Feb. 18, 1941. H. F. SPENCER 2,232,281

MULTIPLE COVER OPERATING MECHANISM

Filed July 14, 1937 4 Sheets-Sheet 1

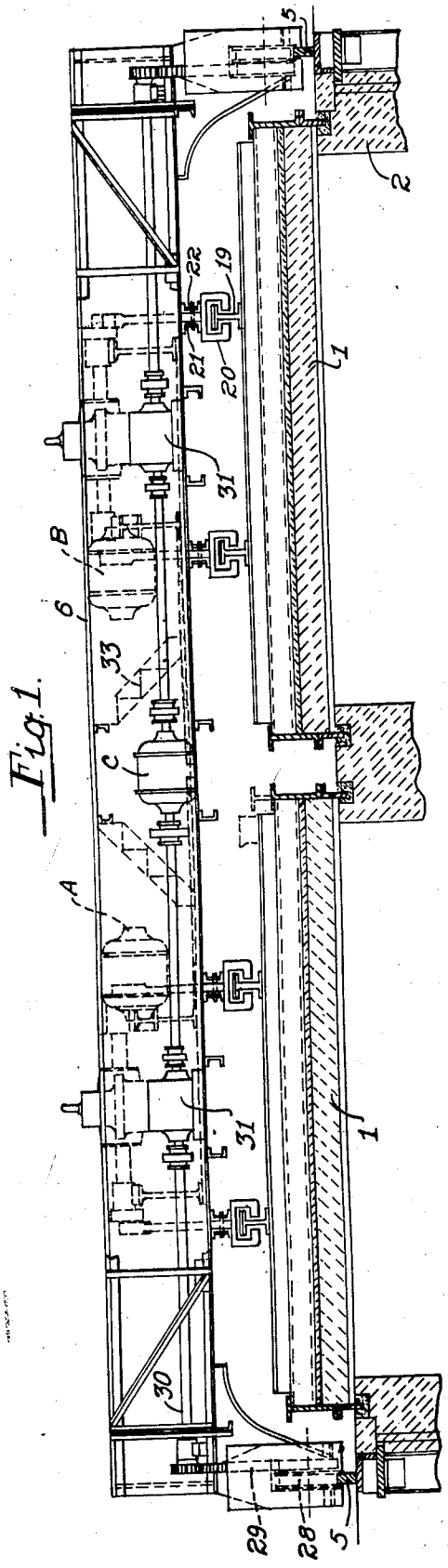


Fig. 1.

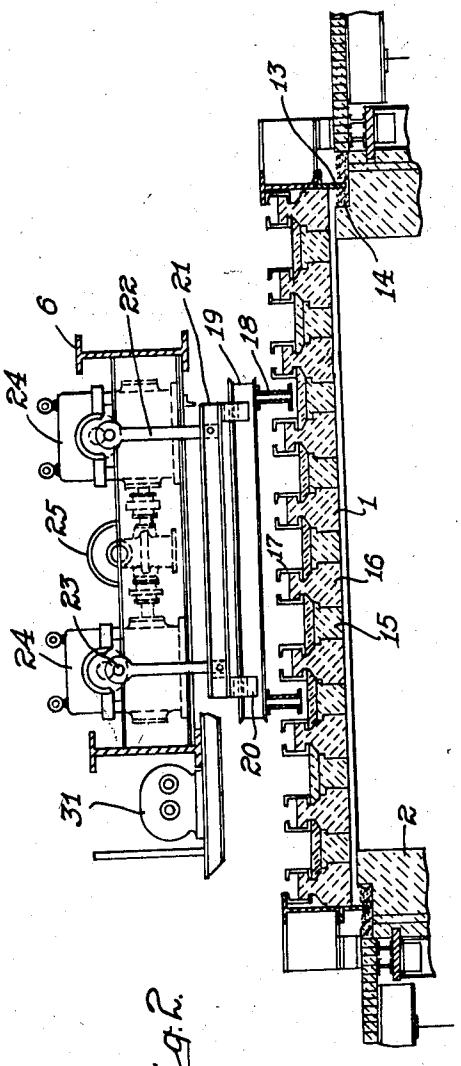


Fig. 2.

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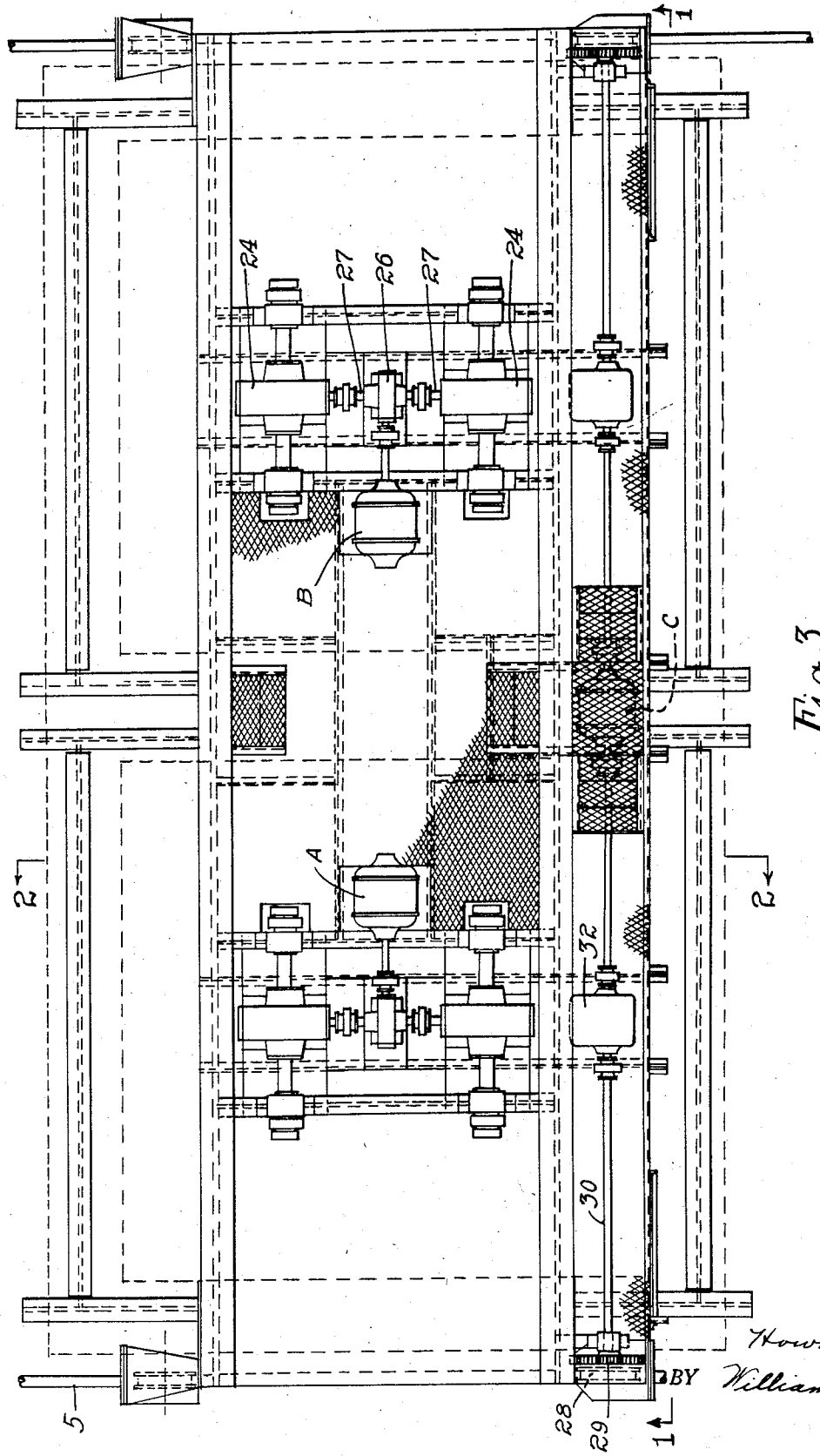


Fig. 3.

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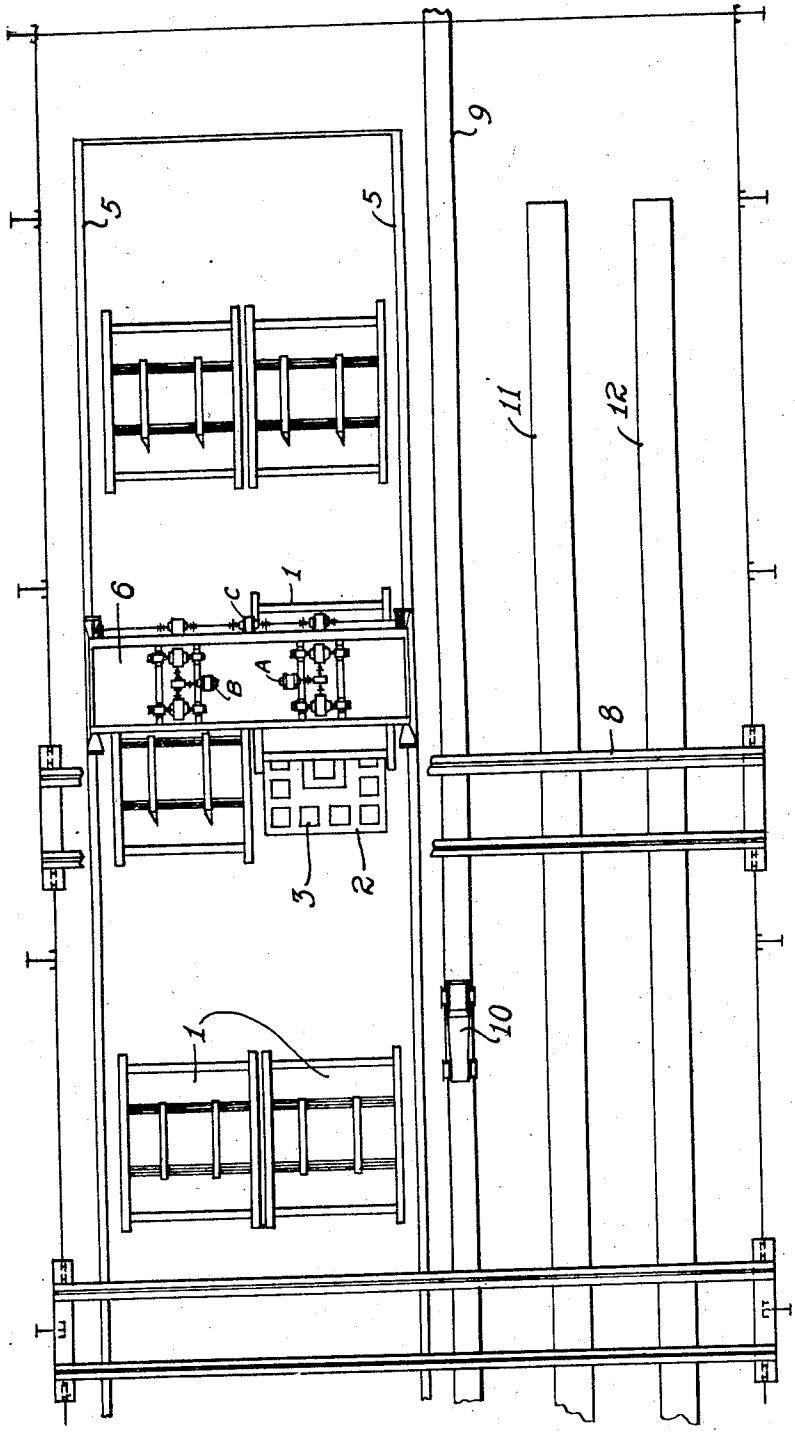


Fig. 4.

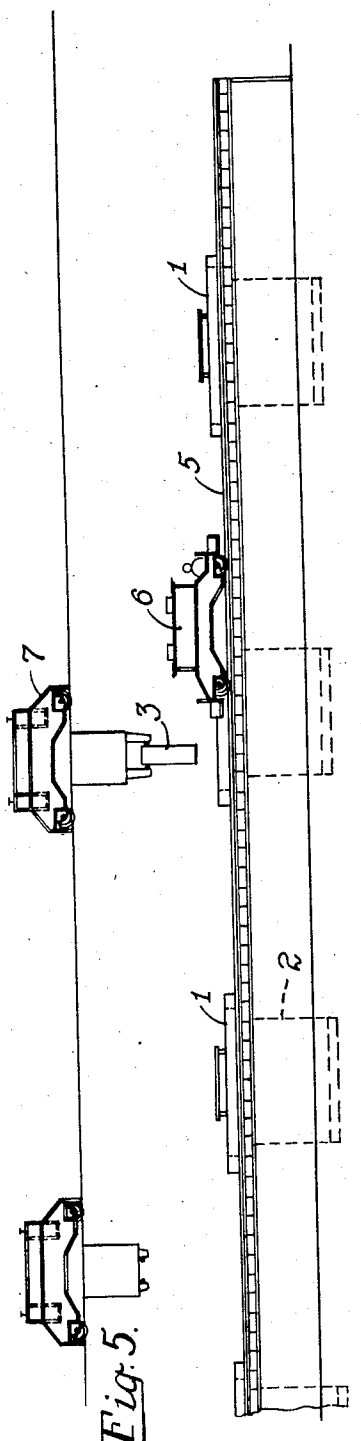


Fig. 5.

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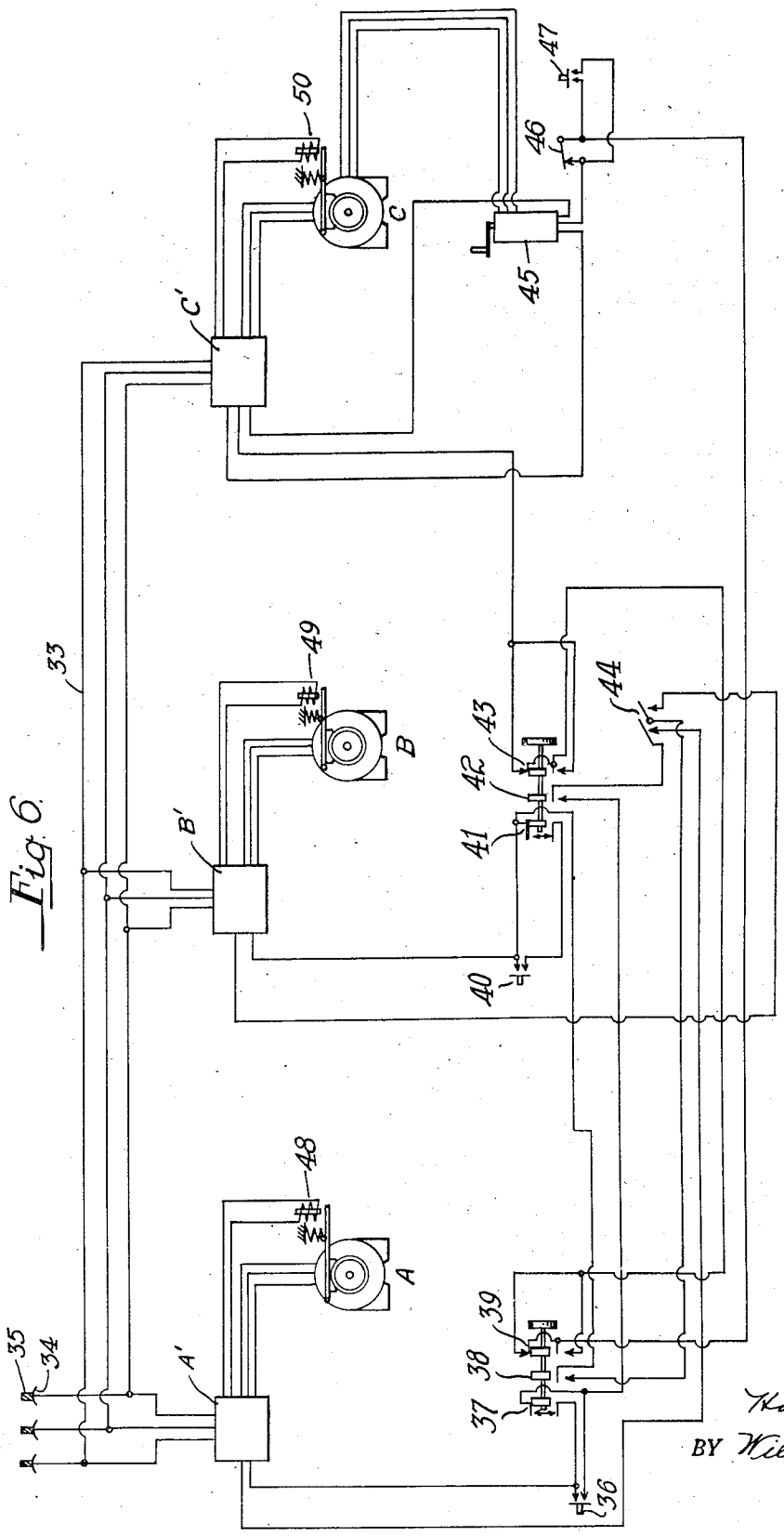


Fig. 6.

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UNITED STATES PATENT OFFICE

2,232,281

MULTIPLE COVER OPERATING MECHANISM

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Application July 14, 1937, Serial No. 153,521

4 Claims. (Cl. 212—4)

This invention relates to new and useful improvements in cover operating mechanism for soaking pit furnaces, and it is among the objects thereof to provide a cover and cover operating mechanism that is especially suited to groups of soaking pits arranged in longitudinal and transverse rows, and whereby a plurality of sealed covers can be manipulated by a single carriage to open and close the soaking pit furnaces.

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

Fig. 1 is a front elevational view partially in section of a cover operating mechanism and soaking pit covers embodying the principles of this invention;

Fig. 2 a side elevational view of the carriage and cover operating mechanism, taken along the line 2—2, Fig. 3, showing the cover and a portion of the soaking pit walls in cross-section;

Fig. 3 a plan view of the carriage and operating mechanism;

Fig. 4 a diagrammatic view illustrating the adaptation of the carriage and operating mechanism to a group of soaking pit furnaces;

Fig. 5 a diagrammatic view illustrating the cooperative relation of the overhead ingot handling crane and the cover operating mechanism; and

Fig. 6 a diagrammatic view of a control system for the hoist and traversing motors.

With reference to Figs. 4 and 5 of the drawings, the numeral 1 designates soaking pit covers which will be hereinafter described in detail, there being six covers shown in Fig. 4, with one cover removed to expose a soaking pit 2, in which steel ingots 3 are placed for heating to bring them to the required temperature for rolling mill operations. On the sides of the soaking pits, rails 5 are provided for supporting a wheeled carriage 6 which traverses all of the soaking pits, and by means of mechanism to be hereinafter described, lifts the covers as desired and moves them a sufficient distance to expose the ingots, which are removed from the soaking pits by means of a series of overhead cranes 7, Fig. 5, that operate on rails 8 transversely disposed to the rails 5 of the cover carriage. A pair of rails 9 is provided parallel to the cover carriage rails 5 for supporting an ingot chariot designated by the numeral 10, and ingot car tracks 11 and 12 are provided parallel to the chariot track 9 for transporting ingots to and from the soaking pit furnaces.

In heating ingots they are delivered on the tracks 11 and 12 in either a cool or hot state but preferably the latter. They are removed by the cranes 7 and placed in the soaking pit furnaces 2, as shown in Fig. 4. The cover operating carriage 6 manipulates the covers 1 by lifting them out of the sand seals in which they are seated around the upper periphery of the furnaces 2, and then moving them in either direction, as required, to render the furnace accessible. When the ingots are heated to a suitable rolling temperature, they are removed from the pit by the crane 7 and placed on the chariot 10, which delivers them to the rolling mill.

The foregoing operations require efficient coordination of the cover operating and crane mechanisms to facilitate delivery of the heated ingots to the rolling mill, which must be operated at maximum capacity for the maintenance of production schedules, and the present invention is directed to cover operating mechanism by means of which suitable coordination of cover movements with crane manipulations are available, such mechanism being shown in detail in Figs. 1 to 3 of the drawings as follows:

With reference to Fig. 2, the cover 1 is shown resting on the vertical walls 2 of a soaking pit, with vertically depending flanges 13 of the cover seating in a sand seal 14, provided all around the top wall of the furnace. The cover is constructed of refractory blocks 15 and 16 tied-in by channels 17. Beams 18 are mounted on the cover and provided with transverse I-beams 19, more clearly shown in Fig. 1, the latter being adapted for engagement by channel-shaped lifting members 20 that are attached to bars 21, which are connected to links 22 of the carriage 6. The links 22 are raised or lowered by crank shafts 23 actuated through transmissions 24, driven by motors A and B. As shown in Fig. 3, the motors A and B are coupled through drive connections 26 to a pair of shafts 27 to drive the transmissions 24 simultaneously, so that all of the links 22, of which there are four for each hoist, will be actuated simultaneously. As shown in Fig. 1, there are two hoists on each carriage, although where but a single row of pits are to be operated, one of the hoists may be employed on a carriage half the size of that shown in Figs. 1 and 3. As shown in Fig. 1, the carriage beam or girder 6 is provided with steps 33 leading to the top of the carriage, on which may be mounted the operator's cab centrally of the carriage.

The carriage traverses the soaking pits by means of wheels 28, which engage the rails 5, the wheels being driven through suitable gearing 29 by a shaft 30 that is connected to a transmission 31, actuated by a drive motor C. A control system as shown in Fig. 6 is provided whereby the hoist motors A and B are interlocked with the carriage traversing motor C to render the hoist motors inoperative during the traversing movement of the carriage and the carriage drive motor inoperative during the hoisting movement of the covers.

As shown in Fig. 6, hoist motors A, B and traversing motor C are connected in a power line 33a with terminals 34 contacting power rails 35. The respective motors are connected to magnetically operated control panels A', B' and C', respectively. The numeral 36 designates a push button control for motor A, and the numerals 37, 38 and 39, rotating gang cam switches actuated by cover operating mechanism driven by motor A. Switch 37 is a limit switch for stopping cover operating mechanism A at extreme top or bottom of travel. It is normally in closed position. Switch 38 is a limit switch preventing action of cover operating mechanism B unless operating mechanism A has returned the cover to lowest position. It is normally in open position. Switch 39 is a limit switch preventing operation of traversing motor except when cover operating mechanism A is at either top or bottom of travel. It is normally open.

Motor B is provided with a push button control switch 40 and limit switches 41, 42 and 43 corresponding in function to switches 37, 38 and 39 of cover mechanism A.

A two-pole limit switch 44 is mounted on the crane carriage 6 and is operated by a lug adjacent rails 5 situated at centerline of the soaking pit. This switch functions to prevent operation of either motors A or B unless carriage 6 is in proper position for placing the pit covers 1.

Cover traversing motor C is controlled by drum type controller 45 which is both the directional and speed control. A limit switch 46 prevents overtravel of motor C at ends of tracks 5 and applies magnetic brake at this point of travel. A push button switch 47 is provided to short-out switch 46 so that the operator can return carriage 6 to normal position.

Motors A, B and C are provided with magnetic brakes 48, 49 and 50, respectively, to prevent overtravel, these brakes being normally applied upon deenergization of the motors.

In the operation of the cover-hoisting and traversing mechanism, the carriage may be moved on the rails 5 to any position over any one of the pairs of soaking pits, shown in Fig. 4, and in so moving, the hoist members 20 pass over the upper sections of the I-beams 19 in the manner shown in Fig. 1, the registry of the lifting elements 20 and I-beams 19 of the covers being maintained at all times as there is no transverse movement of the hoisting mechanism with respect to the carriage on which it is supported.

Proper alignment of the carriage with any particular soaking pit is always effected. The operators will energize the lifting motors A and B of the hoist to engage the lifting means with the particular cover it is desired to manipulate. By means of the lifting links 22 and the engagement of the hoist elements 20 with the I-beams 19, the cover is raised out of the sand seal 14 and the carriage is then propelled by drive motor C to move it on its supporting rails 5 to traverse the soaking pit in either direction, the illustration of Fig. 4 showing half of the soaking pit exposed by movement of the cover in the righthand direction, as viewed from the base line at the side of the sheet. The crane operator then manipulates the crane 7 to engage one of the ingots 3, and immediately upon removal of the ingot, the cover carriage moves back to place, and the cover is lowered into the seal. The removed ingot 3 is placed on the chariot 10 underneath the crane 7 and the ingot is delivered to the rolling mill. Upon the return of the chariot 10, the removal of the ingot is accomplished by repeating the above described operation of removing the cover until all of the ingots on one side of the pit have been removed. Upon the next operation of the cover carriage, the cover is moved in the opposite direction to that shown in Fig. 4 to expose the other half of the furnace until all of the ingots have been discharged from the furnace. The charging of the ingots is accomplished in the same manner, by exposing only half of the furnace, and the ingots are removed from the ingot cars on tracks 11 and 12 by the charging crane 7, and lowered into the soaking pit chambers 2 until the furnace is completely charged.

In the operation of carriage and cover, the control system functions as follows:

With the covers in place and the crane at the end of the track, switches 38, 39, 42, 43 and 46 are closed. The operator then manipulates the controller 45 to bring the carriage over the battery of soaking pits, from which it is desired to remove the cover.

When the carriage is in proper position, as determined by the closing of switch 44 by the stationary lug adjacent the carriage rail, limit switch 42 will be already closed because cover operating mechanism B is at its lowest position. The operator then presses push button 36, which shorts-out limit switch 37, thus completing the control circuit for motor A, which starts lifting the cover. As the cover moves upward, limit switch 37 closes, thus making it unnecessary to hold push button 36. At the same time, switch 39 opens, thus preventing the possibility of the carriage moving. Limit switch 38 also opens at this time, thus preventing the operation of cover operating mechanism motor B. When the cover has reached the top of its travel, switch 37 opens and stops motor A, at the same time applying brake 48 to the motor. At this point, switch 39 is again closed, making it possible to operate the controller 45, which energizes the traversing motor C, causing the carriage and cover to move from the pit. When the carriage moves from the position over the pit, switch 44 opens, thus rendering the hoisting motors A and B inoperative.

To replace the cover, the carriage is traversed to the position over the pit by manipulating the controller 45, and when in proper position, switch 44 again closes and the carriage operator then completes the control circuit for motor A by closing push button switch 36 and the cover is lowered on its seal. When the cover reaches its lowest position, switch 37 opens the circuit of motor A and closes limit switches 38 and 39, thus rendering the control circuit for motor B operative or permitting traversing of the carriage by the controls of motor C. The cover C is operated as above, with the exception that switches 40, 41, 42 and 43 controlling the circuit for motor B are actuated in place of switches

36, 37, 38 and 39 of the control circuit for motor A.

As there is a substantial heating and soaking period during which the ingots are brought to the proper rolling temperature, the cover carriage 6 may service a plurality of soaking pits.

It is apparent from the foregoing description that the soaking pit cover-operating mechanism is efficient in operation and capable of manipulating a plurality of covers, thereby effecting considerable saving in equipment where, for instance, a separate carriage would be employed to operate a single cover.

The invention is furthermore adapted to soaking pit furnace operation where the pits are of unusually large size, as in modern soaking pit construction wherein twelve or more ingots are simultaneously charged and heated in a single pit.

Although one embodiment of the invention has been herein illustrated and described, it will be apparent to those skilled in the art that various modifications may be made in the details of construction without departing from the principles herein set forth.

I claim:

1. A cover lifting mechanism comprising a pair of spaced I-beams on the cover to be lifted, a carriage movable over said cover, a hoist on said carriage comprising a pair of crank shafts, links on the cranks of said shafts, a common motor for actuating said shafts through gear reduction mechanism, parallel beams joined to the lower end of a link of each of said crank shafts and lifting members attached to said beams, said members having T-slots for registering with the upper sections of the I-beams to interact with the tops of said beams whereby the members may slide freely over the I-beams when the carriage passes thereover, and to engage the I-beams to lift the covers when the carriage is in position over the cover.

2. A furnace cover operating mechanism comprising a carriage movable over the furnace in a horizontal plane, a plurality of hoists mounted on said carriage, each adapted to engage a cover of the furnace for raising or lowering the same, a motor for actuating the carriage in its traversing movements over the furnace, a motor for each of the hoists, a control circuit for said motors including a limit switch normally open to render the hoist motor circuits inoperative during the movement of the traversing motor and being adapted for closing automatically when the carriage is in alignment with the cover members, limit switches in said motor circuit adapted to render each of the hoist motors operative separately while the traversing motor is rendered inoperative, and manually operated switches for energizing the motor circuits when the limit switches are in their normally operative position.

3. An apparatus for selectively operating the covers of a plurality of soaking pits arranged in parallel rows, comprising, in combination, a crane bridge mounted to travel transversely of said rows, a plurality of hoisting mechanisms mounted on said bridge, one for each of the covers in a row and each including a motor, a plurality of lifting members spaced apart both longitudinally and transversely of the bridge, and overlying opposite side portions of a cover when in position thereover, and means driven by said motor to actuate said lifting members in unison between upper and lower limit positions, and members rigid with the cover and positioned thereon for coaction with said lifting members, said lifting members and rigid members being shaped to interfit with each other preliminary to cover hoisting engagement as an incident to the horizontal travel of the bridge with the lifting members in their lower limit positions.

4. An apparatus for selectively operating the covers of a plurality of soaking pits arranged in parallel rows, comprising, in combination, a crane bridge mounted to travel transversely of said rows, a plurality of hoisting mechanisms mounted on said bridge, one for each cover in a row and each including a motor, a pair of lifting beams and means driven by said motor to actuate said beams in unison between upper and lower limit positions, the lifting beams of each hoisting mechanism being spaced apart longitudinally of the bridge so as to overlie opposite side portions of a cover when in position thereover, and interfitting coupling means operative automatically as an incident to the horizontal travel of the bridge with the beams in their lower limit positions to effect positive mechanical lifting connections with the cover at the opposite ends of said beams.

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