Aug. 26, 1958 W. A. SLOSS 2,849,128

CONTROL SYSTEM FOR COKE-OVEN PUSHER MACHINE AND COKE-SIDE DOOR MACHINE

Filed Oct. 18, 1956 3 Sheets-Sheet 1

FIG. 1.

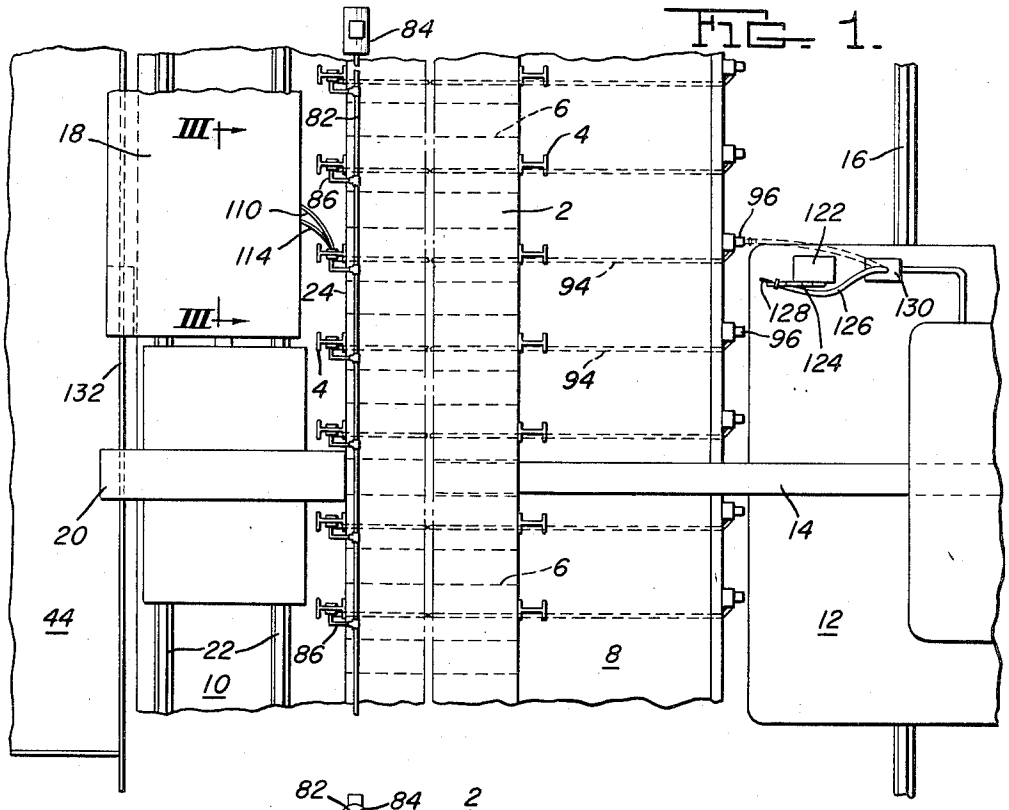
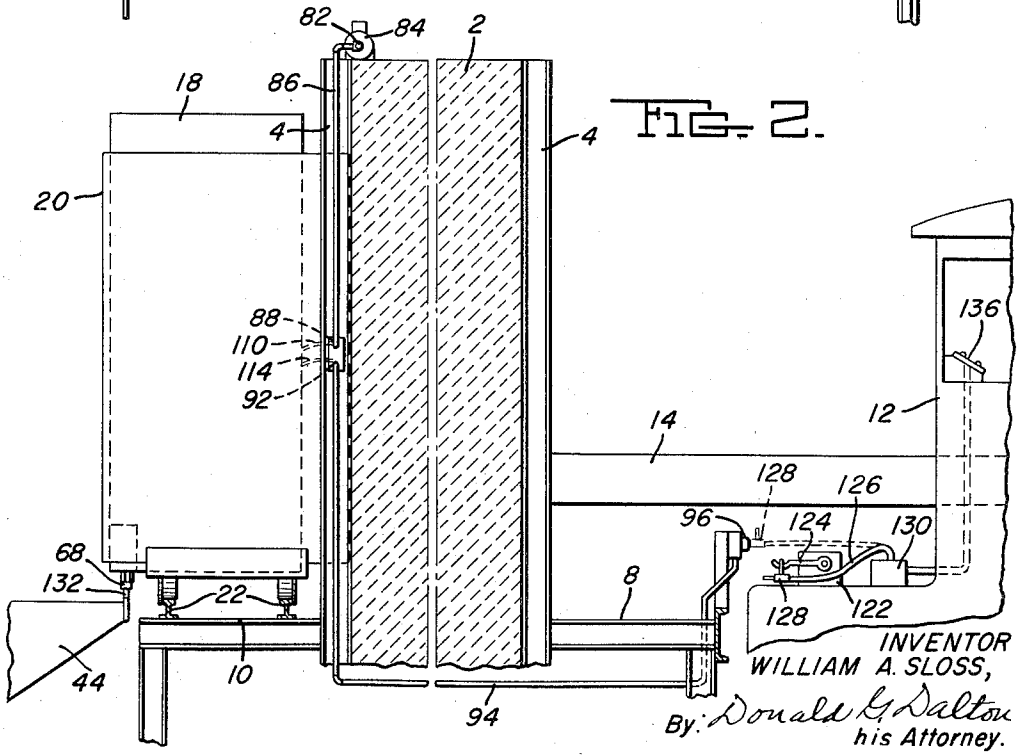


FIG. 2.



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3 Sheets-Sheet 2

FIG. 3.

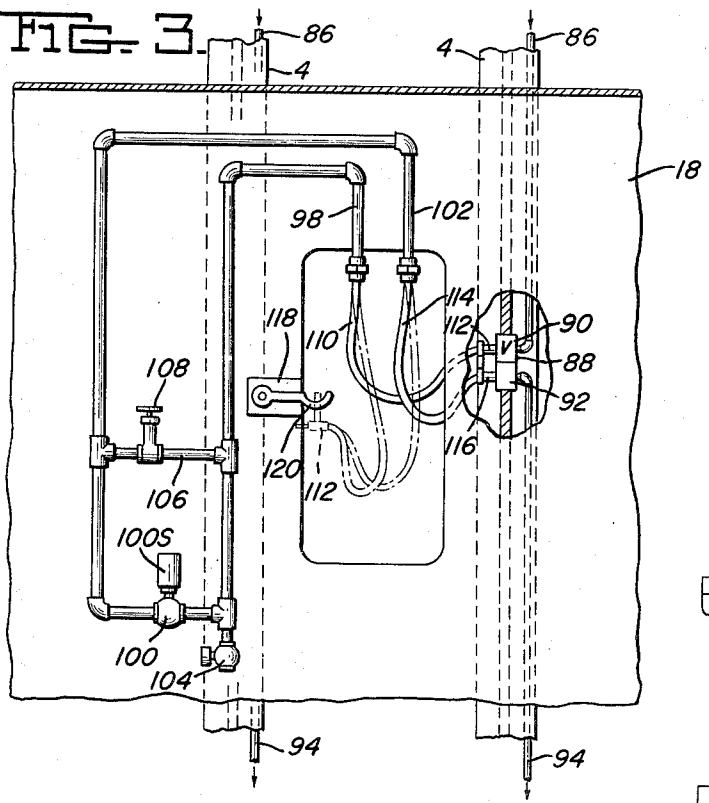
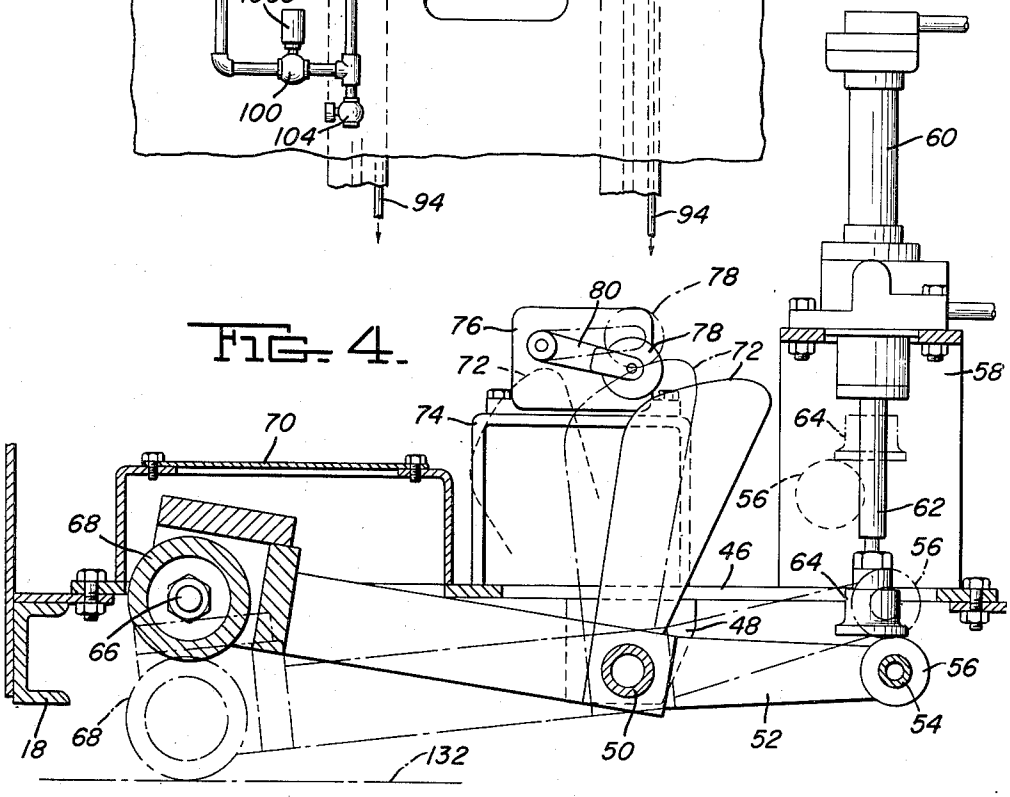


FIG. 4.





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3 Sheets-Sheet 3

FIG. 5.

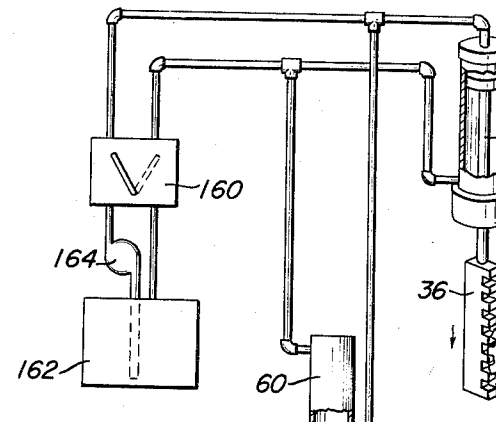
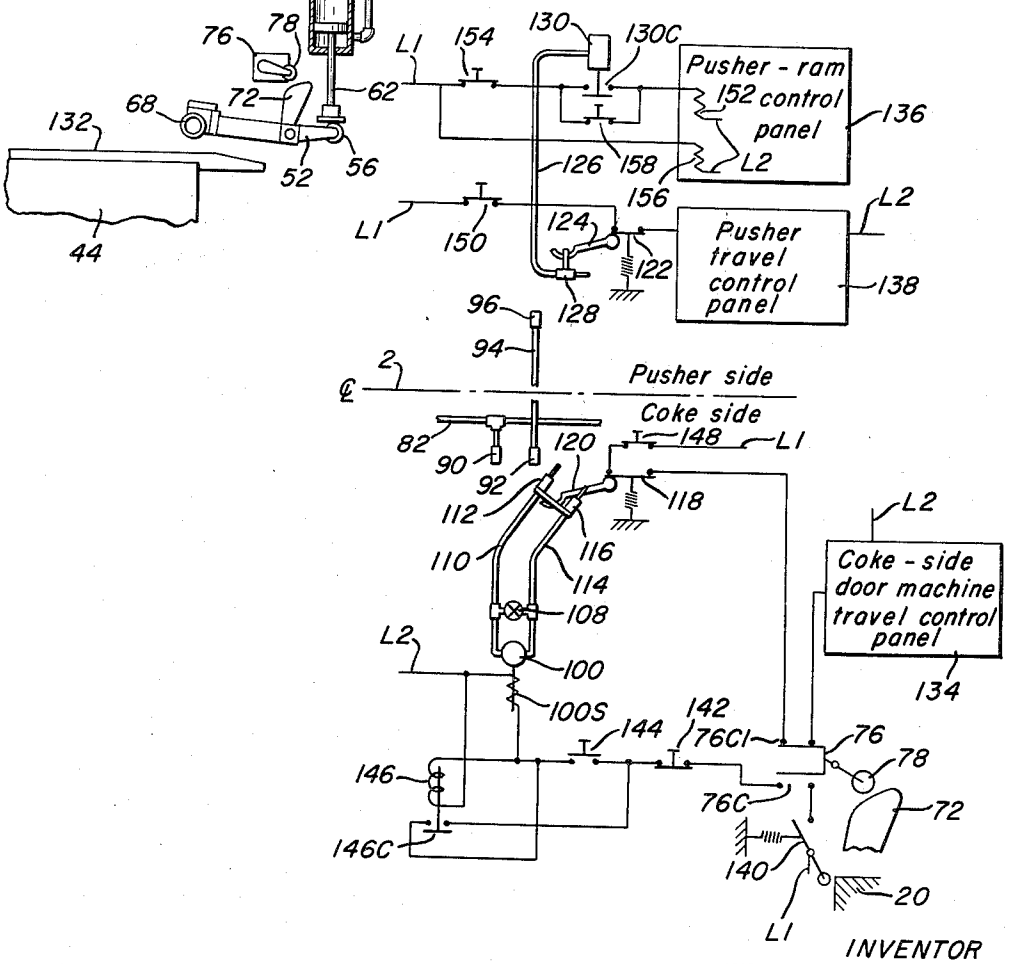


FIG. 6.



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CONTROL SYSTEM FOR COKE-OVEN PUSHER MACHINE AND COKE-SIDE DOOR MACHINE

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Application October 18, 1956, Serial No. 616,672

4 Claims. (Cl. 214—23)

This invention relates to coke-ovens and in particular to an electro-pneumatic system for controlling the operation of the pusher machine of a coke-oven battery and the coke-side door machine so as to insure that the pusher ram may be operated only when the pusher machine is alined with the oven the coke-side door of which has been removed and only after the coke-guide and quenching car have been properly positioned to receive the product.

The system is such, furthermore, as to arrest the pusher ram in midstroke if the quenching car should move beyond receiving position relative to the coke-guide, or if the coke guide should move away from proper position during pushing. Other safety features incorporated include prevention of movement of the pusher machine and the coke-side door machine while pushing is underway. The system also requires a manual switch to be closed by the pusher operator before pushing can begin, thus giving him the opportunity to delay pushing until all is in readiness therefor, as evidenced by his direct operation.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings:

Figure 1 is a diagrammatic plan view of an oven battery door machine, coke guide, pusher and quenching car having the invention applied thereto;

Figure 2 is an elevation of Figure 1 showing a portion of a coke-oven in section;

Figure 3 is an enlarged view of the door machine taken on the line III—III of Figure 1 and showing piping details;

Figure 4 is an enlarged elevation, partly in section, showing parts of my invention mounted on a door machine;

Figure 5 is a diagrammatic view, partly in perspective, showing a detail; and

Figure 6 is a diagram showing the air piping and electrical circuits.

Referring more particularly to Figures 1 and 2 of the drawings, the reference numeral 2 indicates a coke-oven battery having the usual buckstays 4 arranged on each side of each coke chamber 6. Benches 8 and 10 are arranged on the pusher and coke side of the battery 2. A pusher 12 having a ram 14 is mounted for movement along tracks 16 which extend longitudinally of the battery 2. A door machine 18 having a coke guide 20 attached thereto is mounted for movement along tracks 22 carried by bench 10. A door 24 is provided for each chamber 6 on the coke side of the oven. As shown in Figure 5 the coke guide 20 includes a side frame 26 having a connecting bar 28 pivotally attached thereto, the other end of the connecting bar 28 being pivotally attached to one end of a crank arm 30. The other end of the crank arm 30 is keyed to a shaft 32 which has a pinion 34 keyed thereto. Pinion 34 is in mesh with a rack

36 which is connected to piston rod 38 of hydraulic power cylinder assembly 40 which includes a piston 42. A quench car 44 is mounted for movement longitudinally of the bench 10. The parts so far described are conventional and form no part of the present invention. As shown in Figure 4 the door machine 18 includes a floor 46 having a bracket 48 suspended therefrom for supporting a pin 50. A lever 52 is pivotally mounted on the pin 50 intermediate its ends. One end of the lever 52 carries a pin 54 on which is rotatably mounted a roller 56. A bracket 58 is mounted on the floor 46 and carries a hydraulic cylinder 60. Piston rod 62 extends downwardly from the cylinder 60 and carries a fitting 64 at its lower end which is adapted to contact the roller 56. A pin 66 is attached to the end of lever 52 remote from the roller 56 and rotatably carries a roller 68. A cover 70 is attached to the floor 46 to protect the roller 68 from damage and dirt. A cam 72 is attached to lever 52 for movement therewith and extends upwardly adjacent a bracket 74 which is attached to the floor 46. A switch 76 is mounted on the bracket 74. A roller 78 mounted on a switch lever 80 is adapted to be actuated by cam 72. The weight of the lever assembly to the left of the pin 50 is greater than that to the right so that the lever 52 will rotate in a counterclockwise direction when it is free to move.

A compressed air pipe or manifold 82 extends longitudinally on top of the battery 2 adjacent the coke side thereof and is supplied with compressed air from a compressor 84. A branch line 86 extends from the line or manifold 82 downwardly adjacent each chamber 6. The end of each pipe 86 has one half 88 of a spring loaded ball valve coupling attached thereto which is preferably mounted on a buckstay 4. The half coupling 88 includes a valve 90. A similar half coupling 92 is mounted on buckstay 4 adjacent coupling 88 but does not include a valve. A pipe line 94 is attached to and extends downwardly from the coupling 92 beneath the battery 2 over to the pusher side of the battery 2 and terminates in coupling half 96 similar to coupling half 92. An air pipe 98, solenoid valve 100 and piping 102 are mounted on the door machine 18 adjacent the inner side thereof. A drain valve 104 may be attached to the piping 98. A by-pass 106 may be provided in parallel with valve 100 between piping 98 and 102 and is provided with a manually operated valve 108. Flexible hose 110 is attached to piping 98 and has a second half 112 of a coupling attached thereto. A similar hose 114 having a similar half coupling 116 is attached to piping 102. A switch 118 is mounted on the door machine 18 and has a lever 120 for carrying the free ends of the hoses 110 and 114. A switch 122 is attached to the pusher 12 and is provided with an actuating lever 124 for supporting the free end of a hose 126 carried by pusher 12. The free end of the hose 126 carries a half coupling 128 for receiving half coupling 96. Hose 126 terminates in a pressure switch 130. Roller 68 is adapted to ride along a track 132 extending the length of the quench car 44 along the inner side thereof. It is not necessary to use a roller 68 since a non-rotatable curved shoe could be used to function in the same manner. The usual travel control 134 is mounted on the door machine 18 and the usual pusher ram control panel 136 and pusher travel control panel 138 are mounted on the pusher 12. Switch 76 has two contacts 76C and 76C1. Contacts 76C are arranged in series with limit switch 140 which is actuated by the coke guide 20 and also in series with a stop switch 142 and a start switch 144. A relay coil 146 is arranged in series with the switch 144 and has a normally open contact 146C which is arranged in a holding circuit around switch 144. Solenoid 100S is arranged in series with

switch 144. Power is applied to this circuit through lines L1 and L2. Contacts 76C1 are arranged in parallel with the door machine travel control 134 and with switch 118. A manual control switch 148 may be provided to control flow of current to the control panel 134. Switch 122 is in series with pusher travel control 138. A manual control switch 150 is provided in the circuit of control 138. Contacts 130C of switch 130 are in series with forward control relay 152 of the control 136. A manual control switch 154 is arranged in circuit with relay 152. A push button 158 may be arranged in parallel with contacts 130C.

The operation of my device is as follows:

When the pusher machine 12 and the coke side door machine 18 are traveling to an oven to be pushed the equipment associated with the cross battery interlock system is arranged in the following manner. The lever 52 is in the position shown in full lines in Figure 4 so that the contacts 76C are open and contacts 76C1 closed. Limit switch 140 will also be open. Hoses 110 and 114 are mounted on lever 120 and hose 126 on lever 124 so that switches 118 and 122 are closed. Valves 90 are such that they are closed when coupling halves 88 and 112 are not connected. When a push is to be made the operator of the coke side door machine 18 positions it in front of the door 24 to be removed, removes the door and then removes the flexible air hoses 110 and 114 from the switch lever 120 and connects coupling half 112 to coupling half 88 and coupling half 116 to coupling half 92. This causes air from the header 82 to flow through the branch line 86 of the oven to be pushed through open valve 90, hose 110 and pipe 98 to the solenoid valve 100. It also opens switch 118 which prevents travel of the coke side door machine by preventing flow of current to control 134. The operator either before or at this time will move control valve 160 to enable oil to flow from reservoir 162 through pump 164 to the top of cylinder 40 and to the bottom of cylinder 60. Flow of oil to the top of cylinder 40 causes piston rod 38 and rack 36 to move downwardly thus rotating pinion 34 and shaft 32 in a counterclockwise direction. This causes crank arm 30 to rotate in a counterclockwise direction and pushes the coke guide side frame 26 up against the chamber opening between buckstays 4. At the same time piston rod 62 moves upwardly thus enabling lever 52 to rotate in a counterclockwise direction to the lowest dotted line position shown in Figure 4. As the quench car 44 moves to the correct position for receiving coke the roller 68 will be contacted by track 132 and moved to the mid position shown in Figure 4. This causes cam 72 to actuate lever 80 to move the switch 76 from the position shown in Figure 6 to the position where contact 76C is closed and contact 76C1 open. Opening of contact 76C1 serves as a second interruption of the circuit to the control 134. When the coke guide 20 is racked into position limit switch 140 is closed. The pusher machine operator positions pusher 12 in front of the oven to be pushed and removes flexible air hose 126 from lever 124 and connects it to pipe 94 by means of coupling halves 96 and 128. Lifting the hose from lever 124 causes switch 122 to open, thus interrupting the circuit to pusher travel control 138 so that the pusher 12 cannot travel. The operator then pushes switch 144 which completes the circuit to solenoid 100S, thus opening valve 100 and permitting air flow to pressure switch 130. This closes contacts 130C in the circuit to control 136. At the same time relay coil 146 is energized closing its contacts 146C and sealing in the circuit to solenoid 100S so that the operator will not need to hold the switch 144 depressed. The ram 14 may be operated in the reverse direction at all times. The pusher operator then waits until the coke side door machine operator gives the usual signal at which time he presses switch 154 to complete the circuit to relay 152 to move the ram 14 forwardly to discharge the coke into the car 44. The track 132 extends the length of the car so that the roller

68 will remain in contact therewith at all times to keep cam 72 against roller 78. Forward movement of the pusher ram 14 will be interrupted when any of the flexible air hose connections are broken, when the roller 68 causes the switch 76 to disengage, when the coke side door machine operator pushes the stop button 142, by operating valve 160 to cause the rack 36 to move upwardly or by shutting off the air supply. After the coke is pushed from the chamber 6 the ram 14 is retracted, the flexible air hose connection broken and the air hoses returned to their former positions. The switch 160 is moved to raise the rack 36 and retract the coke guide and the cylinder 60 is lowered to raise the roller 68. The pusher 12 and coke side door machine 18 can then be moved to another chamber and the operation repeated.

While one embodiment of my 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.

I claim:

1. In a coke-oven battery having a door for each coking chamber through which coke is discharged, a pusher positioned on the side of the battery opposite the discharge doors, said pusher carrying a ram for pushing the coke from the chamber, an electric control for controlling the travel of the pusher, an electric control for controlling forward movement of the ram, a coke-side door machine, an electric control for controlling the travel of the door machine, a coke-guide, means for racking the coke-guide into place against the coke chamber to be pushed, and a quench car for receiving the coke; the combination including a first electric circuit to said door machine travel control, means for interrupting said first electric circuit when said coke-guide is racked in place, a second electric circuit to said pusher travel control, means for interrupting said second electric circuit when said pusher is in place at the chamber to be pushed, a third electric circuit to said pusher ram control, and means for closing said third electric circuit when said second electric circuit is interrupted, the coke-guide is racked in place at the coking chamber in line with the pusher ram and the car is in position to receive coke.

2. In a coke-oven battery having a door for each coking chamber through which coke is discharged, a pusher positioned on the side of the battery opposite the discharge doors, said pusher carrying a ram for pushig the coke from the chamber, an electric control for controlling the travel of the pusher, an electric control for controlling forward movement of the ram, a coke-side door machine, an electric control for controlling the travel of the door machine, a coke guide, means for racking the coke-guide into place against the coke chamber to be pushed, and a quench car for receiving the coke; the combination including a switch having a normally closed contact and a normally open contact, an electric circuit to said door machine travel control, said normally closed contact being in said electric circuit, a fluid manifold, a branch line from said manifold to each coke chamber, a coupling half at the end of each branch line, piping including a solenoid valve mounted on said door machine, a flexible hose mounted on each end of said piping, a coupling half at the end of each flexible hose, a switch mounted on said door machine, a lever for actuating said last named switch and for supporting said flexible hoses, said last named switch being closed when the flexible hoses are on said lever, said last named switch being in said electric circuit, a second electric circuit for supplying current to the solenoid of said solenoid valve, said normally open contact being in said second circuit, a normally open switch in series with said normally open contact and adapted to be closed when said coke-guide is in position against said coke chamber, means for actuating said first named switch when said coke-guide is racked in place, a conduit leading from the coke to the pusher side of said battery, a coupling half on each end of said conduit, said first named

coupling half being adapted to be connected to the coupling half on one of said hoses, the coupling half on the coke side of said conduit being adapted to be connected to the coupling half on the other side of said hoses, a hose mounted on said pusher, a coupling half on one end of said hose, a normally open pressure switch on the other end of said hose, a switch mounted on said door machine, a lever for actuating said last named switch and for supporting said last named flexible hose, said last named switch being closed when said last named flexible hose is on said last named lever, a third electric circuit to said pusher travel control, said last named switch being in said third electric circuit, and a fourth electric circuit to said ram control, said pressure switch being in said fourth electric circuit.

3. In a coke-oven battery having a door for each coking chamber through which coke is discharged, a pusher positioned on the side of the battery opposite the discharge doors, said pusher carrying a ram for pushing the coke from the chamber, an electric control for controlling the travel of the pusher, an electric control for controlling forward movement of the ram, a coke-side door machine, an electric control for controlling the travel of the door machine, a coke-guide, means for racking the coke-guide into place against the coke chamber to be pushed, and a quench car for receiving the coke; the combination including a lever pivotally mounted adjacent its ends on said door machine, a cam track extending along the inner side of said car, the first end of said lever adapted to contact said cam track when said car is in position to receive coke, a first electric circuit to said door machine travel control, a normally closed switch in said first electric circuit, said lever opening said switch when said coke-guide is racked in place, a second electric circuit to said pusher travel control, means for interrupting said second electric circuit when said pusher is in place at the chamber to be pushed, a third electric circuit to said pusher ram control, and means for closing said third electric circuit when said second electric circuit is interrupted, the coke-guide is racked in place at the coking chamber in line with the pusher ram and the car is in position to receive coke.

4. In a coke-oven battery having a door for each coking chamber through which coke is discharged, a pusher positioned on the side of the battery opposite the discharge doors, said pusher carrying a ram for pushing the coke from the chamber, an electric control for controlling the travel of the pusher, an electric control for controlling forward movement of the ram, a coke-side door machine, an electric control for controlling the travel of the door machine, a coke-guide, means for racking the coke-guide into place against the coke chamber to be pushed, and a quench car for receiving the coke; the combination including a lever pivotally mounted adjacent its ends on said door machine, a cam track extending along the inner side of said car, the first end of said lever adapted to contact said cam track when said car is in position to receive coke, holding means for preventing upward movement of the second end of said lever, a switch having a normally closed contact and a normally open contact, an electric circuit to said door machine travel control, said normally closed contact being in said electric circuit, a fluid manifold, a branch line from said manifold to each coke chamber, a coupling half at the end of each branch line, piping including a solenoid valve mounted on said door machine, a flexible hose mounted on each end of said piping, a coupling half at the end of each flexible hose, a switch mounted on said door machine, a lever for actuating said last named switch and for supporting said flexible hoses, said last named switch being closed when the flexible hoses are on said lever, said last named switch being in said electric circuit, a second electric circuit for supplying current to the solenoid of said solenoid valve, said normally open contact being in said second circuit, a normally open switch in series with said normally open contact and adapted to be closed when said coke-guide is in position against said coke chamber, means for removing said holding means when said coke-guide is racked in place, a conduit leading from the coke to the pusher side of said battery, a coupling half on each end of said conduit, said first named coupling half being adapted to be connected to the coupling half on one of said hoses, the coupling half on the coke side of said conduit being adapted to be connected to the coupling half on the other of said hoses, a hose mounted on said pusher, a coupling half on one end of said hose, a normally open pressure switch on the other end of said hose, a switch mounted on said door machine, a lever for actuating said last named switch and for supporting said last named flexible hose, said last named switch being closed when said last named flexible hose is on said last named lever, a third electric circuit to said pusher travel control, said last named switch being in said third electric circuit, and a fourth electric circuit to said ram control, said pressure switch being in said fourth electric circuit.

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