June 23, 1942. H. F. SPENCER 2,287,645

COVER OPERATING MECHANISM FOR SOAKING PIT FURNACES

Original Filed Dec. 17, 1937 3 Sheets-Sheet 1

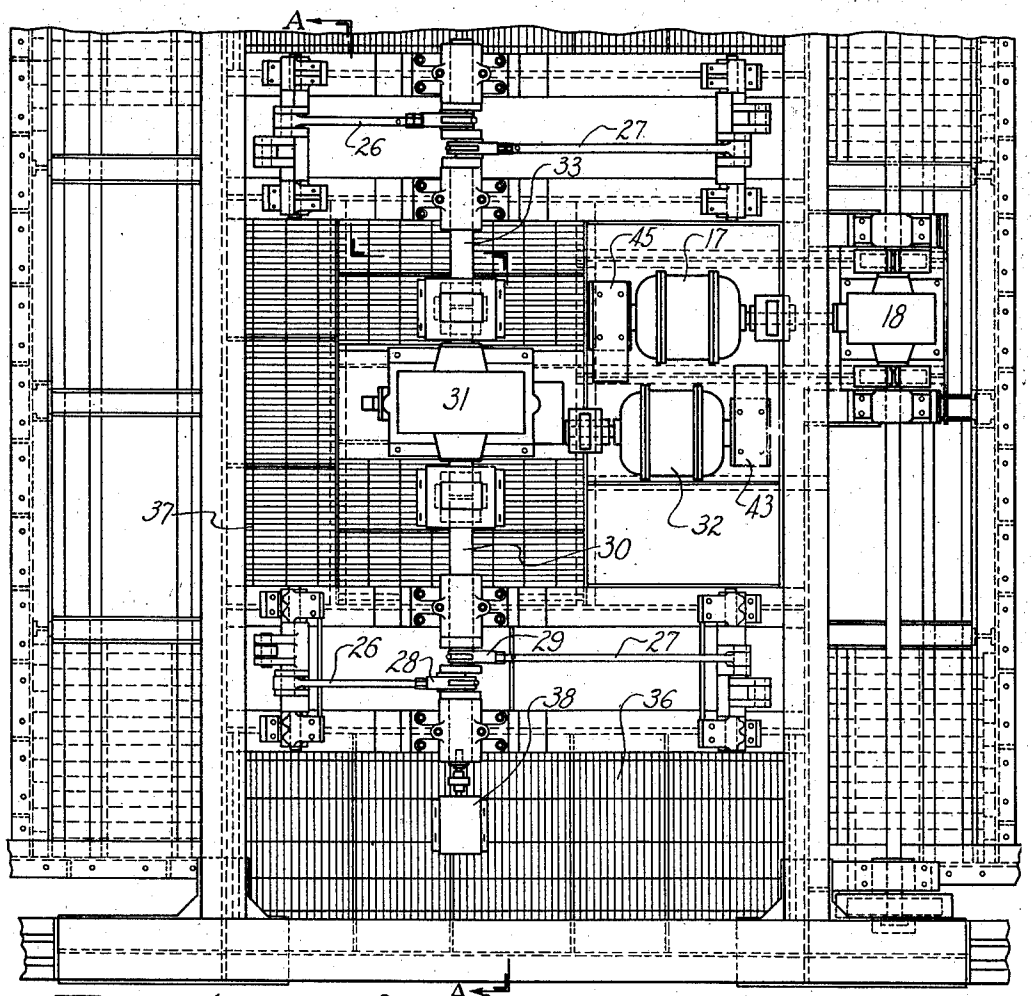

Fig. 1

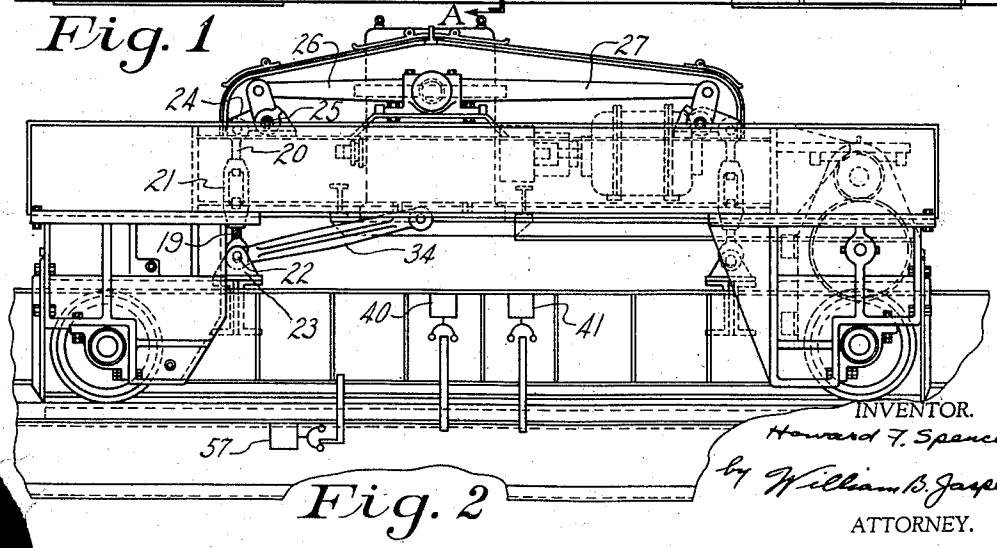

Fig. 2

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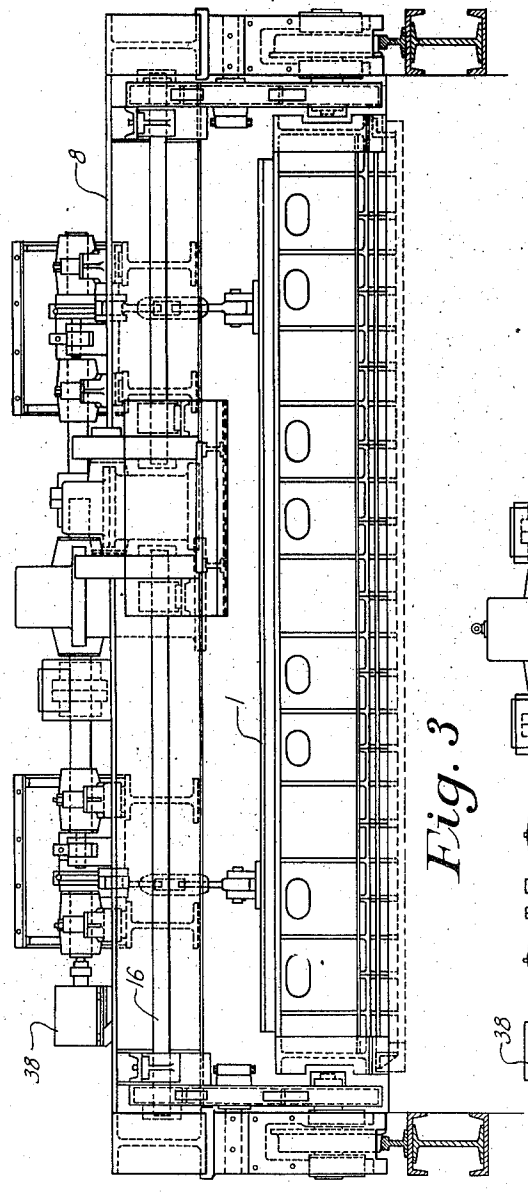

Fig. 3

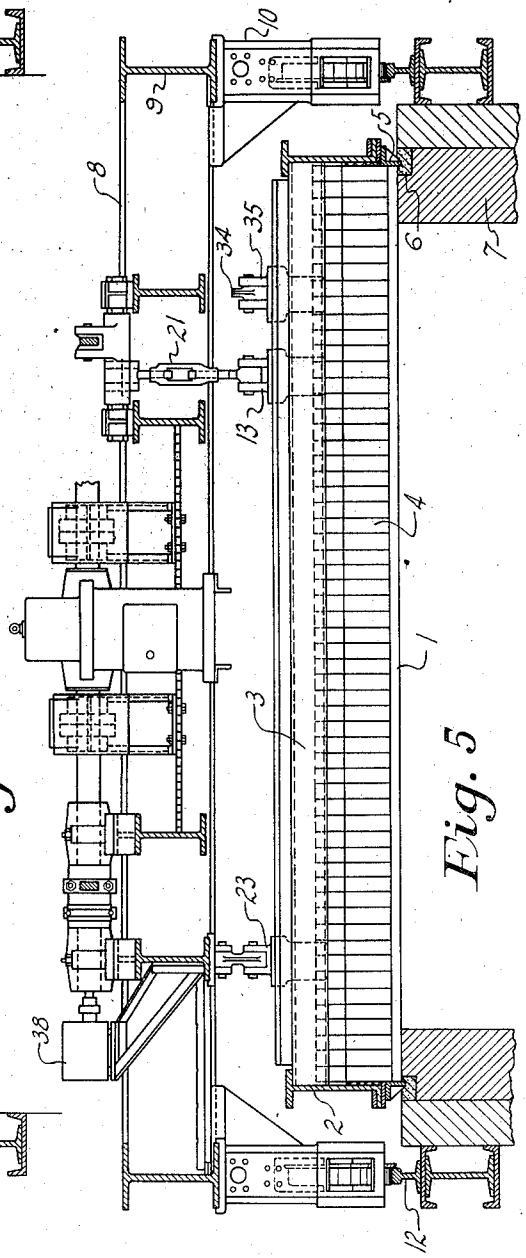

Fig. 5

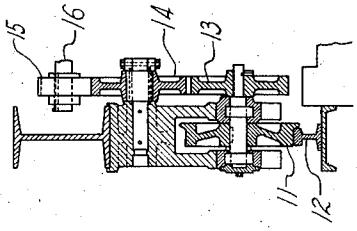

Fig. 4

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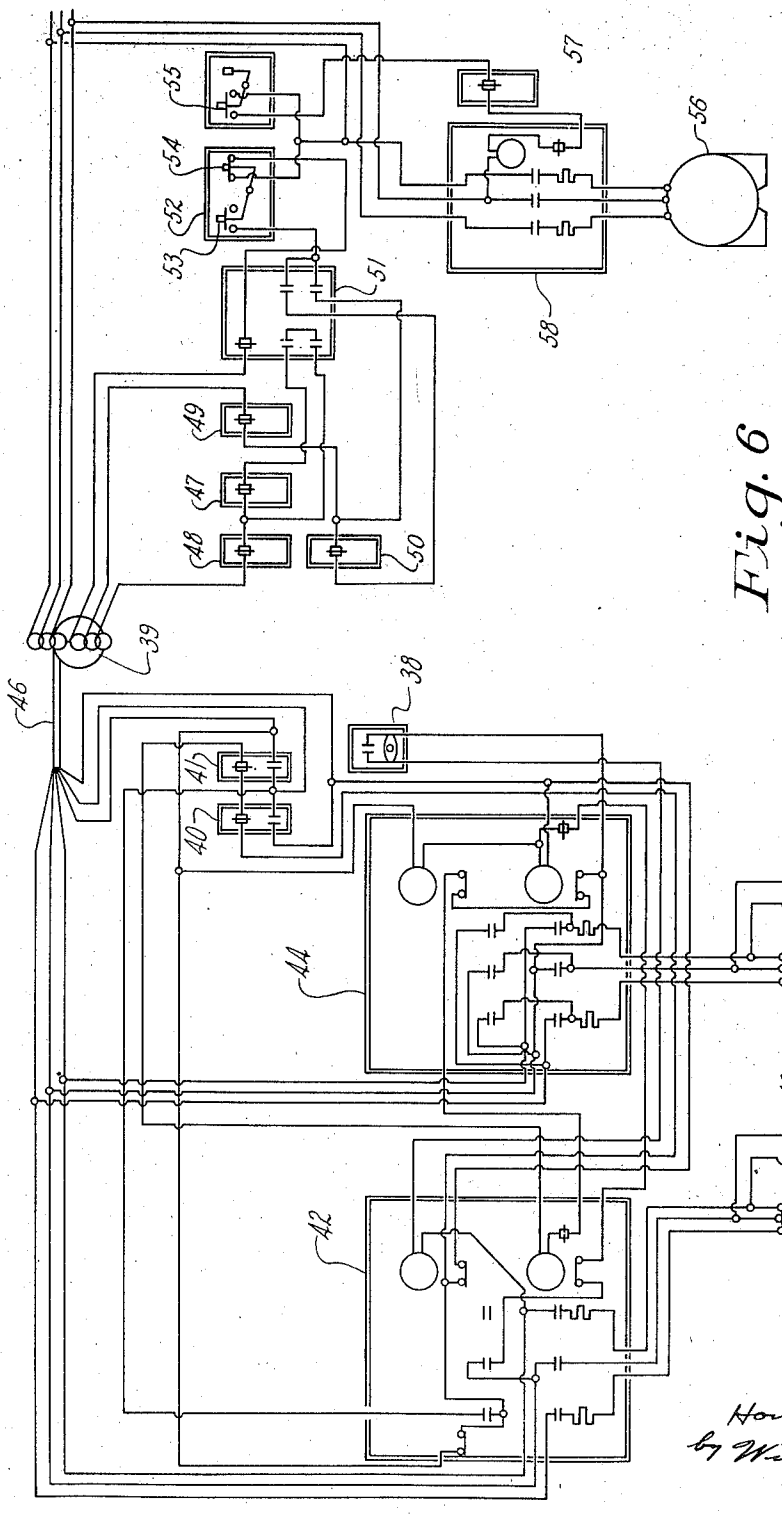

Fig. 6

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COVER OPERATING MECHANISM FOR SOAKING PIT FURNACES

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Original application December 17, 1937, Serial No. 180,337. Divided and this application April 21, 1938, Serial No. 203,337

3 Claims. (Cl. 268—10)

This invention relates to new and useful improvements in cover cranes for soaking pit furnaces or the like, and the present application is a division of my application serially numbered 180,337 filed December 17, 1937. It is among the objects of the invention to provide a crane or cover operating mechanism for raising, traversing and lowering the cover of pit type furnaces. which shall be operated by remote control.

Another object of the invention is the provision of a control circuit for automatically energizing and deenergizing the cover operating and traversing motors in coordinate relation as will be hereinafter stated.

Still another object of the invention is the provision of a cover operating mechanism which shall employ a lever arm suspension for supporting and for raising and lowering the cover mechanism relative to the carriage by an eccentric drive in which the cranks are on dead-centers in both the lowered or retracted positions of the furnace cover, thereby avoiding the necessity of more positive lift positioning mechanism and providing against the imposition of unnecessary strain on the operating parts by balancing the weight of the cover on the eccentric shaft.

These and other 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 plan view of a cover operating mechanism embodying the principles of this invention;

Fig. 2 a side elevational view thereof;

Fig. 3 a front elevational view of the cover and cover operating mechanism;

Fig. 4 a cross-section taken through the end frame of the cover carriage showing the drive mechanism for hoisting the carriage;

Fig. 5 a front elevational view partially in section of the cover and carriage; and

Fig. 6 a wiring diagram of the cover lift and traversing motors with control panels and limit switches, and also showing the control system coupled to the blower control.

Cover structure

With reference to Figs. 1 to 5 inclusive of the drawings, the numeral 1 designates a cover member constructed of channel bars 2 and 3 on which are supported refractory brick 4, the bottom periphery of the cover being provided with a depending flange 5 of a plurality of alloy members that engage a sand seal 6 extending around the entire top of the furnace opening, the inner furnace wall being designated by the reference character 6. The cover 1 is adapted to be raised and lowered by a carriage generally designated by the numeral 8, the cross-beams of which are supported on I-beams 9, resting on castings 10, which are provided with wheels 11 that engage a pair of rails 12 mounted adjacent and parallel to the furnace walls, as is clearly shown in Fig. 5 of the drawings. The carriage 8 is adapted to traverse the rails by operation of a drive mechanism comprising gear wheels 13 and 14, Fig. 4, and pinions 15, the latter being actuated by a shaft 16 that is driven by a reversing motor 17, Fig. 1, through a gear transmission 18. The cover 1 is suspended from the carriage 8 by means of links 19 and 20 joined by a threaded nut or turn-buckle 21 for adjusting the length of the links, the links 19 being pivoted at 22 to a bracket 23 attached to the cover member and links 20 being pivotally connected to a bell-crank lever 24 mounted on a shaft 25. The bell-cranks are subjected to oscillatory movement by the connecting rods 26 and 27, the lever 24 being in the normally lowered position, as shown in Fig. 2 of the drawings. Rods 26 and 27 are provided with eccentric connections 28 and 29 to shafts 30 and 33 that are actuated through a transmission 31 by hoisting motor 32. The operating shaft 33 extends across a cover to operate a second set of actuating rods 26 and 27 and their connected linkage to lift the cover at four points.

As shown in Fig. 2, a guide link 34 is provided to stabilize the cover in its raising and lowering movements, this link being pivotally connected to a bracket 35 on the cover, as shown in Fig. 5. A grill-work 36 and 37 is provided for safe access to the operating parts.

Cover operating control mechanism

A limit switch 38, Figs. 1 and 3, is connected to the operating shaft 30 of the cover lifting mechanism and this switch remains open from zero to 180° rotation of the shaft 30, and is closed from 180° to 360° rotation of the shaft 30.

Other controls of the cover lift and carriage are shown in Fig. 6 of the drawings, wherein all of the controls to the left of the vertical center line are on the carriage and all of the controls to the right of the line are in the main power circuit, the controls on the carriage being connected to the power circuit through a winding reel 39.

In Fig. 6, numerals 40 and 41 designate limit switches in the path of travel of the carriage, these switches being operated by the position of

the carriage on its track. Limit switch 40 controls the position of the crane motion while travelling in reverse direction. Limit switch 41 controls the crane motion while travelling in forward direction. The limit switches 40 and 41 stop the carriage when it is in its correct position over the pit, ready for lowering the cover 1.

A cover control panel 42 is connected across the line of the cover lift motor and is a standard magnetic control. The cover lift motor 32 is of the standard squirrel-cage type and rotates in one direction only. The motor is provided with a spring-loaded magnetic brake, designated by the numeral 43, which acts immediately upon the stopping of the motor 32. The numeral 44 designates a traversing control panel which is a standard magnetic control across the line of the traversing motor 17, which is also a squirrel-cage type connected with the traversing control, to be reversed at will. It is also provided with a spring-loaded magnetic brake designated by the numeral 45, which is applied upon stopping of the motor 17.

All of the above-mentioned control equipment is mounted on the cover carriage and connected to the controls that are manipulated by the operator through a flexible wire cable 46 and cable-winding reel 39. The following equipment shown on the right hand side of the cable-winding reel 39 is stationary and controlled by the operator or by limit switches. Limit switch 47 stops the carriage at 50% of its reverse travel, namely, when the pit cover is half open. Limit switch 48 stops the carriage at 100% of its reverse travel when the pit is completely uncovered. Limit switch 49 stops the carriage when it has travelled 50% in the forward direction with the cover half open and limit switch 50 stops the crane when it has reached its full forward position, in which the pit is completely uncovered.

The numeral 51 designates a master control switch, which determines the direction of movement of the cover carriage and also the extent of its travel in either direction, this switch having control of the cover traversing at all times and can stop the cover traversing at any time when moved to the neutral position.

The numeral 52 designates a cover control switch which determines the position of the cover lift mechanism, that is either up or down to open and close, the pit switch 53 controlling the cover raising movement, and switch 54 the cover lowering movement. Push button switch 55 controls the blower motor 56 for supplying air to the gaseous fuel in the pit. The switch 55 will not start the blower motor 56 unless limit switch 57 is closed, this switch being opened when the cover is raised. The numeral 58 designates the control panel for the blower motor 56.

The operation of the carriage and the above described control mechanism is briefly as follows: The carriage 8 is normally positioned centrally of the pit furnace with the cover 1 grounded in the seal 6, as shown in Fig. 5. When the ingots in the furnace have attained the rolling temperature, the operator, by means of the controls shown in Fig. 6, energizes the hoisting motor 32 to actuate operating shafts 30 and 33, causing rods 26 and 27 to move the bell cranks 24 to raise the cover 1 out of the seal 6. The operator then energizes the motor 17 to traverse the carriage 8 in either direction, forward or reverse, depending upon the side of the pit which it is desired to expose for the removal of ingots. After the ingot is removed or an ingot is charged, as the case may be, he reverses the carriage and then energizes the hoisting motor to lower the cover, the cover and carriage motors, as well as the blower motor, being interlocked by the electrical controls to coordinate their functions, as will be apparent from a description of the operation of the control mechanism as follows:

With the cover seated on the pit in the seal 6, if the operator desires to move the cover 1 forward 50% to half open the pit closure, push button switch 53 is depressed and the master control switch 51 is moved to the forward position. The closing of these switches completes the circuit from the power line through the cover control master switch 42, limit switches 47 and 48, limit switches 40 and 41, to energize cover lift motor 32, which at the same time releases magnetic brake 43 on motor 32. As the cover 1 is raised, limit switch 57 opens, thus deenergizing the blower motor 56 through the control panel 58. When the cover 1 has reached the top of its travel, limit switch 38 closes, which completes the circuit that stops the lifting motor 32 and applies magnetic brake 43 at the same time magnetic brake 45 of the traversing motor 17 is released, motor 17 is energized, and the carriage traverses forward 50% of its total travel, until it comes in contact with limit switch 47, which opens the traversing motor control circuit and stops the carriage.

If it is desired to move the carriage the additional 50% of possible travel, the master control lever of switch 51 is pushed farther in the forward position, which closes an additional contact that shorts-out limit switch 47 and the crane travels forward until it strikes limit switch 48, which again stops the carriage when it reaches 100% of its possible travel in a forward direction. While the traversing motor 17 is operating, the control circuit of the cover lowering mechanism is deenergized, rendering it inoperative. Unless limit switches 40 and 41 are closed, it is impossible to raise or lower the cover 1. These limit switches are closed only when the carriage 8 is in position directly over the pit.

To move the cover 1 back to position over the pit, it is merely necessary to depress push button switch 54 to lower the cover. The crane then traverses to the position over the pit and allows limit switch 40 to open, thus stopping motion of the carriage and starting cover operating motor 32. The cover 1 is lowered until limit switch 38 opens and stops motor 32. As the cover lowers limit switch 57 closes and starts blower motor 56, and all parts of the control circuit are thus returned to their original position.

To move the cover 1 in the reverse direction, the control goes through the reverse contacts of the master controller 51, and the other controls function in the same manner as described above.

Although one embodiment of the invention has been herein illustrated and described, it will be obvious 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 operating mechanism comprising a carriage, a cover suspended from said carriage, means for actuating the cover suspension to raise and lower the cover, said means comprising a plurality of bell crank levers having one arm linked to the cover, a drive shaft having oppositely disposed cranks connected by rods to the other arm of said levers, the angular disposition

of the cranks and levers being such as to lock the cover actuating levers in both the lowered and retracted positions of the cover.

2. A cover operating mechanism comprising a carriage, oppositely disposed bell crank levers pivotally supported on the carriage, links depending from said bell crank levers, a cover suspended by said links, means on said links for varying the height of the cover relative to the carriage, a drive shaft having oppositely disposed cranks connected by rods to said bell crank levers, and means for actuating the drive shaft to raise and lower the cover, the angular disposition of the cranks and levers being such as to lock the cover actuating mechanism in its raised and lowered position.

3. A cover operating mechanism comprising a carriage, oppositely disposed bell crank levers pivotally supported on the carriage, said bell crank levers having one arm extending upwardly and the other arm extending outwardly in opposite directions, links depending from the outwardly extending arms, a cover suspended by said links, a drive shaft supported intermediate of and parallel to the pivotal axes of said oppositely disposed bell crank levers, a crank means on said shaft connected by a rod to the upwardly extending arm of each bell crank, the crank means of oppositely disposed bell cranks being displaced at 180 degrees, thereby balancing the torque load on the drive shaft, and means for actuating the drive shaft to raise and lower the cover.

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