April 21, 1936. J. MARTIN 2,037,990

ASH REMOVING MECHANISM

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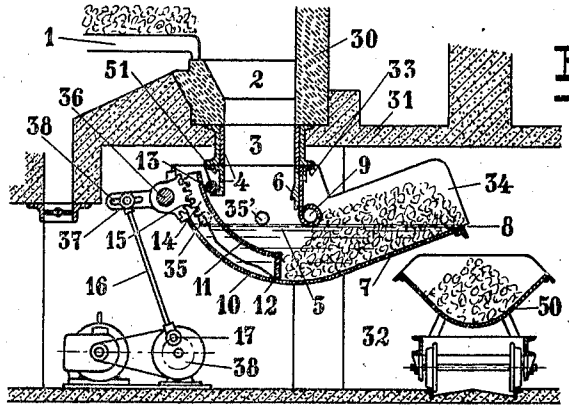


Fig. 1

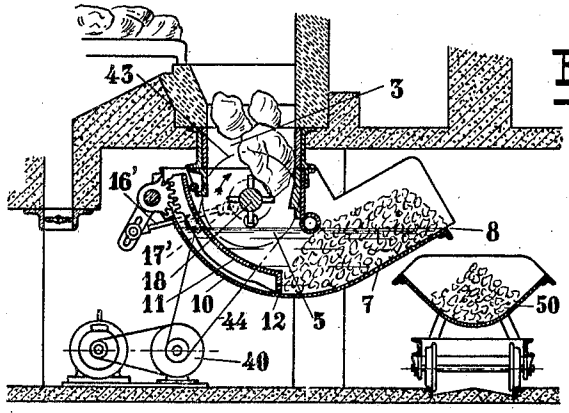


Fig. 2

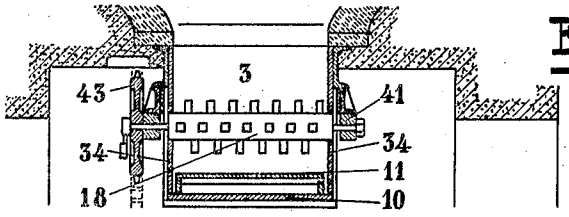


Fig. 3

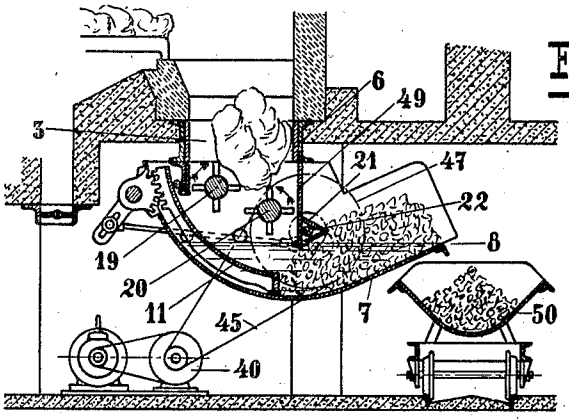


Fig. 4

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ASH REMOVING MECHANISM

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5 Claims. (Cl. 110—165)

This invention relates to improvements in ash removing mechanism.

It refers particularly to a mechanism for eliminating from the combustion chamber of a furnace or the like residuary solid combustion products, clinkers, ashes, etc. For this purpose a chute structure is located at one end of the combustion chamber, permitting residuary combustion products to drop through said structure into a receptacle disposed beneath the same and filled with water to quench the combustion products.

It is an object of the invention to provide means for disposing of residuary combustion products, without the creation of dust and other unsanitary and obnoxious conditions.

Another object of the invention is to provide means for carrying off the residuary combustion products after they have been moistened to an extent to avoid the creation of dust while they are being removed from the furnace.

It is, furthermore, an object of the invention to provide a receptacle in which the residuary combustion products may be collected and from which they may be eliminated by exerting a pushing action on the bulk of the material gathered within this said receptacle to transfer these products onto a conveyor for final removal from the furnace.

It is another object of the invention to provide in a device of this character means for effectively comminuting larger pieces of clinker, slag, etc. which form part of the combustion products, before these products are introduced into the receptacle containing the quenching fluid, to facilitate the subsequent removal of these combustion products after they have been reduced to particles of smaller and practically uniform size.

Another object of the invention is to provide in a device of this character within the chute leading from the furnace to the quenching receptacle mechanism for crushing or comminuting in some other way the larger pieces and to combine the actuation of said crushing mechanism with the actuation of a plunger or pusher, whereby the loose particles collected in the quenching receptacle are expelled over the edge thereof to be transferred by gravity from said receptacle to a conveyor.

It is, furthermore, an object of the invention to provide a pusher to which is imparted an oscillatory movement along the curved bottom of the receptacle in which the combustion products are collected, and to utilize this pusher for continuing the comminuting operation on the combustion products.

With these and numerous other objects in view, embodiments of the invention have been illustrated in the accompanying drawing to which reference is made in the following specification.

In the drawing:

Fig. 1 is a sectional view of a portion of a furnace provided with the equipment for carrying off residuary combustion products from the combustion chamber;

Fig. 2 is a similar cross-sectional view of a mechanism of this character combined with positively actuated mechanism for crushing larger pieces of the residuary combustion products;

Fig. 3 is a transverse sectional view through the mechanism illustrated in Fig. 2, certain parts being shown in elevation;

Fig. 4 is a cross-sectional view similar to Fig. 2 and showing a plurality of comminuting rollers in the chute structure leading from the combustion chamber of the furnace to the ash pit for the same.

The combustion chamber of the furnace is provided with a grate 1 diagrammatically indicated in Fig. 1 and which may either be a stationary grate or a traveling or oscillatory grate supporting the fuel and terminating adjacent a vertical passageway which is interposed between the rear wall 30 of the furnace and the rear portion of the grate and below the same. This passage has an upper flaring portion 2 to facilitate the introduction of those products of combustion which are thrown off the grate, and this upper flaring portion 2 is continued downward in the form of a preferably rectangular shaft or chute structure 3.

The chute is provided with a suitable lining 4 of heat resisting material and of sufficient mechanical strength to withstand the impact of the residuary combustion products discharged from the grate. This lining 4 is continued downward below the brickwork or masonry 31 which forms the ceiling of the ash pit 32.

A receptacle 5 is supported directly below the chute 3, and in the embodiments illustrated this receptacle is shown to be supported by a transverse beam 51 and angle 33 from the chute 3, and composed of two substantially vertical parallel walls 34 and a curved bottom wall connecting the lateral walls 34. The lateral walls and the connecting wall extend at both ends beyond the front and rear walls of the chute 3 and the bottom wall merges into a straight upward slanting portion 7 which also connects the two lateral walls of the receptacle.

The receptacle is partly filled with water or some other quenching fluid which may be intro-

duced into said receptacle through some suitable pipe **35** and which is caused to remain within said receptacle at a predetermined level, for which purpose there is provided an overflow pipe **35'**. A transverse bracing element **9** is provided at the lower edge of the rear wall of chute **3** to keep the walls **34** properly spaced from each other and to enhance the rigidity of the entire structure, and this bracing element is shown in the form of a transverse tubular member associated with the lower edge of the chute. The lowermost portion of said reinforcing transverse element **9** is at a lower level than the free discharging edge of the slanting portion **7** of the bottom.

It will be seen from the drawing that owing to the lower portion of the transverse element **9** being located lower than the edge **8** over which the material will be discharged from said receptacle, the material on said slanting part **7** will form a closure or seal for the throat between the bottom **7** and transverse beam **9**, preventing the introduction of air into the interior of the receptacle **5** and into the chute **3**.

A pushing plunger **11** of inverted trough shape, having practically the width of the receptacle **5**, is adapted to slide on the curved portion **10** of the bottom of the receptacle, at which said plunger engages the bottom wall of the receptacle at the front transverse edge **12**. The opposite end portion of the curved plunger of trough shape projects from the body of water within the receptacle, and the transverse upward-directed bottom of the plunger engages a roller **13** which is supported on the outer face of the wall **4** of the chute structure **3** leading into the ash pit. This roller **13** acts as a pressure member for holding the upper portion of the pusher **11** in engagement with a gear sector **15** which is provided for reciprocating the plunger **11**.

This projecting portion of the plunger **11** has on the lateral walls a rack bar **14** in engagement with a gear sector **15** which is supported on a shaft **36** extending transversely of the ash pit. An oscillatory motion is imparted to said gear sector by means of an arm **37** secured to the shaft, said arm being provided with a slot **38** in which a pin is radially adjustable relatively to the shaft. This pin is pivotally connected with a rod **16** extending to a crank pin **17** which may also be adjustably secured on a sprocket **38**. This sprocket **38**, as shown in Fig. 1, may be a part of a transmission gearing actuated by a motor as shown.

Hence, upon rotation of said sprocket **38**, an oscillatory movement is imparted through the connecting rod **16** to the gear sector **15** with the result that the plunger **11** is positively reciprocated to push the mass of ashes and clinkers on the bottom of the receptacle **5** towards the free end or overflow edge **8** of said receptacle. Owing to the fact that the front portion of the plunger rests in contact with the bottom of the receptacle, the movement of the plunger will take place in an arcuate path following the form of the bottom of the receptacle. Its rack bar **14**, however, may be substantially straight, in order to remain in proper contact or mesh with the gear sector, which engagement also is maintained owing to the provision of the presser roller **13**.

This arrangement has the advantage that any wear to which the plunger may be subjected is primarily effective on that front portion **12** of the plunger which slides on the bottom **10** of the receptacle **5**. Since this front edge is practically coextensive with the width of the receptacle, the wear, even after considerable use, is relatively small. It should also be noted that, owing to the fact that the head of the plunger is almost vertical, the force transmitted from the gear sector to the plunger will have a pressure component in a substantially vertical direction, thereby forcing the front end of the plunger continually into engagement with the bottom of the receptacle and preventing the entry of the particles from the pile of slag, clinker, ashes, etc. beneath the plunger.

The pile of slag, ashes, clinkers, etc. near the front end of the receptacle in the throat between the bottom and the transverse tubular reinforcing element forms an abutment against which the plunger acts in its downward movement, whereby the plunger also becomes effective for further comminution of that material which is pressed by the plunger against the pile. The plunger, therefore, not only acts as a conveying means for the residuary combustion products, but also as a means for effectively reducing the size of the particles of the combustion products that have been dropped from the grate into the receptacle.

It is advisable to introduce the water into the receptacle **5** from above between the plunger and the bottom of the receptacle, whereby said water will also be effective in flushing the lateral walls of the pan for reducing the temperature thereof, and for washing off those substances which might stick to the walls and to the bottom, and this continued cleaning of the receptacle at its walls and bottom also will be of advantage in reducing the wear of the plunger **11** and the receptacle **10**.

Large pieces of clinkers or slag would hardly be sufficiently comminuted by this movement of the plunger and it may, therefore, be of advantage to combine with the described means for carrying off the residuary combustion products, some other means for breaking up larger chunks of slag or clinkers which are dropped into the chute leading to the ash pit.

Figs. 2 to 4 illustrate an additional comminuting means of different forms. According to Fig. 2, a crushing roll **18** is located with its axis intersecting the axis of the chute structure **3** while according to Fig. 4 a pair of crushing rolls **19, 20** is shown, the rolls **19, 20** having their axes offset relatively to the axis of the chute. These rolls are formed preferably as solid cylinders provided with a suitable number of projections or teeth uniformly distributed over the axial length of the roll, but circumferentially offset thereon so as to have the desired crushing effect upon the large pieces or chunks of clinker and slag or other residuary combustion products which may enter the chute.

The dimensions of these rolls and the power applied to the same are determined in accordance with requirements and their circumferential speed is preferably regulated in accordance with the stroke of the plunger. To avoid the clogging of the chute and to prevent the entry of pieces of excessive size into the receptacle **5**, these pieces are reduced by the crushing rolls to permit the plunger to push them forward and continue the crushing action thereon, while conveying them to the pile which is gradually formed at the front end of the receptacle to be discharged over the edge **8** thereof.

While in Figs. 2 and 3 a single crushing roller only is shown, Fig. 4 illustrates an embodiment

with two of these rollers arranged at different horizontal levels, and also indifferent vertical planes. The crushing effect may, furthermore, be enhanced by causing the two crushing rollers to run at different speeds. The lower roller which receives the material precrushed by the upper roller may have a greater circumferential speed than the upper roller. The crushing rolls, as shown in Fig. 2 and Fig. 4, cooperate with the wall of the chute, which wall serves as an abutment for holding the large pieces until they are suitably broken up by the continued hammering and pressure exerted through the teeth of the crushing rolls. Certain of the parts of the large pieces broken off will then drop into the receptacle by passing between the two crushing rolls, Fig. 4, while other smaller pieces will drop between the wall and the lower crushing roll. The action of the quenching water will have an additional cracking effect upon these freshly comminuted elements which are still in sufficiently hot condition, and the reciprocating movement of the plunger will continue the comminuting action thereon.

While in Figs. 2 and 3 the crushing roll **18** is located in a vertical axial plane of the chute, and is supported in bearings **41** mounted on the outer wall of the chute, this crushing roll at the same time also supports the sprocket **43** which is driven by a chain **44** diagrammatically indicated, and this chain may be actuated by a suitable prime mover **40** of any desired character diagrammatically indicated only. A crank rod **16'** extends from the crank pin **17'** on sprocket **43**, to oscillate the gear sector and to reciprocate the plunger.

In the embodiment of Fig. 4, however, the prime mover **40** drives by means of the chain **45** a sprocket **47** mounted on a shaft **22** which extends transversely of the receptacle closely adjacent the forward downwardly extended wall **49** of the chute structure. In order to protect the shaft **22** against the impact of the broken pieces of combustion products, a housing **21** is placed about said shaft, this housing at the same time serving as a protection for the free edge of the wall of the chute structure and having its lower wall approximately parallel to the slanting part **7**. The sprocket **47** or a gear on shaft **22**, not shown, drives the crushing rolls **19, 20**, Fig. 4, and as stated above, this gearing may be selected to impart a differential speed to the two crushing rolls.

It will be seen from the above that the improved construction readily disposes of combustion products in a way to prevent the accumulation of the same in the lower part of the furnace, and it accomplishes this object by proper comminution of these residuary products to substantially uniform size and without the creation of dust or other obnoxious conditions which might be propagated up towards the combustion chamber itself through the chute. The ashes, clinkers, slag, etc. are discharged in moist condition to a conveyor or receptacle, which, in the embodiments illustrated by way of example, are shown as dump cars **50**. It is obvious, however, that in addition to the discharge of the water together with the combustion products, the device may be provided with an overflow to prevent the accumulation of excessive quench water in the receptacle. It is also obvious that the apparatus is effective as a comminuting device for the combustion products to facilitate the handling of the same after their discharge from the plant.

Upon proper adjustment of the connecting rod, the stroke of the plunger may be selected in accordance with the space between the rotary crushing elements, to become effective on those pieces which freely drop through between these rotary elements.

I claim:

1. In a device of the character described, in combination with a furnace chamber having a chute directed downwardly and adapted to receive ashes and clinkers from said chamber, a water receptacle having a curved bottom with the deepest portion of the bottom located directly beneath the chute, a wall of the chute projecting in direction towards the bottom of the receptacle to provide a throat between the bottom of the receptacle and the lowermost edge of the wall, the receptacle bottom slanting upward from said throat, a plunger having a plate curved in conformity with the curvature of the bottom and movable along the bottom of said receptacle in the water contained therein and adapted to comminute by impact the ashes and clinkers dammed up in said throat, and means for reciprocating the plunger.

2. In a device of the character described, the combination of a chute structure extending downwardly, a receptacle adapted to be partly filled with water and having a curved bottom with the deepest portion beneath said chute structure, whereby a throat is formed beneath the chute structure between the latter and the bottom of the receptacle, the bottom of the receptacle extending upwardly and outwardly from said throat, rotary means within the chute structure for crushing material by impact against the wall of the chute structure, reciprocating means operable in the water for forcing material through said throat and thereby effecting a further comminuting of the material, and means for actuating the crushing means and the reciprocating means.

3. In an ash removing device, the combination with an ash discharge chute, of a receptacle arranged under said chute and adapted to be partly filled with water, said receptacle being composed of two spaced parallel side walls and a curved bottom wall terminating at one end in an upwardly inclined portion, the upper edge of which is positioned in a higher plane than the lower edge of the discharge chute, a reciprocating plunger in sliding engagement with said curved bottom, said plunger being provided with a curved top wall positioned directly below said discharge chute and adapted to receive and carry the ashes discharged from said chute, said plunger being also provided with a vertical front wall adapted to push the ashes dropping onto the bottom of the receptacle during the reciprocating movement of the plunger toward the upwardly inclined portion of the receptacle and form on the same a pile of ashes acting as an abutment for any subsequent ashes subjected to the pushing action of said reciprocating plunger, whereby the ashes are further comminuted before being finally discharged from the upper edge of said upwardly inclined portion of the bottom wall of said receptacle.

4. In an ash removing device, the combination with an ash discharge chute, of a receptacle arranged under said chute and adapted to be partly filled with water, said receptacle being composed of two spaced parallel side walls and a curved bottom wall terminating at one end in an upwardly inclined portion, the upper edge of which

is positioned in a higher plane than the lower edge of the discharge chute and projecting laterally from the latter, a reciprocating plunger in sliding engagement with said curved bottom wall, said plunger being provided with a curved top wall positioned directly below said discharge chute and adapted to receive and carry the ashes discharged from said chute, said plunger being also provided with a vertical front wall adapted to push the ashes dropping onto the bottom of the receptacle during the reciprocating movement of the plunger toward the upwardly inclined portion of the receptacle and form on the same a pile of ashes acting as an abutment for any subsequent ashes subjected to the pushing action of said reciprocating plunger, whereby the ashes are further comminuted before being finally discharged from the upper edge of said upwardly inclined portion of the bottom wall of said receptacle, the rear end of said plunger extending upwardly above the water level in said receptacle, and means engaging said rear end of said plunger for transmitting to said plunger a reciprocating movement whose amplitude is only a fraction of the total length of the plunger.

5. In an ash removing device, the combination with an ash discharge chute, of a receptacle adapted to be partly filled with water, said receptacle being composed of two spaced parallel side walls and a curved bottom wall terminating at one end in an upwardly inclined portion, the upper edge of which is positioned in a higher plane than the lower edge of the discharge chute, a reciprocating plunger in sliding engagement with said curved bottom, said plunger being provided with a curved top wall positioned directly below said discharge chute and adapted to receive and carry the ashes discharged from said chute, and said plunger being also provided with a vertical front wall adapted to push the ashes dropping onto the bottom of the receptacle during the reciprocating movement of the plunger toward the upwardly inclined portion of the receptacle and form on the same a pile of ashes acting as an abutment for any subsequent ashes subjected to the pushing action of said plunger, whereby the ashes are further comminuted before being finally discharged from the upper edge of said upwardly inclined portion of the bottom wall of said receptacle, the rear end of said plunger extending upwardly above the water level in said receptacle and being provided on its side facing the bottom of said receptacle with rack teeth, a gear sector supported for rocking movement adjacent the upper portion of said receptacle and meshing with said rack teeth, driving means for rocking said gear sector, and means positioned on the lower end of said chute for maintaining the plunger with its rack teeth in engagement with said gear sector.

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