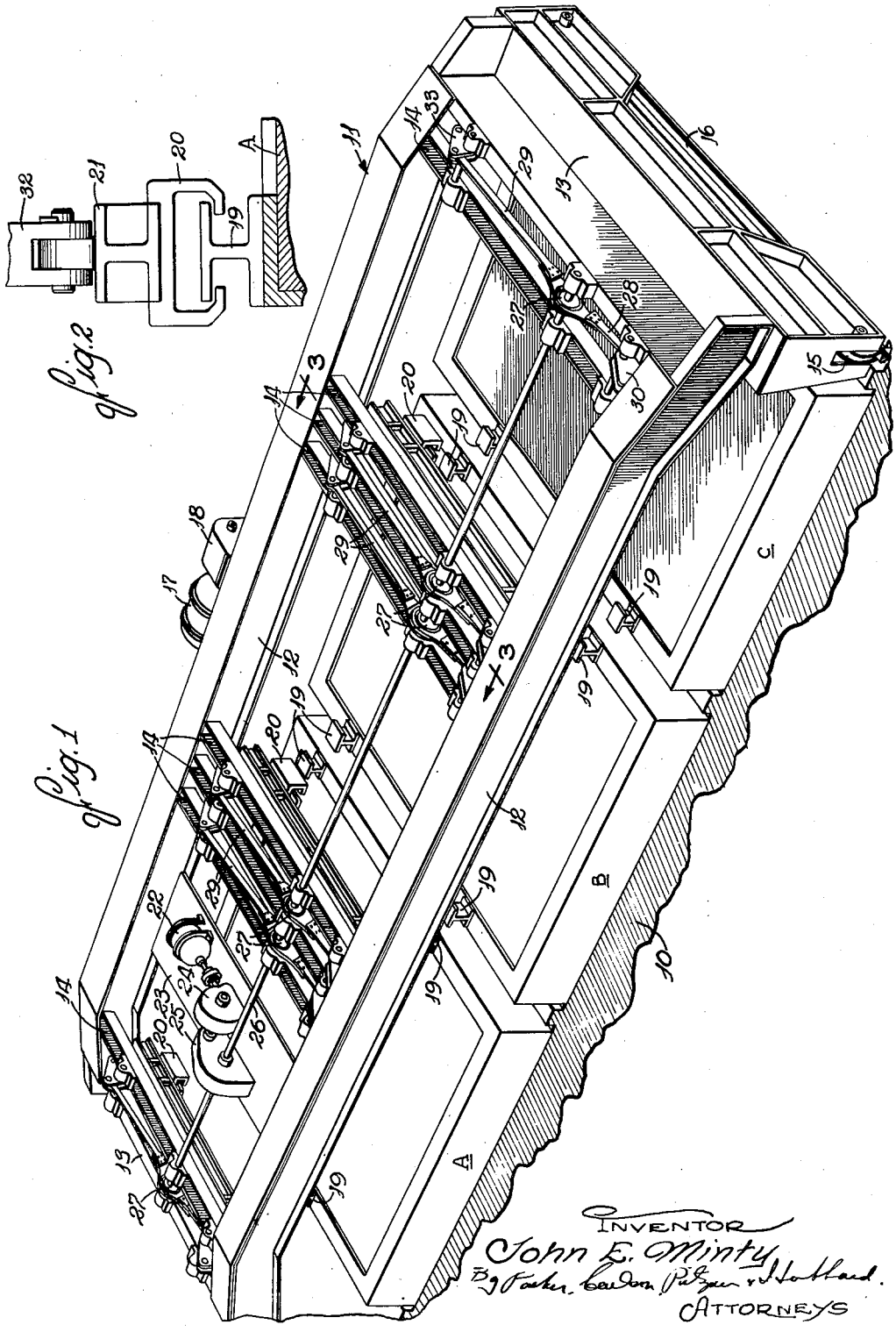
Feb. 3, 1942. J. E. MINTY 2,271,776

SOAKING PIT COVER CRANE

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SOAKING PIT COVER CRANE

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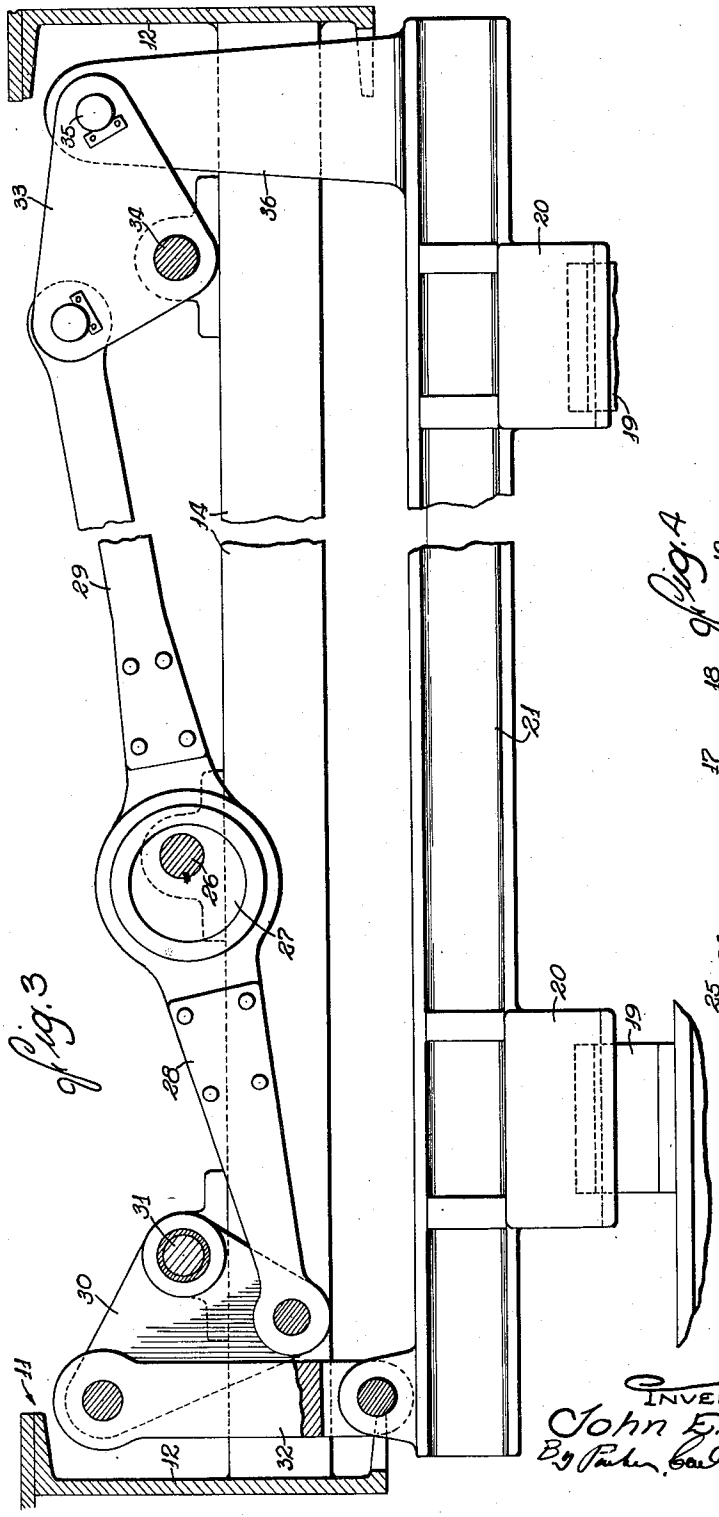


Fig. 3

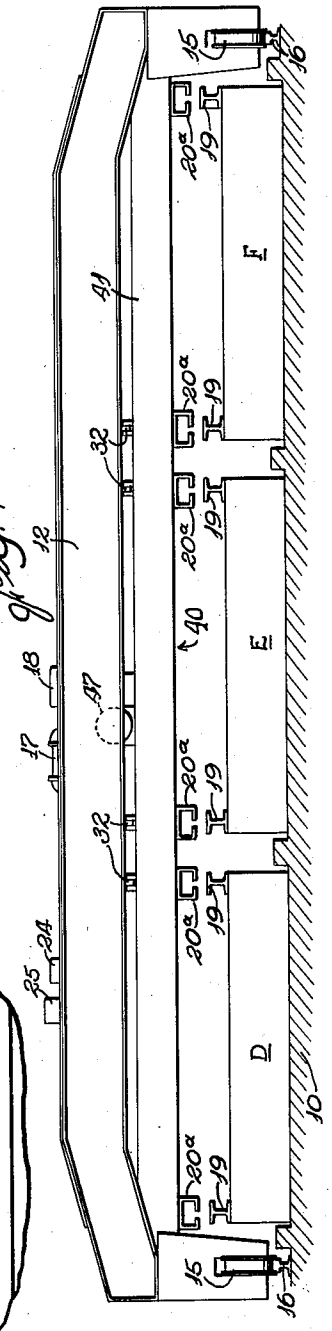


Fig. 4

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SOAKING PIT COVER CRANE

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Fig. 5

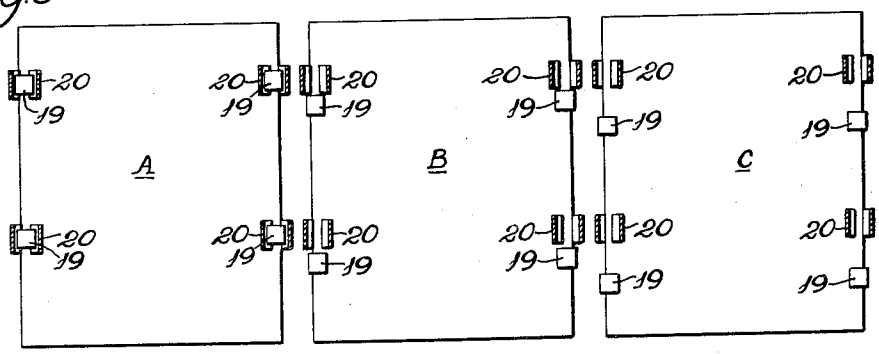


Fig. 6

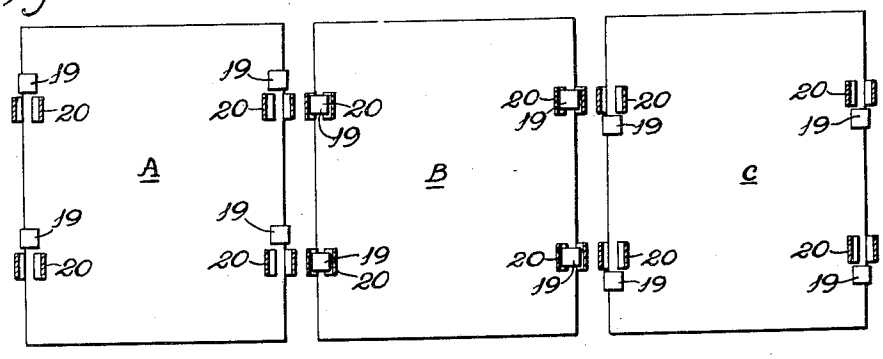
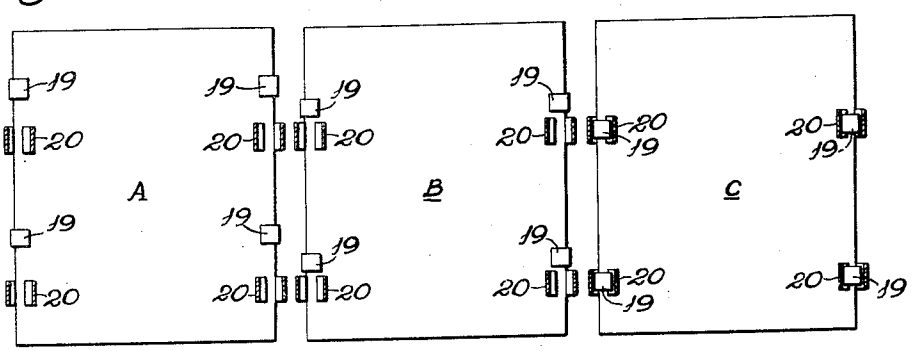


Fig. 7



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SOAKING PIT COVER CRANE

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Fig. 8

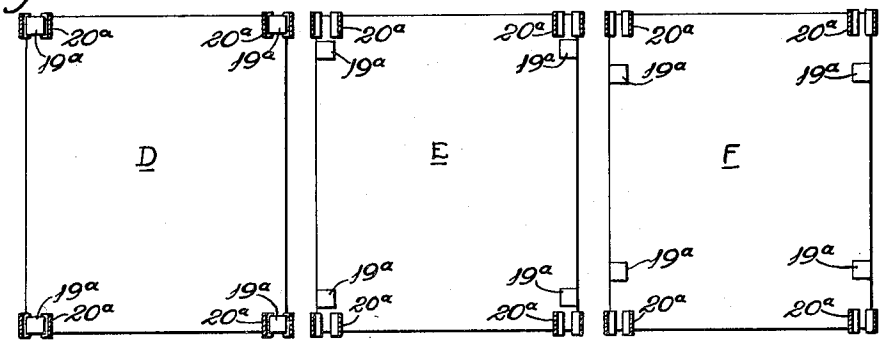


Fig. 9

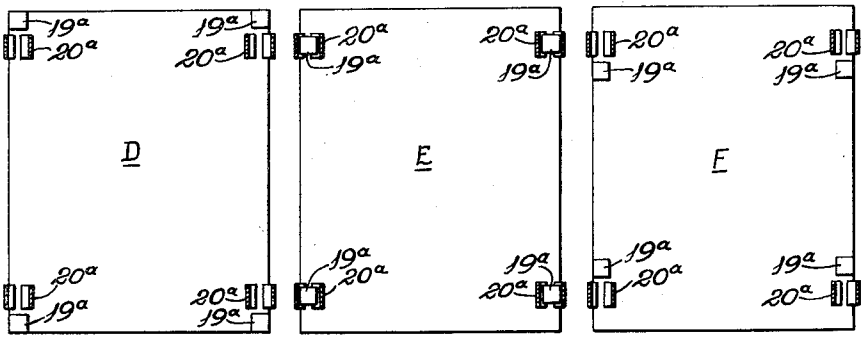
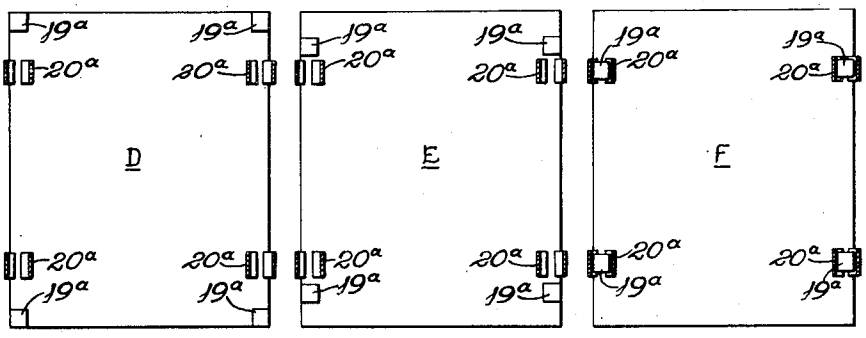


Fig. 10



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SOAKING PIT COVER CRANE

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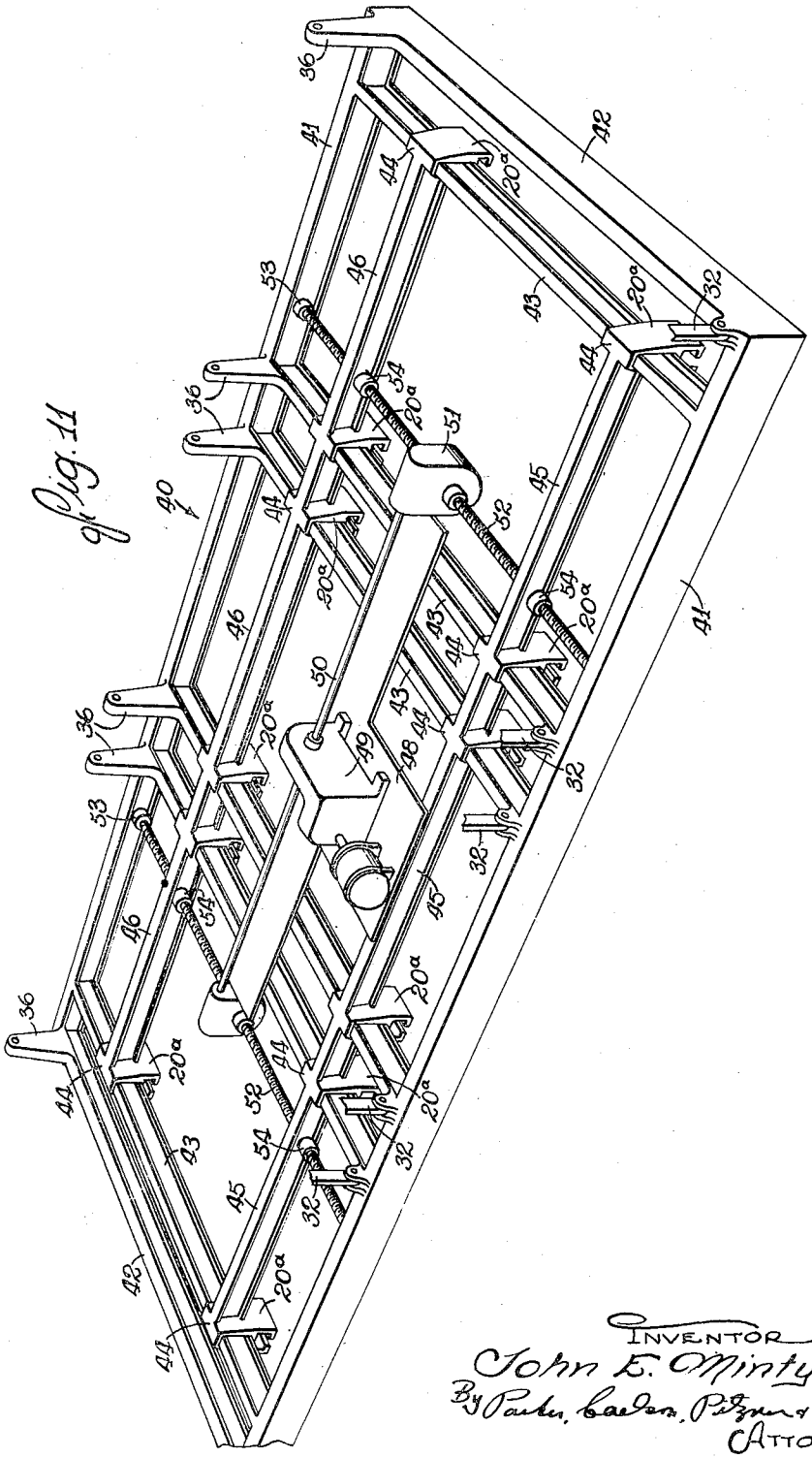


Fig. 11

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UNITED STATES PATENT OFFICE

2,271,776

SOAKING PIT COVER CRANE

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Application March 28, 1940, Serial No. 326,310

11 Claims. (Cl. 212—4)

The invention relates to improvements in traveling cranes and more particularly to cranes for use in raising, lowering and traversing movable members such, for example, as heavy fire brick covers for high temperature furnaces or soaking pits.

As is well known, soaking pits are ordinarily arranged in side-by-side relation in one or more rows with their top covers correspondingly alined. Cranes of the general class here in question are adapted to be positioned above the covers for raising, lowering and traversing the same, as billets or ingots are moved into and out of the pits.

Generally stated, it is an object of the present invention to provide in an installation of the type set forth a novel arrangement of a coupling means between the crane and the movable members to be manipulated such that a selected member in a row may be engaged and then raised by a single hoisting mechanism which lifts in unison all of the coupling elements carried by the crane and corresponding to various ones of all of the members in the row. By virtue of such an arrangement, full selective operation is accomplished and yet the crane is quite simple since a single hoisting means is used to raise and lower in unison all of the member coupling devices, only the desired ones of the latter being engaged to lift the selected member.

More specifically, it is an object of the invention to provide in an installation of the type set forth, and in which all of the coupling means are raised and lowered in unison by a single hoisting mechanism on the crane, a novel arrangement of the coupling means such that their engagement for a single one of the corresponding series of movable members is accomplished by merely positioning the necessary coacting coupling members in registry as distinguished from actuating some movable part in the coupling devices themselves. This makes possible the use of strong, rigid and low cost couplings having no articulated or movable elements likely to become worn or out of order, although full selectivity of operation of the system as a whole is still retained.

In carrying out the present invention couplings between the members to be lifted and crane are used comprising complemental sets of coupling elements carried respectively on the members and crane, and constructed to engage and hold against vertical separation when moved horizontally into registry. A further object of the invention is to provide in an installation embodying such a coupling arrangement, a novel patterned distribution of the coupling elements such that only those for successive respective ones of the members are brought into registry when all of the elements carried by the bridge are moved in unison to corresponding successive positions in a direction transversely to the row of movable members being manipulated. By this means manipulation of the apparatus to effect the desired selection of the member to be raised is greatly simplified.

The invention also resides in a novel crane construction of such character as to provide for a simple manipulation of the coupling elements carried by it, in the course of the selection operation set forth above.

Further objects and advantages of the invention will become apparent as the following description proceeds, taken in connection with the accompanying drawings in which:

Figure 1 is a general perspective view of a soaking pit cover crane installation embodying the invention.

Fig. 2 is a detailed fragmentary end elevation of one of the couplings.

Fig. 3 is an enlarged transverse sectional view of the crane taken substantially along the line 3—3 in Fig. 1.

Fig. 4 is a front elevation of a modified form of apparatus embodying the invention.

Figs. 5, 6 and 7 are generally diagrammatic plan views of the row of soaking pit covers of Fig. 1 showing, respectively, three different positions of the coupling devices for engaging respective ones of the three covers in the row.

Figs. 8, 9 and 10 are generally diagrammatic plan views, of the same character as Figs. 5, 6 and 7, but illustrating the arrangement of coupling elements for the modified form of the installation shown in Fig. 4.

Fig. 11 is a general perspective view of a hoisting frame adapted to be used in the modified construction of Fig. 4.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not intend to limit the invention by such disclosure but aim to cover all modifications and alternative arrangements falling within the spirit and scope of the invention as expressed in the appended claims.

In the first exemplary construction (Fig. 1) the invention has been illustrated as embodied in a traveling crane installation arranged to manipulate a group of soaking pit covers A, B and C, here shown as three in number and disposed in a single row. It will be understood that any reasonable number of covers may be placed in a single row and that further rows, parallel with that shown, may be used if desired. The pit covers A, B and C may be of conventional and well known form and may comprise, for example, a rectangular frame or shell with a heavy re-

fractory lining on its bottom face. These covers close the throats of corresponding soaking pits which open in to a furnace room floor 10. The function of the crane is to manipulate these heavy covers, that is, lift them, traverse them laterally to expose the pit beneath, and then return them to their initial positions.

The traveling crane of the present installation (Fig. 1) comprises a bridge or carriage designated generally as 11, arranged to span the row of covers A, B and C. This carriage embodies a pair of longitudinal I-beam side members 12 arched downward at their opposite ends and rigidly connected to suitably reenforced and generally rectangular end frames 13. A plurality of transverse beams 14, rigidly fixed at their opposite ends to the beams 12, also join the latter. To support the bridge 11 for movement in a direction transverse to the row of covers, it is carried on four flanged wheels 15 (of which one is shown in Fig. 1) arranged in pairs at its respective ends and running on rails 16, which extend along the opposite ends of the row of covers and transverse to the row. The wheels 15 are suitably journaled in the end frames 13.

To traverse the bridge 11 along the rails 16, an electric driving motor 17 (Fig. 1) is mounted on the bridge and connected through a suitable drive connection of well known form (not shown) to the wheels 15. A solenoid brake, indicated generally at 18, serves to arrest rotation of the motor 17 and to stop the bridge when the traversing motor 17 is deenergized. Any suitable form of reversing controller (not shown) may be provided for the traversing motor 17.

A single hoisting mechanism is provided on the crane bridge and in order to make it possible to use this single mechanism to manipulate the covers one by one, means is provided for coupling the hoisting mechanism to only one selected cover at a time. In general, this selection operation is accomplished by utilizing a patterned distribution of the cooperating coupling or connecting elements on the covers and crane respectively so that relative movement between them serves to bring into registry (i. e. into engaging position) only those elements associated with successive ones of the covers.

The first exemplary patterned distribution of the coupling elements will best be understood by reference to Figs. 5, 6 and 7. As therein shown coupling members, each designated generally as 19, are fixed to respective ones of the covers A, B and C, four such coupling members being fixed to each cover. The four coupling members on each cover are located at the corners of a rectangular pattern, such pattern for each cover being of the same size as that for the others. The key to the exemplary arrangement is the fact, however, that the groups of coupling members on successive covers are laterally offset with respect to each other in a direction transverse to the row. On the crane is a set of complemental coupling members each designated generally as 20, and also arranged in rectangular patterns, one for each cover. In the case of these coupling members carried by the crane, however, all of the groups of four are alined longitudinally of the row. Furthermore, they are adapted to be moved in unison transversely of the row of covers, in this instance by traversing of the crane in such direction.

In general, whenever one of the coupling members 20 is in registry with one of the members 19 they are interlocked against separation in a vertical direction, although freely movable in a horizontal direction. Hence, when the crane-carried coupling members 20 are positioned as shown in Fig. 5 they register only with the complemental coupling members 19 on the cover A. Therefore, simultaneous raising of all of the crane-carried coupling members 20, by the single hoisting mechanism noted, causes only the cover A to be lifted. Similarly, to lift the cover B, the crane-carried coupling elements 20 are shifted transversely to the position of Fig. 6 where they register only with the complemental elements 19 on the cover B; and to lift the cover C the elements 20 are traversed to the position of Fig. 7 where they register only with the members 19 on the cover C.

Turning now to the details of the coupling devices 19, 20, it should be noted first of all that the arrangement described for effecting selective engagement of them makes it unnecessary to have any articulated or pivoted parts in the couplings themselves. In other words, tong-type grippers heretofore frequently used can be eliminated and a much more simple and rugged type of coupling utilized, which has no moving parts to get out of order. As shown in Figs. 1 to 3, the coupling members on the covers A, B and C may take the form of simple T-heads, fashioned from suitable lengths of an I-beam and rigidly secured at the proper points to covers. The complemental coupling members 20 on the crane comprise yokes embodying opposed integral C-shaped portions (see particularly Fig. 2) adapted to slide freely in a horizontal direction with respect to the T-heads 19 but engageable with the laterally projecting wing portions of the latter, to prevent relative separation therebetween in a vertical direction, when the parts are in registry or engagement. All of the yokes 20 are welded or otherwise rigidly secured to suitably located transverse I-beams 21, two such beams being provided for the four coupling members corresponding to each cover.

As heretofore noted, a single hoisting mechanism raises and lowers in unison all of the crane-carried coupling members 20, as well as any one of the covers which they may have engaged. This hoisting mechanism comprises an electric hoisting motor 22 (Fig. 1) mounted on a platform 23 fixed between the bridge beams 12. This motor is coupled in driving relation, through a suitable worm and worm wheel in a casing 24 and a speed reduction gearing in a casing 25, with a shaft 26 which extends longitudinally of the bridge and is rotatably journaled in bearing pedestals fixed to the transverse beams 14 of the latter. Keyed on this shaft 26 are three pairs of eccentrics 27. Embracing each of these eccentrics is an eccentric strap 28 (see Fig. 3) and projecting laterally in opposite directions from each of these straps are rigidly connected arms 28, 29.

The outer ends of the arms 28, 29 are connected through pivoted linkages with the opposite ends of the beams 21 which carry the coupling members 20 so as to raise and lower the latter in response to oscillation of the shaft 26 in opposite directions. In particular, the arms 28 (see Fig. 3) are pivotally connected to bell cranks 30, in the form of triangular plates pivoted on the transverse bridge beams 14 at 31. The other arms of these bell cranks 30 are connected through depending pivoted links 32 with the adjacent ends of respective ones of the beams 21. Similarly, the arms 29 are pivotally connected

Consequently, rotation of the motor 47 in opposite directions serves respectively to move the lines of coupling members 20a toward and away from each other.

Hoisting and lowering of the frame 40 serves to raise and lower the coupling members 20a in unison. A single hoisting mechanism is used for this purpose (see Fig. 4) substantially identical with that heretofore described for the installation of Fig. 1. The same reference numerals identify idential parts. Thus, in Fig. 11 it will be observed that the links 32 and 36 heretofore described may be connected to the hoisting frame 40 at the points shown and, of course, the remainder of the hoisting mechanism can from thereon be identified, the whole hoisting frame being suspended beneath a bridge identical with the bridge 11 previously described (Fig. 4).

The operation of the modified apparatus will, in general, be apparent from the foregoing. The hoisting frame is lowered to bring the yokes 20a to "engagement level" and the crane may be centered over the row of covers D, E, F. Assuming it is desired to lift, say, the cover D, the motor 47 (Fig. 11) is rotated to spread the lines of coupling members 20a apart to the position of Fig. 8. Thereupon they register with or embrace only the T-heads 19a in cover D, those on the other covers being disengaged. Consequently, when all of the members 20a rise, upon hoisting the frame 40, only the cover D will rise with them. Similarly, to raise the covers E or F, the lines of crane-carried couplings are shifted respectively to the position of Figs. 9 and 10. To restore the covers to their initial positions it is only necessary to lower the frame 40, whereupon the couplings will be automatically disengaged when the members 20a are moved laterally either by the motor 47 or by traversing the crane bridge.

I claim as my invention:

1. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to move transversely of the row of covers in spanning relation thereto, a first set of connecting means carried by respective ones of said movable members, a second set of connecting means engageable with corresponding ones of the first set when in registry therewith and carried by said bridge, the connecting means in said second set being alined with each other longitudinally of the row, the connecting means in the first set being disposed so that those on each member are offset transversely of the row with respect to those of every other member in the row, whereby the connecting means for the second set can only register with those in the first set for one selected member at a time, and power actuated means for raising and lowering in unison all of said second set of connecting means and the selected member whose corresponding connecting means in the first set is engaged thereby.

2. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to span the row longitudinally, a power actuated hoisting mechanism carried by said bridge, means for coupling said hoisting mechanism to a selected one of said members for raising the same, said last mentioned means comprising a plurality of coupling elements fixed to said covers and a plurality of complemental coupling elements engageable with respective ones of said first mentioned coupling elements when in registry therewith and arranged to be raised and lowered by said hoisting mechanism, said first mentioned coupling elements and said complemental elements being disposed to permit registry therebetween for only the elements associated with one member at a time, and power actuated means for effecting relative movement between said first mentioned coupling elements and said complemental coupling elements in a horizontal direction to bring into registry the elements associated with any selected member in the row.

3. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to move transversely of the row of members in spanning relation thereto; a first set of connecting means carried by respective ones of said members; a second set of connecting means engageable with corresponding ones in the first set when in registry therewith and carried by said bridge; the various connecting means in one of said sets corresponding to each member in the row, being offset with respect to those corresponding to every other member in the row, whereby the connecting means in the other set can at any one time register with those of only one selected member for engagement therewith; and power actuated means on said bridge for raising and lowering in unison all of the said second set of connecting means and the selected member whose corresponding connecting means of the first set is engaged thereby.

4. In an installation of the type set forth, the combination with a row of individually movable members to be manipulated and a crane bridge spanning the row and movable horizontally relative to it, of a first set of coupling elements fixed to individual ones of said members, and a second set of complemental coupling elements carried by the crane bridge, said sets of elements being disposed relative to each other for engagement at any one time of the coupling elements associated with not more than one of said members, and means for raising and lowering in unison all of said second set of coupling elements.

5. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to span the row longitudinally, a first set of connecting means carried by respective ones of said members, a second set of connecting means engageable with corresponding ones of the first set when in registry therewith and carried by said bridge, the connecting means in said second set being alined with each other longitudinally of the row, the connecting means in the first set being disposed so that those on each member are offset transversely of the row with respect to those on every other member in the row, whereby the connecting means in the second set can only register with those in the first set for one selected member at a time, a first power actuated means for moving in unison all of said first set of connecting means in a direction transverse of the row of members to bring them into registry with the connecting means of said first set corresponding to a selected one of said members, and a second power actuated means for raising and lowering in unison all of said set of connecting means.

6. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of coupling means

at their outer ends with arms of bell cranks 33, also shown in the form of triangular plates pivoted on the transverse bridge beams 14 at 34. The other arm of each of these bell cranks 33 is in turn pivotally connected at 35 with an upstanding arm 36 rigid with respective ones of the beams 21.

In the operation of the apparatus described, the hoisting motor 22 is operated to oscillate the shaft 26 in a direction to lower the crane-carried coupling members 20 to what may be termed the "engagement level" shown in Figs. 2 and 3, or, in order words, to a level at which the members 20 can be slid freely in a horizontal direction with respect to the complemental members 19 into engagement therewith. Assuming that the operator desires first of all to lift the cover A, the traversing motor 17 is operated to move the crane bridge 11 along the rails 16 until the coupling elements are positioned as shown in Fig. 5. It will be observed that in such case only the coupling members 19 on the cover A are in registry with their corresponding crane-carried coupling members 20. Having thus selectively positioned the coupling elements of the apparatus the hoisting motor 22 is operated to oscillate the shaft 26 (clockwise as viewed in Fig. 3) to lift in unison all of the crane-carried coupling members 20. The engaged cover A, of course, rises with them. If desired, the crane bridge 11 may then be traversed further along the rail 16 to move the lifted cover away from the throat of its underlying pit so as to afford access to the latter.

To replace the cover it is only necessary to perform in reverse order the operations noted. To lift either of the other covers B and C the crane is positioned to bring the crane-carried coupling members 20 into the positions indicated in Figs. 6 or 7, respectively.

From the foregoing, it will be seen that the illustrative apparatus makes possible full selectivity of operation while using but a single hoisting mechanism on the crane. More than that, the coupling elements for connecting the covers to the crane are of such simple and rugged form that they are not only low in cost but can be made so strong as practically to preclude the possibility of breakage or damage during use, particularly in view of the fact that if desired moving parts may be entirely dispensed with as in the form shown.

In Figs. 8, 9 and 10, I have shown a modified pattern of coupling elements for a row of soaking pit covers D, E and F, also adapted for use in an installation embodying the invention and shown generally in Fig. 4. These covers, incidentally, may be of identically the same form as those heretofore described and arranged in the same manner except for the location of the coupling elements which are attached to them. As before, a group of coupling members 19a are fixed to each of the covers and complemental coupling members 20a are carried by the crane. Also, as before, four coupling members on each cover are disposed at the corners of a rectangular pattern, but in this instance the lateral offset between the coupling members of the various covers is accomplished by making the rectangles of successively smaller width rather than offsetting rectangles of the same size as in the arrangement of Figs. 5 to 7 and furthermore the complemental coupling members on the crane are arranged to be shifted relative to each other on the bridge to engage the members 19a in a selected cover. Thus, in Fig. 8, it will be seen that the coupling members 19a on the middle cover E are arranged substantially at the corners of a square while those on the cover F are arranged at the corners of a somewhat narrower rectangle, and those on the cover D at the corners of a somewhat wider rectangle.

The complemental crane-carried coupling members 20a are arranged in two longitudinally extending rows or lines. As before the crane-carried coupling members are movable horizontally relative to those on the covers to effect the desired selection operation, but in this instance are mounted on the crane so that the lines or rows noted can be moved toward and away from each other to effect the selection operation. When the two lines of coupling members 20a are spread apart, as shown in Fig. 8, they register only with the couping member 19a on the cover D. When drawn together toward each other to the position of Fig. 9 they register only with the members on cover E and, similarly, when drawn together still further to the position of Fig. 10 they register only with the coupling members on the cover F. It will thus be evident that full selectivity of operation is accomplished as before.

The coupling elements 19a, 20a in the modified construction may have the same characteristics of simplicity and ruggedness as those for the installation first described and are, in fact, desirably identical in form with the T-heads and yokes 19 and 20, heretofore set forth.

Some revision is necessary in the crane structure heretofore set forth in order to accommodate the shifting of the two lines of crane-carried coupling members 20a toward and away from each other as described for the modified installation. For this purpose a hoisting frame 40 (Fig. 11) is utilized. This frame comprises a border made up of rigidly joined longitudinal and transverse beams 41 and 42, respectively. Between these longitudinal beams 41 are also fixed transverse beams or rails 43, corresponding in location to the beams 21 described in connection with the first installation. Slidable endwise of each of these beams 43 are two slider heads 44. Integral with each of these heads on their lower sides are the coupling elements 20a. All of the slider heads 44 adjacent one side of the crane are held in alinement longitudinally of the crane by means of interconnecting or hoisting beams 45, rigidly joined to them. In the same way, interconnecting or hoisting beams 46 join the slider heads 44 in the line at the opposite side of the crane.

To move the two lines of slider heads 44, and their attached coupling members 20a, toward and away from each other transversely of the hoisting frame 40, an electric driving motor 47 is utilized. This motor is carried on a platform 48 secured to the central portions of the cross beams 43 and is connected, through a suitable speed reduction gearing housed in a casing 49, with a rotatably mounted shaft 50 extending longitudinally of the hoisting frame 40. The opposite ends of this shaft 50 are connected, through worm and worm wheel drives housed in casings 51, with transverse lead screws 52. These lead screws are journaled for rotation and are restrained against endwise movement by bearings 53 on the border frame longitudinal beams 41. The opposite end portions of the lead screws 52 have right and left hand threads thereon and are threaded in fixed nuts 54 on the hoisting beams 45 and 46.

associated with respective ones of said members, each of said coupling means comprising complemental elements freely movable relative to each other in a horizontal direction transverse to the row of covers into and out of registry and engageable with each other upon vertical movement when in registry, one element of each of said couplings being fixed to a corresponding one of said movable members and the elements fixed to each member being offset in a direction transverse to the row with respect to corresponding elements on other members in the row, the complemental elements being arranged in alinement longitudinally of the row, and power actuated means for traversing in unison said complemental elements in a direction transverse of the row and for raising and lowering the same in unison.

7. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of coupling means associated with respective ones of said members, each of said coupling means comprising a grip element and a complemental head element freely movable relative to each other in a horizontal direction transverse to the row of members into and out of registry and engaged with each other upon vertical movement when in registry, a crane bridge spanning the row of members longitudinally, one element of each coupling being fixed to a member and the other being carried by said bridge for vertical movement, the elements fixed to the members comprising a first set and those carried by the bridge comprising a second set, the elements in one set corresponding to each member being offset transversely of the row with respect to those in the same set corresponding to the other members in the row, the elements in the other set being alined longitudinally of the row, and power actuated means on the bridge for raising and lowering said second set in unison.

8. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to move transversely of the row of members in spanning relation thereto, a coupling element fixed to each of said members and offset in a direction transverse of the row with respect to a correspondingly located coupling element on each of the other members, said elements on the successive members being offset with respect to each other in the same direction, a plurality of complemental coupling elements movable freely with respect to the coupling elements on the members in a horizontal direction but engageable therewith to prevent separation therefrom in a vertical direction when registered therewith, means supporting said complemental elements on the crane bridge for vertical movement but restraining the same against horizontal movement relative to the bridge, a first power actuated means for traversing the bridge relative to the row of members to bring the corresponding coupling elements into registry with those for a selected member, and a second power actuated means for raising and lowering said complemental coupling elements in unison.

9. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to move transversely of the members in spanning relation thereto, four coupling elements fixed to each member at the respective four corners of a rectangular pattern, each of said rectangular patterns being of the same size but offset on its member in a direction transverse to the row with respect to the patterns on the other members, a plurality of complemental coupling elements movable freely with respect to the coupling elements on the members in a horizontal direction but engageable therewith to prevent separation therefrom in a vertical direction when registered therewith, means supporting said complemental coupling elements on said crane bridge for vertical movement but restraining the same against horizontal movement relative to the bridge, said complemental elements being arranged in groups of four corresponding to the respective groups on the movable members but with all of the groups on the crane alined longitudinally on the latter rather than being offset like those on the movable members, whereby the crane may be traversed transversely to the row to bring a corresponding group of coupling elements thereon into registry with that on a selected movable member while the others remain out of registry, and power actuated means for raising and lowering all of said coupling elements on said crane substantially in unison.

10. In combination, a crane bridge adapted to span longitudinally a row of individually movable members such as soaking pit covers and movable transversely of the row, a plurality of beams extending transversely of the bridge and spaced apart from each other longitudinally of it, a shaft rotatably journaled on the bridge and extending longitudinally of it, power actuated means for rotating said shaft in opposite directions, means operatively connecting said shaft and said beams for raising and lowering the latter in response to rotation of the shaft in corresponding directions, and coupling members connected to opposite end portions of each of said beams and adapted to engage complemental coupling members on respective ones of the movable members.

11. The combination with a plurality of individually movable members alined in a row and which are to be manipulated, of a crane bridge arranged to move transversely of the row in spanning relation thereto, four coupling elements fixed to each member at the respective four corners of a rectangular pattern, each of said rectangular patterns being of the same length longitudinally of the row but of successively lesser width on successive members to effect an offset relation between the elements on successive members, a plurality of complemental coupling elements movable freely with respect to the coupling elements on the movable members in a horizontal direction but engageable therewith to prevent separation therefrom in a vertical direction when in registry therewith, said complemental elements being arranged in groups of four but with all of those adjacent one side of the row of movable members disposed in one line and all of those adjacent the other side in a second line, means supporting said set of complemental coupling elements for vertical movement on the bridge, a first power actuated means for moving said rows of complemental coupling elements toward and away from each other to bring corresponding ones thereof into registry with the group of coupling elements of a selected one of said movable members, and a second power actuated means on the bridge for raising and lowering both of said lines of complemental coupling elements in unison.

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