

Feb. 8, 1944.

F. J. TRUESDALE

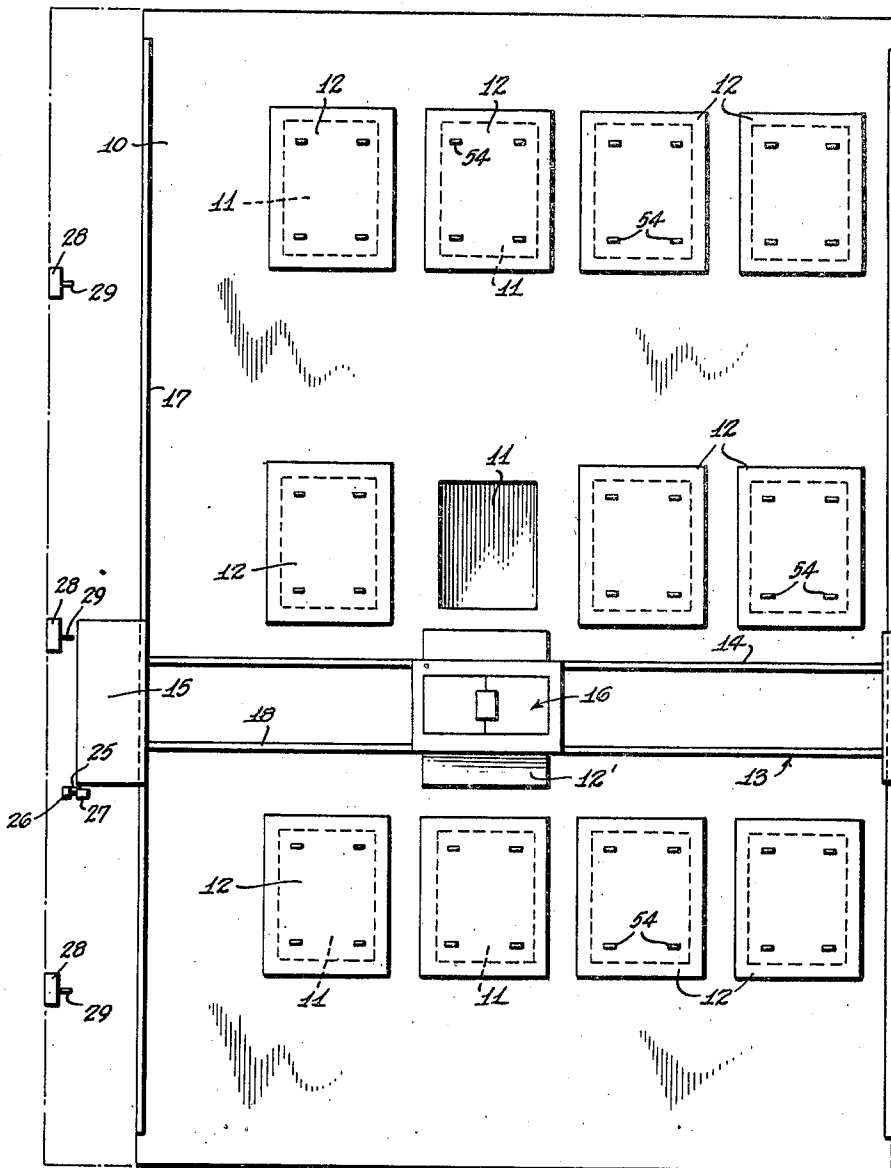
2,340,910

SOAKING PIT COVER CRANE

Filed June 30, 1941

4 Sheets-Sheet 1

Fig. 1.



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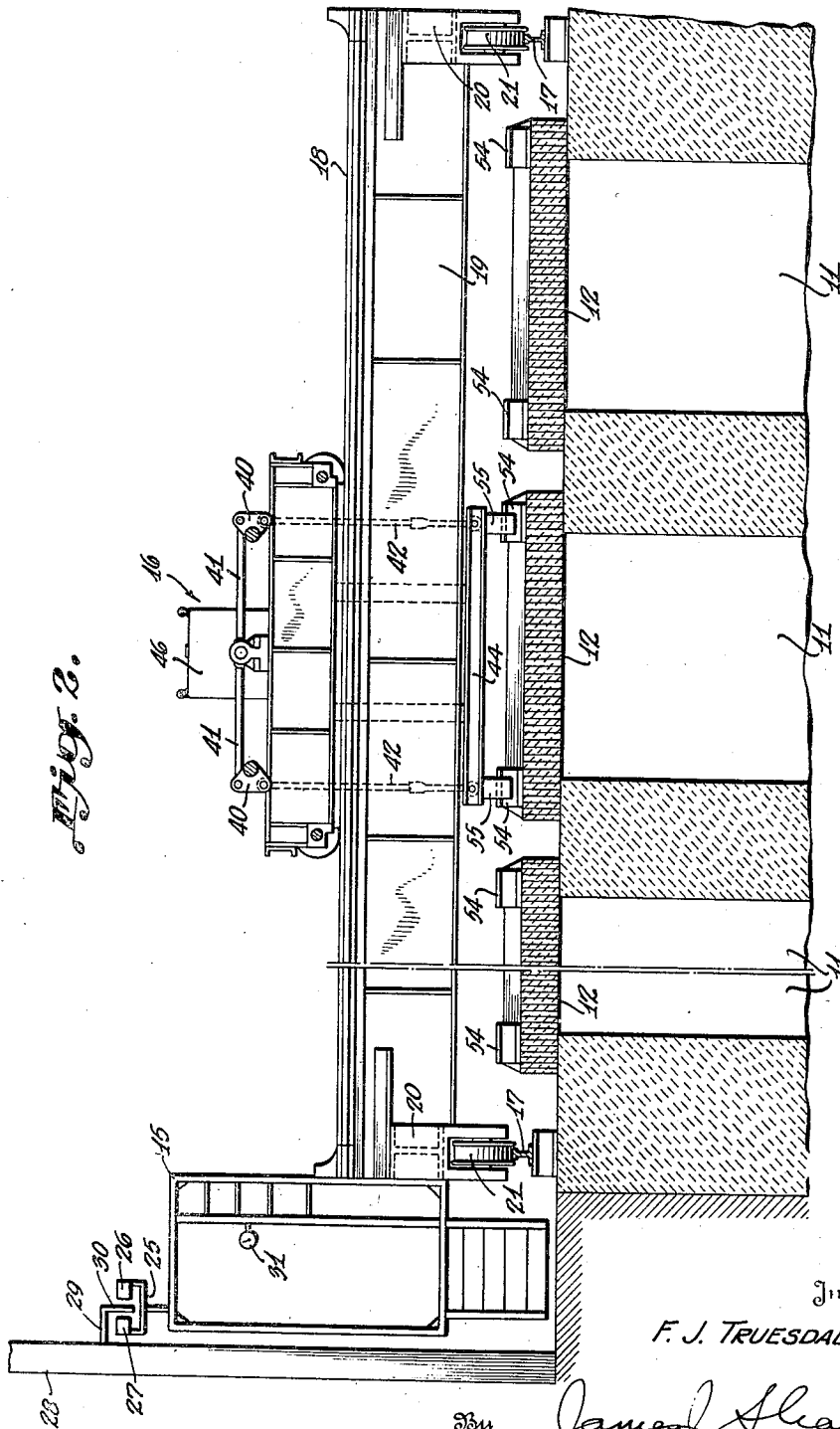
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SOAKING PIT COVER CRANE

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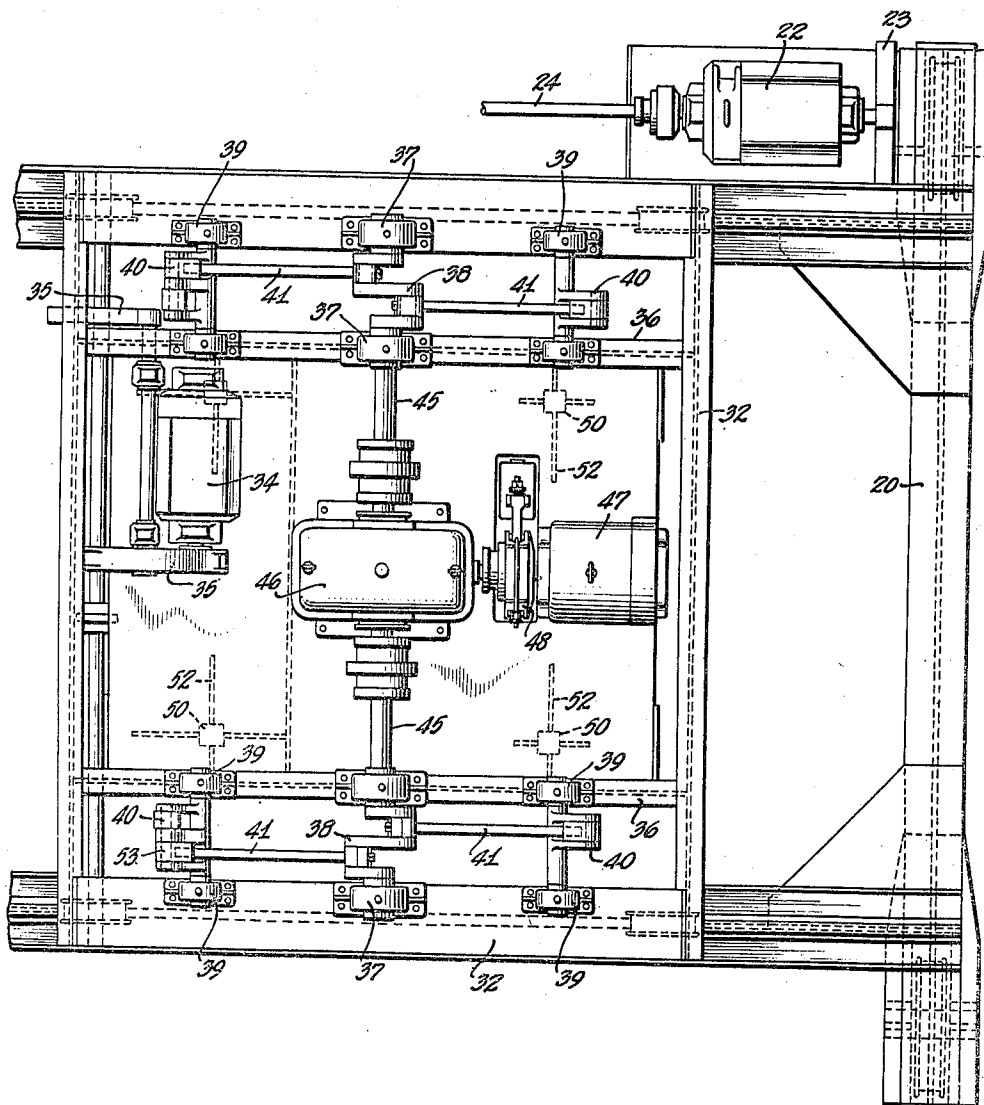
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Fig. 3.



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Fig. 4.

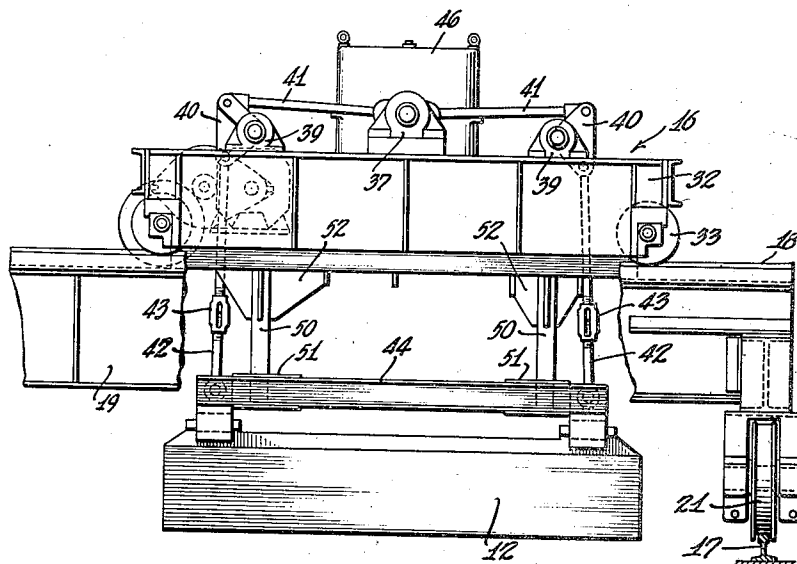
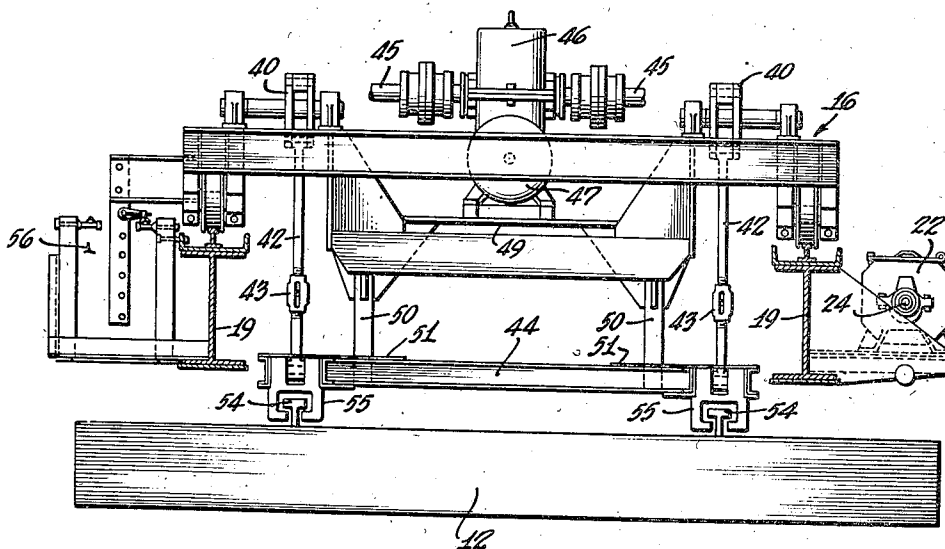


Fig. 5.



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UNITED STATES PATENT OFFICE

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SOAKING PIT COVER CRANE

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Application June 30, 1941, Serial No. 400,525

12 Claims. (Cl. 212-4)

This invention relates to improvements in cranes for lifting soaking pit covers particularly with regard to improvements in ease of operation and efficiency of performance of the same.

The present invention is a departure from the soaking pit cover cranes of the prior art such as shown in Patent No. 2,138,886 to C. H. Schramm and Patent No. 2,232,281 to H. F. Spencer. In cranes of the prior art, the pit cover engaging means was complicated and required skillful handling to operate the same quickly and efficiently. Where simpler forms of cover engaging devices were used, abrupt movement of the crane in moving the cover sometimes caused disengagement resulting in dropping or dragging of the pit cover and expensive damages to both the cover and the furnaces. In lifting the covers the cranes of the prior art, due to unsteadiness and indirect lifting motion, often damaged pit covers adjacent to the one being lifted. These same faults in operation caused the covers being replaced over the pit to be positioned out of alignment, occasioning loss of heat and damage to the cover structure from the heat. In the operation of cranes of the prior art, reliance was placed upon mechanically operated switches to automatically position the bridge or trolley for engagement with the pit cover. Like all mechanical devices, these positioning arrangements were subject to failure and maladjustment.

The present invention provides a soaking pit cover crane in which the cover engaging structure has only vertical movement thereby avoiding swinging of these parts when connection with the cover is being effected, also swinging of the cover while being lifted and on movement of the crane is prevented. This structure makes possible for the first time the use of a simplified cover engaging means which, although old per se, has never had practical application.

The crane of the present invention includes a bridge drive in which the motor is removed from a position over the hot furnaces, yet synchronism of the drive as applied to both sides of the bridge is maintained and this without the use of a heavy drive shaft subject to failure due to the furnace heat coupled with heavy strain and vibration.

An important object of the invention is the provision of an improved soaking pit cover crane for efficient, rapid and safe handling of soaking pit covers wherein a plurality of soaking pits are grouped together in close proximity.

Another important object of the present invention is provision of a soaking pit crane having

simplified and readily engageable means for connection with a soaking pit cover.

A further important object of the present invention is the provision of a soaking pit cover crane which limits lifting movement of the soaking pit cover to a vertical direction.

A further important object of the present invention is the provision of a soaking pit cover crane which can be rapidly sight aligned with a soaking pit cover.

A further important object of the present invention is a provision of a soaking pit cover crane having an improved bridge drive not subject to the furnace heat.

Further objects of the invention will become apparent from the consideration of the accompanying drawings constituting a part hereof and in which like reference characters designate like parts throughout. In the drawings,

Figure 1 is a diagrammatic view of the crane of the invention and the associated soaking pits, Figure 2 is view in elevation of the crane and its relation to the soaking pits, the latter being shown in cross section,

Figure 3 is a plan view of the trolley and part of the bridge,

Figure 4 is a view in side elevation of the trolley and an end of the bridge, part of the bridge structure being broken away to show the trolley, and

Figure 5 is a view taken in section across the bridge showing the trolley in rear elevation.

Referring to Figure 1, reference numeral 10 indicates the top of a furnace structure presenting soaking pits 11 having covers 12. The soaking pits are arranged closely adjacent to one another in rows with space between rows sufficient to accommodate the length of a cover when moved off the soaking pit. A soaking pit cover crane is indicated generally at 13, having a bridge 14, cab 15 and trolley indicated generally at 16. Rails 17 extend along the ends of the rows and support bridge 14 in its movement over the rows. Trolley 16 runs on rails 18 on the bridge so as to be positionable over any one of the pit covers with movement of the bridge. In Figure 1 one of the covers 12 is shown connected to the trolley and moved into position off the soaking pit 11. It will be noted that the soaking pit covers overlap the edges of the soaking pit openings and that they, therefore, come in close proximity to each other in the rows. This requires that they be lifted carefully with little or no lateral movement to avoid damaging each other by collision.

Referring to Figures 2 to 5 inclusive, it will be

seen that the bridge is made up of parallel girders 19 which support rail 18 and terminate at each end in bridge ends 20 mounted on wheels 21 riding tracks 17. A wheel 21 on each side of the bridge is driven by a separate motor 22 through gear structure 23. A light shaft 24 connects the two motors and has merely the function of maintaining the motors in synchronism. Operating cab 15 is mounted on one bridge end 20 and includes facilities for operating all the controls of the crane in the usual manner. Mounted on cab 15 or any other part of the bridge is a support 25 carrying a light source 26 and a photo-electric cell 27, the light source directing a beam of light on the photo-electric cell. Along rails 17 adjacent the path of cab 15 are a series of supports 28 which, in the present instance, are part of the supports of an ingot crane not shown, although any stationary support would be satisfactory. Support 28 carries a projection 29 with a depending opaque member 30. Opaque or light intercepting member 30 is so positioned that it falls between light source 26 and photo-electric cell 27 intercepting the beam of light when the bridge in its travel is directly centered over a row of soaking pit covers. An indicating device 31 in the cab gives a visual indication under these conditions.

Trolley 16 is formed of a frame 32 mounted on wheels 33, the wheels running on track 18 of bridge 14. One of these wheels 33 is driven by motor 34 acting through gear structure 35. Supported by frame 32 are two parallel girders 36 spaced a short distance from the end members of frame 32. Two pairs of bearings 37 are mounted in alignment on members 36 and frame 32. Journalled in bearings 37 are crank shafts 38 having crank pins or bearings 180° apart. On either side of the crank shaft bearings 37 on each side of the trolley, a pair of additional bearings 39 are mounted. Journalled in these bearings are shafts carrying bell cranks 40. Connecting rods 41 connect the crank pins of crank shaft 38 with one side of the bell cranks. With the crank 38 in the position shown in Figure 3, the bell cranks are in the position shown in Figures 2 and 4. Attached to and depending from the other side of the bell cranks are lifting bars 42 including turnbuckles 43. A platform 44 has pivotal connection at each corner with a lifting bar 42. Each crank shaft 38 is connected to a drive shaft 45 which terminates in a gear reduction box 46. A motor 47 having a brake 48 is connected to the input side of the gear reduction box. Gear box 46, motor 48 and the associated parts are supported on a deck 49 suspended from members 36. Obviously any other satisfactory form of support could be used. Depending from frame 32, in the present instance attached to deck 49 are guide posts 50. Four guide posts are shown although any number which would give the desired result would be satisfactory. Guide posts 50 extend downwardly as far as platform 44 moves downwardly and have sliding engagement with platform 44 at guide plates 51, shaped to receive the guide posts. Bracing gussets 52 restrain the guide posts against movement in a lateral direction.

It will be noted that due to the arrangement of bell cranks 40 and crank shaft 38, the lateral swing of the upper ends of lift bars 42 is in opposite direction and compensates. To make possible the positioning of the lift bars in symmetrical relation relative to one another, two of the bell cranks have connection with the associated lift

bars at pivotal connection 53 spaced from the connecting rod connection. Turnbuckles 43 make possible accurate levelling and height adjustment of platform 44. These features assure a perfectly vertical steady reciprocating movement of platform 44 on operation of motor 47.

Each soaking pit cover has lugs 54, in the specific instance four. A cross section of these lugs looking at the front of the trolley (see Figure 5) is T-shaped. Supported by platform 42 are complementary lug engaging brackets 55 having T-shaped slots presenting shoulders to engage the lugs. It will be apparent that the platform and lug engaging brackets 55 can only operatively engage and disengage the cover lugs by a movement of the trolley on the bridge. As used herein the terms "lug" and "bracket" are interchangeable as applied to parts 54 and 55.

Power energy and control energy are transmitted to the trolley through a collecting system indicated generally at 56. All controls terminate in cab 15.

In operation an operator in cab 15 moves bridge 14 to a position over the row of pits which includes the pit desired to be opened. Indicator 31 gives a ready and convenient visual indication when the bridge is so positioned that cover lug engaging brackets 55 are in alignment with the cover lugs. The operator then moves trolley 16 to a position close to the pit cover to be removed and lowers platform 42 to its lowest extreme position. Due to his position in cab 15 the operator can readily see how much movement is required of trolley 16 to bring brackets 55 into engaging position with lugs 54. When this is accomplished, he raises platform 44 to its upper position and actuates the bridge to move the cover into the position of that shown at 12 in Figure 1. The cover is held in this position until the ingot crane delivers or withdraws ingots from pit 11, at which time bridge 14 may be operated to carry the cover back over the pit and platform 44 lowered until lug engaging brackets 55 are free when they are disengaged by movement of the trolley.

It will be apparent that besides preventing platform 44 from swinging and swaying while carrying the cover, guide posts 50 hold the platform against lateral movement to effect rapid engagement of the lug engaging brackets and cover lugs. The direct vertical pull of combined lift bars 42 prevents any great strain from being thrown upon the guide posts when lifting and lowering the cover.

I claim:

1. Apparatus of the character described comprising a plurality of parallel rows of furnace openings, a cover for each opening movable in a direction perpendicular to the row to cover and uncover the opening, a bridge coextensive with a row of furnace openings and movable to a position over any one of the rows, a trolley on the bridge movable along the length of the same, a plurality of lifting lugs on each cover, a platform associated with the trolley, a plurality of pairs of lug engaging shoulders on the platform, extending in a direction parallel to the row and rigidly mounted relative to each other, and lifting means connecting the trolley and the platform.

2. Apparatus of the character described comprising a plurality of parallel rows of furnace openings, a cover for each opening movable in a direction perpendicular to the row to cover and uncover the opening, a bridge coextensive with

a row of furnace openings and movable to a position over any one of the rows, a trolley on the bridge movable along the length of the same, a lifting lug on each cover, a lug engaging bracket associated with the trolley, engageable and disengageable with the lug only by movement in a direction parallel to the bridge, photo-electric means acting between the bridge and a fixed point to indicate when the bracket is in line with a cover lug for engagement therewith by movement of the trolley.

3. Apparatus of the character described comprising a plurality of parallel rows of furnace openings, a cover for each opening movable in a direction perpendicular to the row to cover and uncover the opening, a bridge coextensive with a row of furnace openings and movable to a position over any one of the rows, a trolley on the bridge movable along the length of the same, a lifting lug on each cover, a lug engaging bracket associated with the trolley, engageable and disengageable with the lug only by movement in a direction parallel to the bridge, a source of light and a photo-electric indicating device fixedly mounted relative to the bridge, the source directing a beam of light on the photo-electric indicating device, and a light intercepting member fixedly mounted relatively to a row in such position that the beam is intercepted when the bracket is lined up with a cover lug in the row.

4. A pit cover trolley comprising a frame, a drive shaft rotatably mounted on the frame, a rotatable element mounted on the drive shaft, crank pins mounted on the rotatable element 180° apart, connecting rods on the crank pins, bell cranks on the frame on either side of the drive shaft and connected to the rods, lifting bars connected to the bell cranks so that rotation of the drive shaft raises or lowers the lifting bars in unison, a platform carried by the lifting bars, and a plurality of spaced pit cover engaging elements rigidly mounted on the platform.

5. A pit cover trolley comprising a frame, a drive shaft rotatably mounted on the frame, a rotatable element mounted on the drive shaft, crank pins mounted on the rotatable element 180° apart, connecting rods on the crank pins, bell cranks on the frame on either side of the drive shaft and connected to the rods, lifting bars connected to the bell cranks so that rotation of the drive shaft raises or lowers the lifting bars in unison, a platform carried by the lifting bars, and guide means confining the platform solely to vertical movement relative to the trolley.

6. A pit cover trolley comprising a frame, a drive shaft rotatably mounted on the frame, a rotatable element mounted on the drive shaft, crank pins mounted on the rotatable element 180° apart, connecting rods on the crank pins, bell cranks on the frame on either side of the drive shaft and connected to the rods, lifting bars connected to the bell cranks so that rotation of the drive shaft raises or lowers the lifting bars in unison, a platform carried by the lifting bars, a vertical guide post depending from the frame, and a guide member on the platform coacting with the guide post to prevent the platform from swinging.

7. A pit cover trolley comprising a frame, a

drive shaft rotatably mounted on the frame, a crank shaft mounted on the drive shaft, the crank shaft having two cranks at 180° angle, bell cranks on the frame, lifting bars connected to the bell cranks, connecting rods between the crank shaft and the bell cranks to raise or lower the lifting bars in unison on rotation of the drive shaft, a platform carried by the lifting bars, a vertical guide post depending from the frame, and a guide member on the platform coacting with the guide post to prevent the platform from swinging.

8. A pit cover trolley comprising a frame, a drive shaft rotatably mounted on the frame, a rotatable element mounted on the drive shaft, crank pins mounted on the rotatable element 180° apart, connecting rods on the crank pins, bell cranks on the frame on either side of the drive shaft and connected to the rods, lifting bars connected to the bell cranks so that rotation of the drive shaft raises or lowers the lifting bars in unison, and guide means restraining the lower ends of the lifting bars from lateral movement.

9. A pit cover trolley comprising a frame, a drive shaft rotatably mounted on the frame, a crank shaft mounted on the drive shaft, the crank shaft having two cranks at 180° angle, a bell crank on the frame, lifting bars connected to the bell crank, connecting rods between the crank shaft and the bell cranks to raise or lower the lifting bars in unison on rotation of the drive shaft, and guide means restraining the lower ends of the lifting bars from lateral movement.

10. A pit cover trolley comprising a frame, lifting bars depending from the frame adapted to be reciprocated in unison in a vertical direction, a platform carried by the lifting bars, a guide post rigidly associated with the frame and extending downwardly to the lowest point reached by the platform due to the reciprocating movement of the lifting bars, and guide means on the platform coacting with the guide post to allow vertical movement of the platform while preventing lateral movement of the same.

11. A pit cover trolley comprising a frame, lifting bars depending from the frame adapted to be reciprocated in unison in a vertical direction, a platform carried by the lifting bars, cover engaging elements on the platform adapted to engage the covers by movement of the trolley, a guide post rigidly associated with the frame and extending downwardly to the lowest point reached by the platform due to the reciprocating movement of the lifting bars, and guide means on the platform coacting with the guide post to allow vertical movement of the platform while preventing lateral movement of the same.

12. Apparatus of the character described comprising a plurality of furnace openings, a pair of tracks on each side of the openings and extending parallel to each other, a bridge extending over the opening having wheels riding on the tracks, a motor on the bridge adjacent each track connected to a wheel on that track for driving the wheel, and a shaft connecting the motors to maintain them in synchronism.

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