Nov. 29, 1932. E. E. BROSIUS 1,889,434

CINDER NOTCH STOPPER

Filed Feb. 10, 1932 2 Sheets-Sheet 1

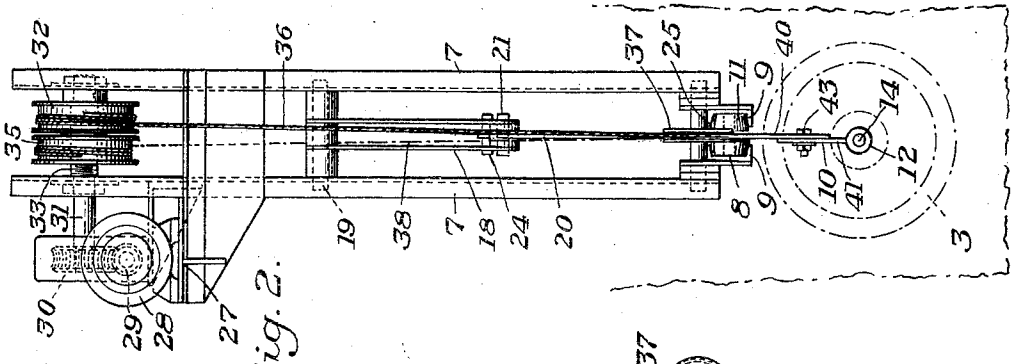


Fig. 2.

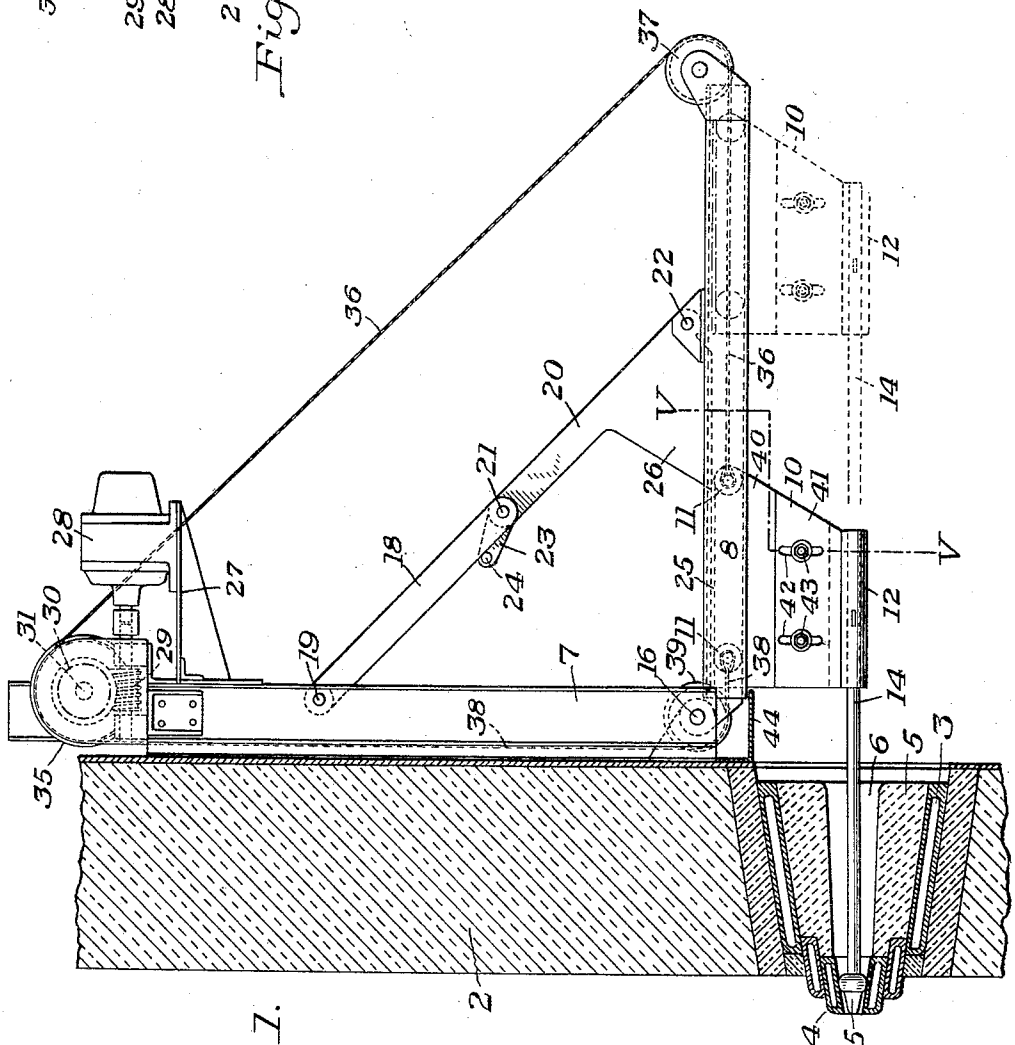


Fig. 1.

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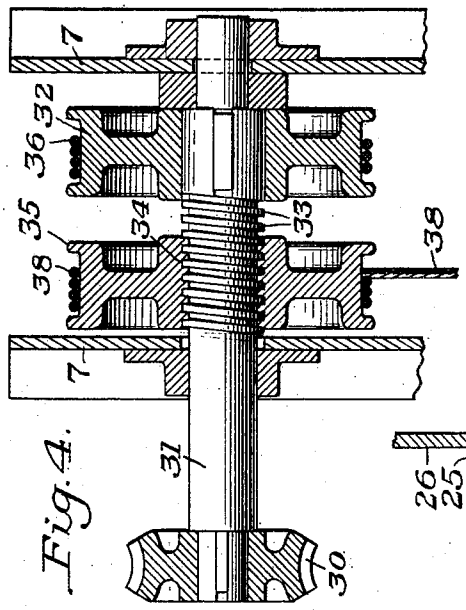


Fig. 4.

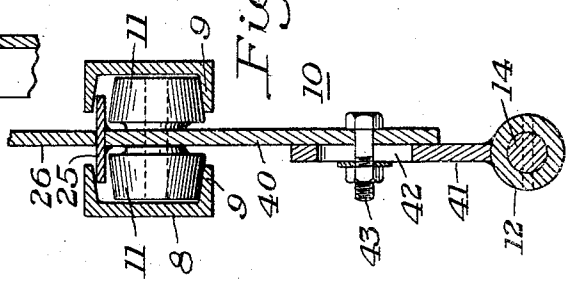


Fig. 5.

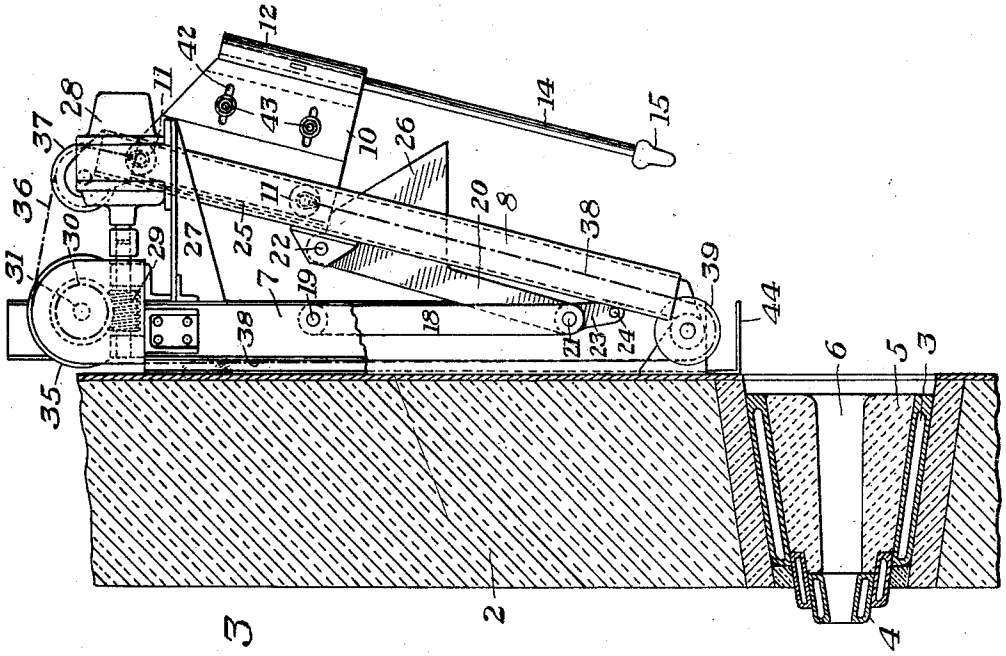


Fig. 3

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Patented Nov. 29, 1932 1,889,434

UNITED STATES PATENT OFFICE

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CINDER NOTCH STOPPER

Application filed February 10, 1932. Serial No. 592,095.

The present invention relates broadly to an improved form of apparatus by means of which the cinder notch or cinder tap hole of a furnace may be closed or opened at will, and more particularly to an improved mounting and operating mechanism for such an apparatus.

Devices of this character, usually referred to as cinder notch stoppers, or botter rods, in order to be capable of successful use must be movable from a position in which they are effective for closing the cinder notch, into an inoperative position. During this movement it is necessary for the botter rod or stopper to move in a substantially straight line, in axial alinement with the monkey or cinder notch for an appreciable distance at least equal in length to the full length of the cooler provided in the furnace wall, and an additional length equivalent to any obstructions provided on the face of the furnace.

Inasmuch as it is desirable in actual practice to "clay up" the cooler to as great an extent as possible, leaving only a comparatively small opening in alinement with the cinder notch, the more nearly the botter rod can be moved in a straight line, the more advantageously the desired conditions with respect to furnace operation can be maintained.

It is one of the objects of the present invention to provide an improved apparatus of the character referred to of such construction that it may have imparted thereto a true straight line movement for the required distance during that period of its travel in axial alinement with the cinder notch.

The botter arm having been fully retracted along such a straight line, it is further necessary that it be so constructed as to permit movement thereof to a position remote from the molten slag being tapped from the furnace. Another object of the invention is to provide an apparatus of the character referred to in which the movement to inoperative position remote from the slag flow line from the furnace occurs automatically upon the conclusion of the straight line movement, the construction of the parts being such that the two movements occur in predetermined sequence preferably through the medium of a single actuating mechanism.

It has heretofore been proposed in the art to mount devices of this general nature on the bustle pipe. I have found that during the operation of a furnace, the different temperature conditions to which the parts are subjected is such that relative movement or "walking" occurs between the bustle pipe and the furnace. It necessarily follows that where the bustle pipe is utilized either as the whole support for the cinder notch stopper or as a partial supporting means therefor, this walking movement is transmitted to the stopper in such manner that even had the prior forms of apparatus been capable of a straight line movement by reason of their inherent construction, such straight line movement would not, at all times, have been in a direction axially of the cinder notch. This has resulted, not infrequently, in preventing the botter from actually seating in the monkey.

In accordance with the present invention, I provide a cinder notch stopping mechanism which is carried directly and solely by the furnace wall and preferably entirely from a section of that wall which is in a vertical plane common to the axis of the cinder notch, where tuyères or other auxiliary structure does not preclude such a mounting, and which in any case is carried by a section of the wall as closely adjacent the vertical plane containing the cinder notch as possible.

While it will be understood that such section, hereinafter referred to as the mounting zone, preferably includes only a relatively small section of the furnace wall located in a vertical plane as before set forth, the actual extent and location of the mounting zone may to some extent be shifted either laterally, angularly, or both, with respect to a given plane without precluding the obtaining of certain of the advantages inherent in the present construction. By utilizing as a mounting zone a section of the furnace wall as referred to, the mounting zone always occupies a predetermined relationship to the axis of the cinder notch such that if the

parts are initially properly alined so that the botter will properly enter the monkey, such a continued alinement may be maintained in service. This is particularly true if the lower point of connection in the mounting zone is relatively closely adjacent the general zone of the cooler. It is another object of the present invention to provide a cinder notch stopper characterized by a support located in such a zone, and mounted entirely independently of any auxiliary supporting means or furnace parts.

In the accompanying drawings I have shown, for purposes of illustration only, a preferred embodiment of the present invention. In the drawings:—

Figure 1 is a vertical sectional view through a portion of a furnace wall illustrating, in elevation, a cinder notch stopper in accordance with the present invention in cooperative hole closing position to the cinder notch illustrated therein;

Figure 2 is a front view of the structure shown in Figure 1;

Figure 3 is a view similar to Figure 1, showing the parts in inoperative position;

Figure 4 is a detail sectional view on an enlarged scale, illustrating a portion of the actuating mechanism; and

Figure 5 is a transverse sectional view on the line V—V of Figure 1.

In the accompanying drawings there is illustrated a portion of a furnace wall 2 having located therein a cooler 3 of any usual construction carrying at its inner end a water cooled monkey 4 defining the axis of the cinder notch or slag flow line. Within the cooler 3 is a protective lining 5 of suitable refractory material providing a slag opening 6 therethrough of limited dimensions.

Mounted on the furnace wall 2 in a mounting zone directly above, and herein shown as being in actual vertical alinement with the axis of the cinder notch, is a cinder notch supporting bracket herein illustrated as comprising a pair of spaced channels 7 symmetrically disposed with respect to the vertical plane containing the axis of the cinder notch. These channels, in practice may be bolted, welded or otherwise secured in position.

Suitably secured to the lower ends of the channels 7 is a horizontally disposed trackway 8 providing opposed flanges 9 along which is adapted to travel a trolley 10. Preferably the trolley at its upper portion is provided with rollers or wheels 11 in rolling engagement with the track flanges 9. Secured to the trolley so as to occupy a position in axial alinement with the axis of the monkey 4 is a botter rod support 12, herein illustrated as comprising a tubular housing within which is supported one end of a botter rod 14, on the inner end of which is mounted a stopper or bott 15 illustrated as being in position within the monkey 4.

In accordance with the preferred form of my invention, the connection between the channels 7 and the trackway 8 comprises a pivot shaft 16. For limiting the downward movement of the trackway about the pivotal mounting, there is provided a toggle structure including a pair of parallelly extending upper links 18 having a pivotal mounting 19 in the channels 7 and a lower link 20 having a pivotal connection 21 at one end with the links 18 and a pivotal connection 22 at the opposite end with the track system. Carried by an extension 23 on the lower link 20 is a transversely extending pin or abutment 24 adapted to engage the under-side of the links 18 when the parts are in the position illustrated in Figure 1, and thereby maintain the links in such position that the pivots 19, 21 and 22 occupy substantially a common plane.

Carried by the trolley 10 is a plate 25 adapted to be engaged by a projection 26 on the link 20 when the parts are in the position shown in Figure 1. During movement of the trolley from its full line position of this figure to its dotted line position, the projection 26 will ride on the plate 25. As soon, however, as the trolley has moved outwardly, or to the right as shown in this figure, a sufficient distance to move out of engagement with the projection 26, that projection is free to move downwardly through the slot between the opposed track flanges 9 in such manner as to permit breaking of the toggle alinement. The toggle alinement having been broken, the entire trackway may be swung from its position of Figure 1 to its position of Figure 3.

For accomplishing movement of the trolley 10 in the manner described, which movement by reason of the construction of the trackway 8 is necessarily a straight line movement, during which the botting arm maintains its axial alinement with the axis of the cinder notch, followed by upward swinging movement of the trackway, I may provide a motor 28 on a bracket 27 carried by the channels 7. As herein shown, the armature shaft of the motor carries a worm 29 meshing with a worm wheel 30 on a trunnion shaft 31. This trunnion shaft has secured thereto for constant rotation therewith, in either direction, a drum 32. At one side of the drum 32 the shaft 31 is provided with threads 33 which engage internal threads 34 on a second drum 35.

Dead-ended to the trolley 10 is one end of a cable 36 passing outwardly around a pulley 37 on the outer end of the trackway 8 and thence upwardly around the drum 32 to which it is in turn dead-ended. A second cable 38 is dead-ended to the opposite side of the trolley 10 passing therefrom around a pulley 39 and thence upwardly to and around the drum 35 and dead-ended thereto. By reference more

particularly to Figure 2 of the drawings, it will be noted that the respective cables 36 and 38 are wound in opposite directions around their respective drums.

If it be assumed that the parts are in the positions illustrated in Figures 1 and 2, and it is desired to move them into the positions corresponding to Figures 3 and 4, the motor 28 will be energized to rotate the drum shaft 31 in such direction that the top portion thereof as viewed in Figure 2 will rotate away from the observer. This rotation of the drum shaft will cause rotation of the drum 32 and therefore wind up the cable 36 in the manner required to move the trolley 10 to the right. At the commencement of this rotative period the two drums will be in the position illustrated in Figure 2. The frictional engagement between the two drums, and the fact that the drum 32 serves as a stop, causes concomitant rotation of the drum 36 which, due to the fact that the cable 38 is wound there-around in the opposite direction, pays out the cable 38 at exactly the speed required to permit such movement of the trolley.

Upon the conclusion of the horizontal component of travel of the trolley 10, further paying out of the cable 38, except to a very slight extent as required by the change in the angular relationship between the channels 7 and the trackway 8 is unnecessary. The drum 35 therefore ceases further rotation, and continued rotation of the shaft 31 causes the drum 35 to move axially of the drum shaft by reason of the threaded engagement between these parts. Continued rotation of the drum shaft and therefore of the drum 32, the link 20 having been released by the movement of the trolley, causes the parts to move into the position illustrated in Figure 3. At this time the drums 32 and 35 are separated as indicated in Figure 4.

When it is desired to return the botting arm to operative position, the motor will be rotated in the opposite direction, thereby moving the top of the drum shaft as viewed in Figures 2 and 4, toward the observer. During the initial portion of this rotative movement of the drum shaft, the drum 32 will pay out the cable 36, and the drum 35 will move along the shaft as a nut until such time as the trackway 8 reaches the position of Figure 1 with the trolley in the dotted line position in this figure. At this time the two drums 32 and 35 will be in engagement, as shown in Figure 2, and continued rotation of the drum shaft 31 in the same direction will result in concomitant rotation of the two drums with the result that the cable 36 will be paid out and the cable 38 wound around the drum 35, thereby moving the trolley from its dotted line position of Figure 1 to its full line position effective for bringing the stopper or bott into its operative position within the monkey.

While I have herein illustrated a motor 28 as a source of power, it will be understood that a hand crank, wheel, or any other desired means for effecting rotation of the worm 29 may be utilized.

From the foregoing description, it will be apparent that a single mechanism is effective for producing in sequence a straight line retraction of the botting arm, followed by a swinging movement thereof or, upon movement in the reverse direction, a swinging movement followed by a straight line entering movement of the botting arm. As the botting arm gradually moves into operative position along such a straight line path, the plate 25 thereon rides under the projection 26 causing the toggle links to assume straight line locking relationship, this relationship necessarily being maintained until the trolley is again moved outwardly to such an extent as to clear the projection 26.

In some cases it may be desirable to provide either a trolley or mounting means of such construction as to permit a relative adjustment between the axis of the botting arm and the axis of the cinder notch either for purposes of initial installation or for purposes of accommodating the botting arm to possible changes in the physical location of the cooler and monkey. To this end, I may, if desired, construct the trolley 10 in the form of a plurality of overlapping plates 40 and 41, one or both of which may be provided with elongated openings 42 adapted to receiving clamping bolts 43. In this manner the vertical plane of the botting arm may be raised or lowered. By suitably spacing the plates by the use of filler plates, the botting arm may be adjusted laterally in one direction or the other.

I also preferably provide a shield 44 adapted to protect the pulley 39 and cable 38 immediately adjacent the cooler from the intense heat of the slag.

The advantages of the present invention arise from a construction including a supporting means for a botting arm secured directly and only to a furnace wall preferably in a zone of the character described; from the characteristic movements which it is possible to obtain; from the utilization of a single means for obtaining predetermined movements in succession, and from a structural relationship by means of which such results are insured.

While I have herein illustrated and described a preferred embodiment of my invention, it will be understood that changes in the construction, relationship and operation of the parts may be made without departing either from the spirit of the invention or the scope of my broader claims.

I claim:

1. The combination with a furnace wall having a cinder notch therein, of a bott for said notch, and mounting means for said bott carried entirely and only by said wall.

2. The combination with a furnace wall having a cinder notch therein, of a bott for said notch, and mounting means for said bott carried entirely and only by a relatively limited zone of the furnace wall adjacent said notch.

3. The combination with a furnace wall having a cinder notch therein, of a bott for said notch, and mounting means for said bott carried entirely and only by the furnace wall and located in the vertical plane of the axis of said notch.

4. The combination with a furnace wall having a cinder notch therein, of a bott for said notch, and mounting and operating means for said bott having a portion thereof located adjacent the wall and in the vertical plane of the axis of said notch.

5. The combination with a furnace wall having a cinder notch therein, of a bott for said notch, mounting means for said bott carried entirely and only by the furnace wall, and means carried by said mounting means for moving said bott to operative and inoperative positions.

6. The combination with a furnace wall having a cinder notch, of a bott for said notch, mounting means for said bott carried entirely and only by the furnace wall, a trackway carried by said mounting means and adapted to project outwardly therefrom in substantially a horizontal plane, and means for moving said bott along said trackway.

7. The combination with a furnace wall having a cinder notch, of a bott for said notch, mounting means for said bott carried entirely and only by the furnace wall, a trackway carried by said mounting means and adapted to project outwardly therefrom in substantially a horizontal plane, and means for moving said bott along said trackway to impart a predetermined straight line movement thereto.

8. In a cinder notch stopper, vertically extending mounting means adapted to extend upwardly along a furnace wall, a trackway lying in substantially a horizontally plane and carried by said mounting means, and a botting arm movable along said trackway.

9. In a cinder notch stopper, mounting means, a trackway pivotally connected to said mounting means and adapted to project therefrom in a substantially horizontal direction, means for maintaining the trackway in a substantially horizontal position, and a botting arm movable along said trackway.

10. In a cinder notch stopper, a mounting means, a trackway carried by said mounting means and adapted to extend therefrom in a substantially horizontal plane, a botting arm, and means for initially moving said botting arm along said trackway and thereafter moving said trackway bodily to inoperative position.

11. In a cinder notch stopper, a mounting means, a trackway carried by said mounting means and adapted to extend therefrom in a substantially horizontal plane, a botting arm, means for initially moving said botting arm along said trackway and thereafter moving said trackway bodily to inoperative position, and means precluding movement of the trackway to inoperative position until movement of the botting arm along said trackway has been completed.

12. In a cinder notch stopper, a botting arm, means for initially imparting a straight line movement to said botting arm, and thereafter a swinging movement thereto during movement of the botting arm from operative to inoperative position.

13. In a cinder notch stopper, a botting arm, and means for initially imparting to said botting arm a swinging movement followed by a straight line movement during movement of the botting arm from inoperative to operative position.

14. In a cinder notch stopper, a botting arm, a single means for initially imparting a straight line movement to said botting arm, and thereafter a swinging movement thereto during movement of the botting arm from operative to inoperative position.

15. In a cinder notch stopper, a botting arm, and a single means for initially imparting to said botting arm a swinging movement followed by a straight line movement during movement of the botting arm from inoperative to operative position.

In testimony whereof I have hereunto set my hand.

EDGAR E. BROSIUS.