

July 7, 1942.

B. W. WINSHIP ET AL

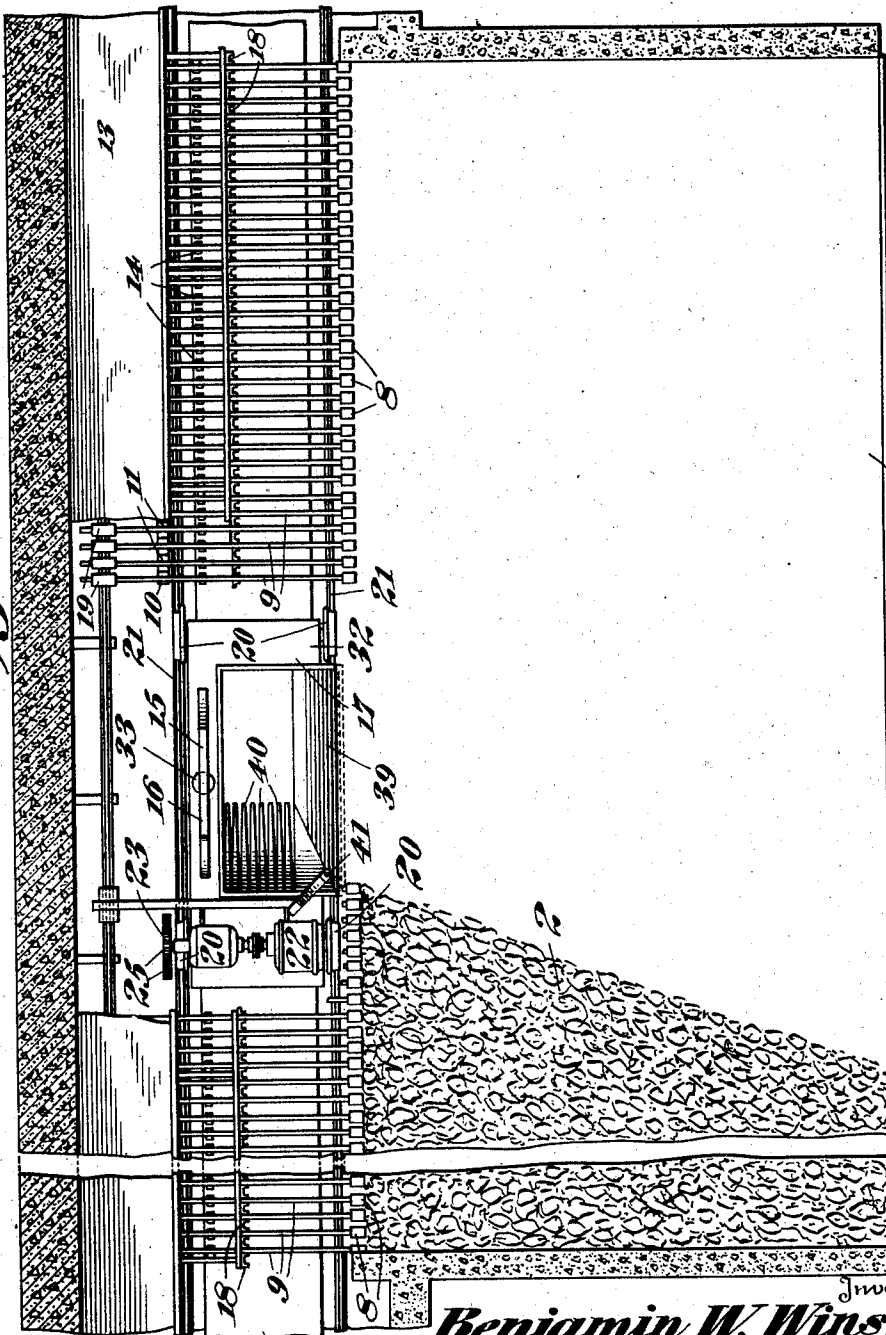
2,288,764

AUTOMATIC COKE WHARF

Original Filed July 2, 1940

6 Sheets-Sheet 1

Fig. 1.



Inventors
Benjamin W. Winship
and **Floyd S. Eckhardt.**
By *R. S. Cougherty.*
Attorney

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B. W. WINSHIP ET AL

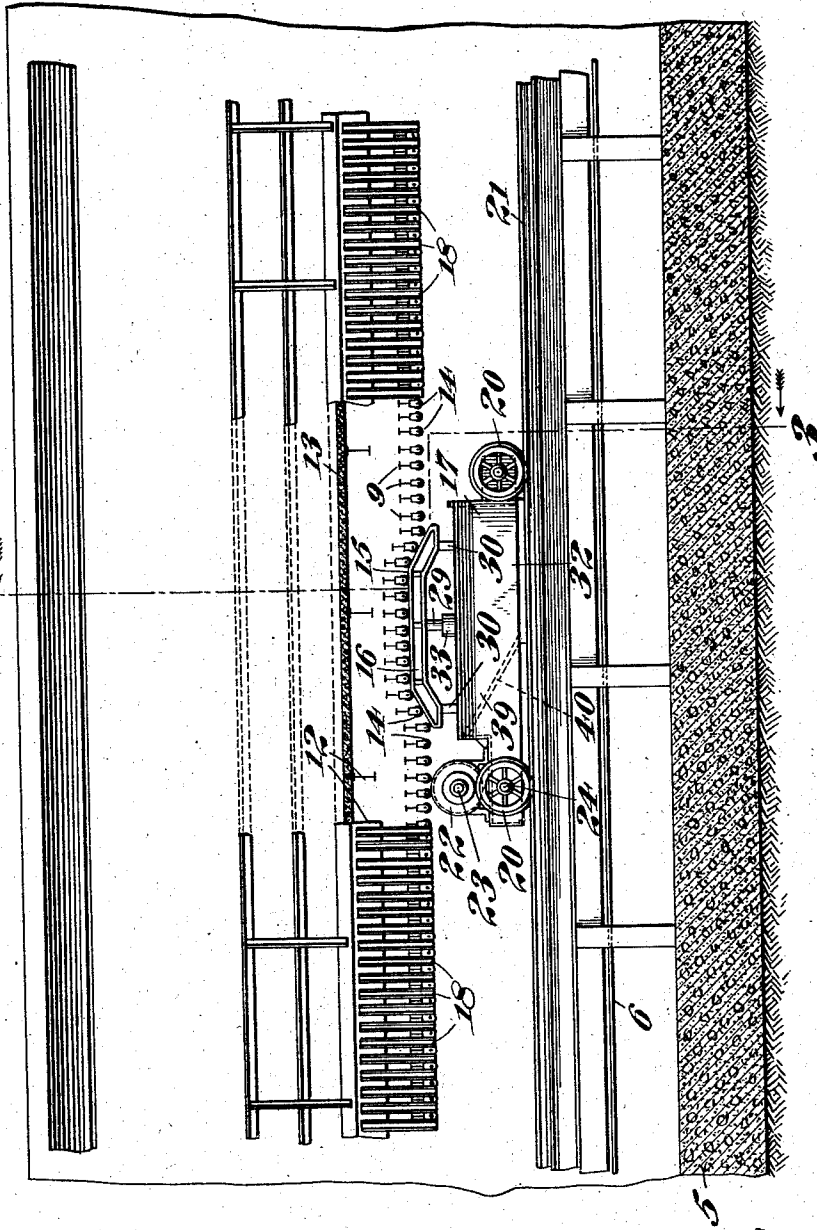
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AUTOMATIC COKE WHARF

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6 Sheets-Sheet 2

Fig. 2.



Inventors

Benjamin W. Winship
and Floyd S. Eckhardt.
By *R. L. O'Dougherty.*
Attorney

July 7, 1942.

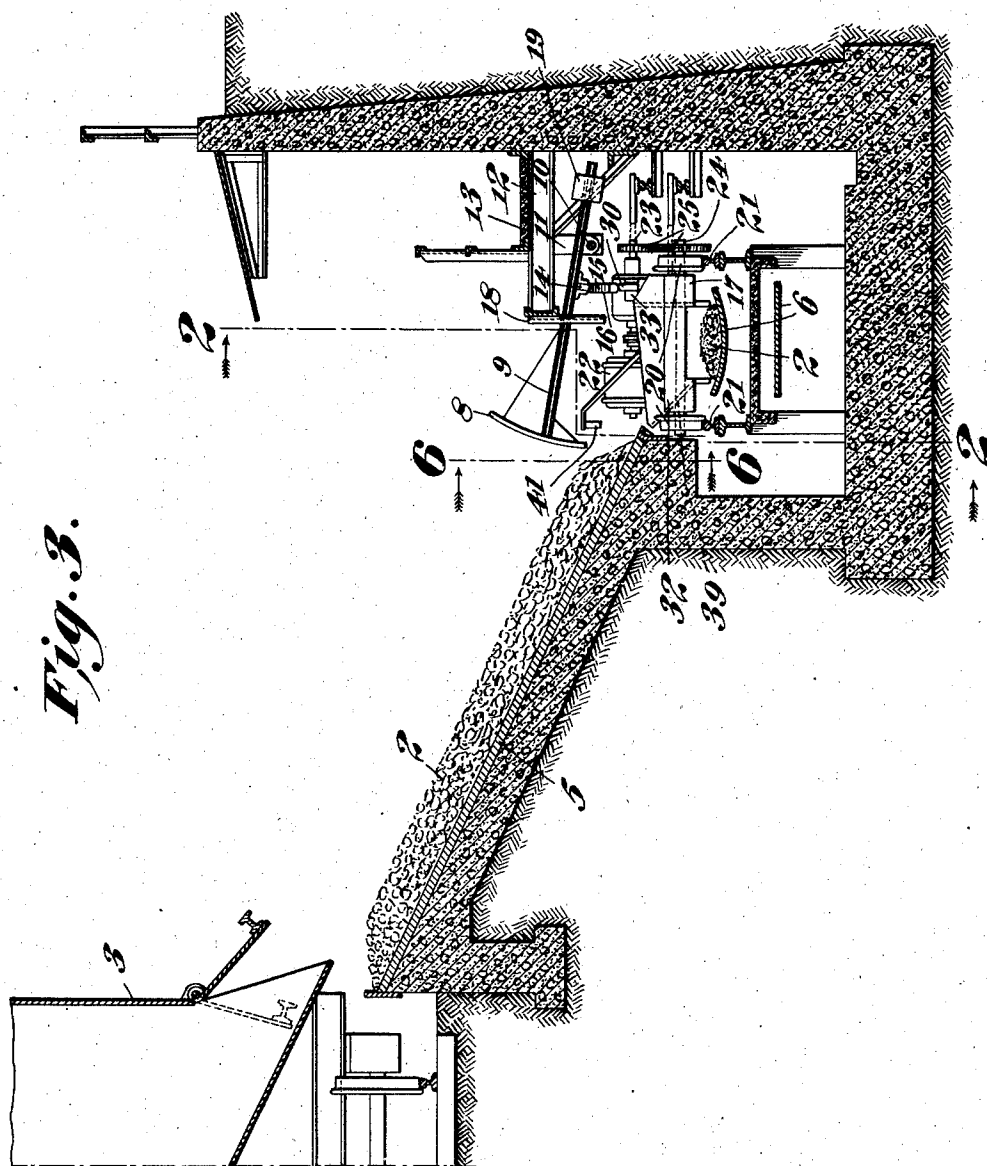
B. W. WINSHIP ET AL

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AUTOMATIC COKE WHARF

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6 Sheets-Sheet 3



Inventors
*and Benjamin W. Winship
Floyd S. Eckhardt.*
By *R. S. C. Dougherty.*
Attorney

July 7, 1942.

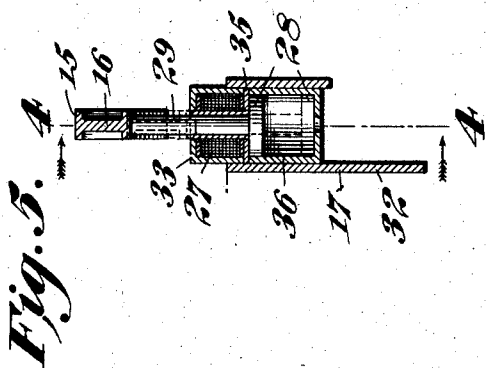
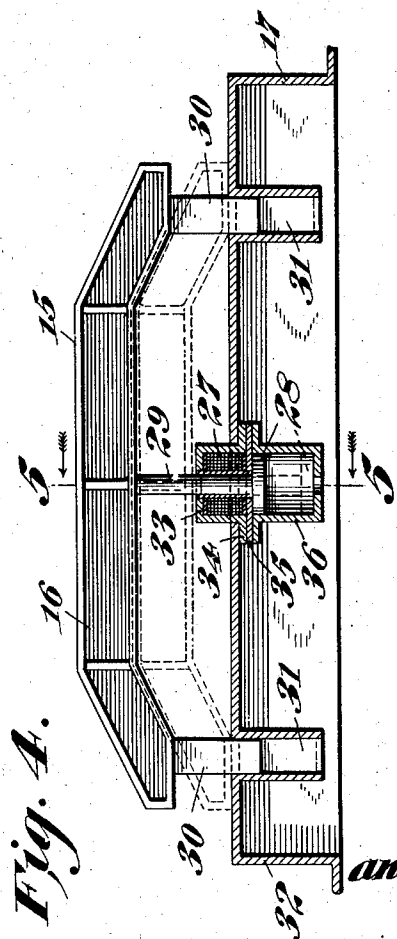
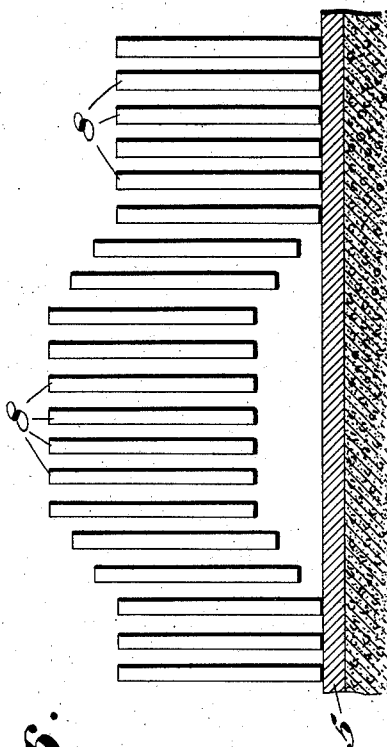
B. W. WINSHIP ET AL

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AUTOMATIC COKE WHARF

Original Filed July 2, 1940

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Inventors
Benjamin W. Winship
and Floyd S. Eckhardt.
By R. S. A. Dougherty.
Attorney

July 7, 1942.

B. W. WINSHIP ET AL

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AUTOMATIC COKE WHARF

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6 Sheets-Sheet 5

Fig. 1.

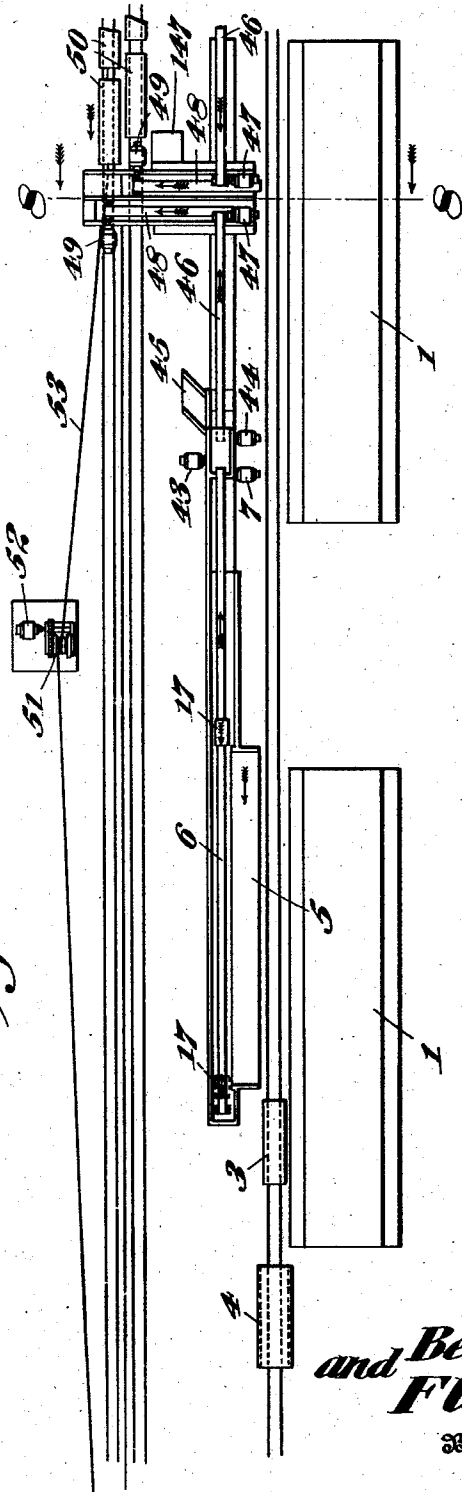


Fig. 8.

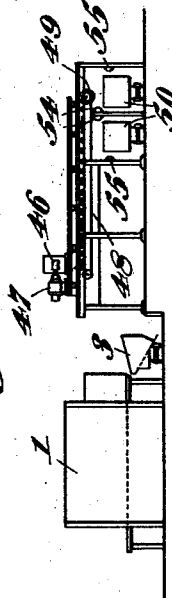
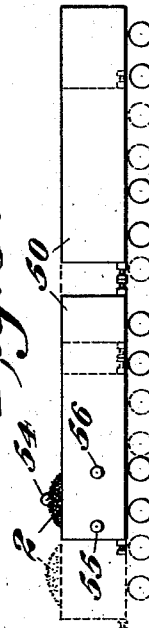


Fig. 9.



Inventors
Benjamin W. Winship
Floyd S. Eckhardt.
 By *R. S. O'Rourke*
 Attorney

July 7, 1942.

B. W. WINSHIP ET AL

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6 Sheets-Sheet 6

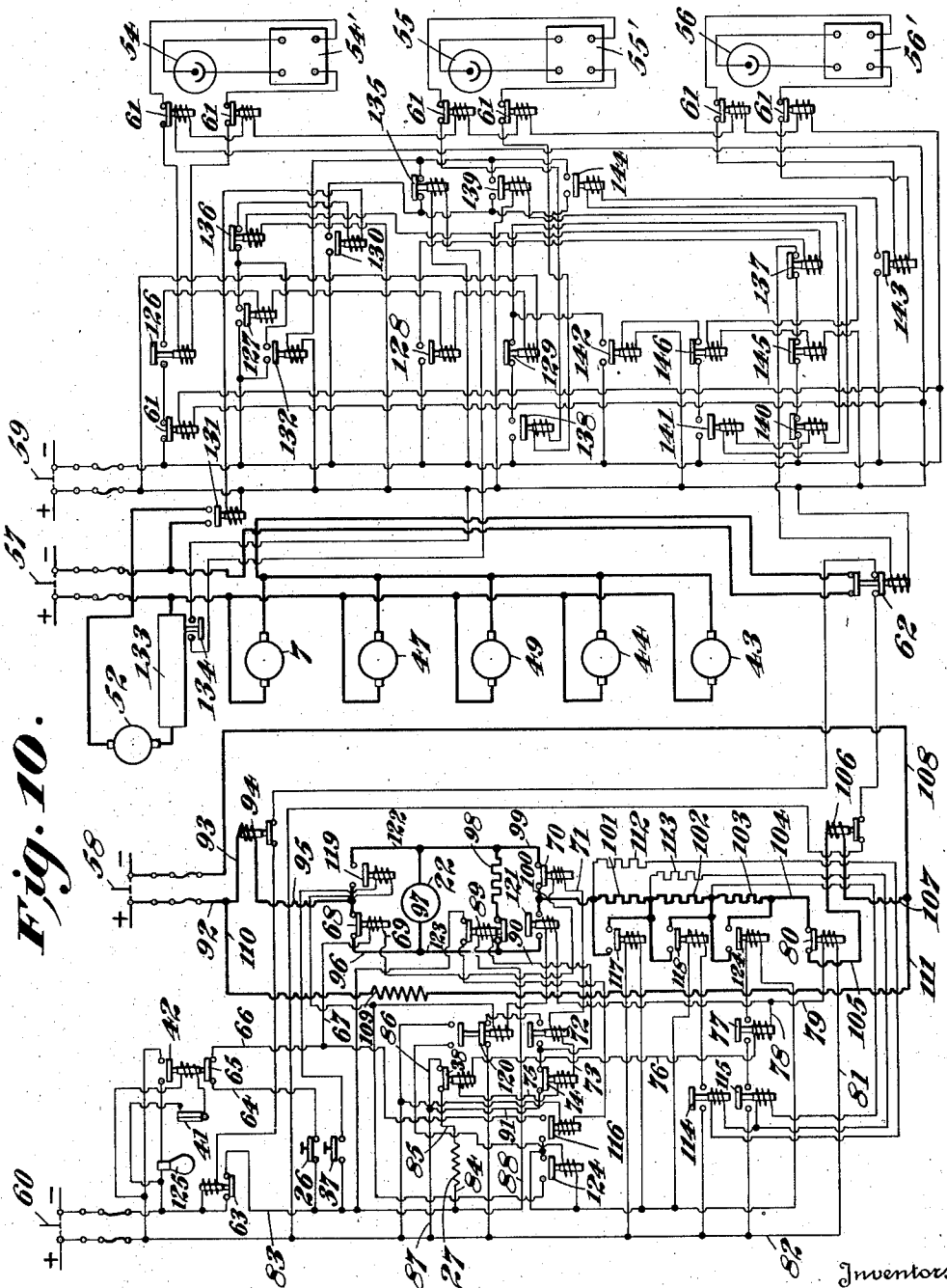


Fig. 10.

Inventors
Benjamin W. Winship
and Floyd S. Eckhardt.

By *R. S. a. Dougherty*
Attorney

UNITED STATES PATENT OFFICE

2,288,764

AUTOMATIC COKE WHARF

Benjamin W. Winship, Orchard Park, and Floyd S. Eckhardt, Hamburg, N. Y., assignors to Bethlehem Steel Company, a corporation of Pennsylvania

Original application July 2, 1940, Serial No. 343,624. Divided and this application March 18, 1941, Serial No. 383,910

24 Claims. (Cl. 214-18)

This invention relates to coke handling apparatus and more especially to means for automatically operating and controlling the gates for a coke wharf, and the conveying, crushing, screening and car loading devices associated therewith, and is a division of our copending application Serial No. 343,624, filed July 2, 1940.

In the manufacture of coke, the hot coke as soon as it is discharged from the coking chamber, such as a retort coke oven is received in a car usually of the inclined bottom side dump hopper type, and carried to a quenching station where a stream of water is sprayed onto the hot coke.

The coke having been quenched is then taken to the coke wharf and dumped from the quenching car onto the inclined top surface of the wharf where it is allowed to remain for several minutes in order that the heat in the coke may evaporate the moisture remaining in the coke from the quenching water.

The coke is retained upon the wharf by a series of gates at the lower edge, said gates being in usual practice from two to five feet wide, and so hinged and counterweighted that they can be hand operated by a series of levers extending to the vicinity of a walkway which extends parallel to the wharf at an elevation somewhat above the lower edge of the wharf.

The rate of flow of the coke from the wharf is regulated by the height to which the gate is lifted. The irregular size of the lumps of which the material is composed makes the regulation of the flow difficult, requiring the constant attention of the operator and frequently resulting in an excess load upon the conveyor belt which conveys the coke to the crushers and screens. Such overload not only causes spillage from the belt but frequently causes damage to the belts and in addition results in inefficient operation of the crushers, screens, etc., to which the coke is conveyed.

In the usual practice, the material falling at right angles to the direction of travel of the belt and because of the variation of conditions prevailing at the regulating gate must of necessity be restrained between the skirt boards which extend vertically down to close proximity to the belt. The hard and abrasive nature of the pieces of coke which are drawn between the edges of the skirt boards and the belt cause a rapid destruction of the belt at this point.

The coke dropping as it does at approximately right angles to the direction of travel of the belt also produces serious wear upon the belt,

One of the objects of our invention relates to the construction and arrangement of the gates of the wharf which comprise a plurality of small individual gates each hinged and counterweighted separately and spaced with such frequency that lifting one gate to its full height will not displace enough coke to overload the belt.

Another object of our invention relates to the means for lifting the gates in succession and holding them open long enough to allow the wharf to clear itself. This is accomplished by a reciprocating feeder car running on rails supported near the conveyor belt. This car is equipped with a lifter bar having a track or cam surface so devised that it lifts the gates in succession and holds them open while the car passes under them, when traveling in one direction and then allows them to close by gravity after its passage for the receipt of other coke dumped on the wharf.

The effect of the successive raising of the multiplicity of small gates is to simulate a receding edge of the wharf, past which the coke flows to the belt at a uniform rate. It is evident that the speed at which the feeder car is made to travel can be made to govern the rate at which the material is delivered to the belt, crushers, screens, etc. The feeder car and supporting structure are provided with means which will allow the lifter bar to be lowered away from contact with the gates when the length of the wharf has been travelled so that the feeder car will be returned to the opposite end of the wharf to again start the unloading of the wharf.

Another feature of our invention relates to the manner of forming the hopper of the feeder car with inclined fingers forming a grate to distribute the coke over the belt in its line of travel, the fines passing through the fingers and forming a cushion for larger lumps which will be distributed over the end of the inclined grate fingers.

Another object of the invention relates to the manner of connecting the reversing limit switches on the feeder car so the lifter bar will be raised at one end of its line of travel and lowered at the end of its reverse movement and at the same time reverse and otherwise control the driving motor so that the feeder car once started will continue its operation uninterruptedly.

A further object of our invention is to have a heat sensitive cell at the point where the

coke enters the hopper of the feeder car having an electrical connection with the control mechanism so that any or all of the following functions will be automatically performed if hot material which would injure the belt were to be fed from the wharf. First, stop the feeder car thereby stopping further progress into the hot area. Second, drop the lifter bar thereby stopping the flow of material in motion on the wharf by returning the gates to their closed position. Third, sound an alarm or light a warning lamp to call the operator to rectify the condition.

Another object of our invention relates to the means for automatically controlling the feed of the coke to the cars, and the movement of the cars at the coke loading station.

Another object of our invention is to control the entire operation automatically from one central station and to interlock electrically the whole equipment with the conveyor belt control so that feeding would stop automatically in case of stoppage of any part of the equipment further along in the operation. The primary control of the whole train of conveyor gates, crushers and screens are interlocked with the car moving device at the loading station and the whole series may be controlled either by a heat sensitive cell, switches actuated by the movement of the cars, or relays operated by a circuit through the coke as it is built up in the cars to the proper height.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended.

Referring now to the accompanying six sheets of drawings which form a part of this specification and on which like characters of reference indicate like parts.

Figure 1 is a top plan view of a coke wharf with parts broken away to more clearly show the construction;

Figure 2 is a vertical longitudinal section through a portion of the coke wharf taken on the line 2—2 of Figure 3, with parts broken away to illustrate the manner of operating the gates;

Figure 3 is a transverse section through the coke wharf taken on the line 3—3 of Figure 2;

Figure 4 is a longitudinal section through a portion of the feeder car taken on the line 4—4 of Figure 5;

Figure 5 is a transverse section through a central portion of the feeder car taken on the line 5—5 of Figure 4;

Figure 6 is a vertical longitudinal section of a portion of the coke wharf taken on the line 6—6 of Figure 3 showing the manner of opening and closing the gates;

Figure 7 illustrates diagrammatically the general arrangement of our automatic coke loading station;

Figure 8 is a transverse section taken through the coke loading station taken on the line 8—8 of Figure 7;

Figure 9 illustrates the position of the photo-electric cells in their relative position to the car at the beginning of the car loading operation; and

Figure 10 is a wiring diagram of the electric circuits and switches and etc., controlling the automatic coke wharf and associated equipment.

Referring now to the character of reference on the drawings, 1 indicates the batteries of re-tort coke ovens from which coke 2 is pushed into an inclined bottom side dump hopper car 3, after

which it is taken to the quenching station 4. As above described, the coke having been quenched is transported to the coke wharf and dumped from the quenching car onto the inclined top surface of the wharf 5 from the right hand end of the wharf as indicated in Figure 7 to the left hand end where it is allowed to remain for several minutes in order that the residual heat in the coke may evaporate the moisture remaining in the coke from the quenching water. It is also desirable that the coke be spread out in a relatively thin layer on the wharf as indicated in Figures 1 and 3 so that pieces of coke still too hot to be conveyed without injury to the conveyor belts may be cooled and such parts as show a tendency to ignite may be further quenched by a small jet of water.

At the lower end of the wharf is an endless conveyor belt 6 which is driven by a motor 7. This conveyor belt 6 is adapted to receive the coke as it is fed from the wharf 5. In our invention the coke is retained on the wharf by means of a plurality of small narrow individual gates 8 which are adapted to close the lower end of the inclined wharf 5 and serve to regulate the passage of the coke 2 from the wharf to the conveyor belt 6. Each of these gates 8 has an arm 9 pivoted at an intermediate point as at 10 to brackets 11 extending downwardly from the superstructure 12 for a walkway 13. The arm 9 for each gate is provided with a roller 14 which is attached to the underside of the arm 9 between the pivotal point 10 and the gate 8 for engaging the cam surface or track 15 of a lifter bar 16, mounted on a feeder car 17.

Guides 18 are also secured to the superstructure 12 and extend downwardly therefrom on each side of the arms 9 to prevent their lateral movement, and to facilitate the operation of the gates a counterweight 19 is mounted on the end of each arm 9 opposite to that of the gate 8.

The feeder car 17 which is provided with the lifter bar 16 for engaging the rollers 14 to raise the gates 8 is mounted above the belt conveyor 6, with its wheels 20 running on rails 21 at the sides thereof. This feeder car 17 is driven by a motor 22 which has its shaft 23 directly connected to one of the axles 24 of the feeder car by means of reduction gearing 25. The feeder car 17 is adapted to travel forward and backward on the rails or track 21 adjacent to the coke wharf 5 and the lifter bar 16 may be electrically connected to raise the gates while the feeder car is travelling in either direction but for illustration as indicated in Figure 7 of the drawings the lifter bar 16 is raised to open the gates while the feeder car is travelling from right to left, and so the gates will remain closed while the feeder car is travelling in the reverse direction.

At the beginning of the coke feeding operation the feeder car 17 will be in the position diagrammatically indicated in full lines in Figure 7 with the switches in the position indicated in Figure 10 with the reversing limit switch 26 closed and the coil 27 of the solenoid is energized to raise the T-shaped magnet 28 which has a cylindrical extension 29 of non-magnetic material such as bronze or the like attached to its upper end for engaging the central portion of the lifter bar 16 which may also be made of the same non-magnetic material and is guided in its vertical movement by means of downwardly extending leg extensions 30 slidably movable in slideways 31 in the feeder car frame 32.

The coil 27 of the solenoid is enclosed in an

iron or soft steel shell 33 which is flanged at its lower edge as at 34 and welded or otherwise secured to the car frame 32. A plate 35 and cup shaped member 36 made of non-magnetic material is secured to the lower flange 34 of the shell for the solenoid for retaining and guiding the magnet 28 in its vertical movement. The top surface or track 15 of the lifter bar 16 is provided with a horizontal portion with downwardly inclined ends for engaging the rollers 14 secured to the arms 9 for raising the gates 8.

The lifter bar 16, having been raised to the position indicated in Figures 3, 4 and 5, the feeder car 17 is then advanced by means of the motor 22 to the opposite end of the wharf as indicated in dotted lines in Figure 7, and in so doing the gates will be raised and lowered in succession as indicated in Figures 2, 3 and 6. The gates opening by means of the rollers 14 on the arms 9 riding up over the upwardly extending inclined forward top end surface of the lifter bar until they reach the horizontal top surface where the gates will be held open for a short time to allow the coke to be cleared from the wharf and then closed after the said rollers pass over the rear downwardly extending inclined top surface of the end portion of the lifter bar 16. When the feeder car 17 reaches the forward end of its line of travel it engages and closes the reversing limit switch 37 thereby opening the reversing limit switch 26 and opening switch 38 controlling the current to the coil 27 thereby allowing the lifter bar 16 to fall by gravity and the feeder car 17 to return to its starting position without operating the gates 8.

As the gates are raised during the forward movement of the feeder car the coke from the wharf is discharged into a hopper 39 formed in the feeder car frame 32. The forward end of the hopper is provided with downwardly extending tapered fingers 40 forming a grating adapted to receive the coke and feed it to the conveyer belt 6 in the line of travel of said conveyer belt. In this manner the fines passing through the spaces between the tapered fingers form a cushion for larger lumps of coke which will be distributed over the ends of the inclined fingers forming the grate.

When the coke is dumped on the wharf there are times when some portions of it may not have been properly quenched and too hot to be fed to the conveyer without injury thereto, and to prevent this an adjustable heat sensitive cell 41 is installed adjacent to the point where the coke enters the hopper 39. This heat sensitive cell 41 is adapted to control a relay switch 42 which will stop the forward movement of the feeder car at any point at which the temperature of the coke reaches the predetermined setting, thereby automatically allowing the lifter bar to be lowered, closing the gates and stopping the feed.

The coke having been fed from the coke wharf onto the belt conveyer 6 is then advanced to a crusher operated by a motor 43, then to a screen operated by a motor 44 where the fines are separated and conveyed from a trough 45 to any desired point by suitable conveying means (not shown), while the larger pieces of coke are received on another belt conveyer 46 driven by the motor 47 and then delivered to third belt conveyer 48, which is disposed at right angles to conveyer 46 and driven by a motor 49 which delivers the coke to cars 50 which are loaded and then transported to any desired point. As these

cars are of considerable length and the belt conveyer 48 is relatively narrow the cars have to be intermittently advanced along the track at the loading station as each portion of the car has been filled to the desired height, this is accomplished by means of a winch 51 which is operated by means of a motor 52. The winch being connected to the cars being loaded by means of a cable 53.

Heretofore it has been the usual practice to operate by hand the controlling switch or switches of the motor 52 for the winch every time the car was advanced during the loading operation for each car. With our device, however, the loading and movements of the car is controlled automatically by means of photo-electric cells 54, 55 and 56 having amplifiers 54', 55' and 56' therefor, respectively. The position of these photo-electric cells in relation to the car for the initial loading operation is shown in Figure 9. In this figure the coke fed to the car 50 has just been piled up high enough at the forward end of the car to interrupt the beam of light and operate relays to actuate motor 52 for the winch 51. After the car 50 has been advanced to the dotted line position the beam of light from the photo-electric cell 54 will be restored thereby operating relays to stop the winch. This operation will be automatically repeated until the car is full and the beam of the photo-electric cell 56 is beyond the end of the car which will actuate relays to automatically stop all feeding and conveyers and etc. and operate relays to again actuate the winch to move the car forward until both beams of the photo-electric cells 55 and 56 are in line with the side of the second car when relays will be actuated to stop the winch and start all feeders and conveyers to load the second car as above described. This car loading operation and the manner of automatically controlling the same will be described more fully hereinafter.

Having thus given a general detailed description of our invention, we will now describe the operation of the control circuits which automatically govern its operation.

Referring now to Figure 10 of the drawings, and to explain the operation of the coke wharf in relation to these control circuits, assume that an empty car is standing in the loading station in its initial position for loading, and that the conveyers, crushers, screens and feeder car are set up and ready to start. Initially the power supply knife switches 57 and 58 for the conveyers, crushers, screens, and the feeder car are closed. Then the knife switches 59 and 60 which energize the control circuits for conveyers, crushers, screens, and feeder car are closed.

When knife switch 59 is closed this actuates the relays 61 for energizing the circuits of the photo-electric cells 54, 55 and 56 and the relay 62 which energizes the circuits of the motors 7, 47 and 49 driving the three conveyers, the motor 43 for the crushers, the motor 44 for the screens and the circuits controlling the operation of the feeder car 17.

The feeder car 17 is started when relay 62 has energized relay 63 which is shown in the energized closed position and completes the control circuits for the feeder. Depending on whether the reversing limit switches 26 or 37 are closed the forward operating or the reverse operating circuits, respectively, for the feeder car motor 22 will be energized. Reversing limit switches 26 and 37 are placed on the feeder car

17 so that they are operated when the car reaches the ends of its line of travel and they are so constructed that when one is closed the other will always be open. When the feeder car reaches the starting end, the forward switch 26 will be closed and 37 will be open and when the end of the forward line of travel is reached, the switch 37 will be closed and the forward switch 26 opened. The open and closing of these switches automatically change the circuits of the driving motor 22 and reverses the movement of the feeder car.

In Figure 10 the switch 26 is shown in the closed position, so that the circuits are set up for the forward movement of the feeder car 17. The associated relay switches are shown in these positions just after the relay 63 has been closed. Now tracing the forward control circuit of the motor starting with switch 26, the current flows through conductor 64, bridging contacts of relay 65, conductors 66 and 67, the coil of the relay 68, conductor 69, the coil of relay 70, conductor 71, the coil of relay 72, conductor 73, coil of relay 74, conductor 75, coil of relay 38, conductor 76, coil of relay 77, conductors 78 and 79, coil of relay 80, and conductor 81 back to positive conductor 82. This closes switches 68, 70, 74, 38 and 80, and opens switches 72 and 77 all of which are shown in these positions, respectively. At the same time current flows from negative conductors 83 through conductor 84, coil 27 of the gate lifter bar, conductor 85, bridging contact of relay 38, and conductors 86 and 87 back to positive conductor 82. Also current flows from negative conductor 83 through conductor 88, the coil relay 89, conductor 90, bridging contacts of relay 74, conductors 91 and 87 to positive conductor 82. This closes relay 89 which is shown in the energized position.

With the actuation of these relays current flows through the feeder car motor 22 from positive power conductor 92, through conductor 93, overload relay coil 94, conductor 95, bridging contacts of relay 68 and conductor 96, where it divides, part of it flowing through armature 97 and part through resistor 98 by means of the lower bridging contacts of relay 89 to conductor 99 where the parts rejoin, then through bridging contacts of relay 70, conductor 100, series resistors 101, 102 and 103, conductor 104, bridging contacts of relay 80, conductor 105, overload relay coil 106, conductor 107, and back through negative conductor 108. Current will also flow through the shunt field 109 from conductor 92 through conductor 110, shunt field 109, conductor 111 to conductor 108. This will start the motor 22 up slowly and at the same time the gate lifter relay is actuated as stated above, lifting the gates 8 on the coke wharf as the feeder car moves forward. Current will also flow through resistors 112 and 113 which, respectively, shunt resistors 101 and 102. In series with resistors 112 is the coil of relay 114 and, with resistor 113 the coil of relay 115. The current through these coils will open relays 114 and 115 as shown.

The upper bridging contacts of relay 89 close a circuit through the coil of relay 116. Relay 116 is a time delay relay which will close a certain definite time after relay 89 has been closed. When relay 116 closes, the coil of relay 117 will be energized and the bridging contacts of relay 117 will shunt out the resistors 101 and 112. This will reduce the current flowing through the coil of relay 114 and allow relay 114 to close. This

will energize relay 118 which will shunt out resistors 102 and 113. The current through the coil of relay 115 will be reduced allowing relay 115 to fall. This will not cause any reaction because relay 77 is still open as described above which keeps this circuit open.

This shunting of the series resistors is timed by suitably controlling the operation of the various relays and allows the current through the motor 22 to increase, speeding it up to its maximum forward speed.

When the feeder car reaches the end of its forward line of travel, the reversing limit switch 37 will be automatically closed and the reversing limit switch 26 will be opened. This will stop the motor 22 and reverse it. The closing of the limit switch 37 will actuate relays 119, 120, 121 and 80. This will cause a current to flow through the armature 97 of the feeding car motor 22 in the opposite direction since current will now flow from conductor 95 through bridging contacts of relays 119, conductor 122, armature 97, conductor 123, bridging contacts of relay 121, to conductor 100 and thence, as heretofore described, this will start the car up at a relatively faster rate of speed than before because shunt 98 is not in the circuit which allows more current to flow through the armature 97.

The motor 22 will now be accelerated in a manner similar to the forward acceleration.

When relay 120 is actuated its upper contacts will energize the coil of relay 124. Relay 124 is identical to relay 116 and will accordingly be actuated after a designated time lapse, whereupon it will similarly energize relay 117. Thus the mechanism for shunting out resistors 101 and 112 and 102 and 113 will be again actuated. However, when relay 115 is allowed to close, relay 124 will be actuated since the bridging contacts of relay 77 will now be closed. Thus resistor 103 will be shunted and the motor will be accelerated to a much higher speed on the return run. The gate lifter bar 16 will be lowered on the return trip since its coil 27 will be deenergized. When the feeder car 17 has reached the end of its return run, reversing limit switch 37 will be opened and reversing limit switch 26 will be closed and the cycle will then be repeated.

In case the coke should be still too hot after it has been quenched and dumped on the wharf 5, it will be desirable to keep it on the wharf for a longer time or to further quench the coke. To ascertain this, a heat sensitive cell 41 is carried on the feeder car. When the feeder car reaches a place where the coke is too hot, the heat sensitive cell 41 will actuate relay 42 which will open the control circuits completed by the reversing limit switch 26 and stop the feeder car, allow the lifter bar 16 to be lowered and drop the gates. The upper bridging contacts of relay 42 will complete the circuit to sound an alarm or light a lamp as indicated at 125.

In the meantime the coke fed by the feeder car 17 to the conveyer 6 is carried to a crusher and screen and then to conveyers 46 and 48 to the loading station where awaits an empty car 50 to be filled. The empty car will be filled in each section until the coke pile rises to such a height that the light beam focused on the photo-electric cell 54 is interrupted and it will then deenergize the circuit of cell 54 which had been previously energized by the closing of relays 61. Relay 126 consequently will be deenergized which will then actuate relays 127, 128 and 129. The closing of relay 127 will in turn actuate relays 130 and 131,

and the closing of relay 131 will start the winch motor 52 and start the car 50 moving. The closing of relay 130 will close relay 132 sealing in relays 130 and 131.

The automatic starter for the winch motor 52 is shown at 133. As part of the starter a relay 134 is actuated in such a way that it will be closed when the winch motor 52 reaches full speed. The starter 133 can be any one of the numerous types that are well known in the art. The closing of relay 134 energizes the coil of the time delay relay 135. After the car 50 has been moved a predetermined distance depending on the setting of the time delay relay 135, relay 135 will open, deenergizing relay 132 and stopping the winch 51 by opening relay 131, the cell 54 having been reenergized in the meantime allows relays 127, and 128 to open and 129 to close.

Relay 128 energizes the coils of hand reset time delay relays 136 and 137 which will open if the car is not moved by the winch 51 after a certain length of time. Relay 129 is used in a manner that will now be described.

Beside photo-electric cells 54 there are also cells 55 and 56 placed as shown in Figure 9 with respect to the cars 50 to be loaded. When the back end of the first car passes cell 56, after the car has been started to move by the action of cell 54, cell 56 is energized by a suitably focused light from the other side of the car. This actuates relay 138 and when cell 54 is reenergized allowing relay 129 to fall and close, relays 139, 140 and 141 are actuated. Relay 140 opens the circuit of relay 62, thereby stopping the operation of the conveyers, crushers, screens, and the feeder car. Relay 141 actuates relay 142 which seals in relays 139, 140 and 141. Relay 139 shunts relay 135 so that when 135 opens at its regular time, the winch 51 is not shut down but will be kept operating so that the loaded car will be moved out of the way and an empty car replace it.

When the end of the loaded car passes cell 56 allowing it to be energized by a suitable focused light, relay 143 is actuated. This in turn actuates relays 144, 145 and 146. Relay 144 shunts both relays 135 and 139, so that when cell 55 is deenergized dropping out relay 139, the winch circuit is kept intact. Relay 145 keeps the conveyers, crushers, screens and the feeder car 17 shut down. Relay 146 breaks the interlocking circuit formed by relays 141 and 142 so that when cell 55 is deenergized, the circuits set up by it will be opened, thereby keeping the winch 51 operating until the end of the next empty car intercepts the beams of cells 55 and 56 and deenergizes their circuits, whereupon the winch is stopped and the conveyers, crushers, screens and feeder car are put back into operation so that the next empty car may be loaded.

In the above description we have described our invention as used in connection with one coke wharf but it can be adapted for use with a plurality of coke wharfs all controlled by one operator equally as well. In Figure 7 we have illustrated the manner in which two coke wharfs could be operated by an operator located in the operator's pulpit 147.

With the use of our device a great amount of labor is eliminated and it reduces the wear and tear on the conveyer belts. Prevents hot coke from reaching the conveyers. Provides a more uniform and efficient crushing, screening, and loading of coke due to the constant flow of material. Increases the possible hourly rate of handling the coke due to the constant rate of

feeding. Enables one operator to control the entire operation automatically from one central location, and a better distribution of the coke received from the wharf onto the belt by means of the inclined hopper carried by the feeder car is obtained.

As illustrated and described, we have included the steps of crushing and screening the coke as a part of the operation, but we wish it understood that one or both of these steps may be eliminated, if desired, without departing from the spirit of our invention.

Although we have shown and described our invention in considerable detail, we do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of our invention or as pointed out in the claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyer at the lower edge of the inclined wharf, a plurality of gates adapted to be independently actuated at the lower edge of said wharf, a feeder car mounted on a track adapted to travel above the conveyer, a motor for reciprocating the feeder car, a lifter bar mounted on the feeder car, means for automatically actuating the lifter bar to engage and open the gates during the forward line of travel for the feeder car, and means for disposing the lifter bar out of operating engagement with the gates during the return movement of the feeder car.

2. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyer at the front edge of the inclined wharf, a plurality of gates at the front edge of the wharf, a feeder car mounted on a track adapted to travel above the conveyer, a motor for reciprocating the feeder car, a lifter bar mounted on the feeder car, a solenoid adapted to be energized for raising the lifter bar to engage and open the gates to feed the coke to the conveyer during the travel of the feeder car in one direction and means for deenergizing the solenoid to lower the lifter bar out of operating engagement with the gates during the return movement of the feeder car.

3. A coke handling apparatus comprising an inclined coke wharf, a conveyer at the front edge of the wharf, a feeder car arranged to be moved over the conveyer and along the front edge of the coke wharf, a hopper on said feeder car having spaced fingers at one end, adapted to allow the fine coke to pass between said spaced fingers, a plurality of gates for controlling the passage of coke to the hopper, a motor on said feeder car for automatically reciprocating the same, and means mounted on said feeder car for automatically controlling the opening and closing of the gates.

4. A coke handling apparatus comprising an inclined coke wharf upon which coke is spread, a conveyer in front of said wharf, a feeder car travelling over the conveyer along said wharf having a hopper formed with spaced fingers at one end for receiving the coke from the wharf and adapted to allow the fine coke to pass between the spaced fingers and feed the large lumps of coke over the ends of the spaced fingers to the said conveyer, a plurality of simultaneously operated gates for controlling the passage of the coke to said hopper, and means on the feeder car

for automatically controlling the opening and closing of the gates.

5. A coke handling apparatus comprising an inclined coke wharf, a plurality of independently actuated gates arranged at the lower edge of the wharf for retaining the coke on the wharf, a conveyor adjacent to the gates, a feeder car mounted on a track adapted to travel over the conveyor, a hopper on the feeder car for receiving the coke from the wharf and feed it to the conveyor, a motor for reciprocating the feeder car over the conveyor, and means on the feeder car for automatically controlling simultaneously the opening and closing of a plurality of said gates during the travel of the feeder car in one direction.

6. A coke handling apparatus comprising an inclined coke wharf upon which coke is spread for discharge from the front edge, a conveyor adjacent to the front edge of said wharf, a plurality of gates each having an arm pivoted to the superstructure adjacent to the front edge of the wharf for retaining the coke on the wharf, a roller secured to the intermediate portion of the arm of each gate, a feeder car mounted to travel along said wharf over the conveyor, and a vertically movable lifter bar having a track for engaging the rollers on the gate arm for simultaneously controlling the opening and closing of a plurality of the gates for feeding the coke from the wharf to the conveyor.

7. A gate operating mechanism for an inclined coke wharf comprising a plurality of small individual gates each hinged and counterweighted separately at the front edge of the wharf, a feeder car arranged to be reciprocated at the front edge of the wharf, a motor for automatically reciprocating the feeder car, a lifter bar vertically movable on the feeder car, a solenoid for raising the lifter bar when the feeder car is travelling in one direction to automatically open and close the gates, and means for lowering the lifter bar automatically out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

8. A gate operating mechanism for an inclined coke wharf having a superstructure adjacent thereto, comprising a plurality of gates each having an arm pivoted to the superstructure adjacent to the front edge of the wharf, a roller secured to the intermediate portion of each arm, a counterweight on each arm to facilitate the operation of the gates, a feeder car mounted on a track at the front edge of the wharf, a motor for automatically reciprocating the feeder car, a lifter bar on the feeder car having a horizontal track surface with inclined ends for engaging the rollers on the gate arms, a solenoid on the feeder car for raising the lifter bar to automatically open and close the gates while the feeder car is travelling in one direction, and means for lowering the lifter bar out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

9. A gate operating mechanism for an inclined coke wharf having a superstructure adjacent thereto, comprising conveying means adapted to receive the coke from the front edge of the inclined wharf, a plurality of gates each having arms pivoted to the superstructure adjacent to the front edge of the wharf, a roller secured to the intermediate portion of each arm, a counterweight on each arm to facilitate the operation of the gates, a feeder car mounted on a track at the front edge of the wharf, a motor for automatically reciprocating the feeder car, a lifter

bar on the feeder car having a horizontal track surface with inclined ends for engaging the rollers on the arms, a solenoid on the feeder car for raising the lifter bar to automatically open and close the gates and to hold a plurality of gates open simultaneously to feed the coke from the wharf to the conveyor while the feeder car is travelling in one direction and means for lowering the lifter bar out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

10. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyor at the front edge of the wharf, a plurality of pivoted individual gates at the front edge of the inclined wharf, a reciprocating feeder car mounted on a track adapted to travel above the conveyor having means mounted thereon for automatically opening and closing the gates and to simultaneously feed the coke to the conveyor, means for electrically actuating the feeder car and conveyor simultaneously and a heat sensitive cell mounted on the feeder car and connected in the electric control circuits for the conveyor and feeder car adapted to automatically stop the conveyor and close the gates and signal an operator when the heat of the coke being fed to the conveyor reaches a predetermined temperature setting.

11. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyor at the front edge of the inclined wharf, a plurality of pivoted individual gates at the front edge of the inclined wharf, a feeder car mounted on a track adapted to travel above the conveyor, a motor for reciprocating the feeder car, a lifter bar mounted on the feeder car for automatically opening and closing the gates during the reciprocation of the feeder car, a hopper on the feeder car for receiving the coke from the wharf and discharge said coke on the conveyor in its line of travel, and limit switches for automatically reversing the feeder car at the end of its forward and backward line of travel.

12. A coke handling apparatus comprising a wharf adapted to receive coke spread thereon, a conveyor at the front edge of the wharf for receiving the coke from the wharf, gates at the front edge of the wharf for controlling the feed of the coke from the wharf to the conveyor, electrically operated means for automatically opening and closing the gates and actuating the conveyor, and electrically operated means automatically controlled by the heat of the coke for simultaneously closing the gates and stopping the conveyor.

13. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyor at the front edge of said wharf for receiving the coke from the wharf, gates at the front edge of the wharf for controlling the feed of the coke from the wharf to the conveyor, a feeder car adapted to reciprocate over the conveyor at the front edge of the wharf having means mounted thereon for automatically opening and closing a plurality of gates in sequence and for holding a plurality of the gates open simultaneously, means for automatically reversing the movement of the feeder car at each end of its line of travel, and electrically operated means controlled automatically by the heat of the coke for simultaneously closing the gates and stopping the conveyor.

14. A coke handling apparatus comprising an

inclined wharf, conveying means adapted to receive the coke from the front edge of the inclined wharf, gates for controlling the feed of the coke from the inclined wharf to the conveying means, electrically operated means for opening and closing a plurality of gates simultaneously, electrically operated means controlled by the heat of the coke for automatically closing the gates to stop the feed of coke from the wharf to the conveyor.

15. A coke handling apparatus comprising an inclined coke wharf, a conveyor at the front edge of the wharf, a plurality of gates at the front edge of the wharf, a feeder car arranged to reciprocate over the conveyor at the front edge of the coke wharf, a hopper on said feeder car for receiving the coke from the wharf and feed it to the conveyor, a motor for reciprocating the feeder cars, means for reversing the movement of the feeder car at each end of its line of travel, and means mounted on said feeder car for controlling the opening and closing of the gates.

16. A coke handling apparatus comprising an inclined coke wharf, a conveyor at the front edge of the wharf, a plurality of gates at the front edge of the wharf, a feeder car arranged to reciprocate over the conveyor and along the front edge of the coke wharf, a hopper on said feeder car for receiving the coke from the wharf and feeding it to the conveyor, a motor for reciprocating the feeder car, an electrical control circuit for the motor, limit switches in said electrical control circuit for reversing the movement of the feeder car at each end of its line of travel, and means mounted on said feeder car and controlled by the limit switches for actuating means to open and close the gates.

17. A coke handling apparatus comprising an inclined coke wharf, a conveyor at the front edge of the wharf, a feeder car arranged to reciprocate over the conveyor at the front edge of the coke wharf, a hopper on said feeder car for receiving the coke from the wharf and feed it to the conveyor, a motor for reciprocating the feeder car, an electrical control circuit for the motor, limit switches in said electrical control circuit for reversing the movement of the feeder car, and a solenoid in the electrical control circuit mounted on said feeder car and controlled by the limit switches for actuating means for opening and closing the gates.

18. A coke handling apparatus for an inclined coke wharf, a conveyor at the front edge of the wharf, a plurality of gates at the front edge of the wharf, a feeder car arranged to be reciprocated over the conveyor at the front edge of the wharf, a motor for reciprocating the feeder car, an electrical control circuit for the motor, a lifter bar vertically movable on the feeder car, a solenoid in the electrical control circuit adapted to be energized to raise the lifter bar when the feeder car is travelling in one direction to open and close the gates, and for deenergizing the solenoid for lowering the lifter bar out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

19. A coke handling apparatus for an inclined coke wharf, a conveyor at the front edge of the wharf, a plurality of gates at the front edge of the wharf, a feeder car arranged to be reciprocated over the conveyor at the front edge of the wharf, a motor for reciprocating the feeder car, an electrical control circuit for the motor, limit switches in the electrical control circuit for re-

versing the feeder car at each end of its line of travel, a lifter bar vertically movable on the feeder car, a solenoid in the electrical circuit controlled by the limit switches adapted to be energized to raise the lifter bar when the feeder car is travelling in one direction to open and close the gates, and for deenergizing the solenoid for lowering the lifter bar out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

20. A coke handling apparatus comprising an inclined coke wharf upon which coke is spread for discharge from its lower front edge, a conveyor at the lower front edge of said wharf, a plurality of gates adapted to be actuated independently of each other in succession at the lower front edge of the wharf for retaining the coke on the wharf, a feeder car adapted to reciprocate along the lower front edge of the wharf over the conveyor, a motor for reciprocating the feeder car, and means mounted on the feeder car for controlling the opening and closing of a plurality of the gates simultaneously in sequence for feeding the coke from the wharf to the conveyor during the travel of the feeder car in one direction.

21. A gate operating mechanism for a coke wharf comprising a plurality of gates adapted to be actuated independently of each other in succession at the edge of the wharf, a conveyor for receiving the coke from the wharf, a feeder car arranged to reciprocate along the edge of the wharf over the conveyor, a motor for reciprocating the feeder car, and means mounted on the feeder car to open and close the gates to feed the coke to the conveyor when the feeder car is travelling in one direction and to be out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

22. A gate operating mechanism for a coke wharf, comprising a plurality of gates adapted to be actuated independently of each other in succession at one edge of said wharf, a conveyor adapted to receive the coke from the wharf, a feeder car arranged to reciprocate along the edge of the wharf over the conveyor, a motor for reciprocating the feeder bar, a lifter bar mounted on the feeder car adapted to be raised to open and close the gates when the feeder car is travelling in one direction and to be lowered out of operating engagement with the gates when the feeder car is travelling in the reverse direction, and means for driving the feeder car at a greater speed when said feeder car is travelling in the reverse direction.

23. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyor at the front edge of the inclined wharf, a plurality of individual pivoted gates adapted to be independently actuated in succession at the front edge of the inclined wharf, a feeder car mounted on a track adapted to travel above the conveyor, a hopper on the feeder car for receiving the coke from the wharf and discharging said coke on the conveyor, a motor for reciprocating the feeder car, an electrical control circuit for the motor, limit switches in the electrical control circuit for reversing the movement of the feeder car at each end of its line of travel, and means on the feeder car controlled by the limit switches for opening and closing the gates.

24. A coke handling apparatus comprising an inclined wharf adapted to receive coke spread thereon, a conveyor at the front edge of the inclined wharf, a plurality of pivoted individual

gates adapted to be independently actuated in succession at the front edge of the inclined wharf, a reciprocating feeder car mounted on a track adapted to travel above the conveyer, a motor for reciprocating the feeder car, an electrical control circuit for the motor having limit switches therein for reversing the movement of the feeder car at each end of its line of travel, a lifter bar vertically movable on the feeder car,

a solenoid in the electrical control circuit for the motor actuated by the limit switches for raising the lifter bar when the feeder car is travelling in one direction to open and close the gates and for lowering the lifter bar automatically out of operating engagement with the gates when the feeder car is travelling in the reverse direction.

BENJAMIN W. WINSHIP.
FLOYD S. ECKHARDT.