April 20, 1965 G. D. ARNOLD 3,179,150

FURNACE

Filed April 30, 1962

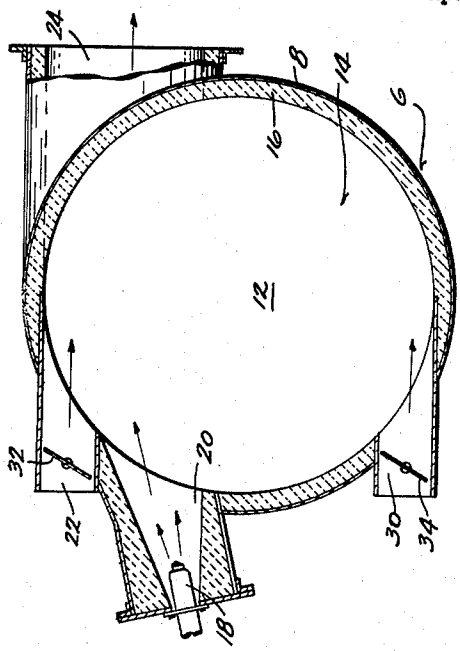


Fig. 2

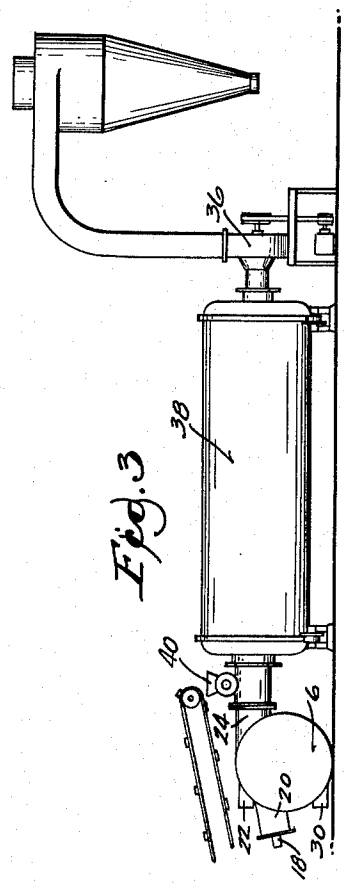


Fig. 3

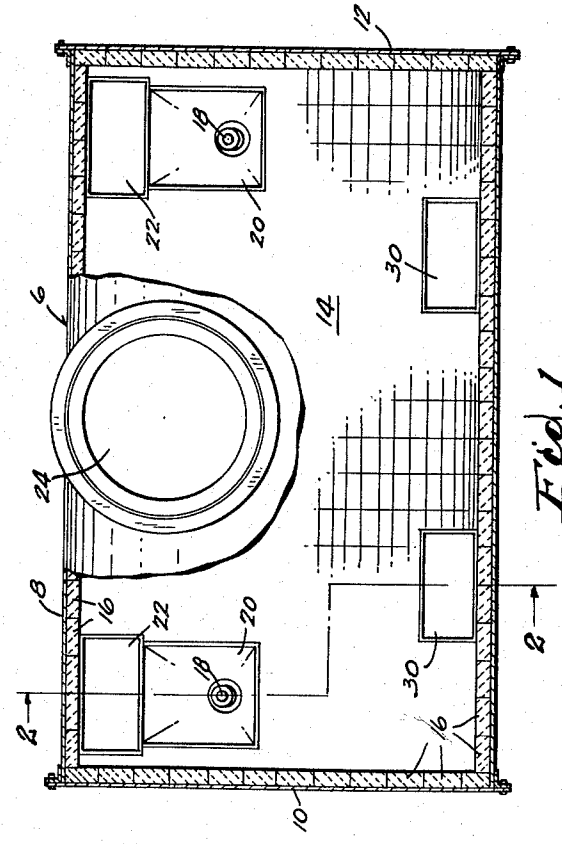


Fig. 1

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FURNACE

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This invention relates to a furnace.

This particular furnace happens to be used to supply hot gaseous products of combustion for use in dehydration. The general organization of a dryer is shown in my Patent 2,822,153. The present furnace is an improvement on those disclosed in said patent.

The object of the invention is to provide a furnace in which combustion will be completed within a refractory lined combustion chamber so that no flame will be communicated through the flue.

In the past, this objective has generally been achieved through the provision of firebrick baffles within a combustion chamber. The furnace herein disclosed achieves the desired result by establishing within the combustion chamber vortex currents of secondary air which are opposed to the currents of primary air and burning gases traversing the cylindrical chamber circumferentially in opposite sense of rotation from the vortex currents of secondary air. The burners and the secondary air ports are desirably tangential and located at opposite ends of the cylindrical combustion chamber, from which the flue opens tangentially midway between the burners. When the opposing currents meet at substantial velocities, the impact of the gases upon each other promotes agitation with consequent intimate mixing and such interruption of movement in the initial direction of gas advance as to result in completion of combustion before the gases resume motion toward the flue.

In the drawings:

FIG. 1 is a view partially in side elevation and partially in axial section through a refractory lined furnace combustion chamber.

FIG. 2 is a view taken in section on the line 2—2 of FIG. 1.

FIG. 3 is a view on a reduced scale, showing in side elevation a dehydrating system in which the furnace herein disclosed may advantageously be used.

As clearly appears in FIG. 1 and FIG. 2, the furnace 6 has a generally cylindrical wall 8 and end walls 10 and 12 providing a combustion chamber 14 lined with fire brick 16 or other refractory lining material. The material used preferably provides thermal insulation. By way of exemplification, oil or gas burners 18 are used as carbureting means to provide the required fuel to carburete the primary air and secondary air hereinafter referred to. These fuel burners are disposed in frustoconically expanding throats 20 which are directed tangentially to the combustion chamber 14. Normally, the fuel admitted through each burner 18 is supplied with primary air from any source (not shown), the arrangement being conventional.

In each instance, secondary air is supllied through an auxiliary inlet 22 which likewise is tangential and opens into the chamber in the path of gases admitted through the flaring passages 20. The burning gases, augmented by such secondary air as is received through the inlet 22, establishes vortices which whirl at relatively high speeds within the opposite ends of the combustion chamber 14. These vortices move axially toward the center of the furnace for escape through the flue 24. The flue is tangential in the same sense as the flaring inlet passage 20 and the secondary inlet passage 22 at each end of the combustion chamber. Pressure differential between the air inlets into the combustion chamber and the point of

gas discharge from the dehydrating drum creates a strong current of dehydrating gas through the entire system. As will be explained, the pressure differential is created by the suction of the blower which exhausts hot gases from the dehydrating drum system hereinafter described and with which this furnace is desirably used.

As is apparent from my patent above identified, the desired pressure differential is preferably established by a blower 36 at the outlet end of the dryer which exhausts the gas from the drying drum 38 and produces a very substantial suction to which the flue 24 is subject. It is suction from the remote end of the drying drum 38 which draws the secondary air through the inlets provided at 22. The material to be dehydrated is supplied to a hopper 40 from which it enters the flue and passes with the hot gases into the drum. The material is separated from the hot gases after the latter have been sucked from the drum by the blower 36. These gases are partly products of combustion of the furnace and they are partly made up of air admitted through the aforesaid auxiliary inlets.

In accordance with the present invention, supplemental secondary inlets are provided at 30 which are tangential with respect to the combustion chamber 14 but directed in an opposite sense to the inlets 20 and 22. Moreover, the inlets 30 are provided midway between the respective inlets 22 and the outlet flue 24. The inlets 22 and the inlets 30 have dampers 32 and 34 for apportioning air flow.

In consequence of this arrangement, the whirling vortices within the furnace abruptly encounter circumferential currents of secondary air admitted through the inlets 30 and whirling in a direction opposite to that of the respective vortices from the burners. The resulting turbulence not only produces thorough mixing with these additional quantities of secondary air but also abruptly interrupts the vortical movement with the result that the products of combustion have to make a fresh start as they approach the flue 24. It has been found that if a fire wall is eliminated from a conventional furnace, the flame will extend into the dehydrating drum. This is not the case if the furnace is made as herein disclosed, since the combustion will be completed within the chamber 14 and no burning fuel will issue through the flue 24.

I claim:

1. A furnace comprising the combination with means forming a generally cylindrical combustion chamber having ends and a generally tangential flue intermediate its ends, of means providing tangential burners constituting means for admitting fuel and primary air adjacent the respective ends of the chamber, and means providing secondary air inlets of generally tangential disposition and constituting means for admitting secondary air tangentially in the same sense in which fuel and primary air are admitted from said burners, whereby the fuel and air admitted to the chamber are directed on a helical path therein, said secondary air inlets opening into the chamber in the path of material from said burners, and means for providing auxiliary secondary air inlets at opposite sides of said flue and disposed intermediate the burners and the flue, said auxiliary secondary air inlets being tangential in a sense opposite to that of the secondary air inlets and the burners.

2. A furnace comprising the combination with means forming a generally cylindrical combustion chamber having a flue opening from its periphery, of first means for admitting a current of air tangentially into said chamber at a point spaced axially from said flue, carbureting means for supplying fuel for mixture with the air so admitted for combustion in said chamber, a second means

for admitting a current of air tangentially into said chamber at a point intermediate the flue and said first means, said second means being remote from the first means for permitting combustion of the fuel to progress during a substantial length of unobstructed helical travel circumferentially and axially of said chamber before meeting the current of air admitted through said second means, the first and second means for admitting air being opposite in sense for effecting impact of said currents to create turbulence, and means for establishing pressure differentials for effecting rapid flow of the several currents of air admitted to said chamber, the impact of such currents upon each other resulting in completion of combustion within said chamber after first allowing a substantial length of travel of burning gases helically of the chamber before said impact occurs.

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