May 30, 1950 J. E. McADAMS 2,509,872

ASH DISPOSAL APPARATUS

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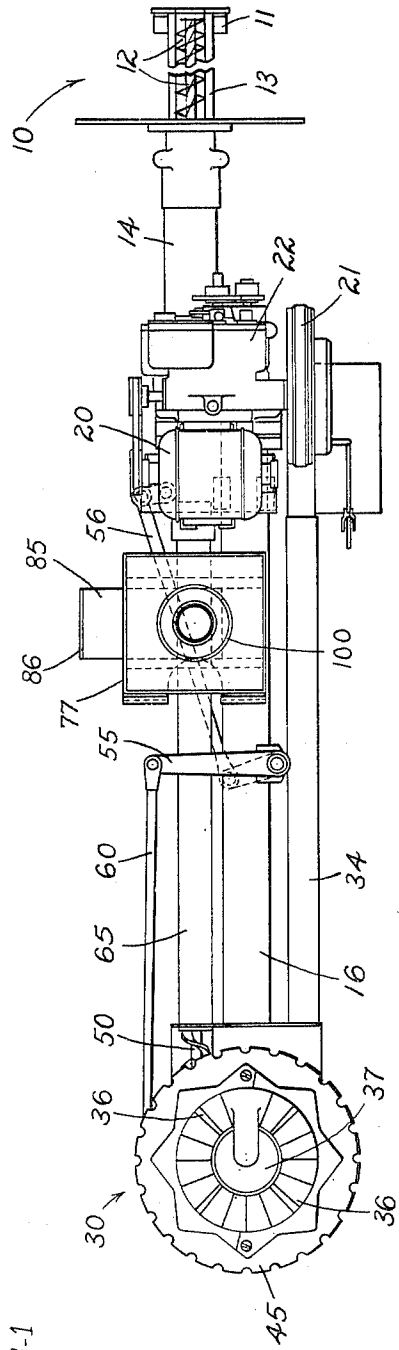


Fig-1

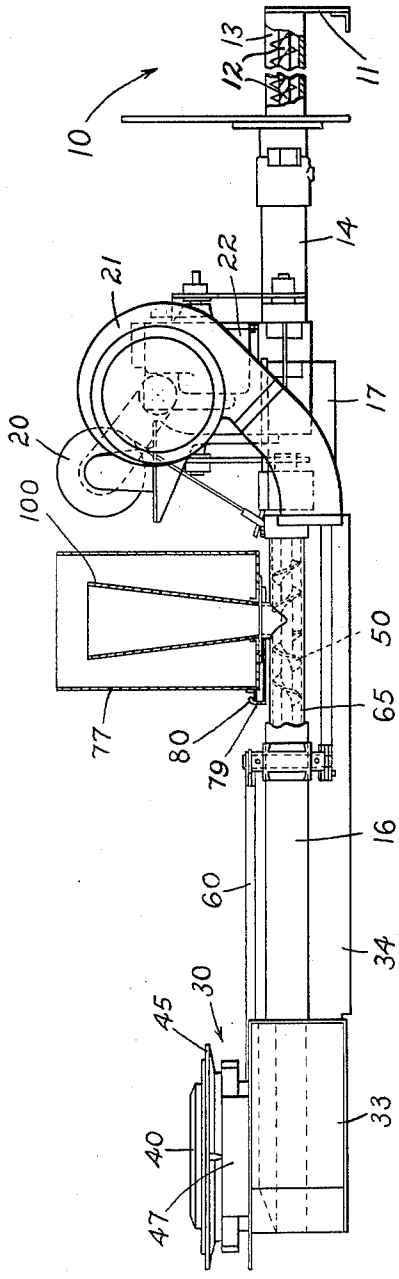


Fig-2

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Fig-5

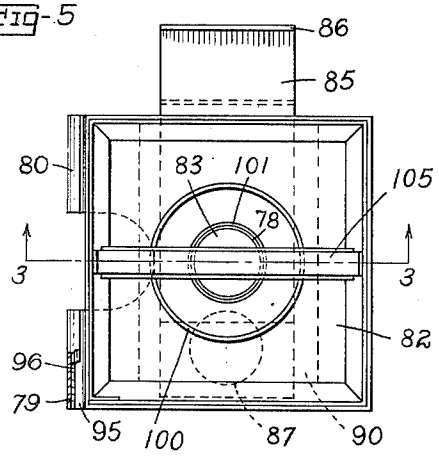


Fig-4

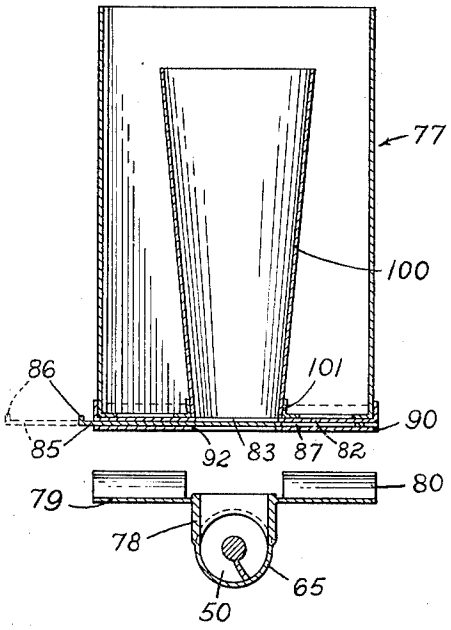


Fig-3

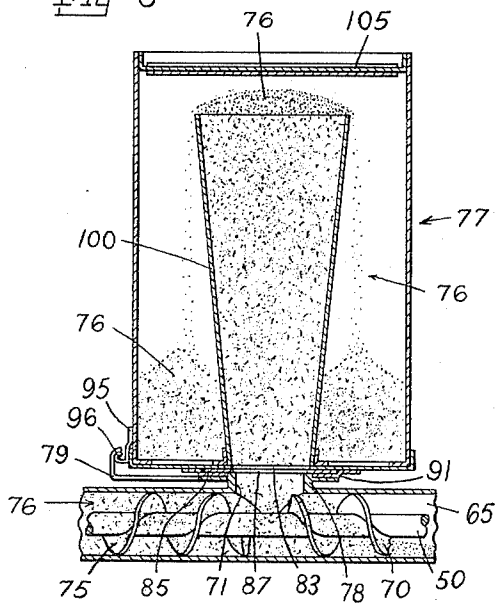
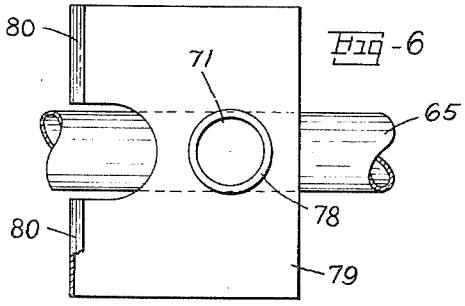


Fig-6



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UNITED STATES PATENT OFFICE

2,509,872

ASH DISPOSAL APPARATUS

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Application January 23, 1947, Serial No. 723,811

10 Claims. (Cl. 110—165)

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This invention relates to an ash disposal system, and more particularly to ash removal means adapted for use in conjunction with mechanical stokers and the like.

One of the principal objects of this invention is to provide an improved ash disposal apparatus for use in connection with domestic stokers which is of simple construction, economically manufactured and efficient in operation in not only having a relatively large storage capacity but also in keeping dust circulation to a minimum, and which collects ashes at a convenient and accessible disposal point with a minimum requirement of power and attention.

Another object of this invention is to provide an improved means for facilitating the removal of ashes from an ash bin, pit or collection chamber and the like, which is economical in operation, and which provides for a larger ash container or receptacle being used at the disposal point than could be used ordinarily with a given amount of power available for lifting or handling the ashes.

A further object is to provide for an ash removal system having a substantially horizontal ash conveyer of an ash container which is removably mounted in a vertical position directly over a discharge point from the conveyer, which facilitates the accumulation of ashes therein by having an inclined passage leading from an opening in the bottom thereof for conducting the ashes up into the interior of the container, and which provides means for collecting ashes with the generation of a minimum amount of dust by introducing them into the container from below or underneath the top exposed surface of the ashes previously collected therein without substantially disturbing that surface.

It is also an object to provide a portable ash container for use with an ash disposal system usable in conjunction with a furnace stoker suitable for domestic applications and the like which is adapted to reduce the normal power consumption required for operating such a system, and which has a relatively small opening in the bottom thereof adapted to receive ashes from a conveyer system, there being a funnel associated with the opening in the bottom of the container to provide an inclined passage of increasing cross sectional area for the passage of ashes up through the container by means of which the ashes are formed into a higher pile within the container with less power consumption required.

Other objects and advantages of this invention will be apparent from the following description, the appended claims, and the accompanying drawings in which:

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Fig. 1 is a plan view of a stoker installation made in accordance with the present invention;

Fig. 2 is a side elevational view of the same mechanism shown in Fig. 1;

Fig. 3 is a longitudinal vertical sectional view taken on the line 3—3 of Fig. 5 through the ash container and ash conveyer tube, the container being partly filled with ashes;

Fig. 4 is a vertical sectional view similar to Fig. 3, but taken at right angles thereto on the center line and showing the container empty of ashes, removed from the ash conveyer tube, with the slide closed and also shown in the open position with dotted lines;

Fig. 5 is a plan view, partly in section, looking down on the ash container and showing the slide in the open position for receiving or removing ashes from the container, the slide being shown in the closed position with dotted lines; and

Fig. 6 is a plan view, partly in section, looking down on the ash conveyer tube and container receiving plate, the ash container being removed.

The invention relates to an ash remover stoker of the general type shown in Burton Patent No. 2,069,940 assigned to the same assignee as this application. It provides an ash conveyer of the worm feed type for withdrawing ashes from the combustion zone, preferably in relatively finely divided form, and conveying the ashes toward an ash receptacle through which they are forced upwardly to be conveniently handled and disposed of. The construction of the present invention embodies certain improvements over that shown in the Burton patent contributing to ease of handling, simplicity in operation and reduced power requirements.

Referring to the drawings which disclose a preferred embodiment of the invention, a bin 10 is shown which is adapted to receive a quantity of the solid fuel to be burned. It is to be understood, however, that the invention is equally suitable for use with a hopper type stoker, and that the showing of the bin feed type is merely illustrative. Extending into the bin 10 and suitably supported upon brackets 11 from the bottom thereof is the bin end of the feed worm 12. This worm is suitably supported, preferably in an open conveyor tube 13 which is open along its entire upper extent within the bin 10, as shown in Fig. 1, so that fuel can be received therein along the entire length of the bin and be conveyed forwardly and into the closed conveyer section 14 located exteriorly of the bin wall.

The feed worm for supplying the fuel into the retort is suitably enclosed within the tube shown at 16, and is located in non-axial relation with respect to the bin worm 12. The adjacent ends of these worms are received within a transfer chamber 17, Fig. 2, to which the fuel is delivered by the bin worm and from which it is withdrawn by the feed worm 16.

A suitable drive mechanism for actuating the worms is provided in the form of a motor 20, preferably mounted above the transfer chamber, and directly belt connected to a blower 21 and through the same shaft connected to a speed reducing mechanism indicated at 22. This mechanism drive shaft extends on opposite sides and carries sprocket wheels suitably connected, as by means of sprocket chains, to driven pulleys provided for the drive of the bin worm 12 and the feed worm 16.

The feed worm 16 extends into the lower portion of a retort, generally indicated by the reference numeral 30, which supplies the fuel delivered by the worm upwardly into the combustion zone. A plenum chamber 33 is provided into which the blower 21 discharges through the air supply conduit 34.

Tuyères 36 are positioned as shown in Fig. 1 and are preferably arranged to provide a combustion space 37 substantially C-shaped in cross section. The tuyères immediately overlying the end of the feed worm 16 extend inwardly and form an arcuate space with means for introducing combustion air into both the inner and outer portions of such space. In this way, proper quantities of air are supplied to the various sections of the fuel bed to effectively complete combustion therein at predetermined and regulated rates of burning. Further details of such tuyère sections and construction are shown in Scholl Patent No. 2,396,888, assigned to the same assignee as this application.

In order to provide for the independent control and regulation of the combustion air, each of the zones in the combustion area into which air is introduced is independently connected with the plenum chamber 33. An adequate supply of combustion air is maintained in the plenum chamber by the blower 21, and thus an assured supply of combustion air to each of the zones is maintained.

Combustion continues with the air being supplied at varying pressures as the fuel passes over the top of the tuyères. By the time the fuel has traveled over the tuyères, its combustion at the desired controlled rate has been substantially completed, and only ash, in a condition of relatively finely divided particles or powder, remains. Such ash is discharged upon the ash ring 45, which is arranged in the form of a grating and may have a series of apertures of predetermined limited size therein. The ash ring is suitably supported for oscillatory movement above an ash chamber 47 into which the particles of ash small enough to drop through the apertures in the ash ring can fall, and as shown the ash chamber is of limited vertical extent so that the entire ash space is located above the level of the feed worm 16. From the ash chamber 47 the ashes are advanced to a sloping surface, not shown, from which they fall into the ash disposal worm 50. If any excessively large clinker formation is formed, such clinkers are not permitted to drop into the ash space, but are held on top of the ash ring where they can be removed through the furnace door.

In order to provide for movement of the ash ring 45, and the continuous removal of the collected ash from the ash chamber 47, suitable drive and conveyer means are provided. As shown in Fig. 1, a pivotally supported lever arm 55 is connected by means of an adjustably mounted link 56 to the drive mechanism 20 and with a connecting rod 60 which extends into the retort, and which is operably connected at its inner end to the ash ring 45. The ash ring 45 in turn is so mounted within the retort that upon reciprocation of rod 60 under the action of the drive mechanism described, the ash ring is given an oscillatory movement. Since this drive is actuated from the reduced speed worm, it will be apparent that the cycle of operation of the ash ring takes place relatively slowly, and that the extent of the oscillatory movement thereof will vary in accordance with the adjustment provided for the link 56.

The ash conveyer worm 50 extends through an enclosed tube 65, and is provided with a forward feeding flight portion 70, Fig. 3, for the removal of the ash from the discharge space 47. This worm is also actuated from the speed reducing mechanism previously described and at the same speed as the fuel feed worm 16 and in correlated feed relation with respect to the drive mechanism for operating the ash ring.

Ash is fed forward through tube 65 to a discharge opening 71 formed therein, Fig. 3, beneath which a reverse flight portion 75 is provided for preventing continued forward feeding of the ash. The combined action of flights 70 and 75 causes the lifting of the ash upwardly through the discharge opening 71, the ash being suitably received within a container shown at 77. This container preferably is of metal construction open at the top and of suitable size for receiving and retaining a proper accumulation of ash 76, and is provided with an inlet opening in the center of its bottom wall, in alignment with the discharge opening 71 of the conveyer tube 65.

Referring to Figs. 3 to 6, a tube opening collar 78 is secured in alignment with the discharge opening 71, preferably by welding, and projects sufficiently to provide means over which the container 77 can be piloted to facilitate the mounting thereof in an ash receiving position. Welded to the tube opening collar 78 is a platform member 79, formed from a substantially flat sheet of metal having the outer edge at one side bent upward to provide a hook or flange 80 with a slightly inwardly curved upper edge.

The container 77 is substantially square in horizontal cross section being formed from flat sheets welded together to provide a structure enclosed on all sides and the bottom. The bottom member 82 is provided with a central aperture 83 adapted to register with the central opening in the tube collar 78 when the container is properly aligned in position to receive ashes as shown in Fig. 3.

A slide valve or gate 85 is provided for manually opening and closing the aperture 83 in the bottom of the container 77 which is opened when ashes are to be received from the conveyer tube 65, and which is closed when the container is to be removed for emptying. This slide 85 is formed from a substantially flat rectangular shaped piece of metal, preferably having one edge thereof bent upward to provide a finger grip 86. The slide is also provided with a central aperture 87, Fig. 5, of sufficient area and positioned to register with the opening 83 in the bottom of

the container, and also with opening in the tube collar 78, when the slide is pulled out, or open, so that ashes can move from the conveyer tube up into the container. When the container 77 is to be removed and emptied, the slide is pushed in, or closed, and these openings are then no longer in alignment since the aperture 87 is moved out of register and ashes within the container are prevented from spilling out through the bottom.

The slide 85 is slidably mounted and held against the bottom of the container by means of a pilot bracket 90 fastened, as by welding, to the underside of the bottom member 82 of the container and within which it is secured. This bracket is also formed from a substantially flat, rectangular sheet of metal the center of which is off-set to provide a depending portion 91 having a central aperture 92 formed therein. Thus when the container is mounted over the tube collar 78 the depending portion 91 rests upon the upper side of the platform member 79 and the upper end of the tube collar projects through the annular opening 92 formed therein.

It will be apparent from the above construction that when the container is mounted over the tube collar 78 it is held effectively in position and prevented from moving laterally or longitudinally in a horizontal plane. To prevent the container from tilting off the tube collar 78, a bracket 95 is mounted, as by welding to one side of the container to extend along the bottom edge thereof, which is provided with an outer edge bent to form a loop 96. This loop 96 is adapted to be received within the hook member 80 as shown most clearly in Fig. 3 and thus provides means for preventing the container from being moved out of position.

In order to facilitate the flow of ashes from the conveyer tube 65 into the container 77, and to secure a higher piling therein with less power consumption, there is provided within the container a funnel 100 of sheet metal in the form of a hollow truncated cone, the interior of which presents a relatively smooth tapered surface free of seams and other projections, which flares upward and outwardly from the bottom, and over which the ashes from the conveyer tube 65 move with a minimum amount of frictional resistance. It has been found that the size and shape of the funnel are of importance with respect to the container 77. That is, certain limits must be observed if the flow of ashes is to move up through the tunnel with a minimum amount of frictional resistance to such flow being developed. Thus, for example, in operation with a container substantially 11" square and approximately 16" high, and having a circular funnel about 13½" high with a 3⅜" diameter bottom and a 7⅜" diameter top, the travel of the ashes up through the funnel is so slow as to be almost imperceptible to the eye and such movement thereof as does take place occurs without producing a substantially turbulent flow, the entire body of ashes traveling upward substantially free of churning. Since the ashes move upwardly along the relatively smooth sheet metal surface of funnel 11, they do not have certain sections or portions therein moving upward with substantially different rates of speed and therefore are not tumbled and churned by such movement over a contacting surface of other ashes which thereby tend to produce a higher frictional resistance to such movement than does the smooth steel surface as herein provided.

The funnel 100 is open at both the top and bottom and secured in position within the container 77 so that its lower end is in register with the opening 83 provided in the bottom member 82. To secure the funnel in proper position it is fastened, as by welding, to the flanged ring 101 which in turn is attached, as by welding, to the bottom of the container. It will be noted that the funnel 100 is of circular cross sectional configuration in the horizontal plane, and is also of progressively increasing cross sectional area from the bottom to the top, which extends preferably up toward and adjacent the top, but spaced sufficiently below the top wall thereof to allow the ash to spill over from the central funnel to the surrounding space without falling out of the container.

A handle 105, fastened to the top of the container 77 which is open, is also provided to facilitate lifting the container manually when it is desired to remove it from its position over the ash conveyer tube 65 for emptying the ashes therefrom when the container is full.

In operation it has been found that a considerable decrease in power consumption was obtained when the funnel 100 was used within the container 77 as described, as compared with the same operation and having the funnel removed from the container. Thus it was found that the power input readings in watts to the drive motor, observed and recorded at the time the container filled and allowing the ashes to spill over from a height of eighteen inches above the centerline of the ash conveyer into a container sixteen inches in height were substantially reduced over similar readings taken with the funnel removed. One set of such readings showed a decrease of the order of 145 power input watts to 115.

It was found also that with a container substantially 10⅞" square and 16" deep the most economical size funnel from the point of power requirements was one having a 3⅜" bottom x 7⅜" diameter top x 13½" high. When using this size funnel the drive required an average of 21% less power than in the case where the container was used without the funnel. It was also found that the power requirements were considerably less for all of the sizes of funnels tested, which had top diameters varying from 6" to 9" and heights from 8⅝" to 13½", than it was where the container was operated without a funnel therein.

From the above description it will be apparent that there is provided an ash removal means for use with domestic stokers which facilitates the piling, storing and handling of larger quantities of ashes within a removable container with the creation of a minimum amount of dust, and which operates with less power consumption due to increased efficiency in securing lower frictional resistance to the flow of ashes into such a container.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyer having a discharge opening in the upper part thereof,

the combination of an ash container removably mounted over said opening in said ash conveyer, said ash container having an opening in the bottom thereof in register with said opening in the ash conveyer, and a funnel positioned within said container, the lower end of said funnel being in communication with said opening in the bottom of the ash container to receive the ashes from the conveyer, said funnel having a limited but progressively increasing cross sectional area providing a tapered passage for the upward travel of substantially the entire body of ashes therethrough.

2. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyer having a discharge opening in the upper part thereof, the combination of an ash container removably mounted over said opening in said ash conveyer, said container having a relatively narrow opening extending through the bottom thereof adapted to register with said opening in the ash conveyer, and a funnel mounted in upright relation within said container, the lower end of said funnel being in communication with said opening in the bottom of the ash container to receive ashes from the conveyer, said funnel extending a substantial distance up into the interior of said container and having such a limited cross sectional area that ashes delivered by said worm travel upwardly therethrough substantially free of churning.

3. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyer having a discharge opening in the upper part thereof, the combination of an ash container removably mounted over said opening in said ash conveyer, said container having a relatively narrow opening extending through the bottom thereof adapted to register with said opening in the ash conveyer, and a funnel mounted within said container, the lower end of said funnel being in communication with said opening in the bottom of the ash container to receive ashes from the conveyer, said funnel having a relatively smooth upwardly and outwardly inclined inner surface over which substantially the entire body of ashes travels upward into the interior of said container.

4. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyer having a discharge opening in the upper part thereof, the combination of an ash container removably mounted directly over said opening, said container having a relatively narrow opening extending through the bottom thereof adapted to register with said opening in the ash conveyer, and a funnel mounted within said container, the lower end of said funnel being in communication with said opening in the bottom of the ash container to receive ashes from the conveyer, said funnel providing an upwardly and outwardly tapered passage of increasing cross sectional area through which substantially the entire body of ashes moves upward from said conveyer into said container.

5. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyor having a discharge opening in the upper part thereof, the combination of an ash container removably mounted over said opening, said container having an opening extending through the bottom thereof adapted to register with said opening in the ash conveyer, means for opening and closing said opening in said container, and a funnel mounted within said container in an upright position, the lower end of said funnel being in communication with said opening in the bottom of the ash container to receive ashes from the conveyer, said funnel providing an upwardly extending passage having a smooth and outwardly inclined annular inner surface against which the ashes travel upward into said container.

6. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyor having a discharge opening in the upper part thereof, the combination of an ash container removably mounted over said opening, said container having an opening extending through the bottom thereof adapted to register with said opening in the ash conveyer, slidably mounted means for opening and closing said opening in said ash container, and a funnel mounted within said container, the lower end of said funnel being in communication with said opening in the bottom of said ash container to receive ashes from the conveyer, said funnel being of less height than said container and providing an upwardly and outwardly flaring smooth surfaced passage of increasing cross sectional area for receiving ashes from said conveyer up through the bottom of said container to conduct said ashes to the interior of said container.

7. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyor having a discharge opening in the upper part thereof and having lifting means therein for lifting ashes upwardly through said opening, the combination of an ash container removably mounted over said opening, said ash container having an opening in the bottom thereof in register with said opening in said conveyer, and a funnel mounted within said container, the lower end of said funnel being in communication with said opening in the bottom of said container to receive ashes from said conveyer, said funnel providing a smooth surfaced annularly tapered passage extending upward to a plane adjacent the top of said container but spaced substantially below the top wall thereof to provide for ashes spilling over from the funnel to the surrounding space without falling out of said container.

8. In an ash disposal system having an ash chamber for the collection of ashes from a retort, and a worm feed ash conveyer for removing the ashes therefrom, said ash conveyor having a discharge opening in the upper part thereof, the combination of an ash container open at the top and having a handle attached thereto for manually lifting said container, said container being removably mounted directly over said opening provided in said conveyer and having an opening in the bottom thereof in register with said opening in said conveyer, said funnel being equal in height to a major proportion of the height of said container, and a funnel mounted within said container, the lower end of said funnel being in communication with said opening in the bottom of said container to receive ashes from said con-

veyer, said funnel providing an upwardly extending passage having a smooth and outwardly inclined inner surface and extending up through the interior for conducting ashes up into said container.

9. Ash receiving apparatus of the character described for use with an ash conveyor having a discharge opening in the upper part thereof, comprising a container adapted for removable mounting on said conveyor, said container having an opening extending through the bottom thereof to receive ashes from said discharge opening, a funnel mounted in upright position within said container with the smaller end thereof lowermost, means for securing said lower end of said funnel to the bottom of said container in register with said ash receiving opening, said funnel extending upwardly a substantial distance within said container to provide an expanding passage for the upward travel of ashes therethrough, and means on said container for closing said lower end of said funnel to prevent escape of ashes therethrough during removal of said container from said conveyor.

10. Ash receiving apparatus of the character described for use with an ash conveyor having a discharge opening in the upper part thereof, comprising a container adapted for removable mounting on said conveyor, said container having an opening extending through the bottom thereof to receive ashes from said discharge opening, a funnel mounted in upright position within said container with the smaller end thereof lowermost, means securing said funnel to the bottom of said container with said lower end thereof in register with said ash receiving opening, said funnel extending upwardly to a position adjacent but below the top of said container and providing an upwardly extending passage of increasing cross-sectional area through which the ashes from said conveyor move before being discharged into said container, and a closure movably secured to the bottom of said container for closing the lower end of said funnel to prevent escape of ashes therethrough when said container is removed from said conveyor.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 22,694	Winter	Nov. 20, 1945
1,971,035	Fulton	Aug. 21, 1934
2,069,940	Burton	Feb. 9, 1937
2,321,389	Julian et al.	June 8, 1943

Certificate of Correction

Patent No. 2,509,872 May 30, 1950

JOSEPH E. McADAMS

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 5, line 54, for "tunnel" read *funnel*; column 8, line 70, beginning with "said funnel" strike out all to and including the word and comma "container," in line 72, and insert the same after the comma and before "the" in line 73;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of September, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.