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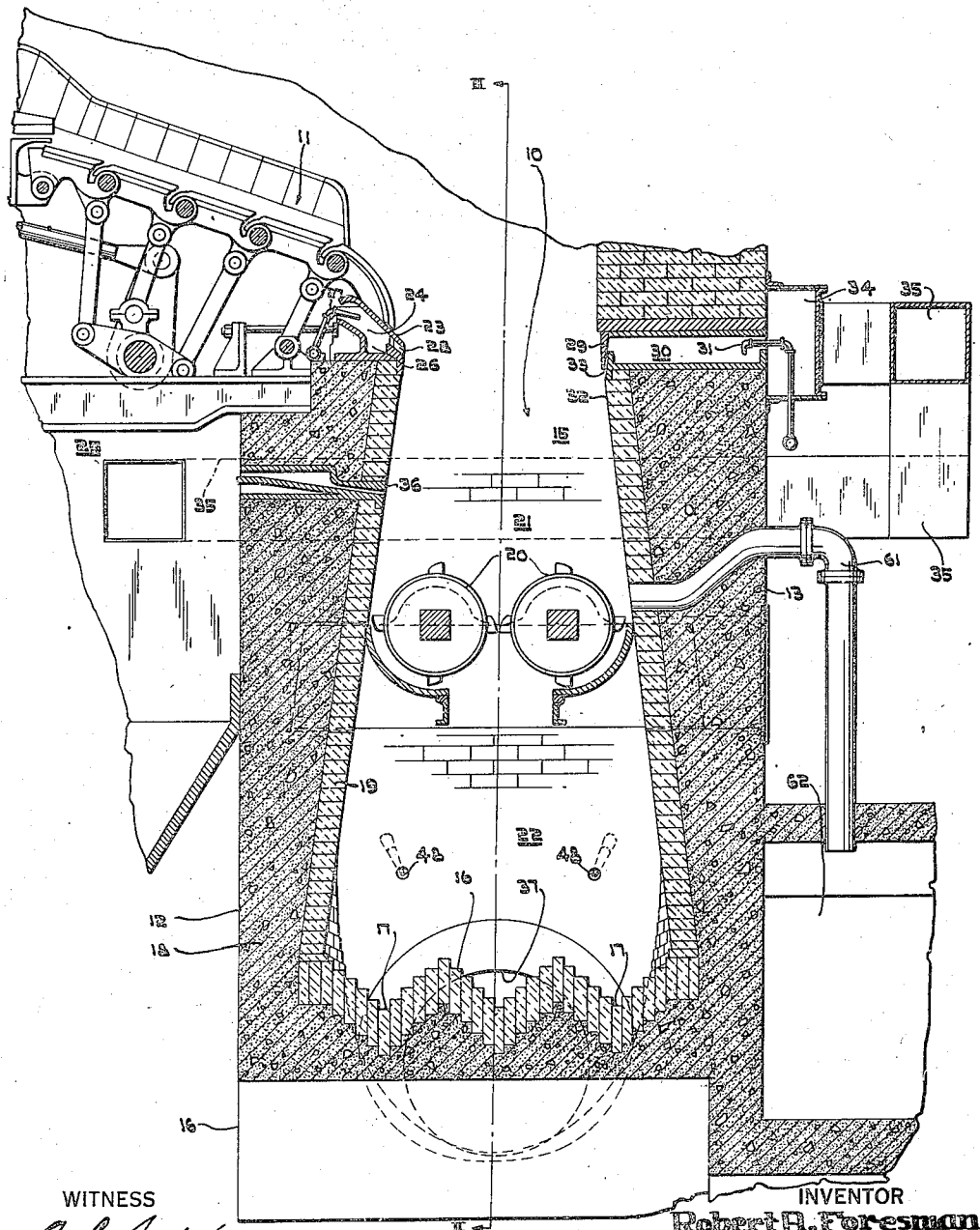
R. A. FORESMAN

1,843,274

COMBUSTION APPARATUS

Filed Sept. 18, 1929

3 Sheets-Sheet 1



WITNESS
C. L. Anderson

INVENTOR
Robert H. Foresman

BY

A. B. Reavis
ATTORNEY

Fig. 1.

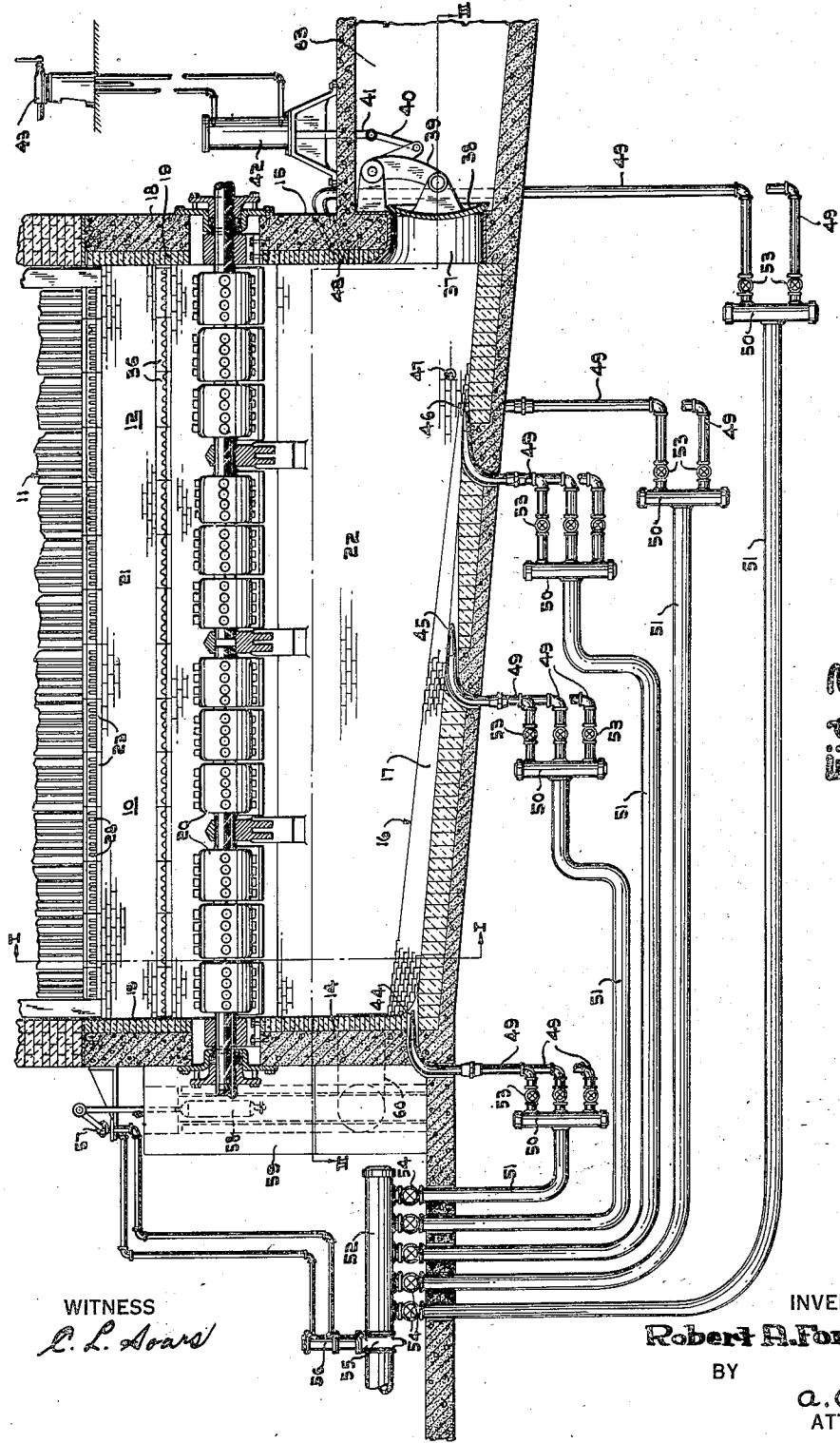
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WITNESS
C. L. Davis

INVENTOR
Robert A. Foresman.
BY
A. B. Reavis
ATTORNEY

Fig. 2.

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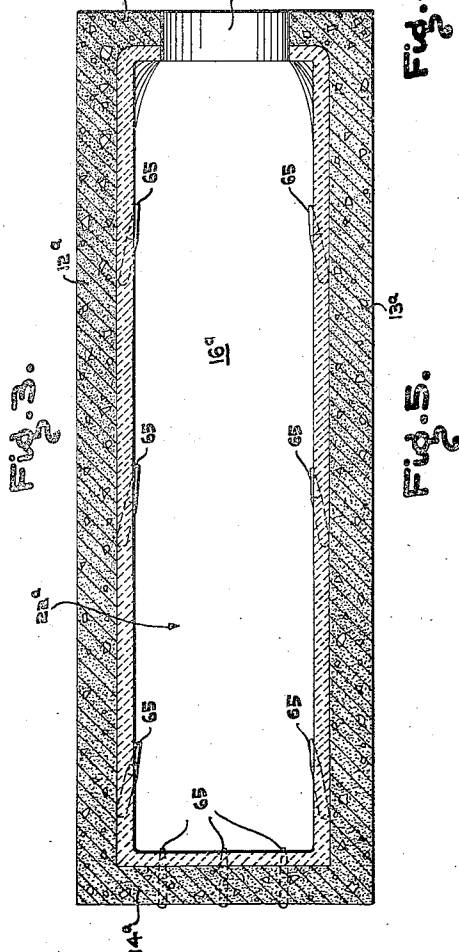
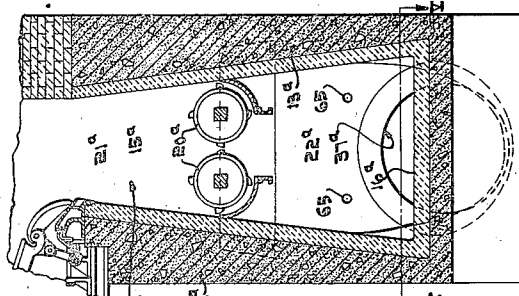
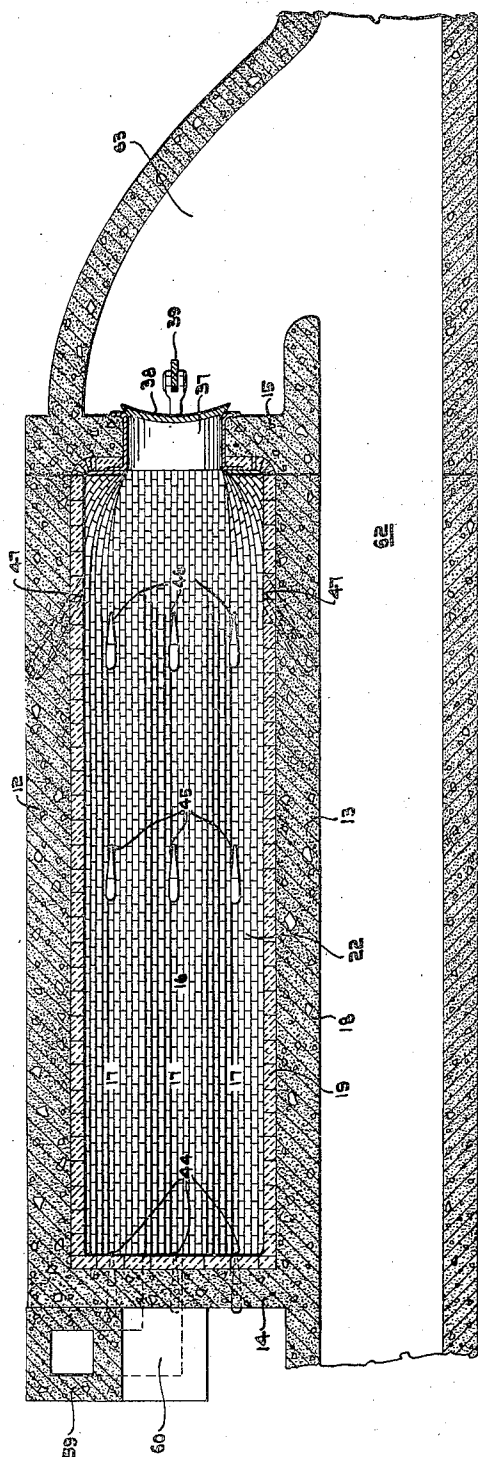
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3 Sheets-Sheet 3



INVENTOR
Robert H. Foresman

BY

A. B. Reavis
ATTORNEY

UNITED STATES PATENT OFFICE

ROBERT A. FORESMAN, OF MOORES, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

COMBUSTION APPARATUS

Application filed September 18, 1929. Serial No. 393,481.

My invention relates to combustion apparatus and more particularly to the disposal and removal of the ash or solid products of combustion from a stoker fired furnace, and it has for an object to provide an improved refuse pit which is extremely simple and durable in construction.

In my copending application, Serial No. 378,103, filed July 13, 1929, I have disclosed an ash disposal apparatus which, due to its construction and operation, permits the use of relatively shallow clinker pits and ash pits, thereby shortening the over-all height or head room of the basement, which, as is well known, is the most expensive portion of the power house to provide.

The present application is in the nature of a modification or improvement of the structure disclosed and claimed in the aforesaid application and it has for a more specific object to provide a refuse pit which, due to its shape, construction, and operation provides for the effective and efficient removal of the ash and in addition permits the construction of a relatively shallow pit.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings forming a part of this application, in which:

Fig. 1 is a fragmentary vertical sectional view showing a portion of a progressive feed stoker and a refuse pit constructed in accordance with my invention, the view being taken on the section line I—I of Fig. 2;

Fig. 2 is a vertical sectional view taken on the line II—II of Fig. 1;

Fig. 3 is a horizontal sectional plan view taken on the broken section line III—III of Fig. 2;

Fig. 4 is a view similar to Fig. 1 showing a modification of my invention, the view being on a reduced scale; and,

Fig. 5 is a horizontal sectional view taken on the line V—V of Fig. 4.

According to one aspect of the present invention, I provide a refuse pit which is adapted to be disposed at the discharge end of a progressive feed stoker and comprises continuous front, rear and end walls having at least

their inner surfaces formed of refractory material. The front and rear walls diverge downwardly. Clinker grinder rolls are disposed transversely of the refuse pit at a point intermediate the height thereof and divide the pit into a clinker pit which communicates at its upper end with the interior of the furnace and an ash pit for storing the ash from the rolls and having a valve-controlled discharge opening in one of the upright walls for permitting the periodic removal of the ash. The bottom wall of the ash pit is composed of channels arranged in side-by-side relation and having their discharge ends opening toward the discharge opening. A plurality of jets are provided for supplying water for filling the ash pit and for aiding in forcing the ash out of the discharge opening when the latter is opened. When the discharge opening is closed, the water level is carried slightly above the grinder rolls, so that the latter may be protected from the heat of the burning material in the clinker pit.

The downwardly-diverging walls of the clinker pit provide for the free downward movement of the ash toward the rolls. By reason of the fact that a mass composed of fallen material will naturally have a downwardly-flaring shape, the downwardly-diverging walls of the ash pit provide a relatively large storage space for a pit of given height. Also, the channels act to direct the flow of the material toward the discharge opening and in addition, permit the jets to concentrate on small areas of ash, thereby providing for the more effective movement of the ash. Furthermore, the refractory lined pit provides an immovable, gas-tight construction which is extremely durable.

Referring now in detail to the construction illustrated, and particularly to Figs. 1, 2 and 3, it will be observed that I have shown a refuse pit disposed transversely of the discharge end of a progressive feed stoker. The refuse pit comprises an upright front wall, rear wall and end walls and a downwardly inclined bottom wall composed of channels arranged in side-by-side relation. The front and rear

walls 12 and 13 diverge downwardly from the fuel-receiving end, as shown.

The walls of the refuse pit are immovable and are preferably provided with an inner lining of refractory material. In the accompanying drawings, I have shown the walls as composed of a supporting structure 18 of concrete and an inner lining 19 of brick. This provides a continuous, gas-tight relatively smooth inner surface for the refuse pit. It is to be understood, however, that the pit may be constructed in a number of ways without departing from certain of the aspects of the present invention.

A pair of grinder rolls 20, 20 is disposed transversely of the refuse pit 10 at a point intermediate the height thereof and divides such pit into a clinker pit 21 for receiving the burning material from the stoker, and an ash pit 22 for storing the ground ash from the rolls.

Means are provided for maintaining the front and rear walls of the clinker pit in a relatively cool condition so that the walls will be protected from the burning material and so that clinker will not adhere thereto and obstruct the downward movement of such material. Means are also provided for admitting air to the interior of the clinker pit so as to support the combustion of the burning material within such pit.

A plurality of box-like castings 23 are disposed in side-by-side relation upon the upper surface of the front wall 12 of the clinker pit. Each of these castings is so constructed as to provide a passage 24 therethrough which provides for the flow of air from a wind box 25 disposed beneath the stoker to the interior of the pit. The interior of each casting is so constructed as to also provide a basin 26 which serves to collect cooling water emitting from a supply pipe 27. The water will flow from the basin 26 and through openings 28, 28 and onto the inner surface of the front wall 12 of the clinker pit in a relatively thin sheet, thereby covering and protecting the wall.

Box-like castings 29 are disposed within the rear wall 13 of the clinker pit and also provide for the admission of air and water to the interior of the pit for supporting combustion and for covering the rear wall with a sheet of cooling water. The castings 29 are also so formed as to provide an inner basin 30 for collecting cooling water emitting from a supply pipe 31. The water overflows from the basin and onto the inner surface of the wall 32 through openings 33. Air is supplied to the interior of the castings by means of a manifold 34 disposed at the rear of the wall and a conduit 35 connecting such manifold with the wind box 25.

A plurality of hollow castings 36, 36 are arranged within the front wall 12 of the clinker pit and provide additional means for

supplying the pit with air for supporting combustion.

The ash pit 22 is provided with a discharge opening 37 in the lower portion of the end wall 15. A suitable valve 38 serves to control the passage of material through the discharge opening 37. The valve 38 is operated by means of a lever 39 and link 40 from the piston rod 41 of a hydraulic cylinder 42. The hydraulic cylinder is operated by a hand-operated reversing valve 43.

Means are provided for filling the ash pit 22 with a body of water when the discharge opening 37 is closed and for aiding in the ejecting of the ash from the ash pit when the discharge opening is open. As shown, I provide, within each of the channels 17, a series of nozzles 44, 45 and 46. I provide additional nozzles 47, 47 in the front and rear walls 12 and 13 of the ash pit and nozzles 48, 48 within the end wall 15 of the ash pit. The nozzles 44, 44, 45, 45, 46, 46 and 47, 47 are all arranged so as to direct a stream of water under pressure toward the discharge opening 37. The nozzles 48, 48 are so arranged as to direct a stream of water away from the discharge opening so as to provide a placer-mining effect upon the material within the ash pit.

All of the nozzles are connected by pipes 49, 49 and manifolds 50, 50 with pipes 51, 51, which latter are connected to a water supply main 52. Each of the pipes 49 is provided with a suitable valve 53 for controlling the flow of water to any one of the nozzles. Each of the pipes 51 is provided with a valve 54 for controlling the flow of water to the different sets of nozzles.

The flow of water from the main 52 is controlled by means of a gate valve 55 operated by a hydraulic cylinder 56. The operation of the hydraulic cylinder is controlled by a reversing valve 57, which valve is operated by means of a float 58 disposed within a well structure 59. The well structure communicates at its lower end with the interior of the ash pit 22 by a passage 60. The operation of the float-controlled reversing valve is such that when the level of the water within the ash pit reaches a predetermined height, the reversing valve will effect the operation of the hydraulic cylinder 56 to close the gate valve 55. When the level of water falls below this predetermined height, the float 58 will move downwardly and operate the reversing valve to effect the opening of the gate valve.

From the above description, the operation of the applicant's device will be apparent. Burning material and ash passes into the clinker pit 21 from the end of the progressive feed stoker 11, and the combustible in this material is burned out within and over the pit 21. As the combustion of this material is being effected, it is moved downwardly

through the clinker pit by reason of the grinding action of the rolls 20, 20. The material is ground out through the rolls 20, 20 and is deposited in the ash pit 22. Periodically, the valve 38 is opened and the body of ash begins moving through the discharge opening by virtue of the head of water within the pit. The flow of ash and water through the discharge opening is aided by the streams of water under pressure from the various nozzles. The nozzles 44, 44, 45, 45 and 46, 46 within the bottom of the channels 17, concentrate on small areas of ash and thereby effectively undermine this ash and force the same toward the discharge opening. The nozzles 47, 47 serve to clear away any ash which may collect adjacent the discharge opening 37. The nozzles 48, 48 exert a placer-mining effect upon the material and thereby also aid in the movement to the ash through the discharge opening.

As soon as the discharge valve 38 is open, the level of the water within the pit will fall below the predetermined height and the float-operated reversing valve 57 will operate to open the gate valve 55 to permit the flow of water through the nozzle. These nozzles remain open until the ash has been cleared from the pit and the valve 38 has been closed and the predetermined level of water has been again attained.

Obviously, the movement of the ash and water through the discharge opening will result in the establishing of a somewhat vacuous condition within the ash pit. Such a condition might be extremely detrimental for the reason that the burning gases within the clinker pit will be sucked downward into the ash pit and might result in the burning out of the grinder rolls. In order to obviate this difficulty, I have provided an improved means for breaking the vacuum. As shown in Fig. 1, a pipe 61 extends through the rear wall 13 and connects the interior of the pit with a main sluice 62 which is at atmospheric pressure. The pipe is so constructed that its central portion is above the end of the pipe which communicates with the interior of the pit. By reason of this construction, the water within the pit will rise within the pipe when the pit is filled and provide a seal. The pipe 61 also acts as an overflow and thereby aids in maintaining the upper level of the water constant.

The discharge opening 37 opens into a short conduit 63 and the latter is connected to the main sluice 62. The main sluice 62 extends parallel to the center line of the ash pit and the bottom wall thereof is inclined downwardly to provide for the flow therethrough of ash and water.

In Figs. 4 and 5 of the drawings, I have illustrated a refuse pit constructed somewhat along the same lines as the pit previously described. However, in this construction, I

have eliminated the channels within the bottom wall of the pit. As shown, I have provided a refuse pit 10a having upright front and rear walls 12a and 13a, respectively, end walls 14a and 15a and a bottom wall 16a. The front and rear walls 12a and 13a diverge downwardly as in the previous construction and grinder rolls 20a extend transversely of the pit at a point intermediate its height, thereby dividing the refuse pit into a clinker pit 21a and an ash pit 22a.

The ash pit 22a is provided at the lower portion of one of the end walls with a discharge opening 37a, which is adapted to be controlled by a suitable valve (not shown). Nozzles 65, 65 are disposed within the lower portion of the front, rear and end walls of the pit and are disposed to force the ash and body of water already within the walls out the discharge opening.

From the above description, it will be observed that I have provided a refuse pit which is extremely simple and durable in construction and which, by reason of its peculiar shape, provides for the storage of a relatively large amount of ash for a given height of the pit. The channels of the construction shown in Figs. 1 to 3, act to direct the flow of the material toward the discharge opening and, in addition, permit the jets to concentrate on small areas of ash, thereby providing for the more effective movement of such ash. In addition, the immovable, refractory lined pit provides an effective gas-tight construction.

It is to be observed that in the above description, and in the accompanying claims, I have referred to the terms "clinker pit", "ash pit" and "refuse pit". The term "clinker pit" is intended to mean any pit which is in open communication at its upper end with the interior of the furnace and is provided at its lower end with means for supporting and removing the ash. The term "ash pit" is intended to include any pit which is not in open communication with the furnace and which receives and stores ash. For example, the ash may be deposited in the ash pit either from the grinder rolls as shown or from a dump grate of a dump grate stoker or from the end of a traveling grate stoker. The term "refuse pit" is intended to include both the ash pit and the clinker pit, or, in some cases, either one separately.

While I have shown my invention in two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes 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. In combustion apparatus, the combina-

tion with a progressive feed stoker, of a clinker pit disposed to receive the refuse from the stoker and comprising immovable, gas-tight, refractory walls having a relatively smooth inner surface, and means providing a relatively thin covering of cooling water for the rear wall.

2. In combustion apparatus, the combination with a progressive feed stoker, of a clinker pit disposed to receive the refuse from the stoker and comprising immovable, gas-tight, refractory walls having a relatively smooth inner surface, and means providing a relatively thin covering of cooling water for both the front and rear walls.

3. In combustion apparatus, the combination of an ash pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, and means for removing the ash from the channels.

4. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, and means providing for the movement of refuse along said channels and through said discharge opening.

5. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, and hydraulic means for moving refuse along said channels and through said discharge opening.

6. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, and jet means disposed within the channels for directing a stream of fluid along the bottom of the channels toward said discharge opening.

7. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, means for opening and closing the discharge openings, means for maintaining a body of water within the pit when the discharge opening is closed, and jet means effective when the discharge opening is open for aiding the outwardly moving body of water in moving refuse

use along said channels and through said discharge opening.

8. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, means for opening and closing the discharge opening, means for maintaining a body of water within the ash pit when the discharge opening is closed, jet means effective when the discharge opening is open for aiding the outwardly moving body of water in moving refuse along said channels and through said discharge opening, and means for breaking the vacuum produced by the outwardly moving body of water and ash.

9. In combustion apparatus, the combination of a refuse pit having front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the refuse pit having a discharge opening disposed to receive material from the ends of the channels, means for opening and closing the discharge opening, means for maintaining a body of water within the ash pit when the discharge opening is closed, jet means effective when the discharge opening is open for aiding the outwardly moving body of water in moving refuse along said channels and through said discharge opening, and means for breaking the vacuum produced by the outwardly moving body of water and ash, said means comprising a conduit connecting the exterior with the interior of the pit and having a portion thereof extending upwardly above the end which communicates with the interior of the pit so as to effect a seal when the level of the water within the pit is above such end.

10. The combination with refuse grinding means, of an ash pit disposed to receive the material from said means and including front and rear walls diverging downwardly and a bottom wall comprising a plurality of channels disposed in side-by-side relation, the ash pit having a refuse discharge opening disposed to receive the material from said channels, means for opening and closing the discharge opening, means for maintaining a body of water within the ash pit when the discharge opening is closed, and jet means effective when the discharge opening is open for aiding the outwardly moving body of water in moving refuse along said channels and through said discharge opening.

11. In combustion apparatus, the combination of a refuse pit, grinding means disposed intermediately of the height of the pit, the portion of the pit below the grinding means having front and rear walls diverging downwardly from the grinding means, a plurality of channels arranged side-by-side and pro-

viding a bottom for said pit, and refuse-removal means for each channel.

12. In combustion apparatus, the combination of a refuse pit, grinding means disposed intermediately of the height of the pit, the portion of the pit below the grinding means having the front and rear walls diverging downwardly from the grinding means, means for supplying water to the pit, means for maintaining the level of the water adjacent the grinding means, and means providing for the periodic removal of the material and water from the lower portion of the pit.

13. In combustion apparatus, the combination of a refuse pit, grinding roll means disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of the grinding roll means and diverging downwardly from the latter, means for supplying water to the pit, and means for maintaining the level of the water adjacent the grinding roll means, and means for removing from said lower portion of the pit material entering therein from the grinding roll means.

14. In combustion apparatus, the combination of a refuse pit therefor, grinding roll means disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of the grinding roll means and diverging downwardly from the latter, a plurality of channels arranged side-by-side and forming a bottom for said pit, means providing for the filling of said lower portion of the pit with water and for maintaining the level adjacent the grinding roll means, and means associated with each of said channels for removing ground material entering the lower portion of said pit from the grinding roll means.

15. In combustion apparatus, the combination of a refuse pit, grinding roll means disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of said grinding roll means and diverging downwardly from the latter, a plurality of channels arranged side-by-side and substantially parallel to the grinding roll means and forming a bottom for said pit, means for maintaining a level of water in the lower portion of said pit at such a point that at least a portion of the grinding roll means is submerged except when ground material is being removed from the lower portion of said pit, and means, effective when said level-maintaining means is not effective, for removing from said lower portion of the pit material entering therein from the grinding roll means.

16. In combustion apparatus, the combination of a refuse pit, grinding roll means

disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of said grinding roll means and diverging downwardly from the latter, a plurality of channels arranged side-by-side and substantially parallel to the axis of the grinding roll means and forming a bottom for said pit, means for maintaining a level of water in the lower portion of said pit at such a point that at least a portion of the grinding roll means is submerged except when material is being removed from the lower portion of said pit, jet means associated with each of said channels for removing from said lower portion of the pit ground material when said level-maintaining means is ineffective.

17. In combustion apparatus, the combination of a refuse pit, grinding roll means disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of said grinding roll means and diverging downwardly from the latter, a plurality of channels arranged side-by-side and substantially parallel to the axis of the grinding roll means and forming a bottom for said pit, means for maintaining a level of water in the lower portion of said pit at such a point that at least a portion of the grinding roll means is submerged except when material is being removed from the lower portion of said pit, and means for removing from said lower portion of the pit ground material entering therein from the grinding means.

18. In combustion apparatus, the combination of a refuse pit therefor, grinding roll means disposed intermediately of the height of the pit, the portion of the pit below the grinding roll means having certain of the walls thereof arranged parallel to the axis of said grinding roll means and diverging downwardly from the latter, a plurality of channels arranged side-by-side and substantially parallel to the axis of the grinding roll means and forming a bottom for said pit, means for maintaining a level of water in the lower portion of said pit at such a point that at least a portion of the grinding roll means is submerged except when ground material is being removed from the lower portion of said pit, and jet means effective when said level-maintaining means is effective for removing from said lower portion of the pit material entering therein from the grinding means.

In testimony whereof, I have hereunto subscribed my name this 17th day of September, 1929.

ROBERT A. FORESMAN.