March 22, 1966 N. A. MINER, JR 3,241,506

STOKER FIRING OF FUELS

Filed March 15, 1963 2 Sheets-Sheet 1

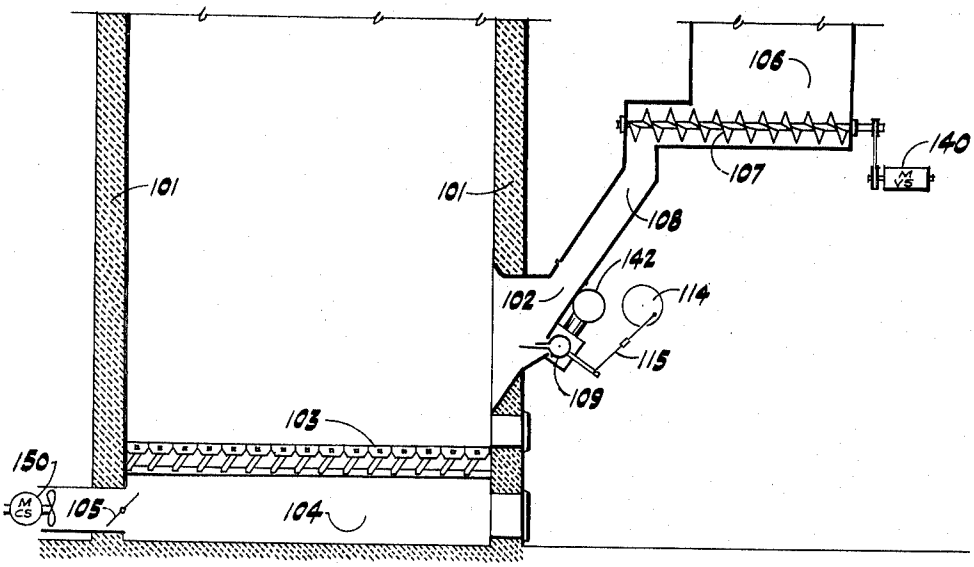


Fig - 1

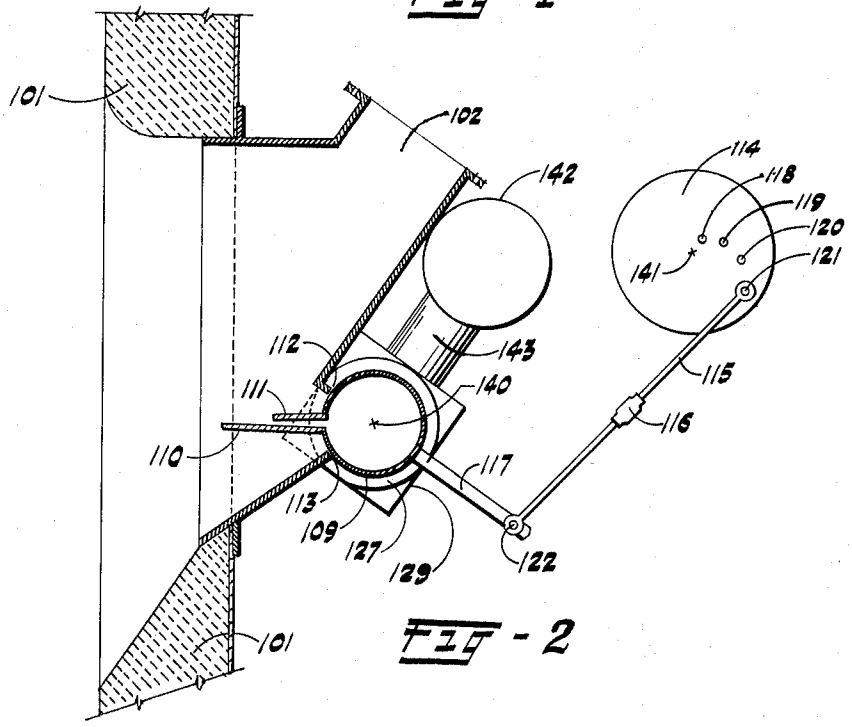


Fig - 2

INVENTOR.

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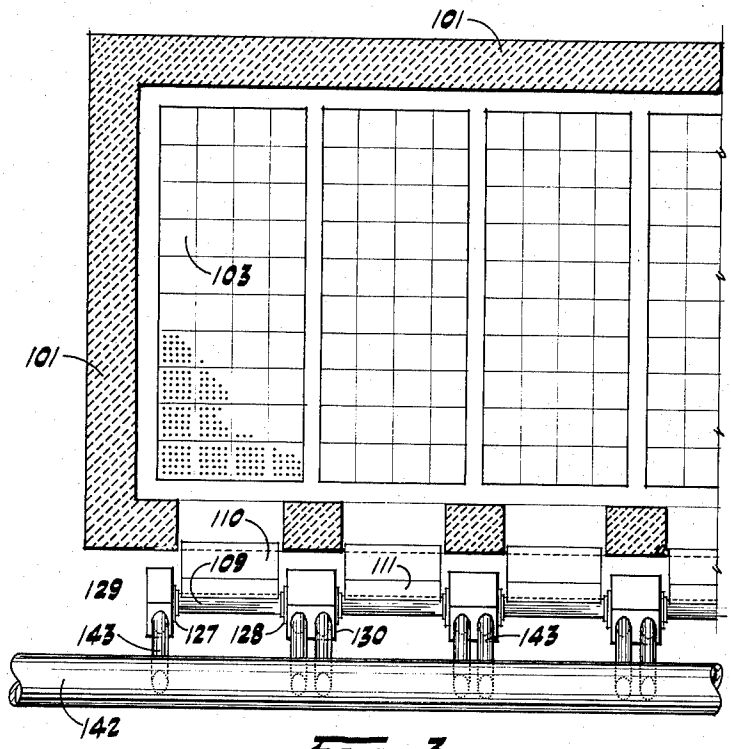


FIG - 3

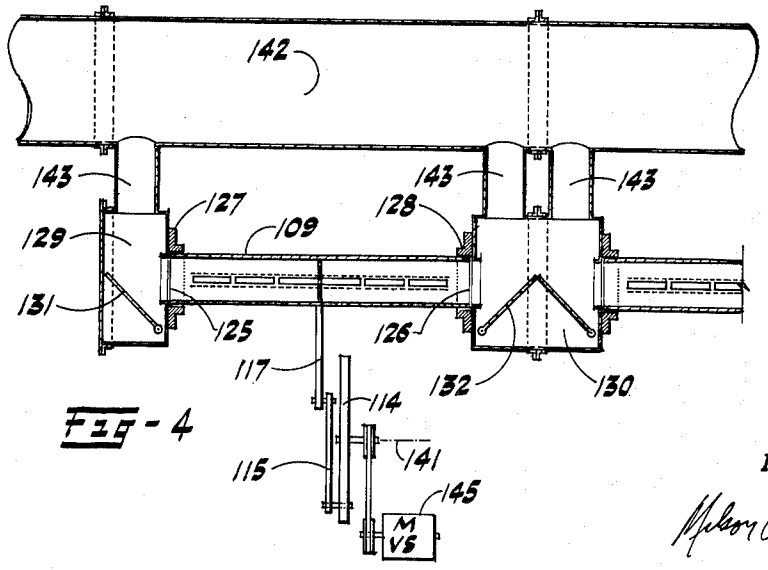


FIG - 4

INVENTOR.

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3,241,506

STOKER FIRING OF FUELS

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1 Claim. (Cl. 110—105.5)

This invention relates to improvements in the stoker firing of fuel in furnaces such as are associated with boilers, incinerators, smelters, kilns, ovens and the like and in accordance with the present invention improved means is provided for evenly distributing the fuel in the furnace and also improved means is provided for adding a fluid (hereinafter called air) both to assist in the distribution of fuel and to assist in good combustion of the combustible gases above the fuel bed by being "secondary" combustion air as well as air which will provide turbulence, thereby assisting combustion by helping to intimately mix the combustion gases with air, thus resulting in improved combustion and a reduction in "smoking" of the furnace.

The invention together with its numerous objects and advantages will be best understood from a study of the following description taken in connection with the accompanying drawings which illustrate one form of the invention.

In the accompanying drawings,

FIG. 1 represents a diagrammatic longitudinal, vertical section through a furnace showing my improved spreader stoker mechanism as it would be installed in order that it could spread the particles of fuel, which it would receive from a feeder mechanism shown above, on to the grates shown in the furnace.

FIG. 2 is a sectional, elevational view of my new spreader stoker mechanism enlarged in size so as to more clearly show its parts and their relation to each other.

FIG. 3 is a plan view showing three and a portion of a fourth of my new fuel spreader or injector mechanisms and an arrangement of a number of these injectors installed in the same furnace. In the interest of clarity the "throat" **102** portions are deleted from this view. In actual practice a "throat" **102** would be installed in each of the openings shown in the refractory **101**.

FIG. 4 represents a longitudinal, sectional view as it would appear when cut by a plane passing through or near the centers of the air supply duct **142** and the deflector plate/nozzle/air tube assembly **110, 111, 109**. This view also has the "throat" **102** portions deleted in the interest of clarity.

Now referring to the drawings **101** indicates the heat resistant walls of this furnace; **103** indicates the grate structure which receives and supports the heavier particles of fuel during combustion. Air openings are provided in this grate structure and a portion of the combustion air required is supplied through the air plenum and ash pit **104**; through a controllable damper **105**; either from the surrounding atmosphere as "natural draft" or as "forced draft"; in this drawing I have symbolized as **150** as "forced draft" fan driven by a constant speed motor. Fuel for my stoker would normally be received and temporarily stored in a receptacle or bin shown as **106** from which it is discharged as needed by a controllable feeding or metering device shown in this drawing as a feed screw **107** (this shown as being driven by a variable speed motor **140**) down through a chute or duct **108** for injection or spreading into the previously described furnace by my improved spreader stoker mechanism. The improved method of distributing fuel hereinafter described and particularly pointed out in the claims and accompanying drawings results from the use of a constantly oscillating deflector plate/nozzle/air tube assembly **110, 111, 109**. Referring again to FIG. 1 of

the drawings, as the fuel slides down the chute or duct **108** and into the throat **102** of this stoker, it will be deflected and directed into the furnace by a deflector plate **110** and also by a controlled jet of fluid (hereinafter called air) issuing from a properly designed nozzle **111**. One method, but not necessarily the only method, of arranging for the proper oscillation of the nozzle **111** and deflector plate **110** would be to firmly fix this nozzle **111** and deflector plate **110** to an air supply tube or plenum **109** so that said tube **109** could then serve as both a supply duct and also as a supporting member. In this case it would be advantageous to so construct and arrange this deflector plate/nozzle/tube assembly **110, 111, 109** in order that it would be capable of being supported in pivots or bearings in order that it could move in an oscillating motion all the while it is receiving its air supply. This deflector plate/nozzle/tube assembly **110, 111, 109** would then be located in close proximity to two edges **112** and **113** which are prepared in the stoker throat **102** portion; this "top" edge **112** and the "bottom" edge **113** would thus act as a seal along the longitudinal portion of the tube **109**. The two "ends" or "sides" of throat **102** would be closed and also arranged to fit in close proximity to tube **109** as well as having sufficient clearance to allow the "ends" of the nozzle **111** and deflector plate **110** to operate freely. This all being so arranged that this deflector plate/nozzle/tube assembly **110, 111, 109** could then be continually oscillated through an arc all without undue friction of interference between the deflector plate/nozzle/tube assembly **110, 111, 109** and the "top" and "bottom" edges **112** and **113**, and the two "ends" or "sides" of the throat. All this being so arranged that there will be a minimum of leakage, either of "outside" air into the furnace or of furnace gases leaking out of the furnace into the surrounding atmosphere. One method of arranging for a continuous supply of air to the nozzle and also of supporting this deflector plate/nozzle/tube assembly **110, 111, 109** so that it might oscillate as a unit would be to furnish the ends of this tube so that it could be supported at each end **125** and **126** (reference FIG. 4) by stationary bearings **127** and **128**. These bearings could then be fastened to stationary windboxes or plenums **129** and **130** which could be supplied with dampers **131** and **132** to adjust, control, and if necessary close off the quantity and/or pressure of the nozzle air supply. These windboxes would be arranged so as to receive their supply of air from the supply duct **142** through distributing ducts **143**.

A mechanism for oscillating this deflector plate/nozzle/tube assembly **110, 111, 109** is also provided so that this assembly can be continuously oscillated through an arc of several degrees all the while with the nozzle being furnished its required supply of air. The oscillating mechanism is made so as to be adjustable as to the portion of the arc this assembly will oscillate in and also variable or adjustable in the amount of arc or number of degrees that it will oscillate. This means that it can be adjusted so that the deflector plate/nozzle/tube assembly **110, 111, 109** can continually oscillate while pointing to a relatively high position, to an infinite number of intermediate positions, or also, of course, to a relatively low position. The arc or degree of oscillation is also made adjustable through as wide a range as may be required. One method of doing this is shown (reference FIG. 2) with **114** representing a crank disk, **115** the connecting rod, **116** the connecting rod adjusting device so arranged that the length of this connecting rod **115** may be changed at will; **117** represents an arm affixed to the deflector plate/nozzle/tube assembly **110, 111, 109** so that with the crank disk **114** rotating about its center of rotation **141** and with the connecting rod **115** then moving back and forth that

the deflector plate/nozzle/tube assembly **110, 111, 109** will of necessity then oscillate about its center of rotation **140**. The crank disk **114** may be driven by a variable speed device such as a variable speed motor, engine or some other adjustable speed driving mechanism; this is shown in FIG. 4 as a variable speed motor **145**. The connecting rod length adjusting mechanism **116** is provided so that the length of the connecting rod between crank pin **121** in the crank disk and crank pin **122** in arm **117** may be adjusted as desired; this in order that the relative position of the deflector plate/nozzle/tube assembly **110, 111, 109** may be changed so that this deflector plate/nozzle/tube assembly **110, 111, 109** can be made to point to a relatively high position, to an infinite number of intermediate positions or, of course, to a relatively low position while it oscillates. The arc or degree of oscillation of this deflector plate/nozzle/tube assembly **10, 111, 109** is also to be made adjustable as required through as wide a range as may be necessary; one, but not necessarily the only method, being by providing as many holes as might be desired at different radii from the center of rotation **141** in the crank disk **114**. With this crank disk **114** so arranged with these several holes, some shown in FIG. 2 as **118, 119** and **120** and with these holes at various radii from the rotation center **141** of the crank disk **114** and so arranged that crank pin **121** may be positioned and properly fastened in either of these several holes, then this travel of the connecting rod **115** and arm **117** may be increased or decreased as desired in order that the amount of angular oscillation of the deflector plate/nozzle/tube assembly **110, 111, 109** may be adjusted as desired.

By providing this continually oscillating deflector plate **110** my invention will improve the distribution of fuel in the furnace because the particles of fuel moving down chute **108** and on into the furnace through throat **102** will be deflected different distances when this deflector plate is in its different positions or angles. When the angle of oscillation of the deflector plate **110** and also its relative position while oscillating are correctly adjusted, fuel can be more accurately and uniformly distributed over the whole of the fuel bed than with a nonoscillatory deflector plate.

While the changing of its angle or position by continually oscillating the deflector plate **110** improves the distribution of the fuel, still further improvement is made by the spreading effect of the constantly moving jet of air issuing from the oscillating air nozzle **111**. With the deflector plate **110** and the air nozzle **111** continually oscillating through their adjusted angle, fuel received down chute **108** can be very evenly spread from the front of the grate (near the stoker mechanism) to the back of the grate. This is a benefit to the user since it is a well established fact that optimum efficiencies and rates of combustion accrue when a fuel bed is evenly distributed. There are other benefits as a result of the oscillating jet of air issuing from nozzle **111**. The use of "secondary" combustion air blown into the furnace through nozzles into the combustible gases above the fuel bed is a presently known art, but my invention of oscillating the nozzle or nozzles used for the introduction of "secondary" combustion air is new, and its use results in a marked improvement in furnace efficiency due to the resulting increase in turbulence and the better mixing of these combustible gases and air that then occurs. This improves combustion thus resulting in higher efficiency and less smoke emission from furnaces thusly equipped.

I recognize that prior to my invention spreader stoker machines have been made both with adjustable deflector plates and with air nozzles to assist in the distribution of fuel. I also recognize the fact that air nozzles have been employed to introduce "secondary" combustion air into furnaces and to give turbulence to the combustion gases. I therefore do not claim such a combination broadly; but I claim:

In a furnace, apparatus for distributing fuel in a furnace, improving furnace turbulence and providing air needed for the secondary combustion of gases within said furnace comprising a chute connected to said furnace, a horizontally extending slot in the rear wall of said chute, a rotatable horizontal tubular member secured to said chute, a deflector plate secured to said tubular member, said plate passing through said slot and terminating in said chute toward said furnace to receive and support fuel particles deposited thereon, means to provide oscillation of said tubular member about its axis, nozzle means connected to said tubular member, said nozzle means passing through said slot and terminating in said chute, a source of air connected to said nozzle means, said nozzle means cooperating with said deflector plate whereby said air assists in the distribution of the fuel deposited upon said deflector plate and causes turbulence and provides for the secondary combustion of gases within the furnace.

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