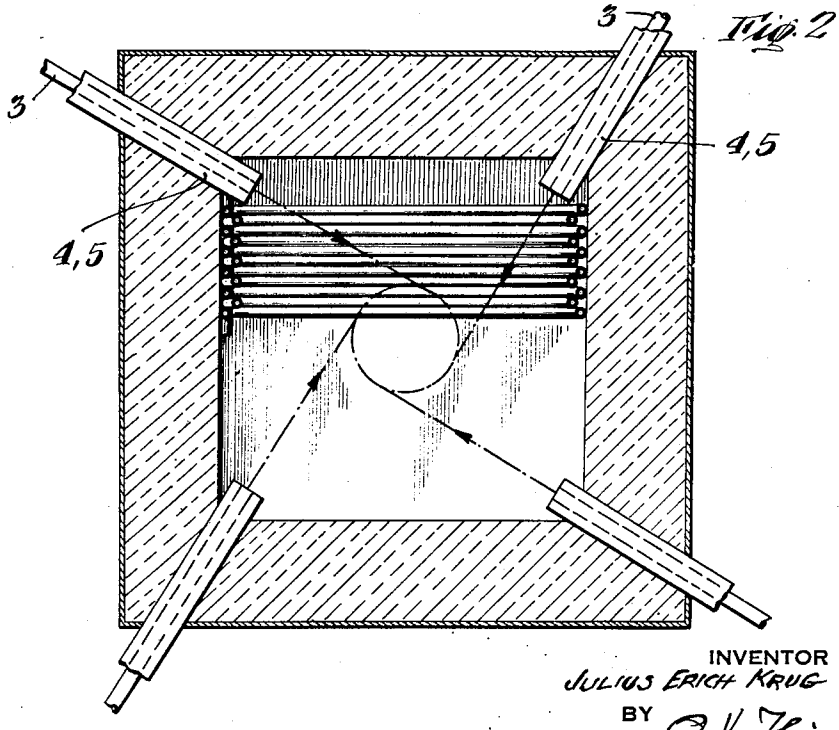


Fig. 2



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FURNACE

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5 Claims. (Cl. 110—28)

The invention relates to pulverized fuel furnaces in which the pulverized fuel is injected into the furnace in several streams or jets through nozzles lying in a plane transverse to the axis of the furnace and distributed around the periphery of the combustion chamber in such a manner that the axes of the streams of pulverized fuel are tangent to an imaginary circle whose center lies in the axis of the furnace, this arrangement being usually referred to as "tangential firing." While in the illustrative example used in the following specification, the invention is shown and described in connection with a vertical updraft furnace, it is not intended that this is to be taken as limiting the claims to such furnaces.

In prior installations of this sort there was forced into the furnace in addition to the primary air contained in the fuel mixture, secondary air in the form of streams of air enveloping the streams of pulverized fuel, such secondary air mingling with the whirl of burning fuel formed at about the level of the pulverized fuel streams. In addition there have in the past been injected further streams of secondary air from nozzles above the fuel burners and delivering their air in a horizontal or substantially horizontal plane and toward the central part of the furnace for the purpose of sustaining the spiral motion of the gases.

For certain types of fuel this known arrangement for introducing the fuel and air is unsatisfactory. For example, when coal with low content of volatiles is burned, the rate of feeding the mixture of pulverized fuel and primary air must be kept low in order to maintain good ignition conditions of the fuel. If the primary air is fed in too fast, the flame propagation, traveling in a direction out from the axis toward the burner, will be too slow to keep the ignition near the burner, and the flame will pulsate and the fire be unstable. Likewise in the prior arrangements referred to above for introducing the secondary air the velocity must be kept low. The resultant low velocities however do no produce a vigorous agitation of the gases in the combustion chamber such as is required to obtain good combustion within a limited space. The difficulties are overcome by the present invention and good combustion is obtained particularly with coal of low volatile content by means of secondary air nozzles arranged above the pulverized fuel streams and directed diagonally downward to deliver vigorous streams of air toward the pulverized fuel flame in the center of the furnace, this downward direction being the point of importance.

It is of advantage to have a higher air pressure in these upper air nozzles than is ordinarily used in the other secondary air nozzles, in order to produce the high velocity of flow which will cause thorough mixing and rapid combustion. Best results are obtained when a pressure for this upper secondary air of 2½ to 4 inches water is used, and when 10 to 15% of the total combustion air is introduced through these upper nozzles. If preferred, the pressure of the air delivered in and around the fuel nozzles may also be in the range mentioned, instead of the usual low range, the necessary low velocities for this air being obtained by partly closing the dampers particularly in the ducts supplying the secondary air around the nozzles. The necessity of two different air pressures may be thus avoided. Such damper arrangements are well known and accordingly are not illustrated in the drawing of the present application.

An illustrative example of the invention is shown in the accompanying drawing, in which Fig. 1 shows a vertical section through the portion of the combustion chamber in which fuel and air are introduced and Fig. 2 shows a horizontal section through the combustion chamber. The pulverized fuel installation is intended in this case for the heating of a steam boiler, and the combustion chamber 1 is shown to be provided with steam generating tubes 2. The installation is of the corner firing type in which the fuel nozzles 3 as well as the secondary air nozzles 4 and 5 are arranged in the corners and, as will be clear from Fig. 2, tangentially to an imaginary circle whose center lies in the vertical central axis of the combustion space. The streams of fuel are introduced through the fuel nozzles 3 which are shown arranged in two superposed groups. Associated with the fuel nozzles and partially or entirely surrounding them are the secondary air nozzles 4 which introduce air at low velocities just as do the fuel nozzles. Above the fuel nozzles are the upper secondary air nozzles 5 through which further secondary air is introduced. These nozzles project their secondary air diagonally downward thereby vigorously stirring up the flame, i. e. the mixture of air and fuel after combustion has begun. As clearly shown in Fig. 2 the secondary air nozzles 5 lie in the same vertical planes with the fuel nozzles 4 and the air discharged from the secondary air nozzles will impinge tangentially on

the central whirling gas mass and accelerate or emphasize such whirling motion.

What I claim is:

1. In a furnace equipped with a plurality of burners distributed about the periphery thereof to project pulverized fuel tangentially to an imaginary circle located in a plane including the axes of the burners so as to produce a whirling mass of burning fuel in the furnace, the combination with said burners of nozzles for supplying secondary air located above said burners and directed downward toward said circle so as to supply air for complete combustion to said whirling mass and to maintain the whirling motion of the burning fuel.

2. In a furnace equipped with a plurality of burners distributed about the periphery thereof to project pulverized fuel tangentially to an imaginary circle located in a plane including the axes of the burners so as to produce a whirling mass of burning fuel in the furnace, the combination with said burners of nozzles for supplying secondary air spaced from said burners in the direction of gas movement and disposed so as to direct secondary air toward said circle for completing combustion in said mass and maintaining the whirling motion thereof.

3. The process of burning pulverized fuel in suspension in a furnace comprising the steps of injecting pulverized fuel with air in amounts sufficient for rapid ignition but insufficient for complete combustion from a plurality of points at the periphery of the furnace in a direction tangential to an imaginary circle located in a plane normal to the axis of the furnace, and injecting additional air sufficient for complete combustion from a plurality of points along the periphery of the furnace at one side of the plane of said circle and in a direction substantially toward said circle to supply to the mixture of air and fuel injected by said burners air to complete combustion.

4. The method of burning pulverized coal of a variety such that the flame propagation is relatively slow when the coal is burned in pulverized form in suspension in a furnace having a plurality of burners arranged in a single plane and distributed about the periphery of the furnace and directed tangentially to an imaginary circle located in a plane containing the axes of the burners comprising injecting the coal with air in amounts sufficient to maintain ignition but insufficient to complete combustion and at a velocity low enough to keep the flame near the burners, and injecting additional air at relatively high velocity into the furnace from a plurality of points at one side of said plane around the periphery of the furnace and so that said air is directed toward said circle and in a direction to accelerate the whirling movement of the gases and to complete combustion.

5. The method of burning pulverized coal of a variety such that the flame propagation is relatively slow when the coal is burned in pulverized form in suspension in a furnace having a plurality of burners arranged in a single plane and distributed about the periphery of the furnace and directed tangentially to an imaginary circle located in a plane containing the axes of the burners comprising injecting the coal with air in amounts sufficient to maintain ignition but insufficient for complete combustion and at a velocity low enough to keep the flame near the burners, and injecting additional air at relatively high velocity into the furnace from a plurality of points located beyond the points of injection of the fuel in the direction of the furnace offtake and directed toward the burning mass of fuel so as to supply additional air for complete combustion and to maintain turbulence in the burning fuel mass.

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