

Sept. 2, 1958

SADAO SHIMAZAKI

2,850,173

COKE OVEN DOOR LIFTER MACHINERY

Filed Dec. 17, 1952

2 Sheets-Sheet 1

Fig. 1.

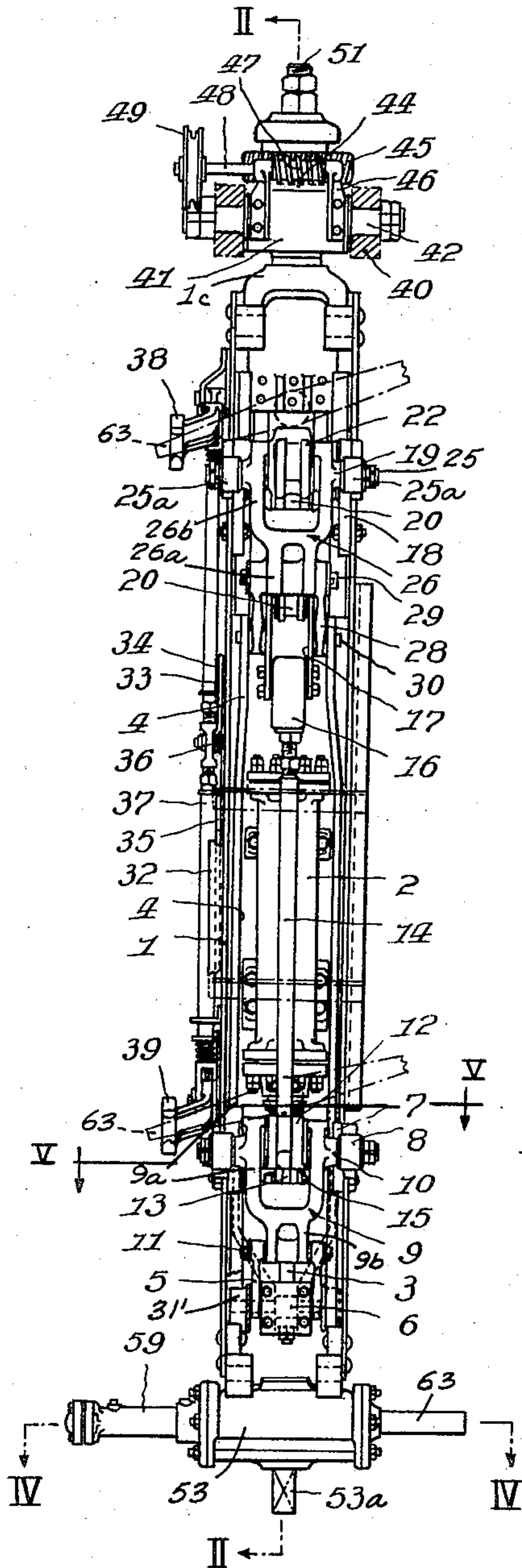
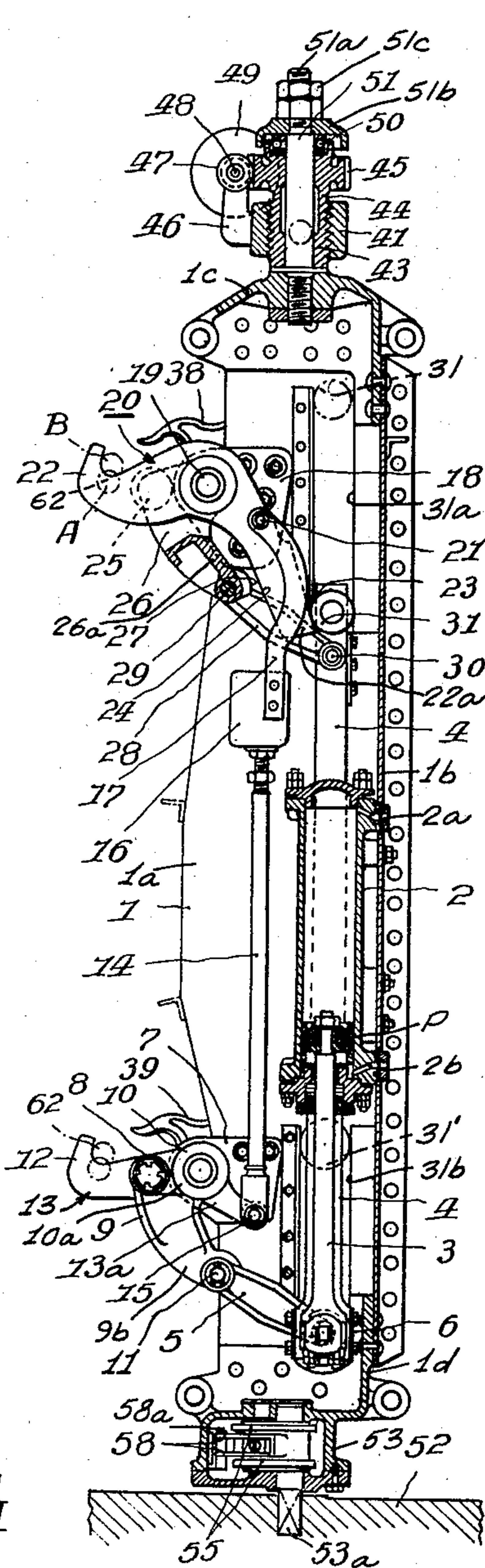


Fig. 2.



INVENTOR
Sadao Shimazaki
By Shoemaker & Mattare
ATTORNEYS

Sept. 2, 1958

SADAO SHIMAZAKI

2,850,173

COKE OVEN DOOR LIFTER MACHINERY

Filed Dec. 17, 1952

2 Sheets-Sheet 2

Fig. 3.

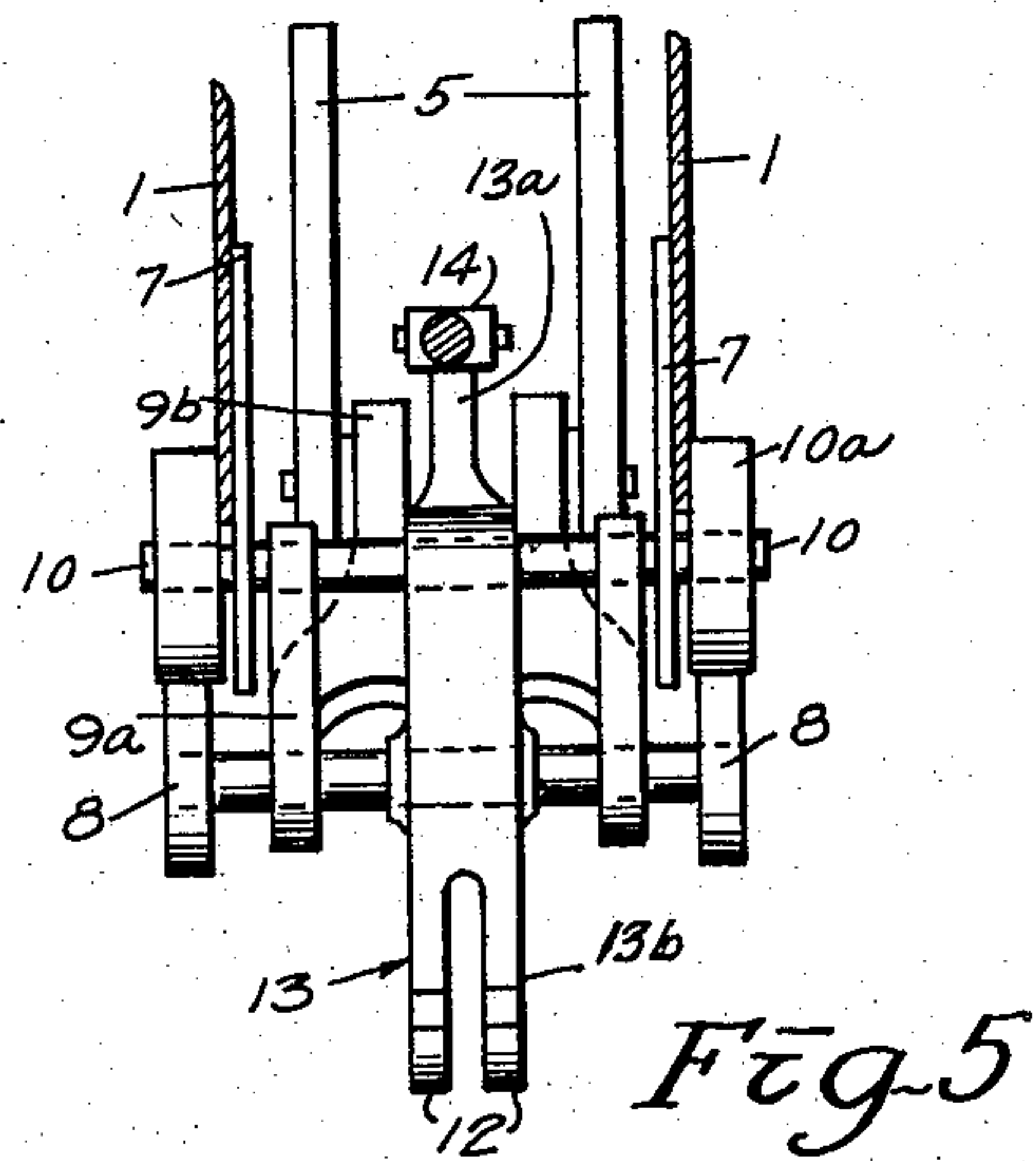
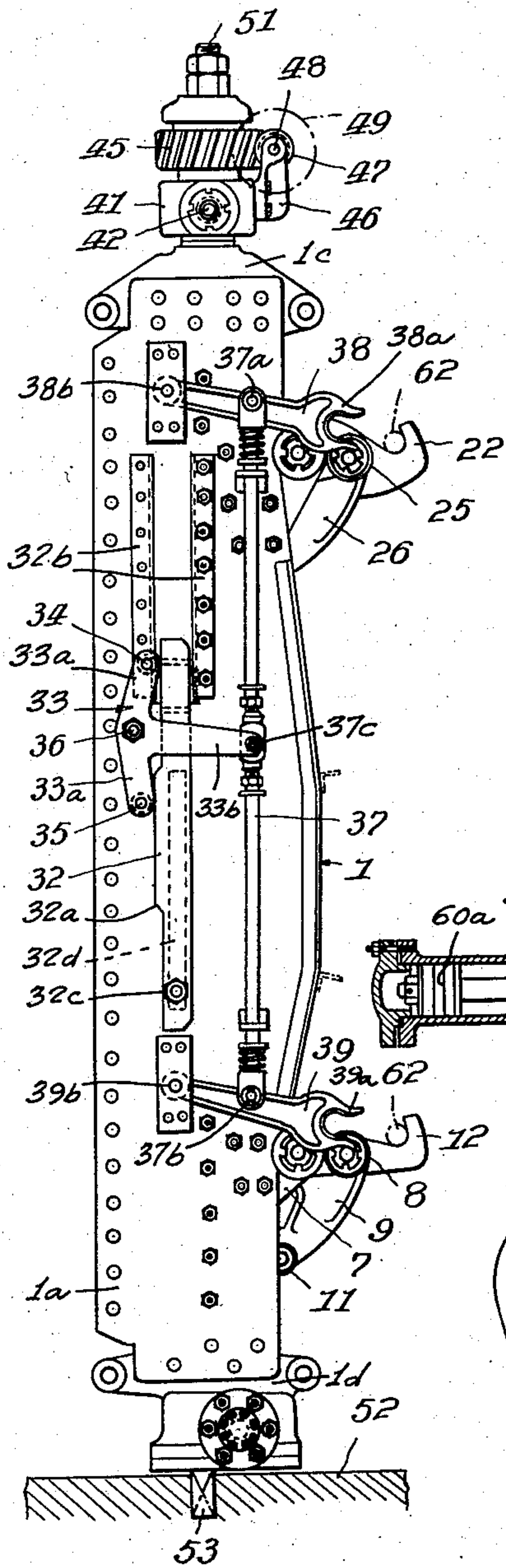


Fig. 4.

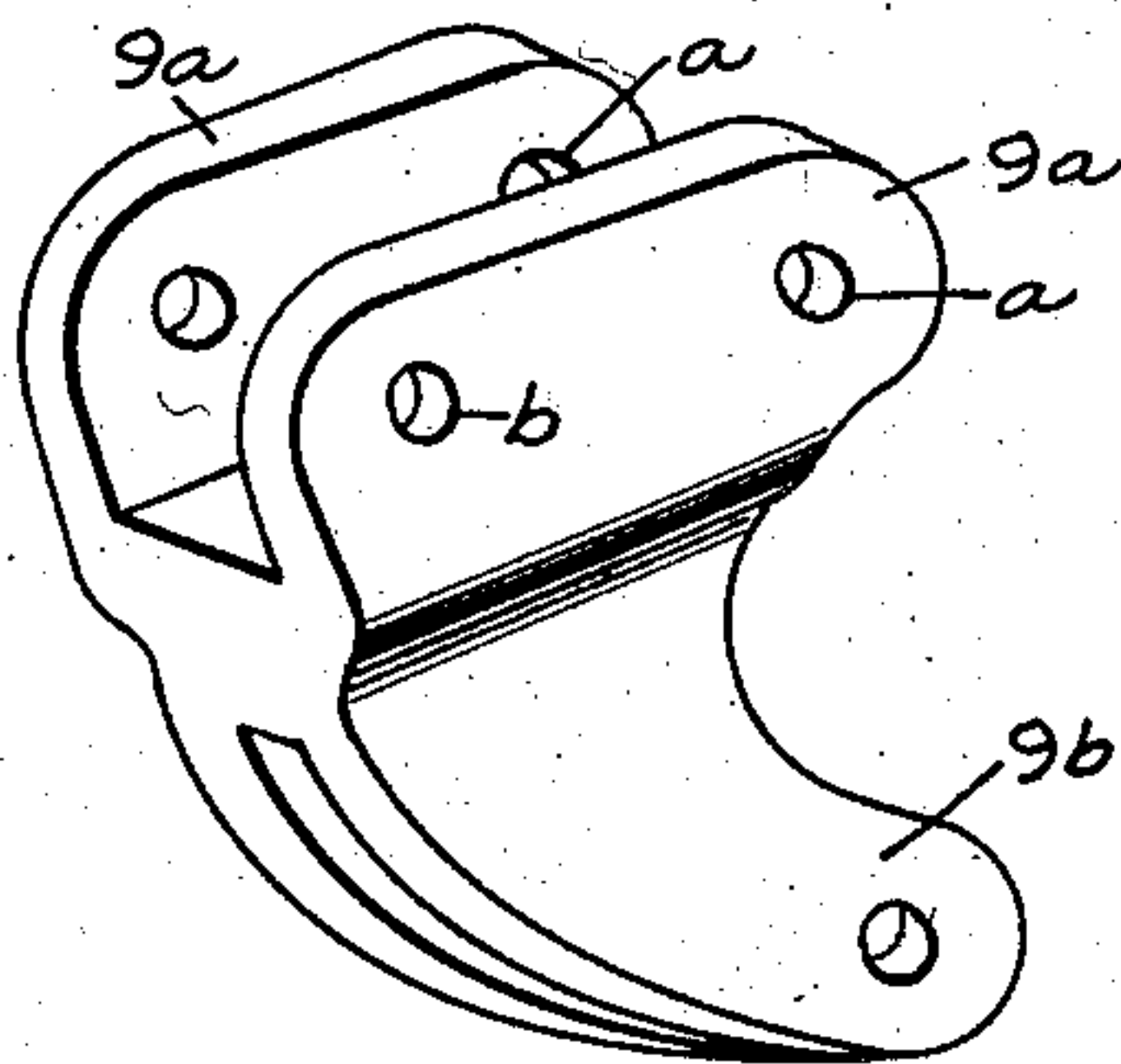
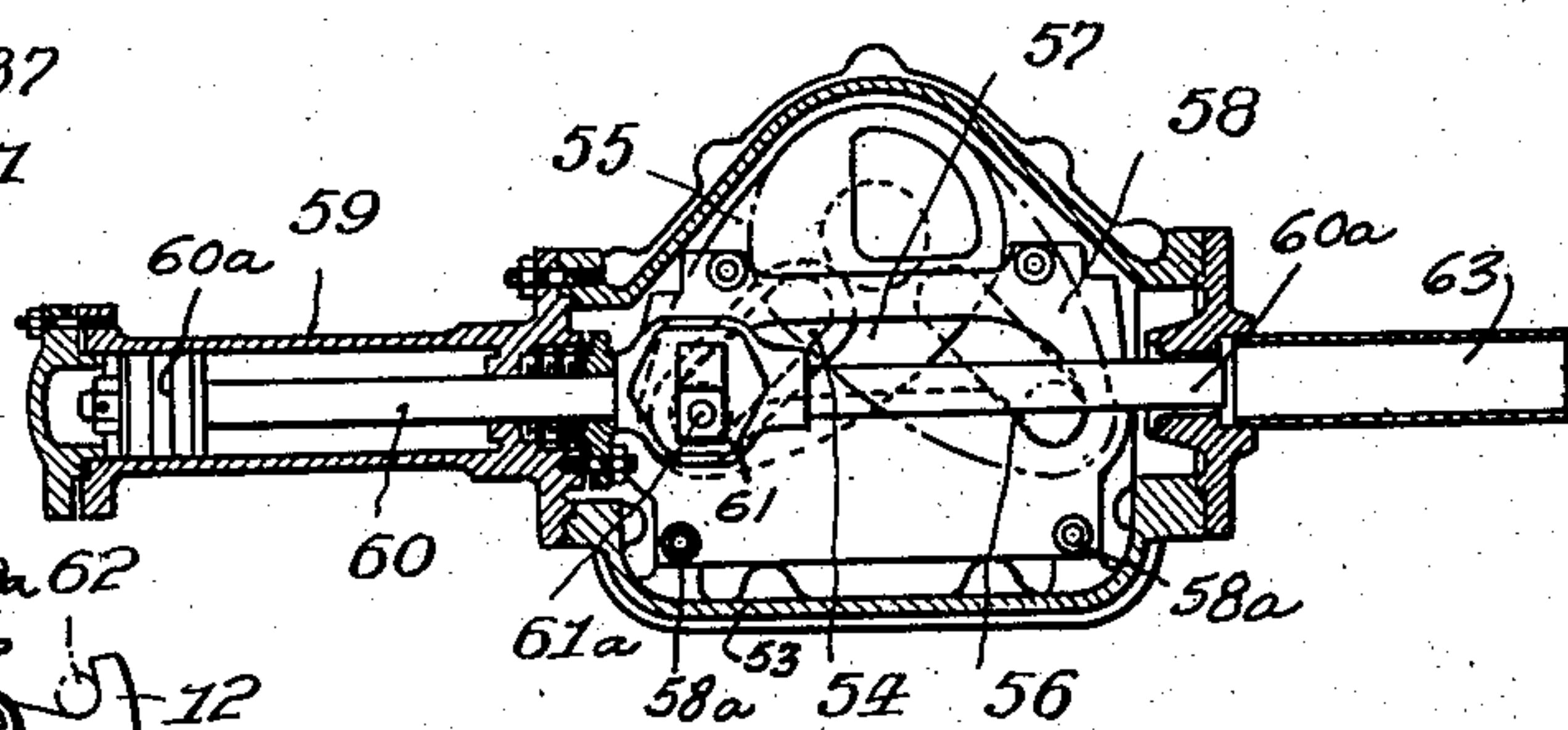


Fig. 6

INVENTOR
Sadao Shimazaki
By *Shoemaker & Mattara*
ATTORNEYS

1

2,850,173

COKE OVEN DOOR LIFTER MACHINERY

Sadao Shimazaki, Toshima-ku, Tokyo, Japan

Application December 17, 1952, Serial No. 326,405

6 Claims. (Cl. 212—4)

This invention has relation to the manufacturing of improved coke oven door lifter machinery used to move coke oven doors into and out of their closed position.

This invention is adapted to press the coke oven door with the moving pressing portion by moving the door lifter, and to move the bar holding it with the cooperating hook when the bar is released, and to turn the moving frame at right angle to a stationary position by moving the moving frame with the door cover.

When the coke oven door is going to be removed, the moving frame is moved in front of the coke oven and the plunger is dropped, and the pressing frame is given a thrust by the pressure roller and the connection between the locking bar and the cooperating hook is released. At the same time, the bill portion of the hook is engaged with the connective bar and the door cover is raised a little and pulled towards the operator. Then the moving frame can be turned to a right angle position by moving the piston rod.

My invention is illustrated in the accompanying drawings wherein:

Figure 1 is a front view of the door lifter.

Figure 2 is a view partially in elevation and partially in vertical section taken along the line II—II of Figure 1.

Figure 3 is an elevation looking at the opposite side of Figure 2.

Figure 4 is a transverse sectional view taken along the line IV—IV of Figure 1.

Figure 5 is a partial horizontal section taken substantially on the line V—V of Figure 1;

Figure 6 is a view in perspective of a yoke.

The coke oven door lifter mechanism of the present invention is designed to facilitate the removal of coke oven doors for whatever purpose may be required and this apparatus, as illustrated in the drawings, embodies the following structure.

The numeral 1 generally designates an elongate vertically disposed frame body which is of channel cross sectional form and comprises the side plates 1a and back 1b together with a head 1c and base 1d. This structure has mounted therein between the side plates 1a and secured to the back 1b a vertical cylinder 2 having at its upper and lower ends means 2a and 2b for connection therewith of suitable means for injecting operating fluid thereinto for the movement of the piston P. This piston has connected to it the rod 3 which extends downwardly through suitable packing means in the lower end of the cylinder.

Extending lengthwise of the inner sides of the side plates 1a and on opposite sides of the cylinder 2 are pitman bars 4 which are pivotally connected at their lower ends with the lower or outer end of the piston rod 3 as indicated at 6.

Also pivotally connected at 6 to opposite sides of the pitman bars are the short links 5 to be hereinafter more particularly described.

There are also connected to the upper and lower ends

2

of the pitman bars 4 upper and lower rollers 31 and 31' respectively, and these rollers move between vertical guide tracks 31a and 31b lying upon the inner sides of the frame side plate 1a.

Secured to the inner sides of the sides plates 1a of the frame adjacent to the lower end of the frame are the forwardly projecting bracket plates 7 which support the transverse shaft 10 and on the outer ends of this shaft 10 are rollers 10a.

The numeral 9 generally designates a forked lever which is longitudinally arcuate and embodies two spaced head portions 9a which form a fork for the purpose about to be described, and the downwardly curving two-part tail piece 9b to which are attached or coupled by a transverse pivot pin 11, the outer ends of the links 5.

The shaft 10 passes through the apertures a at the inner ends of the head portions 9a whereby the forked lever may rock thereon.

The numeral 13 generally designates a hook which carries or is formed with an outer or forward bill 12 and a rear tail piece 13a. This hook 13 is mounted for rocking movement on the shaft 10 and forwardly of the shaft 10 it has connected therewith the outwardly or laterally extending shaft ends 13b which pass through the transversely aligned bearing apertures b in the head portions 9a forwardly of the apertures a.

Upon the outer sides of the forked lever the shaft ends 13b carry the coke oven door frame pressing rollers 8.

The rearwardly and downwardly extending tail portion 13a of the forked lever is pivotally coupled as at 15 to the lower end of a vertically extending reach rod 14 which is attached to and carries upon its upper end a weight 16.

The rollers 8 at the outer sides of the forked lever 9 have peripheral contact with the rollers 10a carried on the shaft 10 and the function of these rollers 8 will be hereinafter set forth.

Secured to and extending upwardly from opposite sides of the weight 16 are the longitudinally bowed bars 17 which are connected to opposite sides of an upper hook member which is generally designated 20, the structure of which will be hereinafter described.

The inner sides of the side plates 1a of the frame have secured thereto near the top of the structure and directly above the bracket plates 7, the upper bracket plates 18 which project forwardly beyond the adjacent edges of the side plates 1a to which they are attached. These upper bracket plates 18 support the transversely extending shaft 19 and upon this shaft is rockably mounted the upper hook 20 which, like the lower hook 13, is adapted in the operation of the mechanism to be coupled with the connector bar which forms a part of the coke oven door structure, not shown, which the lifter mechanism is designed to remove and replace.

The connector bar hook 20 is supported intermediate its ends on the shaft 19 and embodies the forwardly extending upturned bill 22 and the relatively long rearwardly and downwardly extending tail 22a which has the curved back and forward edges 23 and 24 respectively, with which adjacent parts of the mechanism engage in the operation of the mechanism.

The numeral 28 designates a pair of connecting links corresponding to the links 5 and each of these links is pivotally connected at one end to a pitman bar 4 as indicated at 30, just below the upper roller 31. The links 28 extend upwardly and outwardly on opposite sides of the tail portion 22a of the connector bar hook 20.

The numeral 26 generally designates an upper forked lever of similar construction to the lever 9. This upper lever 26 embodies the spaced head portions 26b and the downwardly and rearwardly curving lower end 26a to the opposite sides of which the outer ends of the links 28 are pivotally coupled by the pivot pin 29.

On the inner side of the lower end 26a of the forked lever 26 is a rearwardly projecting abutment 27 which is positioned for contact with the edge 24 of the hook tail 22a during a part of the operation of the lifter mechanism and the upper rollers 31 are located for engagement with the rear curved edge 23 of the tail 22a also during certain periods of operation of the mechanism as hereinafter set forth.

The part of the hook 20 lying between the bill and the shaft 19 is located between the head portions 26b and these head portions 26b are pivotally coupled by laterally extending portions of the shaft 25 with the hook body forwardly of the shaft 19, as stated. Upon the outer sides of the head portions of the forked lever 26 the shaft 25 carries coke oven door pressing rollers 25a and these have peripheral contact with rollers 19a carried by the ends of the shaft 19.

The tail part 22a of the hook 20 lies between the upper ends of the curved bars 17 and these bars are pivotally connected thereto as at 21.

On the outer side of one side plate or side wall 1a of the frame structure 1 is positioned the vertically disposed and vertically slidable cam bar 32, an edge of which is formed, intermediate the ends of the bar, with the cam 32a. This cam bar at its upper end is located between and guided by the spaced guide strips 32b and at its lower end the cam bar is connected by a bolt or pin 32c with the lower end portion of a pitman bar 4, the bolt passing through the side wall plate 1a by way of the vertical slot 32d.

Adjacent to the upper and lower ends of the frame structure are located the forked levers 38 and 39 respectively which have the forwardly directed forked ends 38a and 39a, which ends extend beyond the adjacent forward edges of the side wall or plate 1a of the frame.

The levers 38 and 39 are pivotally attached to the adjacent wall as indicated at 38b and 39b, so that they may swing in a vertical plane.

The forked levers 38 and 39 are connected by a reach rod 37, the ends of which are pivotally attached to the levers 38 and 39 as indicated at 37a and 37b.

Approximately midway between the pivots 38b and 39b there is mounted on the pivot pin 36 carried by the adjacent side wall plate 1a, a T-shaped lever which is generally designated 33, which comprises the two arms 33a and the intermediate leg 33b. The pivot 36 is located approximately midway between the ends of the arms 33a and the leg extends from the mid portion of the lever between these arms and is pivotally attached as at 37c to the reach rod 37 midway between the ends of the latter.

The arms 33a of the lever 33 extend in the direction of the length of the cam bar 32 and carry the upper and lower cam followers 34 and 35 which have sliding contact or rolling contact with the adjacent cammed edge of the bar 32. It will thus be seen that upon up and down movement of the bar 32 the cam portion 32a will alternately engage the followers 34 and 35 so as to rock the T-shaped lever 33 and swing the leg 33b to impart up and down motion to the reach rod 37 and corresponding up and down swinging movement to the forked levers 38 and 39.

The head 1c of the frame has fixed therein the upstanding post 51, the top end of which is reduced and screw threaded as indicated at 51a.

Encircling the post 51 is a sleeve 44 which has formed integrally with its upper end the worm gear 45.

The sleeve 44 below the worm gear is screw threaded as indicated at 43 and encircled by and has threaded connection in a collar frame 41 from opposite sides of which project the stub shafts 42.

The numeral 40 designates portions of a body frame by which the lifter mechanism is carried and another part of this body frame, lying below the lifter mechanism, is designated 52. The remaining portion of such

body frame is not illustrated, for purpose of clarity, and since the body frame itself forms no part of the invention, but it will be understood that such frame carries the mechanism and facilitates the placing of the mechanism in position before or in front of the coke oven door, for use.

The stub shafts 42 are mounted in the parts 40 of the body frame so that the lifter mechanism may have rocking movement when necessary during certain periods of operation of the mechanism.

The reduced top end 51a of the post 51 is encircled by a bearing 50 which engages the upper side of the worm gear 45 and is held in place by the cover cap 51b and the nuts 51c threaded on the reduced portion of the post.

The frame 41 carries the spaced brackets 46 between which is rotatably mounted a worm 47 which meshes with the gear 45 and this worm is secured to or carried by the shaft 48 on which is mounted the pulley wheel 49 which preferably is of the type adapted to receive a sprocket chain. Rotation of the worm 47 by means of a chain engaged around the wheel 49 will impart turning movement to the sleeve 44.

The base portion 1d of the frame 1 is formed integral with and forms the top of a casing 53 and this casing has extending vertically therethrough a shaft 53a, the lower end of which is mounted in and fixed to the portion of the body frame illustrated in section and designated 52. Thus, as previously stated, the lifter mechanism is held by the body frame between the parts thereof which are here shown and designated 40 and 52.

Within the casing 52 the vertical shaft 53a has secured thereto the vertically spaced horizontally disposed arms 55. These arms are formed with vertically aligned slots 54 and between the arms 55 are located the vertically spaced fixed plates 58 which are secured to the wall of the casing at 58a.

The fixed plates 58 are also formed with slots 57 which are in vertical alignment.

The arms 55 are secured at one end to the shaft 53a and extend therefrom across the slots 57 of the fixed plates for the purpose about to be described.

From one side of the casing 53 there extends the piston cylinder 59 in which is mounted the piston 60a connected to a rod 60 which passes through suitable packing into the casing and which is attached at the end lying within the casing to a cross head block 61 which carries pins and sleeves 61a which fit into the slots 54 and 57 formed in the plates 56 and 58.

At the opposite side of the casing 53 from the piston cylinder 59 there extends the tubular sleeve 63 which protectively receives a stabilizing rod 60a forming an extension of the piston rod 60 on the side of the cross head remote from the piston rod.

It is believed that the operation of the mechanism will be readily apparent from the foregoing description. However, a short description of such operation will be given and in this connection reference is made to the disclosure in applicant's issued Patent No. 2,803,592, of August 20, 1957, showing a coke oven door of a type with which the present mechanism is designed for use.

In the patent referred to the coke oven door is illustrated as having upper and lower connector bars or lift bars which in the present case are indicated in Figs. 2 and 3 in dotted outline and designated 62. These connecting bars 62 are disposed horizontally adjacent to the upper and lower ends of the oven door. Also in the oven door structure in the patent referred to there are illustrated upper and lower door clamping bars which extend across the face of the door and are pivoted midway between their ends to the door and are designed when rocked in one direction to have clamping and locking engagement with side hooks carried by the door frame. Such clamping and locking bars are shown in broken

5

outline in Fig. 1 of the drawings of this application and are designated 63.

For the removal of the coke oven door by the present mechanism, the latter is moved by the supporting body frame into the proper position at the front of the coke oven door. The piston P in the cylinder 2 is actuated to the upper end of the cylinder so as to move the pitman bars upwardly to the positions where the rollers 31 and 31' are shown in dotted outline in Fig. 2. This movement of the pitman bars will carry the attached ends of the links 5 and 28 upwardly, rocking the forked levers 9 and 26 on the shafts 10 and 19 respectively, and at the same time the abutment portion 27 of the upper forked lever will be moved into contact with or against the forward edge 24 of the tail 22a of the upper hook 20 and the upper hook will be swung down and corresponding movement will also be given to the hook 13, both by the pull applied to the forked lever by the links 5 and by the upward pull applied to the reach rod 14 which is connected with the rear end portion 13a of the lower hook 13. This upward movement of the pitman bars will also slide the cam bar 32 upwardly by reason of the pin connection 32c between the cam bar and the adjacent pitman bar, thus effecting the rocking of the T-shaped lever 33 so as to raise or elevate the forked hooks 38 and 39.

The door connector bar engaging hooks 13 and 20 will then be in position to have the bills extended to the underside of the door connector bars or door lift bars and the forked forward ends of the levers 38 and 39 will be in the proper elevation for each to receive an end of a door clamping bar 63.

By introducing pressure fluid into the cylinder 2 at the upper end, reverse movement of the piston may then be effected and as the pitman bars move downwardly, thrust will be applied through the links 5 and 28 to the forked levers moving the abutment 27 away from the forward edge of the tail 22a of the upper hook and the weight 16 on the rod 14 will apply downward thrust to the rear end 13a of the hook 13, assisting in the upward swinging of the bill end of the hook. The bills of the hooks will thus be elevated against the undersides of the door lift or connector bars 62 and as the forked levers are swung during this lifting of the hooks, the pressure rollers 8 and 25 will bear against the adjacent sides of the door and apply pressure to the door and this will release slightly the engagement between the hooks and the bars 62.

Continued downward movement of the piston will then raise the door connecting bars from approximately the position shown in dotted lines at A to the position shown at B. The door will therefore be first raised slightly and then pushed in by the rollers 8 and 26 and as the hooks continue to be moved upwardly, the door will be elevated a little more and pulled slightly outward.

At the same time that the above described operation is taking place, the cam bar 32 will be moved downwardly and the cam will effect the oscillation of the lever 33 in an obvious manner so as to swing the forked levers 38 and 39 downwardly and since these levers are each engaged with an end of a clamping bar when they are so swung downwardly, the clamping bars 63 will be turned to disengage the oven door from the holding hooks which form a part of the door frame.

After the door is freed from the frame, it can be moved outwardly easily with the mechanism and by then actuating the piston 60a through the introduction of fluid under pressure into the outer end of the cylinder 59, turning movement may be imparted to the entire mechanism by means of the thrust imposed by the cross head against the slotted arms 55. Since the plates 58 are rigidly secured to the casing 53 while the slotted arms are fixed to the post 53a which is in turn fixed against rotation with respect to the body frame 52, it will be seen that when the piston is moved toward the inner end

6

of the cylinder the pin and sleeve connection between the cross head and the slotted plates and arms will move in the elongated slot 57 and simultaneously in the slots of the arms 55 and impose the desired thrust against the arms to force the casing and the mechanism supported thereabove to rotate.

If the cover of the coke oven has become warped or otherwise distorted, movement can be imparted to the lifter mechanism by means of the chain, not shown, coupled with the wheel 49. Such movement is given by turning the wheel so as to effect relative turning between the threaded sleeve and the frame 41 or, in other words, to give an up and down movement to the mechanism to break the door loose.

Having thus described my invention, what I claim as new is:

1. In an operating mechanism for a coke oven door, a vertically disposed movable frame having a rear wall and side walls and being open along its front, upper and lower hooks pivotally mounted in said frame and projecting outwardly through the open front of the frame and having upwardly presented bills at their outer ends for engaging bars of a door and having shanks at their inner ends, a weighted connection between the shanks of said hooks, upper and lower levers pivotally mounted at one side of said frame adjacent to the upper and lower hooks and each having a bar-engaging front end fork disposed at a side of the adjacent hook, upper and lower yokes straddling said hooks and pivotally mounted in position for engaging said levers, pitman bars slidable vertically in said frame, links connecting said pitman bars with said hooks, a cam bar slidable vertically externally of one side of said frame and connected with an adjacent pitman bar within the frame for vertical movement therewith, a reach rod connecting the upper and lower levers, and a crank lever having pivotal connection at one end to said frame and having its other end pivotally coupled to said reach rod to reciprocate the latter, said crank lever having a cross head at said one end for engagement by said cam bar, the cam bar serving to rock the lever and move the reach rod longitudinally and swing the forked levers in cooperating relation to the movements of the hooks.

2. The structure of claim 1 wherein the pitman bars within the frame are slidable vertically along tracks carried by side walls of the frame and carry rollers engaging the shank of one hook and tilting the connected hooks during vertical movement of the pitman bars.

3. The structure of claim 1 wherein the pitman bars within the frame are provided with members engaging and tilting one hook during vertical movement of the pitman bars, a cylinder mounted vertically in said frame, and a piston in said cylinder carried by a piston rod projecting from an end of said cylinder and connected with said pitman bars for sliding the pitman bars vertically during movements of the piston in the cylinder.

4. In an operating mechanism for a coke oven door, a vertically disposed movable frame, mechanism in said frame including hooks projecting from the frame in position for engaging bars of a coke oven door and actuating members for swinging said hooks, forked bars carried by said frame in cooperating relation to said hooks, a pivoted lever on the frame for moving the forked bars, the lever having side arms, a cam bar for tilting said lever by engagement with the arms thereof, said cam bar being connected with the mechanism within the casing and moved thereby for effecting operation of the forked bars in cooperating relation to said hooks, and driving means for the mechanism in the frame.

5. The structure of claim 4 wherein the moving frame is mounted for turning movement about a vertical axis, a head for the upper end of said frame, a post extending upwardly from said head, a sleeve encircling the post, a collar about said sleeve carrying bearings, a worm gear upon said sleeve, a worm rotatably supported in said

7

bearings and meshing with the worm gear and a threaded coupling between the sleeve and collar.

6. The structure of claim 4 wherein the vertically movable frame is rotatable above a vertical axis, a casing at the lower end of said frame, a stationary pivot shaft disposed vertically in said casing and projecting downwardly therefrom, a horizontal plate fixed to and extending laterally from said pivot shaft within the casing and formed with a slot extending radially of the pivot shaft, a stationary horizontal plate fixed in and to said casing formed with a slot extending across the slot in the plate carried by the pivot and having diagonally extending end portions, a cylinder carried horizontally by said casing, a piston in said cylinder carried by a piston

8

rod projecting from an end of the cylinder and across said plates, and a cross-head member carried by said piston rod and engaged in the slots and movable in the slots to impart turning movement to the casing in its movement in the slots.

References Cited in the file of this patent

UNITED STATES PATENTS

2,190,297	Salkvist	Feb. 13, 1940
2,335,866	Lavelly	Dec. 7, 1943
2,478,215	Van Ackeren	Aug. 9, 1949
2,491,831	Rackoff	Dec. 20, 1949