May 22, 1956 G. HENSELEIT 2,746,611

COKE OVEN DOOR HANDLING MACHINE

Filed Nov. 20, 1951 4 Sheets-Sheet 1

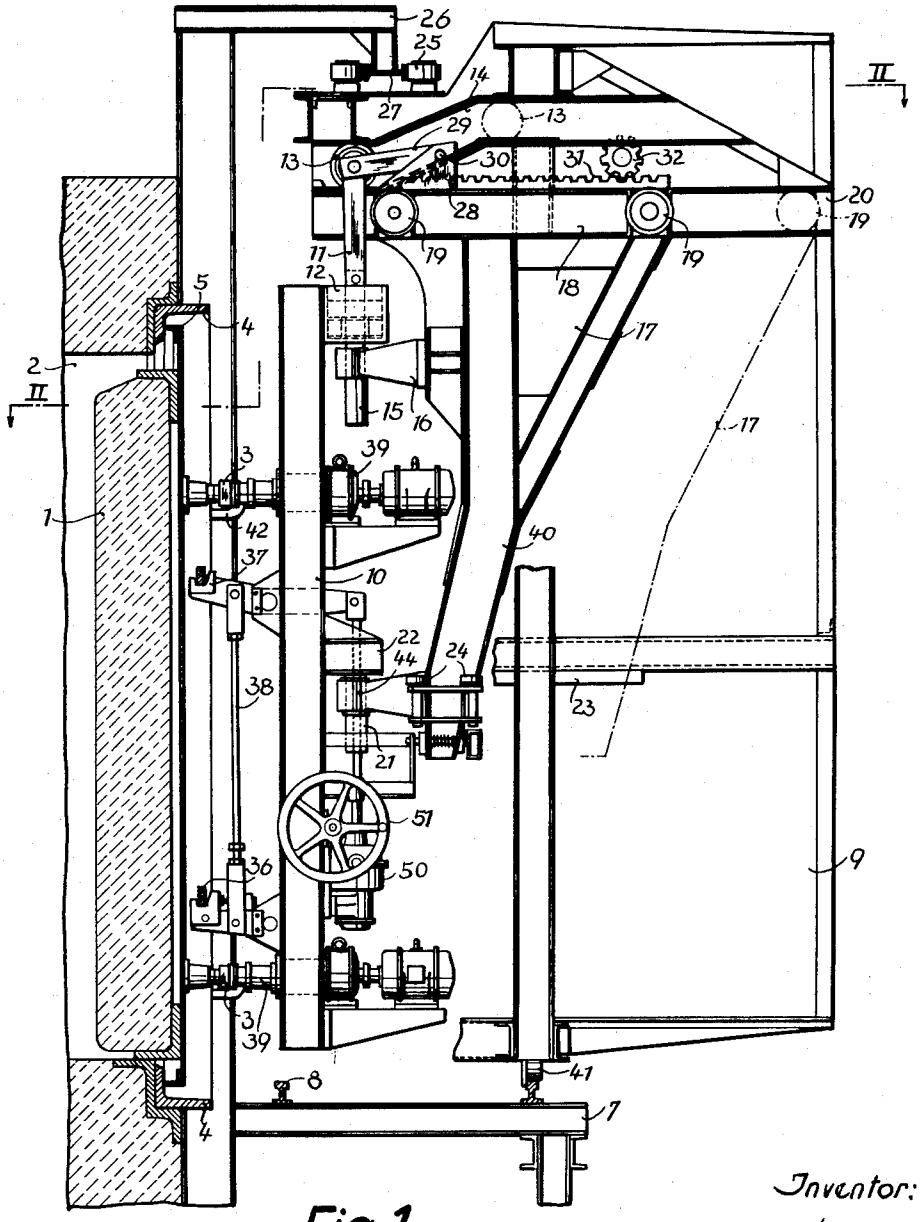


Fig. 1

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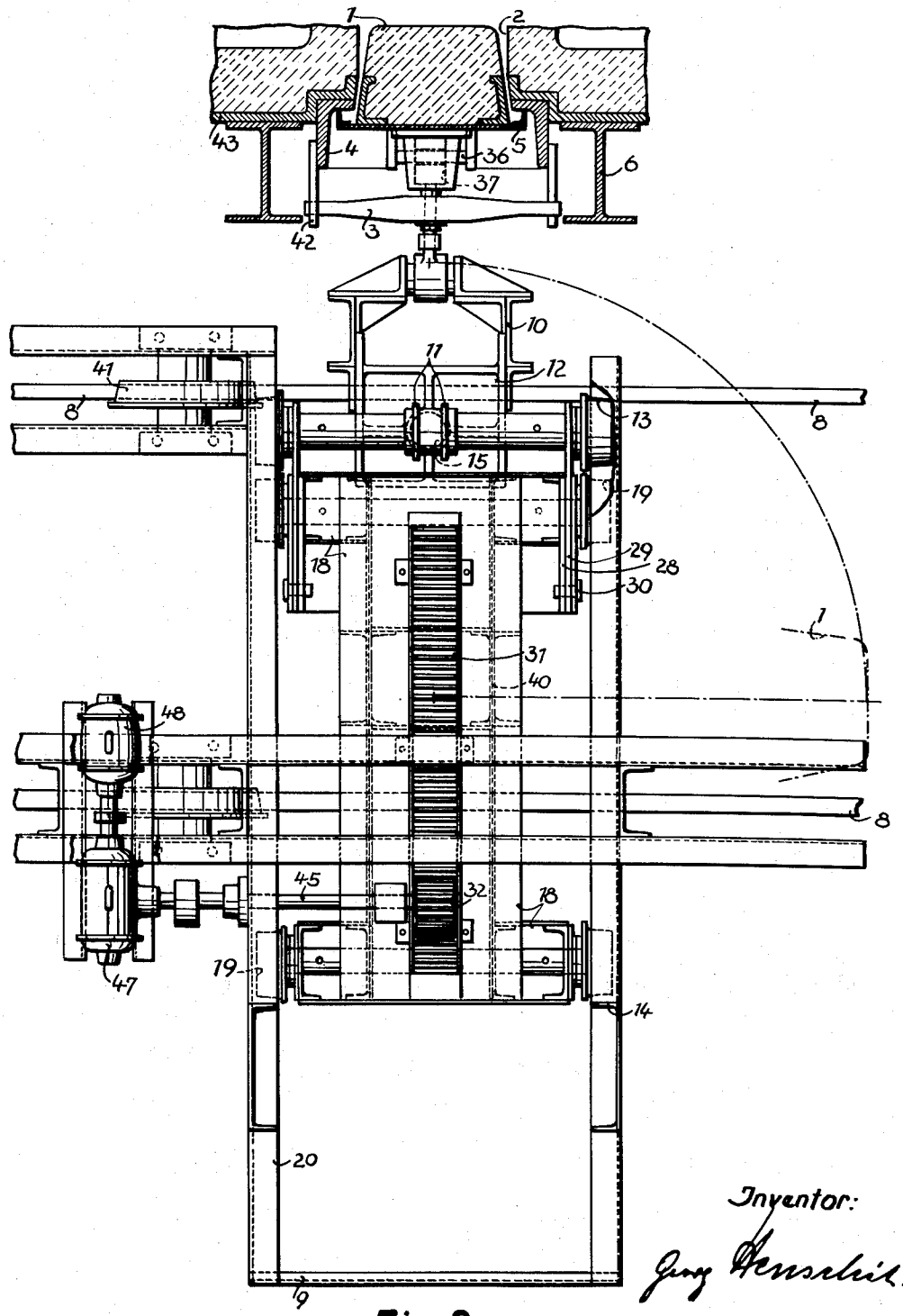


Fig. 2

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COKE OVEN DOOR HANDLING MACHINE

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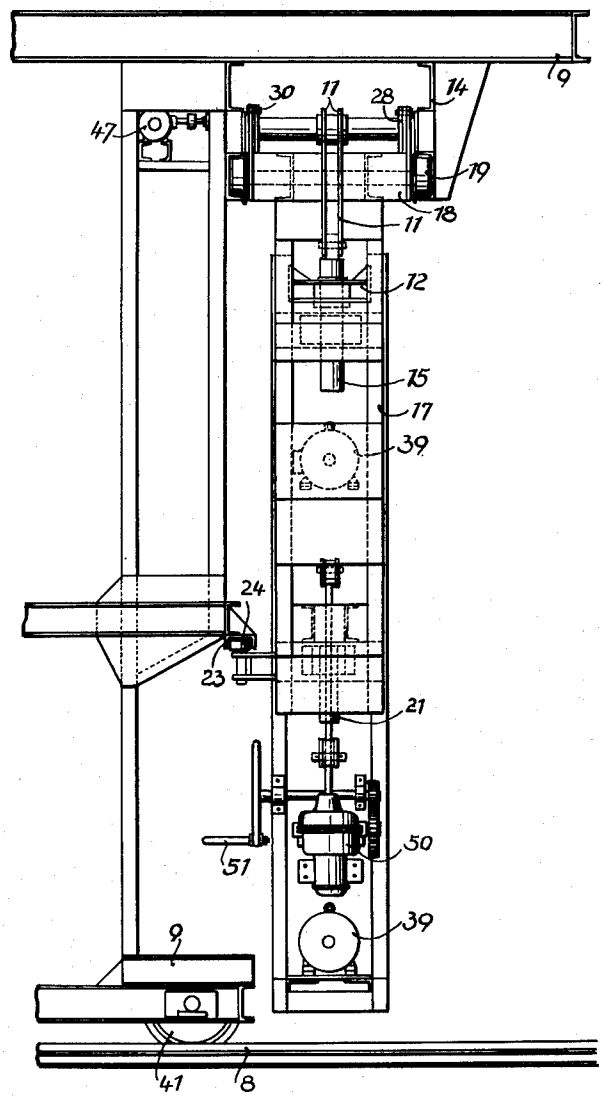


Fig.3

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COKE OVEN DOOR HANDLING MACHINE

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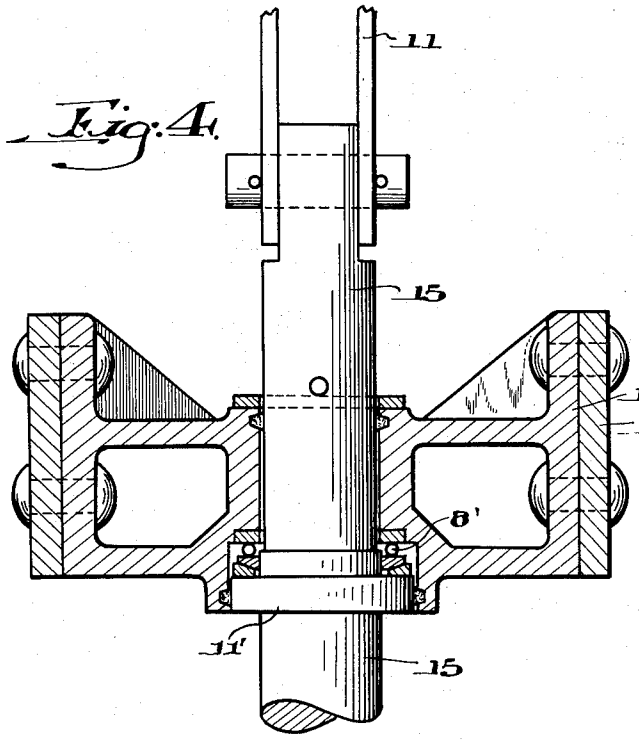


Fig. 4.

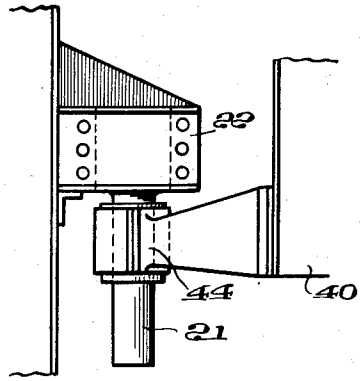


Fig. 6.

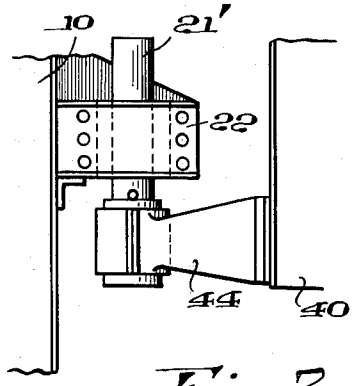


Fig. 7.

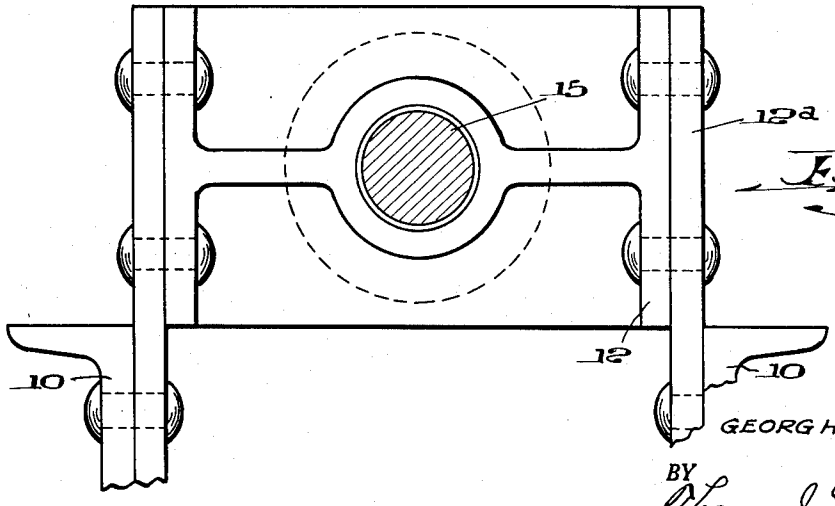


Fig. 5.

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2,746,611

COKE OVEN DOOR HANDLING MACHINE

Georg Henseleit, Essen, Germany, assignor, by mesne assignments, to Koppers Company, Inc., Pittsburgh, Pa., a corporation of Delaware

Application November 20, 1951, Serial No. 257,233

3 Claims. (Cl. 212—4)

This invention relates to improvements in coke oven door handling machines or the like and has reference particularly to such machines which have means for operating the door hooks and latches, means for breaking the seal between the door and the door frame, means for retracting the door, means for hoisting the door relative to its door frame, and means for swinging the door around 90° so that the surfaces of the door may be readily accessible for cleaning and repair.

Door handling machines are known in which the weight of the door is carried by a cam track to reduce the power requirements in retracting the door and changing its elevation relative to its door frame, when the door, held by a door carrier, is guided and also lifted or lowered by means of a curved track in reseating the door and in retracting the door from the coke oven chamber, and then swung 90° sideways to position it over a bench at the level accessible for cleaning. In these conventional door handling machines the door is supported by the door carrier from one side of the door carrier as it is moved along the curved track. In such one-sided support of the heavy door there is the risk of the cam track causing a canting of the door out of its vertical position for seating of the door frame, so that the proper sealing of the door with the frame is a doubtful matter when rapidly returning the door along the cam track into the chamber, and damaging of the sealing means may result. For such proper sealing of the door it is essential that it would be reseated always in the same place on its door frame and in a flush manner evenly all around the door frame.

It has also been proposed heretofore to support the door carrier on one arm of a twin lever which is supported by a guide carriage which is horizontally movable parallel to the door and secured against canting and wherein the other arm of the twin lever travels in the curved or cam track. Certainly, by such movements canting of the door is prevented by the parallel guide. However, in this method the door is supported also on one side so that some of the supporting and guiding rolls of the horizontally movable guide carriage are subjected to directional stress and therefore to a heavy wear and tear. Furthermore the lateral swinging motion of the door 90° though not envisaged, is not possible with this equipment without the arrangement of special intermediate members.

The invention now consists in providing a door handling machine in which the door carrier is supported at only one single point from an immovable cam track means which always effects the same alignment and lifting of the door relative to its door frame, and in which the door carrier is advanced and retracted by a horizontally movable retractive carriage means which is separate and distinct from the cam track means and which holds, through vertically spaced sliding connections, the door carrier and the door, when lifted by the cam track means in retracting and reseating and lifting the door, in their vertical position.

Such a construction of the door handling machine in the preferred embodiment of this invention, also allows the pivot like connection of the door carrier relative to the retractive carriage means and thereby an easy lateral swinging motion of the door of about 90° about the single point of support after the door has been retracted from the oven chamber.

According to the preferred form of the invention, a pendant shaft, which carries the door carrier and travels along the immovable cam track means on cam roll means, is also hinged at its upper part to, and laterally restrained from below by, the separate and distinct retractive carriage means through vertically spaced arms which allow for axial movement of the shaft relative to the retractive carriage means, so that the shaft and door always maintain their vertical position during their advance and retractive cam movement while allowing rotary movement of the door carrier 90° relative to the guiding device when retracted.

Another feature of the invention consists in arranging on the pivoted part of the door carrier, a toothed rack into which engages a pinion provided on the door machine. The door after having been released from the oven chamber can be laterally moved 90° by hand or mechanically, by means of this simple driving device.

Finally the invention comprises providing a large space between the retractive carriage means and the coke oven door carrier for the installation of an automatic latching device on the door carrier.

In the accompanying drawings forming a part of this specification and showing for purposes of exemplification, the preferred form and manner in which the invention may be embodied and practiced but without limiting the claimed invention to such instance or instances:

Fig. 1 is a vertical sectional view of the end of a coke oven chamber and of its door in sealed and latched position having the improvement in coke oven door handling machine embodied therein, the latter being in side elevation;

Fig. 2 is the horizontal top plan view taken along the line II—II of Fig. 1;

Fig. 3 is a front vertical elevational view of the door handling machine;

Fig. 4 is a vertical sectional view through the socket member 12;

Fig. 5 is a horizontal section through the same;

Fig. 6 is an enlarged view of members 22, 44 and 21;

Fig. 7 is an enlarged view of a modified construction of members 22, 44 and 21.

The same characters of reference designate the same parts in each of the views of the drawings.

Referring to the drawings, the coke oven door 1 is sealed and latched in position in the oven chamber 2, by latch bars 3 which act upon hooks 42, which are connected with the door frame 4. The sealing edge 5 of the door 1 seals it at its flanged end against sealing surfaces on the door frame 4. Between each two adjacent oven chambers 2, buckstays 6 are provided on the metallic armor 43 of the oven brickwork.

The door handling machine 9 as shown in Fig. 1, is mounted on tracks 8 of a platform 7 along which it is propelled alongside the battery by means of wheels 41. A door carrier 10 is provided on the door handling machine 9 for movement longitudinally along the row of doors of the coke oven battery. The door carrier 10 is supported by vertical supporting straps 11 through a shaft 15 and a socket arm 12, arranged on the door carrier 10 for free rotation of socket arm 12 on the upper part of a non-rotatable collar 11' fixed as by welding or beading on shaft 15. Straps 11 have at their top cam-follower carrier-rolls 13 situated in ascending cam tracks 14. Below the foot of socket arm 12 is a prolongation

extension of shaft 15 which is axially movable in, and extends through, an arm 16 of a horizontally movable retractive carriage means 17 which restrains lateral movement of the shaft 15 and socket 12. As shown in Figs. 4 and 5, bearing 12 is intersected by a shaft 15 which has fastened thereto as by welding or beading, a collar 11' which bearing rests on the ball bearing 8' on the bearing or collar 11'.

As shown in Fig. 5 bearing 12 is connected with the door carrier 10 by angular sheets 12*a*.

The upper portion of the retractive carriage means 17 is connected at its top to a supporting framework 18 therefor on which are provided traction means in the form of supporting rolls 19. The supporting rolls 19 travel in rectilinear guide tracks 20 which are rigidly connected with the framework of the door handling machine 9. A pivot 21 provided by an arm 22 which is rigidly connected with the door carrier 10 also extends through a socket arm 44 fixed to the front of the retractive carriage means 17 as more clearly shown in Fig. 6. The pivot 21 may also be rigidly connected to the arm 44 and loosely passed through a socket in arm 22 as shown in Fig. 7 whereby the arm 22 may be raised, lowered and rotated with the door carrier 10 around pivot 21' fixed on arm 44 instead of, as in Fig. 6, the pivot 21 being raised, lowered and rotated with the door carrier 10 in a socket in the fixed arm 44. In both embodiments the entire weight of the door carrier 10 is carried at one single point where its arm 12 rests on the shaft 15 through the collar 11' below arm 12. The lower portion of shaft 15 and pivot 21 need only serve as guides for axial movement and lateral restraint of the door carrier.

Fixed to the framework of the door handling machine 9 are, furthermore, rectilinear track means in the form of horizontal guide tracks 23 on which the guide rolls 24 of the retractive carriage means 17 travel in order to prevent any canting of the door when it is held by the door carrier 10. The framework of the door handling machine 9 is guided at its top by guide rolls 25 which travel on a track arranged at the end of arms 26 on the buckstays 6 along both sides of the coke oven battery.

Arms 29 are rotatably arranged on a pivot 30 carried in the brackets 28 of the supporting framework 18 of the retractive carriage means. The other ends of the arms 29 are hinged to a horizontal shaft for the supporting cam rolls 13 that govern the change in elevation of the hanger straps 11 for the shaft 15 of the door carrier 10. In this way the suspension member in the form of straps 11 and shaft 15 is connected with arms 29 and is kept in its vertical position when elevated relative to the door frame in retracting the door carrier 10 by the separate and distinct movement of the retractive carriage means 17. The carriage 17 is driven by means of a pinion 32 supported by the framework of the door handling machine 9 through a shaft 45, transmission gear 47 and motor 48. The pinion 32 engages in a rack 31 connected with the supporting frame 18 of the retractive carriage 17. After having retracted the door from the coke oven chamber the door carrier 10, while still holding the door, is swung around the axis of shafts 15 and 21 by about 90° by a driving device shown at 34 on the drawing of the companion British Patent 687,058.

A door lifting hook 37 is provided at the top and bottom of the door carrier 10. Both lifting hooks 37 are coupled with a rod 38 and actuated by a drive 50, and a handwheel 51 in a manner that they come into and out of a grasping relation with the pockets of the door hooks 36 arranged on the door. Mechanical latching means 39 are also provided on the door carrier 10 within reach of the door latches 3. The bolts for the bars of these latches 3 are loosened and tightened by the latching means 39 in order to secure a tight fit of the door between the sealing frame 5 and the sealing surface of the door frame 4. The vertical supporting beam 40 of the retractive carriage 17 is offset in a direction leading away from the door carrier 10 to leave space for arranging therein the door latching means 39.

To retract the door 1 from the coke oven chamber the door handling machine 9 is first moved along the tracks 8 on the platform to that oven chamber of the battery from which the coke is to be pushed and so that the latching means 39 are brought into line with the axis of the latch bolts of the latches 3. Then the retractive carriage 17 with the door carrier 10 connected thereto, is moved toward the coke oven door in a direction along the coke oven chamber axis. The latching bolts are now loosened and the latches 3 swung out of the reach of their latch hooks 42 after previously having the lifting hooks 37 engaged in the pockets 36. The door is now lifted somewhat by means of the lifting hooks 37 and the door carrier 10 retracted by the carriage 17 through operation of pinion 32, to move the door from the coke oven chamber as indicated by the dotted lines in the drawing. Simultaneously the door is lifted by means of the supporting cam-follower rolls 13 in the cam tracks 14 so that the pivot shaft 15 together with collar 11', and socket arm 12 and pivot extension of shaft 15, are lifted relative to the socket of the arm 16 and, correspondingly, pivot 21 of the arm 22 is lifted in the socket of arm 44. The door removed from the coke oven chamber can now be swung around by 90° on such pivots and in this position the sealing frame 5 may be cleaned.

When rollers 13 rise in cam tracks 14 straps 11 raise the lower non-rotatable collar 11' which raises socket arm 12. This raises both the carrier 10 and pivot extension of shaft 15. When the carrier is swung 90° to swing the door 90°, the arm 12 freely rotates on the non-rotatable collar 11' at the intermediate part of shaft 15. The pivot extension moves axially at this time in arm 16 which, however, continues to restrain lateral movement of the lower part of shaft 15, arm 12, and carrier 10, and at all times carrier 10 and arm 12 are supported solely by suspension from shaft 15, straps 11, cam rollers 13 and tracks 14, the arms 16, 44 merely acting as guides.

After having moved aside the door handling machine 9 at the coke side, or at the pusher side, the coke guide, which is preferably connected with the door handling machine 9 at the coke side, or the pusher ram at the pusher side, can now be brought into reach of the coke oven chamber to push the coke from the coke chamber.

The invention as set forth is embodied in particular form and manner but may be variously embodied within the scope of the claims hereinafter made.

What I claim is:

1. A coke oven door operating machine, comprising: a carriage movable along a coke oven battery from chamber to chamber in position to remove and replace coke oven doors from door frames of said chambers; cam track means immovably mounted on the carriage for carrying the weight of the doors while guiding and elevating the doors in their movement to and from their door frames in seating and unseating the doors with respect to the individual door frames; cam-follower means operatively associated with said cam track means; a door carrier having means for supporting said doors individually thereon in vertical position and means for supporting the door carrier at only a single point from said cam-follower means; retractive carriage means, separate and distinct from said cam track means, for moving the door towards and away from the furnace with rectilinear movement of said door carrier and the cam-follower means along the cam track means to and from the individual door frames for the doors; means for moving the retractive carriage means towards and away from the furnace; and vertically spaced sliding con-

nections between the retractive carriage means and the door carrier for holding the door carrier vertical while accommodating vertical movement of the door carrier as it is being moved to and from the furnace so as to maintain the door in a vertical plane in all positions of the movement of the door to and from the furnace, whereby the door is sustained by the cam track means for vertical movement and is laterally restrained by the retractive carriage means, as the cam-follower means rises and falls during movement toward and away from the furnace.

2. Coke oven door operating apparatus as claimed in claim 1, and which includes means for effecting rotary translation of the door carrier 90° relative to the cam track.

3. Coke oven door handling machine as claimed in claim 1, and in which the cam track means is immovably mounted at a level above the door carrier, and in which the means for supporting the door carrier at a single point from the cam-follower means comprises, a single pendant vertical supporting shaft, arm means pivoted to the retractive carriage means and hinge connected to the vertical supporting shaft and the cam-follower means at a level above the rotatable support for the door carrier, for maintaining the verticality of the vertical supporting shaft, a rotatable support connected with the door carrier and mounted for rotation on the vertical

shaft as its pivot at a level below the cam-follower, and a bearing on said shaft for said rotatable support; and in which the spaced sliding connections comprise an upper pivot extension of said shaft below said bearing and axially movable in an arm on the retractive carriage means to restrain lateral movement of the pivot extension relative to the retractive carriage means while allowing vertical movement relative thereto, and a lower pivot and bearing between the retractive carriage means and the door carrier for maintaining the door carrier vertical while accommodating vertical movement of the carrier with lateral restraint thereof relative to the guide device.

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