Feb. 26, 1963 W. A. BOWMAN ETAL 3,079,007

APPARATUS FOR REMOVING AND REPLACING CHARGING HOLE COVERS OF COKE OVENS

Filed Sept. 26, 1960

5 Sheets-Sheet 1

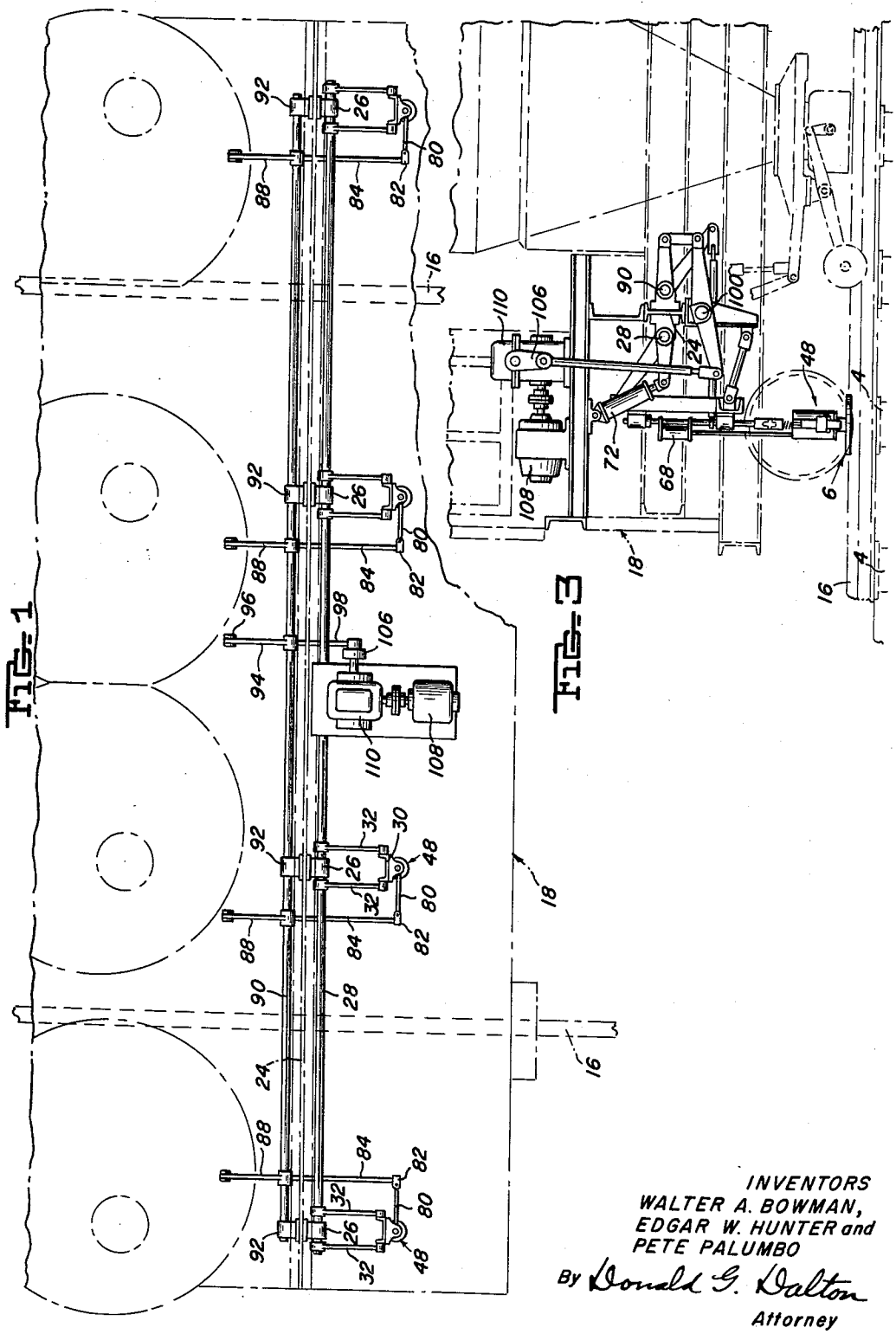


FIG. 1

FIG. 3

INVENTORS
WALTER A. BOWMAN,
EDGAR W. HUNTER and
PETE PALUMBO

By Donald G. Dalton
Attorney

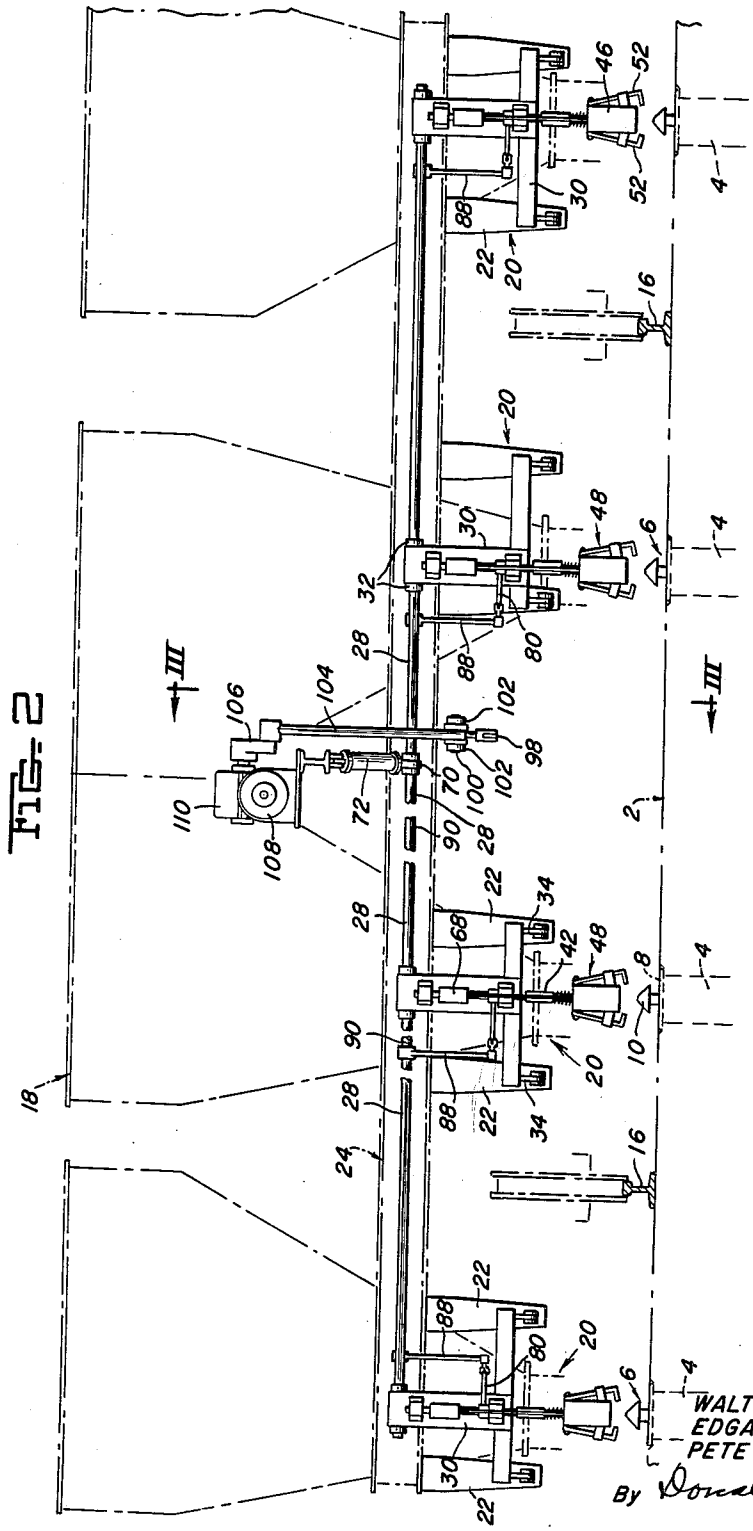
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APPARATUS FOR REMOVING AND REPLACING CHARGING HOLE COVERS OF COKE OVENS

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5 Sheets-Sheet 2

FIG. 2



INVENTORS
WALTER A. BOWMAN,
EDGAR W. HUNTER and
PETE PALUMBO
By Donald G. Dalton
Attorney

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Filed Sept. 26, 1960

5 Sheets-Sheet 3

FIG. 4

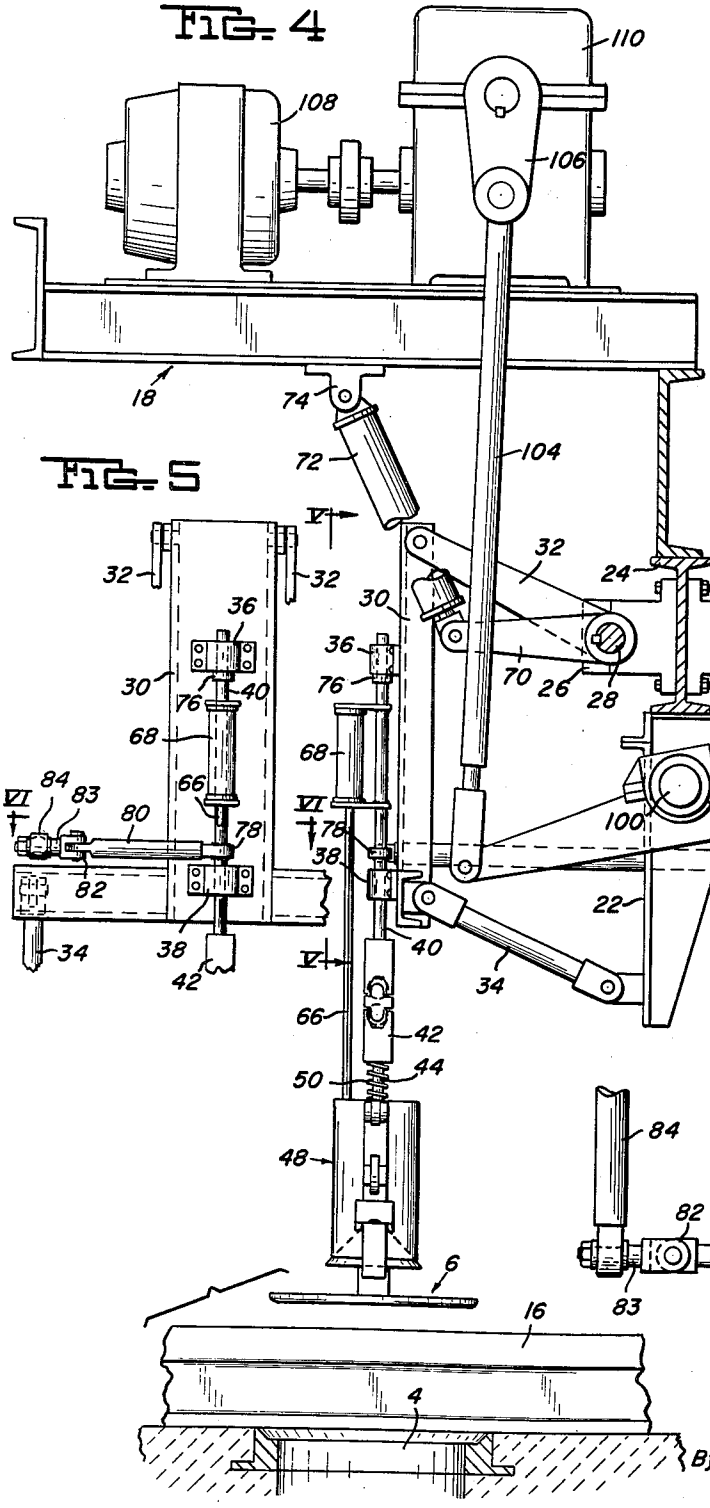
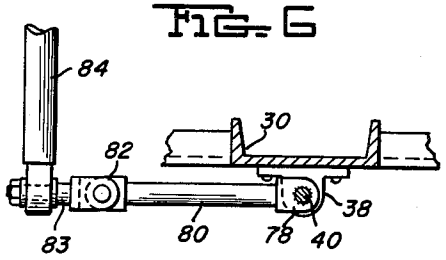


FIG. 5

FIG. 6



INVENTORS
WALTER A. BOWMAN,
EDGAR W. HUNTER and
PETE PALUMBO
By Donald G. Dalton
Attorney

Feb. 26, 1963 W. A. BOWMAN ETAL 3,079,007

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Filed Sept. 26, 1960

5 Sheets-Sheet 4

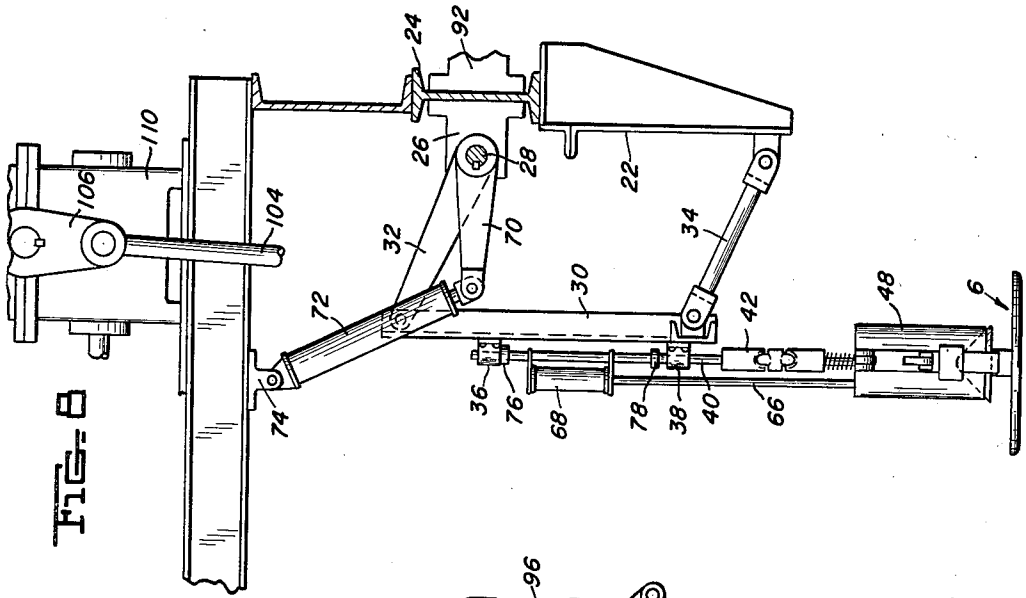


FIG. 8

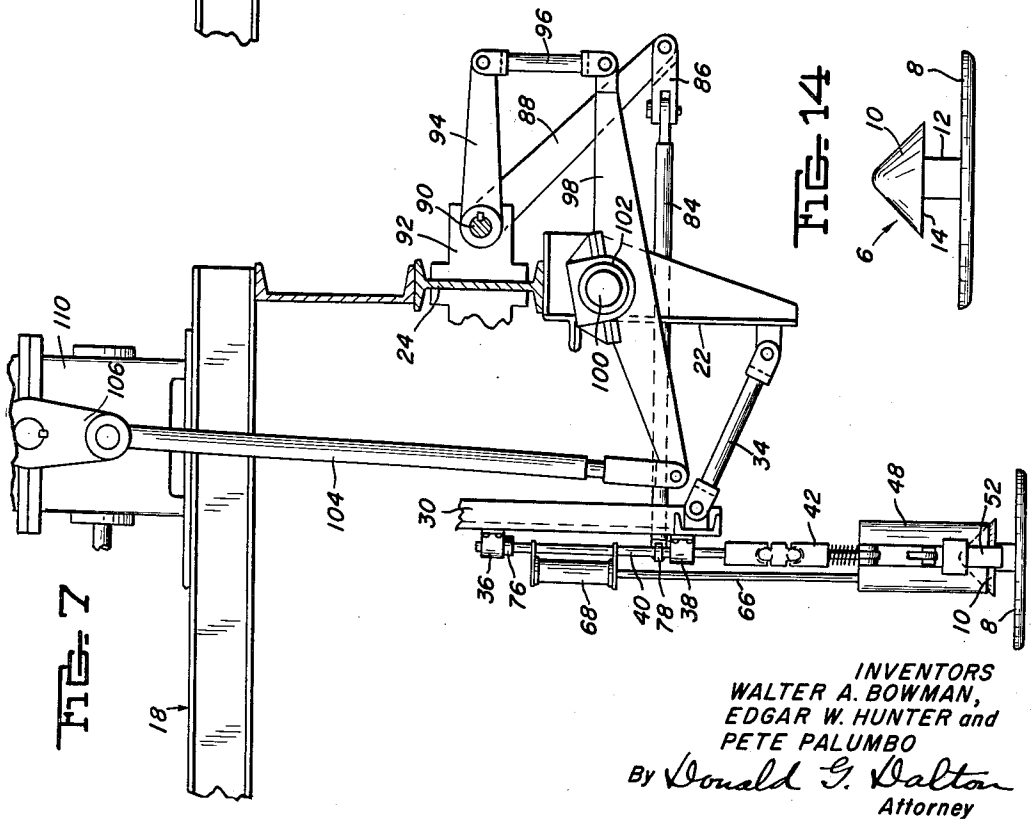


FIG. 7

FIG. 14

INVENTORS
WALTER A. BOWMAN,
EDGAR W. HUNTER and
PETE PALUMBO
By Donald G. Dalton
Attorney

Feb. 26, 1963 W. A. BOWMAN ETAL 3,079,007

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Filed Sept. 26, 1960

5 Sheets-Sheet 5

FIG. 9

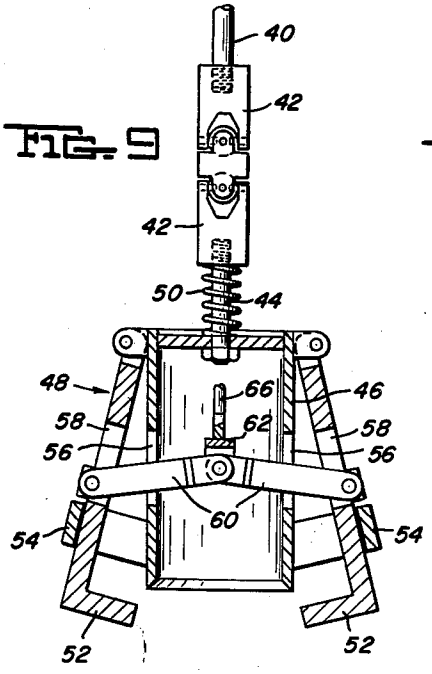


FIG. 10

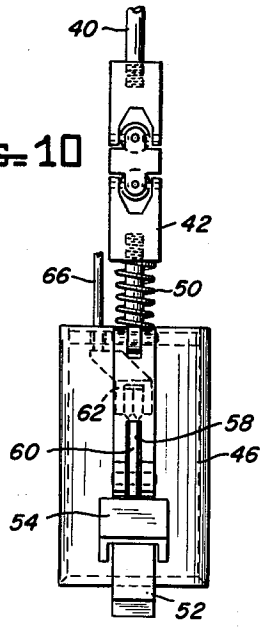


FIG. 11

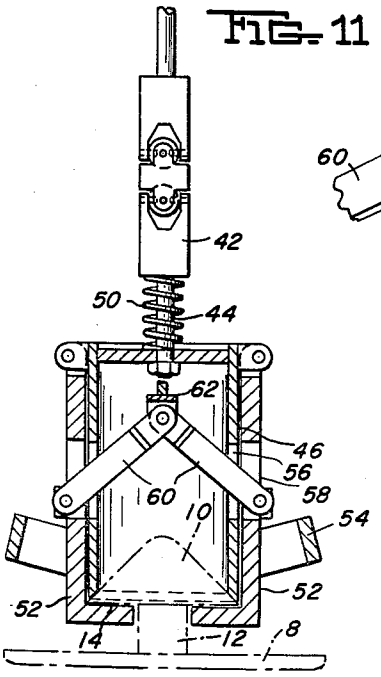


FIG. 12

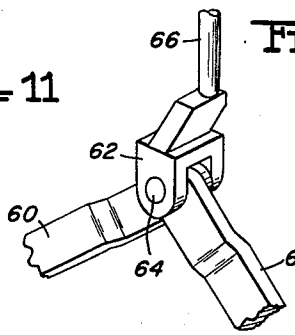
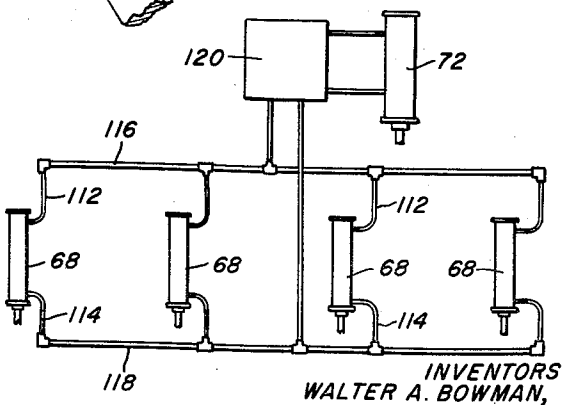


FIG. 13



INVENTORS
WALTER A. BOWMAN,
EDGAR W. HUNTER and
PETE PALUMBO
By Donald G. Dalton
Attorney

United States Patent Office

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APPARATUS FOR REMOVING AND REPLACING CHARGING HOLE COVERS OF COKE OVENS

Walter A. Bowman, Pittsburgh, Edgar W. Hunter, Finleyville, and Pete Palumbo, Bethel Park, Pa., assignors to United States Steel Corporation, a corporation of New Jersey

Filed Sept. 26, 1960, Ser. No. 58,360
6 Claims. (Cl. 212—4)

This invention relates to apparatus for removing and replacing charging hole covers of coke ovens. The coking coal is transferred from the coke oven coal bunker by a larry car which runs over the tops of the coke oven batteries. The coal is charged to the individual ovens from bins on the larry car through several holes on the top of each oven. The holes are covered with lids which previous to our invention were manually removed by a workman with the aid of hooked bars. After the oven was charged and the larry car moved from over the holes the lids were replaced by the workman in the same manner. Because of the heat and the dirty conditions which exist on the top of coke oven batteries this work was difficult and dangerous.

It is therefore an object of our invention to provide apparatus for removing and replacing charging hole covers on coke ovens automatically.

This and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a plan view showing a larry car with the apparatus of our invention incorporated thereon;

FIGURE 2 is a front elevation of FIGURE 1;

FIGURE 3 is a view taken on the line III—III of FIGURE 2;

FIGURE 4 is an enlarged view, similar to FIGURE 3, but showing the parts in greater detail;

FIGURE 5 is a view taken on the line V—V of FIGURE 4;

FIGURE 6 is a view taken on the line VI—VI of FIGURE 5;

FIGURE 7 is a view, similar to FIGURE 4, showing the linkage operation for oscillating the cover plates;

FIGURE 8 is a view, similar to FIGURE 4, showing the linkage operation for lifting and replacing the cover plates;

FIGURE 9 is a vertical section of the lifting head of our invention;

FIGURE 10 is a side elevation of FIGURE 9, with the tongs in closed position;

FIGURE 11 is a view, similar to FIGURE 9, but showing the parts in different position;

FIGURE 12 is an isometric view showing a detail of the lifting head;

FIGURE 13 is a schematic view of the hydraulic system used in our invention;

FIGURE 14 is an elevation of the lid used to cover the hole in the coke oven top.

Referring more particularly to the drawings reference numeral 2 indicates the top of a coke oven having several holes 4 therein. A lid 6 is provided for each of the holes and as shown in FIGURE 14 consists of a flat plate portion 8 and a conical upper portion 10 connected by a square stem 12 welded to each of the members 8 and 10. It will be seen that the base of the cone 10 is larger than the cross section of the stem 12 so as to provide a shoulder 14 for a purpose which will appear later. Rails 16 are provided on the top of the coke ovens for supporting a larry car 18 shown in dash dot lines in FIGURES 1, 2 and 3. A lid handling device 20 is associated with each of the holes 4 of the coke oven. Since the

lid handling devices are essentially alike only one will be described in detail. A pair of brackets 22 are supported from a beam 24 forming part of the larry car 18. Bearings 26 are attached to the beam 24 along the length thereof and support a longitudinal shaft 28. Each of the lid handling devices includes a T-shaped frame 30 which is supported at the top thereof by means of a pair of links 32 keyed to the shaft 28. The bottom of the frame 30 is pivotally connected to a pair of links 34, one at each end thereof, links 34 being provided with bifurcated ends as shown with the other ends of the links being pivotally connected to the bottom of brackets 22. A pair of bearings or pillow blocks 36 and 38 are supported on the frame 30 in vertical alignment and rotatably support a rod 40. The bottom of the rod 40 is connected to a double universal joint 42 which in turn carries a threaded rod 44 at its lower end. Tube 46 of a lifting head 48 is supported by the rod 44 with a spring 50 surrounding the rod 44 between the universal joint 42 and the closed top of tube 46. A pair of L-shaped arms 52 are pivotally mounted to the top of tube 46. U-shaped lugs 54 are welded to the tube 46 and limit outward movement of the arms 52. Aligned openings 56 and 58 are provided in the tube 46 and arms 52 to receive links 60, one pivotally attached to each of the arms 52. The inner ends of links 60 are pivotally connected to each other and to a clevis 62 by means of a pin 64. The clevis 62 is attached to the bottom of a rod 66 which extends upwardly through the top of tube 46 with its upper end being connected to a double acting hydraulic cylinder 68 attached to the rod 40 for movement therewith. The shaft 28 is rotated by means of a link 70 keyed thereto with free end of the link 70 being pivotally secured to the piston rod of a double acting cylinder 72 pivotally mounted on a bracket 74 mounted on the larry car 18. The rod 40 is prevented from moving vertically with respect to member 30 by means of a collar 76 attached to the rod 40 beneath the bearing 36 and a clamp 78 secured to the rod 40 above the bearing 38. The clamp 78 is secured to a lever 80, the other end of which is pivotally connected to a clevis 82 having a stem 83 about which is pivotally supported one end of a link 84. The other end of link 84 is pivotally connected to a clevis 86 which in turn is pivotally connected to a link 88 keyed to a shaft 90. A plurality of bearings 92 are attached to the beam 24 on the side opposite bearings 26. The shaft 90 is rotatably supported in the bearings 92. A link 94 is keyed to the shaft 90 adjacent the center of the larry car. A link 96 has one end pivotally connected to link 94 and its other end pivotally connected to a lever 98 pivotally mounted on a shaft 100 mounted in spaced bearings 102 supported by the larry car. The other end of lever 98 is connected to the bottom end of a connecting rod 104, the upper end of which is connected to a crank 106. The crank 106 is driven by a motor 108 through a gear reducer 110. As seen in FIGURE 13 cylinders 68 are connected in parallel by means of flexible tubing 112 and 114 to manifolds 116 and 118 which in turn are connected to an oil power unit 120. The cylinder 72 is also connected to the oil power unit 120.

In the operation of our device the larry car is moved along the coke oven battery until it is positioned over the coke oven chamber to be charged with the lifting heads 48 spotted over the respective charging holes 4. Fluid is introduced into the top of cylinders 68 so as to cause the arms 52 to move outwardly to the position shown in FIGURE 9. Fluid is then introduced into the top of cylinder 72 so as to cause all of the lifting heads 48 to move downwardly with the tubes 46 sliding downwardly over the cone 10 to the position shown in FIGURE 11. Fluid is then introduced into the bottom of the cylinder 68 so as to cause the arms 52 to move in-

wardly to the position shown in FIGURE 11. In this position the arms 52 engage the non-circular stem 12. The motor 108 is then started in operation to cause the shaft 90 to oscillate. Oscillation of shaft 90 causes the rods 40 to oscillate so that the lifting heads 48 and the lids 6 supported thereby oscillate to break the seal between the lid and the charging hole frame. Fluid is then introduced into the bottom of cylinder 72, thus raising the lifting heads 48 and the lids 6. The larry car 18 is then moved to position the bins of the larry car over the holes 4 and coal is discharged into the oven. After the oven is charged the lifting heads 48 and lids 6 are positioned over their respective holes 4 and fluid introduced into the top of cylinder 72 to lower the lids 6 into position. The motor 108 is then energized to cause oscillation of the lifting heads 48 to create a seal between the lids and the slightly tapered charging hole frame. After the seal has been formed, fluid is introduced into the top of cylinder 68 to release the clamping arms 52 after which fluid is introduced into the bottom of cylinder 72 to raise the lifting heads 48. The larry car is then ready to repeat the cycle on another chamber to be charged.

While one embodiment of our invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. In an apparatus for handling coke oven charging hole covers having a conical portion spaced from and attached to the main portion of the cover by means of a non-circular stem which apparatus includes a car, the improvement which comprises a lifting head mounted on said car for vertical movement, said lifting head including a vertical tubular member for receiving the said conical portion and a pair of diametrically opposed arms pivotally mounted on said tubular member for movement about horizontal axes, means for moving said arms about their axes from a position in engagement with said stem to a position beyond said conical portion, means for raising and lowering said lifting head, means to permit limited lateral movement of said lifting head into vertical alignment with said stem, and means for oscillating said lifting head about a vertical axis.

2. In an apparatus for handling coke oven charging hole covers having a conical portion spaced from and attached to the main portion of the cover by means of a non-circular stem, which apparatus includes a car, the improvement which comprises a lifting head mounted on said car for vertical movement, said lifting head including a vertical tubular member for receiving the conical portion and a pair of diametrically opposed arms pivotally mounted on said tubular member for movement about horizontal axes, means for moving said arms about their axes from a position in engagement with said stem to a position beyond said conical portion, a generally vertical shaft attached to and extending upwardly from said lifting head, universal joint means interposed between said lifting head and said vertical shaft, a support for rotatably supporting said shaft, means for raising and lowering said support with the lifting head attached thereto, and means for oscillating said shaft.

3. In an apparatus for handling coke oven charging hole covers having a conical portion spaced from and attached to the main portion of the cover by means of a non-circular stem which apparatus includes a car, the improvement which comprises a plurality of spaced apart lifting heads mounted on said car for vertical movement, each of said lifting heads including a vertical tubular member for receiving the said conical portion and a pair of diametrically opposed arms pivotally mounted on said tubular member for movement about horizontal axes, means for moving each of said pairs of arms about their axes from a position in engagement with one of said stems to a position beyond the associated conical portion, means for raising and lowering said lifting heads, means to permit limited lateral movement of said lifting heads into vertical alignment with the stem of the covers, and means for simultaneously oscillating said lifting heads about their vertical axes.

4. In an apparatus for handling coke oven charging hole covers having a conical portion spaced from and attached to the main portion of the cover by means of a non-circular stem which apparatus includes a car, the improvement which comprises a plurality of spaced apart lifting heads, each of said lifting heads including a vertical tubular member for receiving the conical portion and a pair of diametrically opposed arms pivotally mounted on said tubular member for movement about horizontal axes, means for moving each of said pair of arms about their axes from a position in engagement with one of said stems to a position beyond the associated conical portion, a generally vertical shaft attached to and extending upwardly from each of said lifting heads, universal joint means interposed between each lifting head and its vertical shaft, a support for rotatably supporting each of said shafts, means for simultaneously raising and lowering said supports with the lifting head attached thereto, and means for simultaneously oscillating said shafts.

5. In a car for handling coke oven charging hole covers the improvement which comprises a lifting head mounted on said car for vertical movement, means for selectively causing said lifting head to engage and disengage the covers, means for raising and lowering said lifting head, means for oscillating said lifting head about a vertical axis, and means to permit limited lateral movement of said lifting head independently of said car for alignment of said head centrally on the cover it is handling.

6. The device of claim 5 wherein said last named means includes a shaft carried by said car and universal joint means operably interconnecting said shaft and said lifting head.

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