Jan. 17, 1933. R. A. FORESMAN 1,894,267

ASH HANDLING APPARATUS

Filed Feb. 2, 1928 3 Sheets-Sheet 1

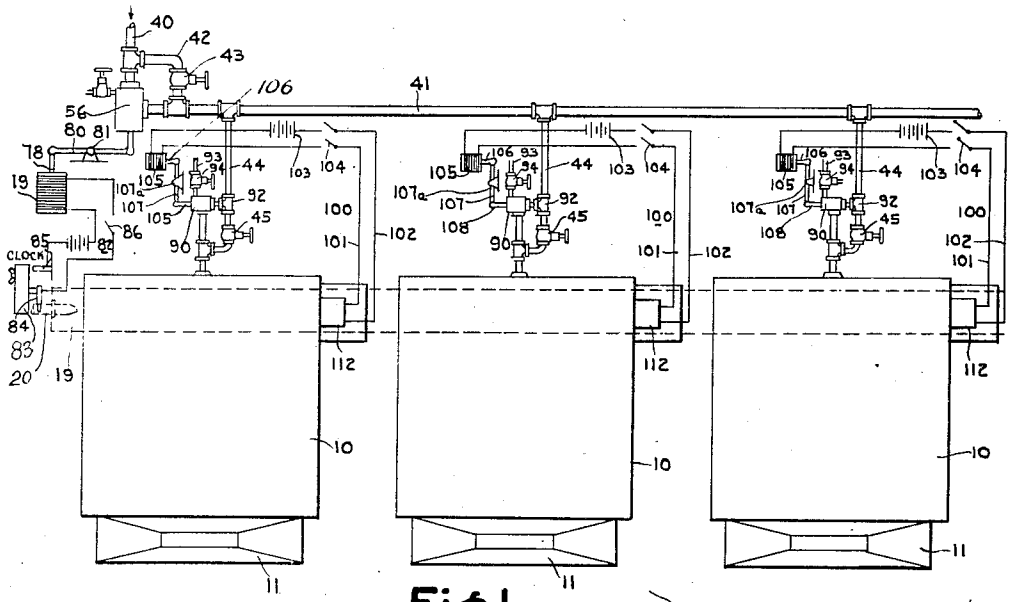
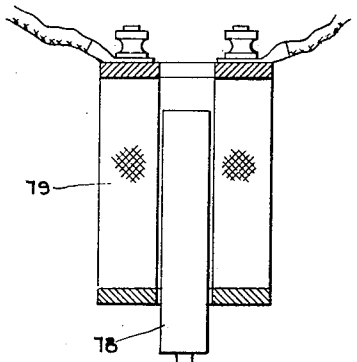
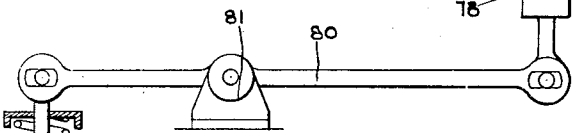


Fig. 1.





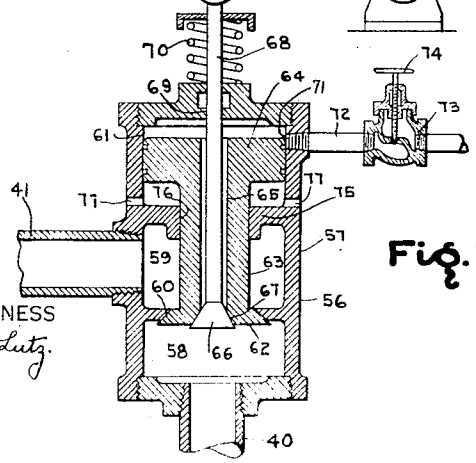


Fig. 3.

WITNESS
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ASH HANDLING APPARATUS

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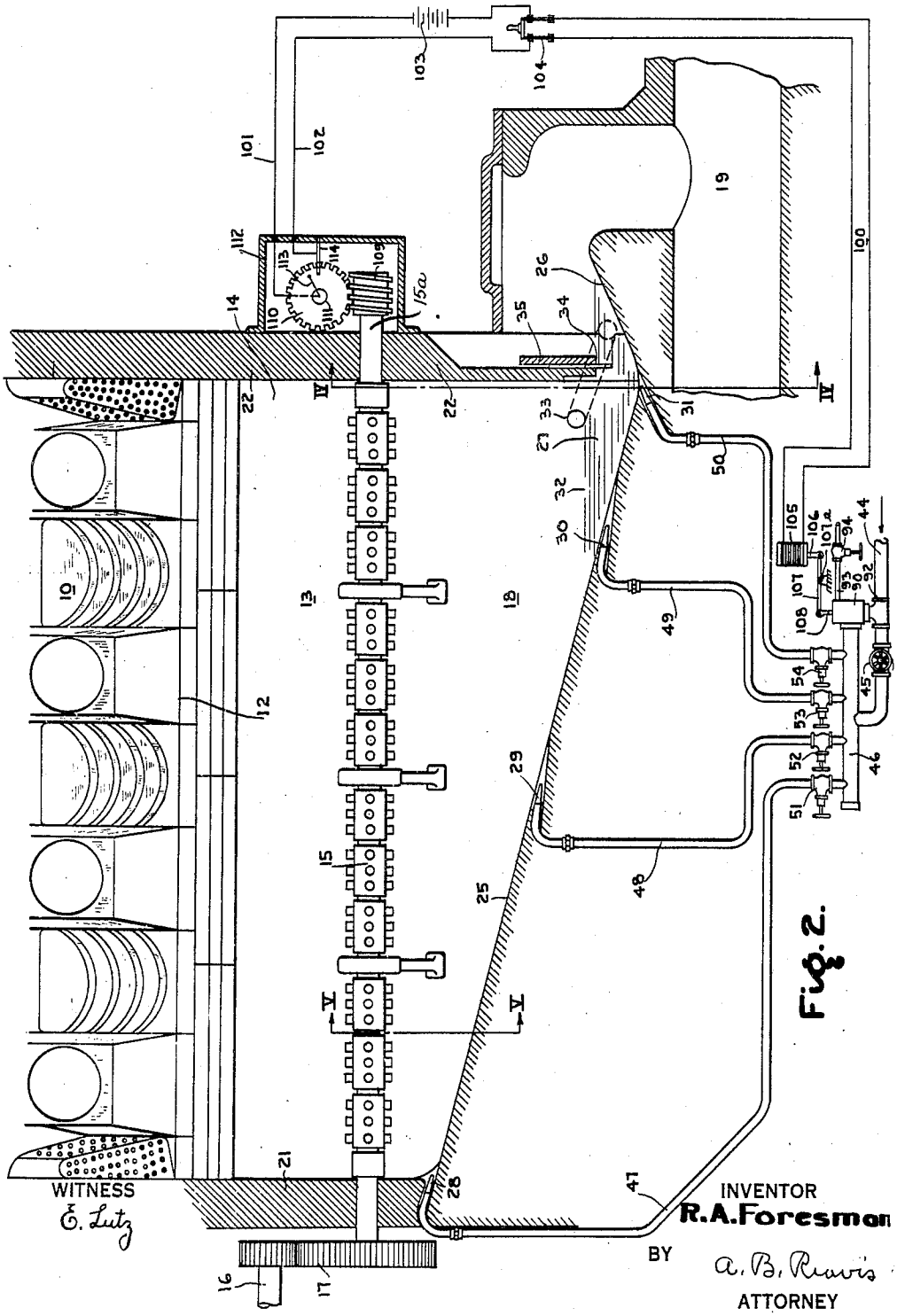


Fig. 2.

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ASH HANDLING APPARATUS

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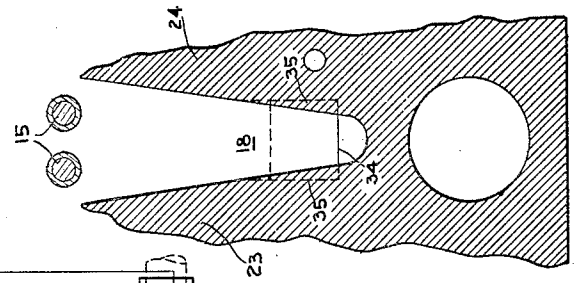


Fig. 4.

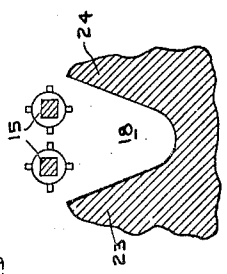


Fig. 5.

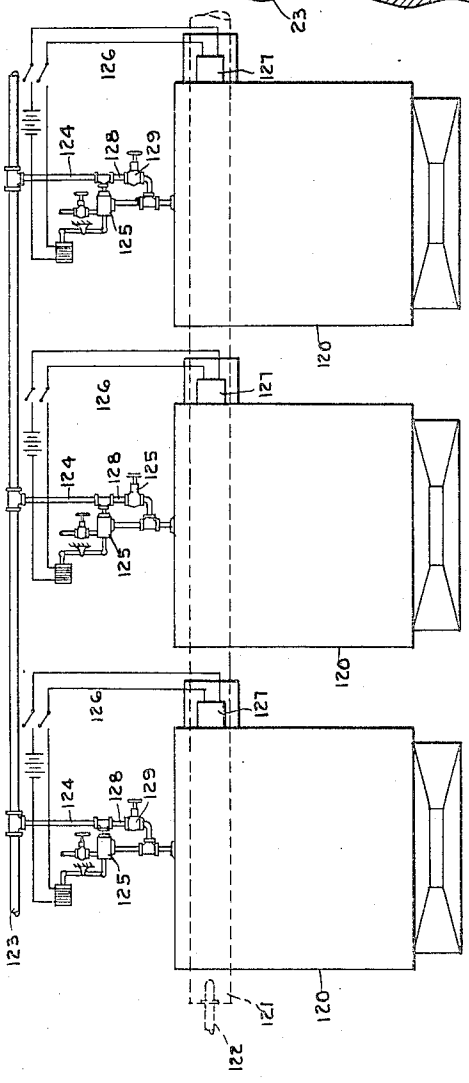


Fig. 6.

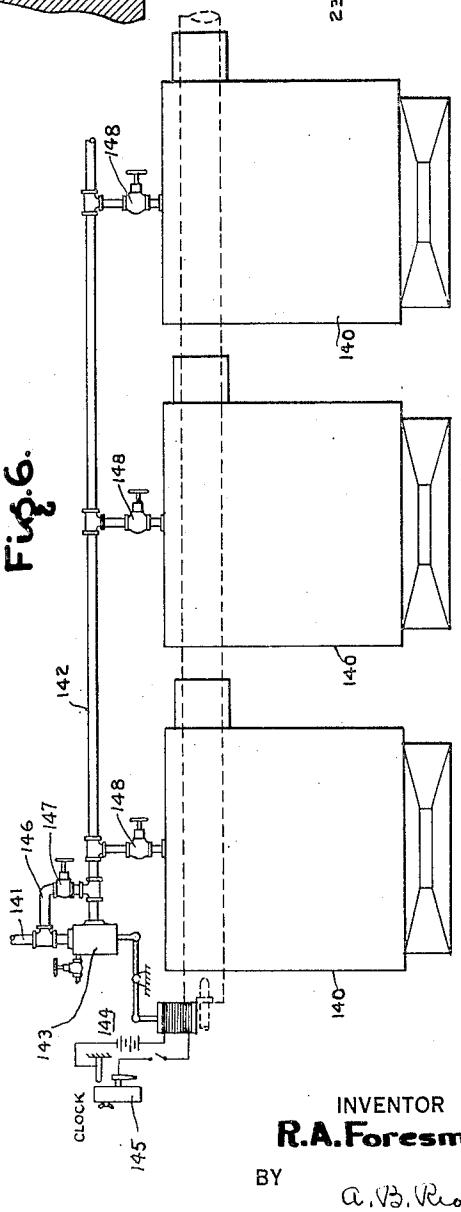


Fig. 7.

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Patented Jan. 17, 1933

1,894,267

UNITED STATES PATENT OFFICE

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ASH HANDLING APPARATUS

Application filed February 2, 1928. Serial No. 251,391.

My invention relates to ash handling apparatus and more particularly to ash handling apparatus used in connection with modern combustion furnaces, and has for its object the provision of apparatus of the character designated which is of improved construction and arrangement of parts.

In the design of ash conveying systems, one of the major problems has been that of providing a suitable air-tight seal between the furnace or furnaces and the conveyor which carries the ashes away from the furnace to a dump, bin or other suitable place of discharge. In solving this problem, it has heretofore been the practice to provide a relatively large hopper beneath the furnace so that a relatively large quantity of ash may be maintained therein at all times. Ashes in such constructions are then removed from the bottom of the hopper, either periodically or continuously, but a sufficient quantity is always maintained in the hopper to prevent air from passing upwardly through the hopper and into the furnace. Should air enter the furnace through the hopper it might undesirably affect combustion as well as support the combustion of any combustible remaining in the ash which has fallen into the hopper, thereby resulting in overheating and damaging the hopper construction. In ash-conveying systems, such as are referred to above, the construction of the ash hoppers is necessarily such as to entail considerable expense both as to initial cost and upkeep. Besides this, the hoppers occupy considerable valuable space in a power plant. Also in all of the prior proposals the operation of the dumping apparatus is dependent entirely upon the manual element.

More particularly, therefore, an object of this invention is to provide an apparatus of the character designated which is simple and inexpensive in both construction and operation, one in which an air-tight seal is maintained at all times between the exterior and interior of the furnace, one which can be operated either continuously or intermittently, one in which the operation can be either manually or automatically controlled, or a combination of both, and lastly, one which occupies a minimum amount of space in the power plant.

Other objects more or less incidental or ancillary to the foregoing will be apparent to those skilled in the art to which this invention appertains from an examination of the following description when taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view, in part diagrammatic, showing my improved apparatus installed in a plurality of furnaces;

Fig. 2 is a longitudinal sectional view through a furnace in which my improved apparatus is installed;

Fig. 3 is a fragmentary sectional view illustrating a valve used in my improved apparatus and also illustrating a part of the control mechanism therefor;

Fig. 4 is a fragmentary transverse sectional view taken along the line IV—IV of Fig. 2;

Fig. 5 is a fragmentary transverse sectional view taken along the line V—V of Fig. 2;

Fig. 6 is a view similar to Fig. 1 illustrating an alternative installation; and

Fig. 7 is a view similar to Figs. 1 and 6 and illustrating a still different installation.

According to one application of my invention, an inclined trough is disposed beneath the usual furnace ash disposal means, which in this instance is the clinker grinder rolls. The side walls of the trough have an air-tight connection with the furnace, and an end portion of the trough extends outwardly beyond the confines of the furnace to provide a discharge therefor. The discharge end is turned upwardly to provide a basin at the point where the trough passes through the furnace wall. The trough is provided in its bottom wall with fluid jet means which serves to impel the ash material along the bottom, through the basin and out over the discharge end and into a suitable ash receiver, such, for instance, as a main sluiceway. The basin is adapted to hold water and a plate member which has an air-tight connection with the furnace extends downwardly below the level of water in the basin to pro-

vide an effective liquid seal. Mechanism is also provided for controlling the operation of the fluid jet means so that they may be operated intermittently for predetermined periods of time.

Referring now in detail to the drawings and particularly to Figs. 1 and 2, the reference numerals 10, 10 indicate a plurality of furnaces, each of which is provided with a fuel hopper 11, a progressive feed stoker 12, and a suitable ash disposal means 13, which in this instance comprises a clinker grinder pit 14 and clinker grinder rolls 15, 15 arranged within the pit. The rolls 15 are operated from a power shaft 16 by any suitable means such as speed reduction gearing 17. After the fuel is burned the residue or ash falls into the clinker pit 14 wherein it is ground between the rolls 15, 15. The ground ash falls from the rolls into a trough 18 which forms a part of my improved ash handling apparatus. From there it is discharged outwardly into a main sluiceway 19 which serves all of the furnaces 10. The ash from the furnaces is propelled along the sluiceway 19 by water under pressure supplied by a nozzle 20.

The trough 18 may be of any suitable construction, a conventional form being herein shown. The trough extends longitudinally of the clinker grinder rolls 15, 15 from side to side of the furnace. The furnace 10 is provided with walls 21, 22, 23 and 24 which extend downwardly to form the side walls of the clinker pit 14. In the construction illustrated, these walls extend still further to form in effect the side walls of the trough 18. Thus an air-tight connection is provided between the side walls of the trough 18 and the furnace 10.

The trough 18 is also provided with a downwardly-inclined bottom 25 which has an end portion 26 extending outwardly beyond the confines of the furnace to provide a discharge end for the trough. The end 26 is turned upwardly as shown, thus providing a basin 27, the deepest portion of which is at the point where the trough passes through the wall 22. The basin 27 is adapted to hold water, the level of which is indicated at 32. A suitable overflow device 33 serves to maintain this level. The ashes falling in the trough 18 are discharged from the furnace by water under pressure supplied by a plurality of jets 28, 29, 30 and 31, which are suitably mounted in the bottom wall 25 and are adapted to discharge the water under pressure along the trough and force the ashes outwardly over the discharge end thereof.

In order to prevent the undesired admission of air to the clinker pit 14, which might adversely affect combustion, I provide a plate member 34, adjacent the wall 22, which has an air-tight connection with the walls 22, 23 and 24. The plate 34 extends downwardly to a point beneath the level 32 of the water in the basin 27, thereby providing an effective liquid seal between the clinker pit 14 and the exterior of the furnace. The plate member 34 is mounted to slide in a pair of vertically arranged guides 35, 35, carried by the side wall 22, thus providing a means for adjusting the plate vertically. The plate may be removed entirely to permit access to the interior of the furnace.

As stated above, the jets 28, 29, 30 and 31 provide an effective means for forcing the ashes out of the furnace. They also serve to maintain sufficient water in the basin for the liquid seal.

My improved ash-handling apparatus may be operated either continuously or intermittently for predetermined periods of time. Also the apparatus may be operated either manually or in response to a timing mechanism.

The timing mechanism may be either an ordinary clock, or it might be some operating part of the stoker, the operation of which is closely related to the operation of the ash-handling apparatus. Also, the ash-handling apparatus for all of the furnaces may be operated as a unit, or each apparatus may be operated separately. In this latter case the operation may also be effected either manually or in response to a timing element.

I will first describe the manual means for effecting these different results. In Fig. 1, I have shown an installation in which all of my different controls are embodied. Water under pressure is delivered by a supply conduit 40. A second conduit 41 is connected to the conduit 40 by a short conduit 42 in which is installed a manually operated valve 43. The conduit 41 is in effect a water supply manifold for each of the furnaces and the valve 43 serves as a manual control for the water supply for all of the furnaces.

A plurality of separate conduits 44, 44 are provided, each of which serves to connect the ash handling apparatus in a furnace with the conduit 41. A manually operated cut-off valve 45 is provided in each of the conduits 44 and serves as a means for manually controlling the water supply to any one of the furnaces.

Referring now to Fig. 2, it will be seen that each of the conduits 44 terminates in a short supply manifold 46 for each furnace. The jets 28, 29, 30 and 31 communicate with the manifold 46 by a plurality of pipes 47, 48, 49 and 50, respectively. The pipes 47, 48, 49 and 50 are provided with cut-off valves 51, 52, 53 and 54 which serve as a manual means for controlling the supply of water under pressure to any one of the jets. The above described water supply conduits and valves provide an extremely effective means for manually controlling the flow of water to the jets in any way desired.

As stated above, a means is also provided

for controlling the operation of the jets in all of the furnaces in response to a timing mechanism whereby the jets will operate intermittently for predetermined periods of time. The conduits 40 and 41 are also connected by a special valve 56, which, when actuated, will allow water under pressure to flow to the conduit 41 for a certain period of time. The valve is provided with adjusting means so that the period of time which it is open may be varied to suit the operating conditions of the furnaces.

In Fig. 3, I have shown the valve 56 in detail. The valve comprises a casing 57 which is provided with an inlet chamber 58 for the water under pressure received from the conduit 40, an outlet chamber 59 which communicates with the jets 28, 29, 30 and 31 by the conduit 41, a valve seat 60, and an upper cylinder portion 61. The valve is provided with a valve member 62 for the seat 60, a valve stem 63 secured to the valve member, and an operating piston 64 formed integral with the stem and fitting within the cylinder portion 61 of the valve casing. A bore 65 extends through the piston 64, stem 63, and valve member 62 and provides a means of communication between the inlet chamber 58 of the valve casing 57 and the space above the piston member 64.

The flow of water under pressure through the bore 65 is controlled by a second valve member 66 which is provided with a seat 67 formed in the valve member 62. The valve member 66 is provided with an actuating stem 68 which extends upwardly through the bore 65 and out through an opening 69 in the top part of the casing 57. The valve member 68 is urged to closed position by means of a suitable coil spring 70.

The upper part of the cylinder portion 61 is provided with an outlet opening 71, within which a waste pipe 72 is secured. The pipe is provided with a needle valve 73 having an operating disk 74 secured to its stem. The purpose of the needle valve 73 is to regulate the flow of water under pressure from that portion of the space within the valve casing which is above the operating piston 64. A division member 75 is formed integral with the valve casing 57 and is provided with a central opening 76 within which the movable valve stem 63 fits in a fluid-tight manner. The valve casing 57 is also provided with discharge openings 77 which permit any fluid which might collect below the piston member 64 to escape freely to the atmosphere.

The valve stem 68 is connected to a core member 78 of a solenoid 79 by a rocker arm 80 which is provided intermediate its end with a suitable fulcrum support 81. Thus when the solenoid 79 is energized the core member 78 will move upward and thereby cause the valve stem 68 to move downward and open the valve 66 thereby permitting water under pressure to flow into the cylinder portion of the casing.

The solenoid 79 is in a battery circuit 82, which is adapted to be closed intermittently by a suitable timing mechanism, for example, a clock 83. The clock 83 is provided with a rotating hand 84 which is formed of material suitable for conducting electricity. The hand 84 is connected to one side of the circuit 82 and is adapted to contact once during every revolution with a suitable contact member 85 connected to the opposite side of the circuit. A suitable throw out switch 86 is arranged within the circuit 82.

When it is desired that the ash handling apparatus in all of the furnace be simultaneously operated intermittently for predetermined periods of time, the valves 45, 51, 52, 53, and 54 are all turned to the full open position, and the valve 43 is closed. The valve 56 will now control the flow of water to all of the furnaces. When the circuit 82 is closed by the clock hand 84 contacting with the member 85 the solenoid 79 will be energized, thus causing the rocker arm 80 to move about its support and force the valve stem 68 and valve member 66 downward, thereby permitting water under pressure in the conduit 40 to flow through the bore 65 and into the space above the piston member 64. It will be observed that the small valve member 66 is off its seat for a very short period of time, for as soon as the electric contact is broken by the further movement of the clock hand 84 the valve member 66 will be returned to its seat by the spring 70. The water in the space above the piston 64 cannot escape except through the pipe 72 and needle valve 73.

As the area of the top surface of the piston 64 is much larger than that of the under surface of the valve member 62, the valve member 62 will be forced to an open position and thus permit the water to flow through the casing 57 and to the furnaces for effecting the discharge of the ashes therefrom.

The valve member 62 will remain off its seat until the down forces acting on the top surface of the piston member 64 are less than the up forces acting on the under surface of valve member 62. Thus when a sufficient amount of water has leaked past the valve 73 the pressure of the water within the chamber 58 will force the valve 62 to closed position; thereby shutting off the flow of water to the conduit 41. As the water above the piston 64 can only leak out past the needle valve 73, the period of time which the valve member 62 remains off its seat will be governed entirely by the adjustment of the needle valve. Thus the operation of the ash handling apparatus in each of the furnaces may be controlled as a unit, and also their operation may be effected intermittently for predetermined

periods of time. It will of course be understood that both the details of the control means and its manner of operation may be varied widely to accommodate any number of desired operating conditions.

As stated above, an improved means is also provided for controlling the operation of the ash handling apparatus in each of the furnaces independently of the operation of the others, whereby the particular apparatus will operate intermittently for predetermined periods of time. This control means also operates in response to a timing mechanism, but in this case the timing mechanism is operated by the clinker grinder rolls 15.

A plurality of valves 90 are provided which are identical in construction and operation with the previously described valves 56. In the valve 90 the inlet for water under pressure is connected to its respective conduit 44 at points ahead of the valve 45 by a suitable T connection 92, and the outlet for the water under pressure is connected to one end of the manifold 46. Thus by throwing out the switch 86 in the battery circuit 82, opening the valve 43, and closing the valves 45 the valves 90 will control the flow of water to the jets 28, 29, 30 and 31. Each of the valves 90 is provided with a pipe 93 similar to pipe 72 for permitting the discharge of water from above the valve operating piston (not shown). This discharge of water is controlled by a manually operated needle valve 94 in the same manner as previously described needle valve 73.

The operation of each valve 90 is controlled by a separate battery circuit 100 which includes a pair of wires 101 and 102, a battery 103, and a cut out switch 104. A solenoid 105 is arranged within the circuit and is provided with a core member 106 the lower end of which is pivotally connected to one end of a rocker arm 107, which is supported intermediate its ends as indicated at 107*a*. The other end of the rocker arm is pivotally connected to the upper end of a valve actuating stem 108 which is adapted to operate in the exact same manner as stem 68 of the valve 56. One of the clinker grinder rolls 15 is provided with an extension 15*a* which extends outwardly from the furnace wall 22 and has a worm 109 keyed thereto. The worm meshes with a worm wheel 110 which is keyed to a rotating shaft 111 carried by an enclosing casing 112. The wire 101 of the battery circuit is connected to a contact member 113 carried by the worm wheel 110, and the other wire 102 of the battery circuit is connected to a stationary contact 114 carried by the casing 112. Thus once during every revolution of the worm wheel 110 the contact member 113 engages the contact member 114, thereby closing the circuit 100 and energizing the solenoid 105 which in turn operates the actuating stem 108. The water will then be permitted to flow through the valve 90 and to the nozzles 28, 29, 30 and 31 for a predetermined period of time, which depends of course upon the adjustment of the needle valve 94.

It will thus be seen that the extension 15*a* of the grinder rolls 15, the worm 109 and the worm wheel 110 form, in effect, a timing mechanism for controlling the operation of the valve 90.

As is well known, there is a definite relationship existing between the operation of the clinker grinder rolls and the amount of fuel fed to the furnace by the fuel-feeding mechanism; and in some instances there is a positive mechanical connection between the operating mechanisms of both the grinder rolls and the fuel-feeding mechanism for maintaining this definite relationship. Each time the clinker grinder rolls rotate a certain amount of ash will be ground out; and as a large head of material is always maintained above the rolls, the amount of ash ground out by the rolls for each rotation will be approximately the same. It may, therefore, be stated that the amount of ash deposited in the troughs 18 is in direct proportion to the number of rotations of the clinker grinder rolls. Thus, by utilizing the clinker grinder rolls for controlling the operation of the timing mechanism, which in turn controls the operation of the ash handling apparatus; I have provided an extremely efficient means for automatically controlling the discharge of the ash from the furnace.

It will be observed that in Fig. 1, I have shown an installation which includes both the means for controlling the operation of all of the ash-handling apparatus as a unit, and also the means for controlling the operation of the ash-handling apparatus in each furnace independently of the other. When all of the furnaces are operating under a constant load the operator can determine the amount of ash discharged in the several troughs 18 over a period of time, and then adjust the clock mechanism 83 and the needle valve 73 so that the accumulated ash from all of the furnaces may be discharged at one time. Where possible this latter control is highly desirable as it eliminates the added complications of extra control circuits. But in cases where the load varies to any great extent, it will be difficult to determine the amount of ash deposited for successive periods of time, and, as a result, it will be desirable to have a separate control for each furnace. It is, therefore, desirable to have both control means installed so as to be ready for use at all times.

In Fig. 6, I have shown an installation in which the separate control for each furnace alone is installed. This installation can be used where the furnaces always operate under varying loads. The several furnaces are indicated by the reference numerals 120, 120.

Each of these furnaces has my improved ash-handling apparatus installed therein, as will be readily understood. The furnaces are provided with a main sluiceway 121 for carrying away the ash discharged therefrom and a nozzle 122 for furnishing water under pressure to the sluice. Water under pressure is supplied by a main 123, and a plurality of conduits 124 provide means for conducting the water under pressure to each of the furnaces. Valves 125 which are identical in construction with valves 56 and 90 are installed in the conduits 124 and control the flow of water therethrough in the same manner as before. As in the prior construction, each of these valves is provided with a battery circuit 126 for controlling the operation thereof. The circuit is adapted to be intermittently closed by means of a timing mechanism enclosed within the casing 127. As in the prior construction, this timing element is operated by the clinker grinder rolls. I also provide a by-pass 128 in each of the conduits 124, in which a manually operated valve 129 is installed for manually controlling the flow of water if desired.

In Fig. 7, I have disclosed an installation in which a single means is provided for controlling the operation of the ash-handling apparatus in all of the furnaces. This installation is desirable where the load remains substantially constant. As in the prior construction, I provide a plurality of furnaces 140, 140, having my improved ash-handling apparatus installed, a water main 141, a manifold conduit 142 supplying water to all of the furnaces, and a valve 143 identical in construction and operation with the previously described valves 56, 90 and 125 for controlling the flow of water to the furnaces. As in the prior construction, the operation of this valve is controlled by a battery circuit 144 which is adapted to be intermittently closed by means of the clock mechanism 145. I also provide a by-pass 146 having a control valve 147 so that the ash-handling apparatus may be controlled manually, if desired. I also provide a manually operated valve 148 in each of the conduits leading from the manifold to the furnace for cutting off the water supply to any one of the ash-handling apparatus.

From the foregoing it will be apparent that I have devised an improved ash-handling apparatus of the liquid conveyor type, wherein the ready removal of ash from a furnace may be attained with a minimum of expense and labor, wherein the undesired admission of air to the furnace is obviated and which may be operated either continuously or intermittently. Also it will be observed that I have devised an improved control means for my apparatus which operates in response to a timing mechanism and will cause the apparatus to operate intermittently for predetermined periods of time.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. The combination with a furnace having a progressive feed stoker and an ash disposal mechanism arranged at the discharge end thereof, of an inclined trough-like structure extending beneath the ash disposal mechanism and having an air-tight connection with the furnace, the trough-like structure being adapted to discharge ash beyond the confines of the furnace, said trough-like structure having its discharge end turned upwardly to provide a basin, fluid jet means for conveying ash downwardly through the trough-like structure and for maintaining a body of liquid in the basin portion of the structure, and a plate member having an air-tight connection with the furnace and extending transversely of the trough-like structure and downwardly into the basin to a point beneath the liquid level therein for maintaining a liquid seal between the interior of the furnace and the discharge end of the trough.

2. The combination with a plurality of furnaces, each having a progressive feed stoker and an ash disposal mechanism arranged at the discharge end of the stoker, of a main sluiceway extending along all the furnaces, an inclined trough-like structure extending beneath each of the ash disposal mechanisms and having an air-tight connection with its respective furnace, each of the trough-like structures being adapted to discharge into the main sluiceway and having an upturned portion at the discharge end thereof providing a basin, fluid jet means for impelling ash along each of the inclined trough-like structures and into the main sluiceway and for maintaining a body of liquid in the basin of each of the inclined trough-like structures, and sealing means having an air-tight connection with its respective furnace and extending beneath the water level in each of the basins.

3. The combination with a furnace, of an inclined trough having side walls opening upwardly toward and having an air-tight connection with the furnace, said trough having an end portion extending outwardly beyond the confines of the furnace and turned upwardly to provide a basin, liquid jet means for impelling ashes outwardly of the trough and over the upturned portion and for main-

taining a body of liquid in the basin thereof, and a plate member having an air-tight connection with the furnace and extending downwardly along the adjacent wall of the trough to a point beneath the liquid level in the basin thereof thereby forming a liquid seal between the furnace and the discharge end of the trough.

4. The combination with a furnace, of an inclined trough having side walls opening upwardly toward and having an air-tight connection with the furnace, an end portion of the trough extending outwardly beyond the confines of the furnace and being turned upwardly to provide a basin, a liquid jet means extending through the wall of the trough near the upper end thereof for impelling ashes downwardly along the inclined bottom thereof, liquid jet means arranged near the bottom of the basin at the discharge end of the trough and so positioned as to convey ashes outwardly through the discharge end, and a plate member having an air-tight connection with the furnace and extending from side to side of the trough and downwardly beneath the liquid level in the basin thereof for forming a liquid seal between the furnace and the discharge end of the trough.

5. In combustion apparatus, the combination of a furnace; a fuel burning grate structure disposed within the furnace; an ash receiver disposed exteriorly of the furnace; and a sluicing apparatus for receiving the solid products of combustion from the grate structure and for ejecting such products from the furnace and into the ash receiver, and at the same time preventing the undesired admission of air to the interior of the furnace; said sluicing apparatus comprising side walls having an air tight connection with the furnace, a downwardly inclined bottom wall disposed to receive the solid products of combustion from the grate structure and defining at its lower end in conjunction with one of the side walls an opening, the bottom wall having an end portion extending outwardly of the furnace and being turned upwardly to provide a basin contiguous with the opening, the upturned end being in communication with the ash receiver, and fluid jets so disposed as to move the solid products of combustion along the bottom wall, through the opening and into the ash receiver, and to maintain a body of liquid within the basin at a level sufficiently high for sealing the opening.

6. In combustion apparatus, the combination of a furnace; a fuel burning grate structure disposed within the furnace; an ash receiver disposed exteriorly of the furnace; and a sluicing apparatus for receiving the solid products of combustion from the grate structure and for ejecting such products from the furnace and into the ash receiver, and at the same time preventing the undersired admission of air to the interior of the furnace; said sluicing apparatus comprising side walls having an air tight connection with the furnace, a downwardly inclined bottom wall disposed to receive the solid products of combustion from the grate structure and defining at its lower end in conjunction with one of the side walls an opening, the bottom wall having an end portion extending outwardly of the furnace and being turned upwardly to provide a basin contiguous with the opening, the upturned end being in communication with the ash receiver, fluid jet means for impelling the solid products of combustion along the inclined bottom wall through the opening and into the ash receiver and for maintaining a body of liquid in the basin, and a sealing member having an air tight connection with the furnace and extending beneath the water level in the basin.

7. In combustion apparatus, the combination of a furnace; a fuel burning grate disposed within the furnace; clinker grinding apparatus disposed to receive the solid products of combustion from the grate; structural means for receiving the solid products of combustion from the grinding apparatus; an ash receiver disposed exteriorly of the furnace; apparatus for discharging such solid products of combustion from said structural means and into said ash receiver; timing mechanism operated by said clinker grinding apparatus; and mechanism responsive to the operation of the timing mechanism for effecting intermittently for predetermined periods of time, the operation of the discharging apparatus.

8. The combination with a furnace including a progressive feed stoker and an ash disposal means associated with the discharge end thereof; of a trough-like structure disposed beneath the ash disposal means and adapted to receive the ashes therefrom; said trough-like structure having an end portion thereof extending outwardly beyond the confines of the furnace to provide a discharge therefor; means associated with the trough-like structure for discharging the ash material therefrom; timing mechanism; and mechanism responsive to the operation of the timing mechanism for effecting intermittently for predetermined periods of time, the operation of the ash discharge means.

9. The combination with a furnace including a progressive feed stoker and ash disposal means having grinder rolls adapted to receive and grind the ash material discharged from the stoker; of a trough-like structure arranged beneath the grinder rolls for receiving the discharged ash material; the trough-like structure having an end portion extending outwardly beyond the confines of the furnace to provide a discharge therefor; means associated with the trough-like structure for

discharging the ash material therefrom; and mechanism responsive to the operation of the clinker grinder rolls for effecting intermittently for predetermined periods of time, the operation of the ash discharge means.

10. The combination with a furnace including a progressive feed stoker and an ash disposal means having clinker grinder rolls adapted to receive and grind the ash material discharged from the stoker; of an inclined trough extending longitudinally beneath the grinder rolls and adapted to receive the ground ash therefrom; the trough having an air-tight connection with the furnace and having an end portion thereof extending outwardly beyond the confines of the furnace to provide a discharge therefor; means for maintaining a liquid seal between the discharge end of the trough and the interior of the furnace; fluid jet means for impelling ash along the trough and out the discharge end thereof; and mechanism responsive to the operation of the clinker grinder rolls for effecting intermittently, for predetermined periods of time the operation of the fluid jet means.

11. The combination with a furnace including a progressive feed stoker and ash disposal means including clinker grinder rolls adapted to receive and grind the ash material discharged from the stoker; of a trough-like structure disposed beneath the rolls and adapted to receive the ground ash material; the trough-like structure having an air-tight connection with the furnace and having an end portion thereof extending outwardly beyond the furnace to provide a discharge end; means for maintaining an air-tight seal between the interior of the furnace and the discharge end of the trough; means associated with the trough-like structure for discharging the ash therefrom; and mechanism responsive to the operation of the clinker grinder rolls for effecting intermittently for predetermined periods of time, the operation of the ash discharge means.

12. The combination with a furnace including a progressive feed stoker and an ash disposal means having grinder rolls adapted to receive and grind the ash material discharged from the stoker; of a trough-like structure arranged beneath the grinder rolls for receiving the ground ash material; the trough-like structure having an end portion extending outwardly beyond the confines of the furnace to provide a discharge therefor; means associated with the trough-like structure for discharging the ash material therefrom; and mechanism for effecting intermittently and for predetermined periods of time, the operation of the ash discharge means.

13. The combination with a furnace including a progressive feed stoker and an ash disposal means having clinker grinder rolls adapted to receive and grind the ash material discharged from the stoker; of an inclined trough extending longitudinally beneath the grinder rolls and adapted to receive the ground ash therefrom; the trough having an air-tight connection with the furnace and having an end portion thereof extending outwardly beyond the confines of the furnace to provide a discharge therefor; means for maintaining a liquid seal between the discharge end of the trough and the interior of the furnace; fluid jet means for impelling ash along the trough and out the discharge end thereof; timing mechanism; and mechanism responsive to the operation of the timing mechanism for effecting intermittently for predetermined periods of time, the operation of the fluid jet means.

14. The combination with a progressive feed stoker and a clinker pit arranged at one end of the stoker to receive refuse discharged from the latter and having clinker grinder mechanism in the lower portion thereof; of apparatus for disposing of refuse discharged by the clinker grinder mechanism and cooperating with said clinker pit to avoid the entrance or exit of gaseous media through said apparatus; said apparatus including an ash pit having bottom, side and end walls and the bottom and side walls being disposed transverse to the stoker; the bottom wall of the ash pit providing, with respect to one of the remaining walls of said pit, a discharge opening; means providing for the sluicing of material along the bottom wall and out through the discharge opening; and means providing a water seal for the discharge opening.

15. The combination with a progressive feed stoker and a clinker pit arranged to receive refuse discharged from the latter and having clinker grinder mechanism in the lower portion thereof; of apparatus for disposing of refuse discharged by the clinker grinder mechanism and cooperating with said clinker pit to avoid the entrance or exit of gaseous media through said apparatus; said apparatus including an ash pit having bottom, side and end walls and the bottom and side walls being disposed transverse to the stoker; one of the end walls of said ash pit providing, with respect to the bottom wall of the latter, a discharge opening; means providing for the sluicing of material along the bottom wall and out through the discharge opening; and means providing a water seal for the discharge opening.

16. The combination with a progressive feed stoker, and a clinker pit arranged to receive the refuse from the latter and having clinker grinder mechanism disposed within the lower portion thereof; of apparatus for disposing of refuse discharged by the clinker grinder mechanism and cooperating with said clinker pit to avoid the entrance or exit of gaseous media through said apparatus;

said apparatus including an ash pit having end, side and bottom walls and the side and bottom walls being disposed in a direction which is transverse to the stoker; the bottom wall of the ash pit providing, with respect to one of the remaining walls, a discharge opening; one or more jets arranged along the bottom of the ash pit and directed toward the discharge opening; and means providing a water seal for the discharge opening.

17. The combination with a progressive feed stoker, and a clinker pit arranged to receive the material discharged from the latter and having clinker grinder mechanism disposed within the lower portion thereof; of apparatus for disposing of refuse discharged by the clinker grinder mechanism and cooperating with said clinker pit to avoid the entrance or exit of gaseous media through said apparatus; said apparatus including an ash pit having end, side and bottom walls and the bottom and side walls being disposed in a direction which is transverse to the stoker; said bottom wall being inclined, whereby the ash pit increases in depth from one side of the stoker to the other; the end wall at the deeper end of the ash pit providing with respect to the bottom wall, a discharge opening; means for sluicing material along said inclined bottom wall and out the discharge opening; and means providing a water seal for the discharge opening.

18. The combination with a progressive feed stoker and a clinker pit arranged to receive the material discharged from the latter and having clinker grinder mechanism disposed within the lower portion thereof; of apparatus for disposing of refuse discharged by the clinker grinder mechanism and cooperating with said clinker pit to avoid the entrance or exit of gaseous media through said apparatus; said apparatus including an ash pit having end, side and bottom walls and the bottom and side walls being disposed in a direction which is transverse to the stoker; said bottom wall being inclined, whereby the ash pit increases in depth from one side of the stoker to the other; the end wall at the deeper end of the ash pit providing, with respect to the bottom wall, a discharge opening; a plurality of jets disposed within the bottom wall in spaced relation to one another and being directed toward the discharge opening; and means providing a water seal for the discharge opening.

19. In combustion apparatus, the combination of a fuel burning structure; an ash storage pit disposed to receive the ash discharged from the structure, and having a discharge opening in the lower portion thereof; means including fluid jets in the pit for effecting removal of the ash through the discharge opening; and means dependent upon an operating characteristic of the ash pit for effecting periodically, and for predetermined periods of time, the operation of the ash removing means.

20. In combustion apparatus, the combination of a fuel burning structure; a pit for receiving the ash as it is discharged from the structure; ash supporting and crushing means disposed in the lower portion of the pit; an ash storage pit disposed beneath the first named pit and arranged to receive the ash as it is discharged from the crushing means; the last-named pit having an ash discharge opening in the lower portion thereof; means including fluid jets for effecting the removal of the ash through the discharge opening; and means dependent upon an operating characteristic of the pit for effecting periodically the operation of the ash-removing means.

In testimony whereof, I have hereunto subscribed my name this 27th day of January, 1928.

ROBERT A. FORESMAN.