Sept. 13, 1932. C. E. UNDERWOOD ET AL 1,876,799

GATE FOR COKE WHARVES

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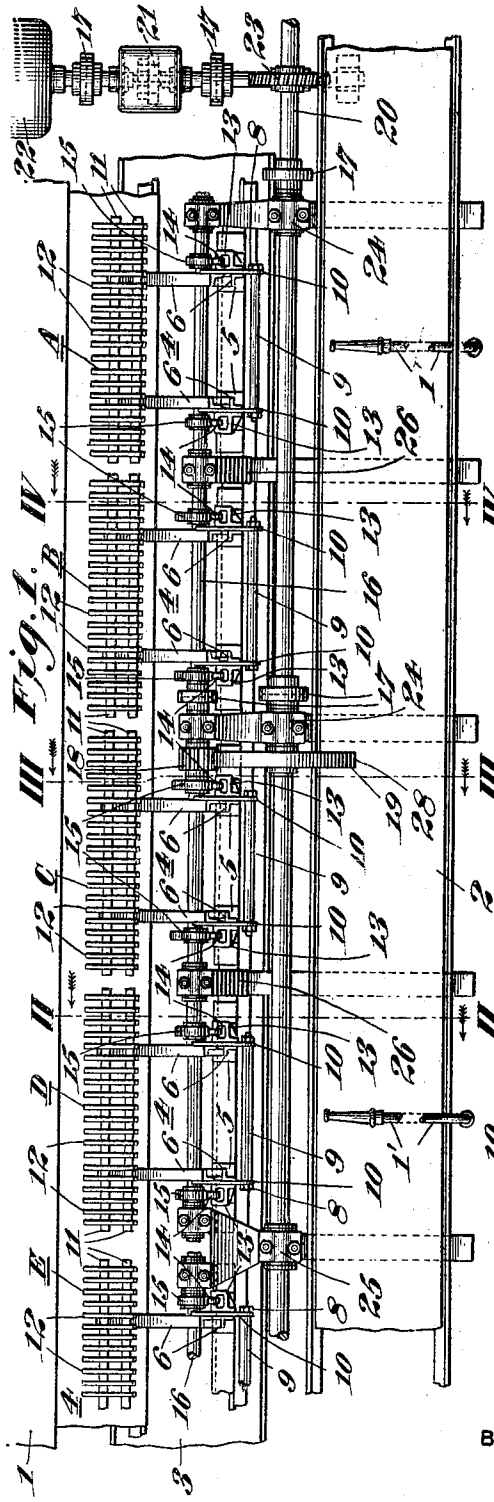


Fig. 1.

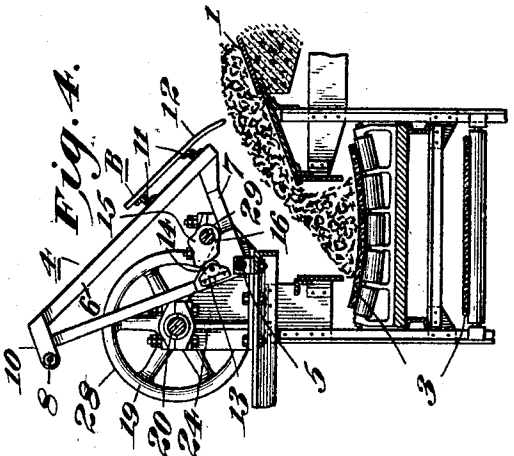


Fig. 4.

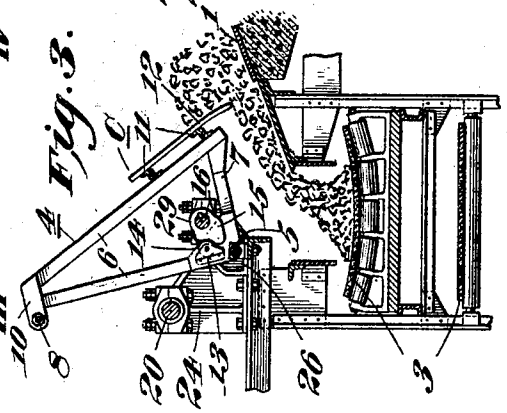


Fig. 3.

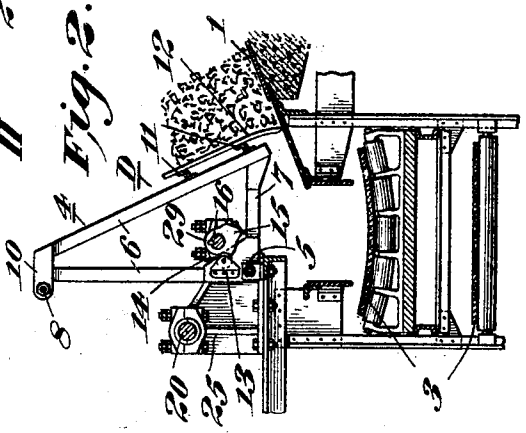


Fig. 2.

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Fig. 7.

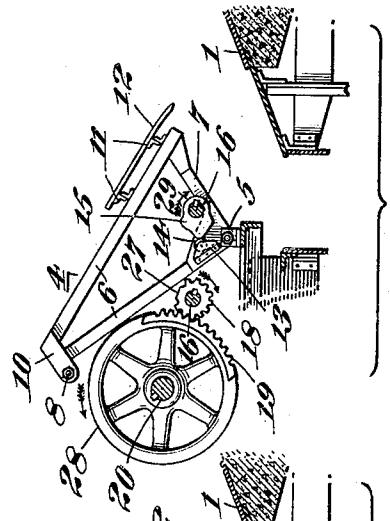


Fig. 6.

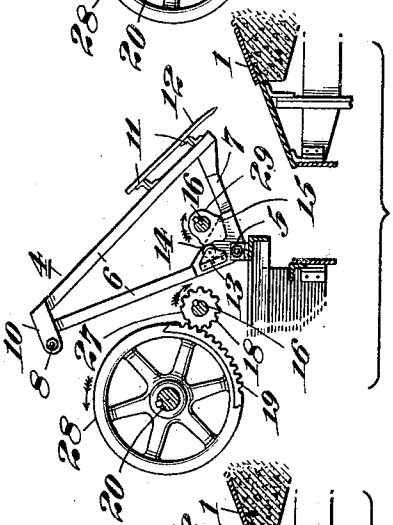


Fig. 5.

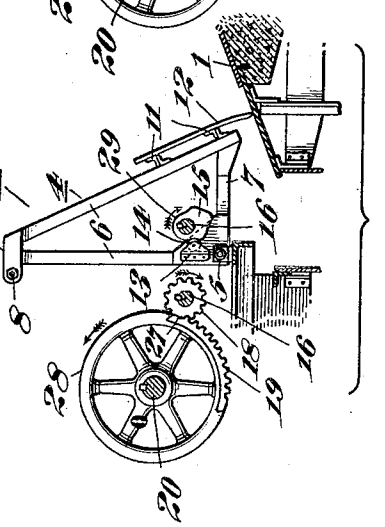


Fig. 12.

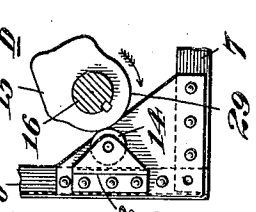


Fig. 11.

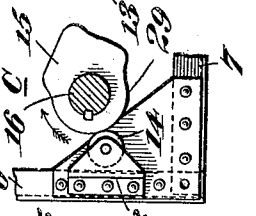


Fig. 10.

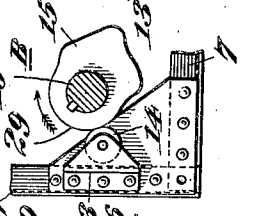


Fig. 9.

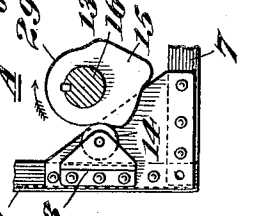
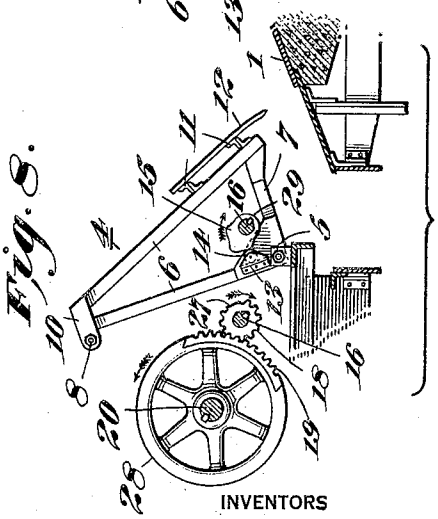


Fig. 8.



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# UNITED STATES PATENT OFFICE

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## GATE FOR COKE WHARVES

Application filed March 8, 1928. Serial No. 259,961.

This invention relates to coke handling apparatus and particularly to automatic coke wharf gates.

An object of our invention is to provide automatic means for feeding quenched coke from a coke wharf to a belt conveyer.

Another object of our invention is to provide automatic means for uniformly feeding coke from a coke wharf to a belt conveyer in such a manner that the conveyer will not be overloaded or choked by an oversupply.

A further object of our invention is to reduce the manual labor required to operate the gates and to eliminate as far as possible the necessity of manual attention to work that is hot, dirty and disagreeable.

Heretofore it has been customary to operate these gates by hand and in order to regulate the discharge of coke from the wharf to the conveyer the operators had to stand in front of the gates and hold them open until that section of the wharf is cleared.

Usually the hot coke is pushed from the ovens into a quenching car, having an inclined bottom, and hinged doors adapted to be swung outwardly to enable the coke to slide out of the car onto an inclined wharf. The coke is partially quenched in the car by streams of water directed upon the top surface of the mass, after which it is taken to the wharf and distributed thereon for further quenching of any part of the mass which had not been sufficiently cooled while in the quenching car. Further cooling takes place on the wharf by exposure to the air and the evaporation of moisture in the coke. This creates much hot vapor which at times envelopes the attendants, making it a hot and very disagreeable job.

It is therefore the primary object of our invention to operate these gates by power, making their action automatic and to reduce to a minimum the necessity for manual attention and at the same time provide for a uniform distribution of the coke on the conveyor.

The novel features will be more fully understood from the following description taken with the drawings.

Fig. 1 is a plan view of one section of gates and power means for operating same;

Fig. 2 is a sectional view taken on the line II—II of Fig. 1, showing a gate in closed position about to open;

Fig. 3 is a sectional view taken on the line III—III of Fig. 1, showing a gate in a half opened position;

Fig. 4 is a sectional view taken on the line IV—IV of Fig. 1. showing a gate in a closing position;

Figs. 5, 6, 7 and 8 are diagrammatic views of the relative positions of the driving gears and cams, and the corresponding positions of the gates; and

Figs. 9, 10, 11 and 12 show the cams relatively mounted in different angular positions on the cam shaft, corresponding to their respective gates.

The inclined coke wharf 1 is of the conventional type onto which the coke is dumped from a quenching car (car not shown). On this wharf the coke is further quenched by water directed from a hose 1′ connected with any suitable water supply, which is controlled by the operator stationed on a platform 2 extending along the lower end of the wharf. At the lower end of the wharf 1 is an endless conveyor 3 which is driven in a manner well known to the art and is adapted to carry away the cooled coke for the usual subsequent handling. Before and during the quenching operation, the coke is prevented from falling onto the upper belt of the conveyer by means of pivoted gates 4 which are adapted to close the lower end of the inclined wharf 1 and thus serve to regulate the passage of the coke from the wharf to the conveyor.

Referring to Fig. 1 it will be noted that the gates are arranged in series along the lower end of the wharf and are pivoted at their lower ends in brackets 5 which are secured to the platform 2 as shown in Figs. 2, 3 and 4. Each gate consists of a metallic frame of structural shapes having two side frames 6 of an inverted V-shape which are connected at their lower ends by struts 7. The top ends of the two side frames are tied together by means of a headed rod and nut 8 passing through a pipe separator 9, located between the inside faces of the extending gusset pieces 10. This tie also serves as a handle.

At the lower ends of the frames 6, on the wharf side of the gates, are two cross members 11 securing the ends of the side frames which also serve as means for securing a series of spaced bars 12 adapted to form a barrier for the coke. To each side frame is attached a bracket 13 in which is mounted a roller 14 adapted to coact with a cam 15. The cams are shaped so that when rotated they impart an irregular and retarded oscillatory motion to the gates by reason of their contact with the rollers attached to the gate frames 6. The cams are mounted on a cam shaft 16 extending lengthwise of the wharf. Flexible couplings 17 are provided to allow for irregularity of shaft alignment. The cam shaft is actuated by means of a pinion 18 driven by gear 19 which is mounted on a shaft 20. Suitable brackets 24 and 25 with bearings for the driving and cam shafts are provided at regular intervals along the length of the shafts and additional cam shaft brackets 26 are provided intermediate the double bearing brackets.

Inasmuch as a very slow motion of the gates is required to successfully control the discharge of the coke from the wharf, a speed reducing gear 21 is introduced between the electric motor 22 and the worm drive 23 at the end of the driving shaft 20.

It will be noted from Fig. 1 that the cam shaft 16 is not continuous throughout the length of the wharf and serves to operate but four gates which may be considered as one complete unit. The cam shaft in this particular unit starts at the right hand bracket 24 and terminates at bracket 25. The cam shaft for the next unit starts at bracket 25 and ends at a similar bracket (not shown) farther to the left, and a gear and pinion similar to 19 and 18 is provided for this unit. In this manner as many units can be installed as may be required to cover the entire length of the wharf. The driving shaft 20 is common to all the units and is provided with flexible couplings 17 at intervals throughout its length.

One of the features of this invention is to provide for the opening of the gates in timed relation, in the manner hereinafter described, so that the feeding of the coke from the wharf to the conveyer will start at one end of the wharf and progress uniformly toward the other end.

Each gate is provided with a handle 9 in order that they may be operated by hand, should the occasion demand. This in no way interferes with the power operating means or the automatic features.

In order to clearly illustrate the angular relation of the gear 19, the pinion 18 and the cam 15, with respect to one another, we have conventionally shown, in Figs. 5 to 8 inclusive, the portion of the shaft 16 which carries the pinion 18 in offset relation to that portion of the shaft 16 which carries the cam 15. However, it is manifest that in the actual construction of our apparatus that the several shafts 16 are continuous and straight throughout their length and the cam and pinion mounted thereon are coaxial, as shown in Figs. 1 and 4.

Attention is directed to Fig. 5, which illustrates graphically a gate in closed position on the wharf, with the cam positioned against the roller on the gate frame. As the cam is revolved by the shaft 16 in the direction of the arrow, the gate starts to open. Corresponding to the position of the cam is the relative position of tooth engagement of the gear 19 and pinion 18. Both the gear and the pinion have blank zones in which there are no teeth. The blank zone 27 on the pinion matches the radius of the pitch diameter 28 of the gear. Both the gear and pinion have the same number of teeth, and are sufficient to produce one complete revolution of the pinion.

Fig. 6 illustrates the gate in its half-open position with relative position of the cam and gears.

Fig. 7 shows the gate fully open and relative position of the cam and gears, and due to the fact that the center of gravity of the gate is beyond its pivot point 5, in the direction of bars 12, the natural tendency is for the gate to resist being opened, therefore, it will close of its own weight after the highest point on the cam passes the roller 14.

Fig. 8 shows the gate when closing and relative position of the cam and gears.

Continued action of the gears revolve the cam until the roller 14 is brought into contact with the dead portion 29 of the cam, wherein there is no motion imparted to the gate. This brings the gate to its closed position while the gears and the cam continue their cycle which brings the cam back to its initial position as shown in Fig. 5. The cam 15 and pinion 18 have now made one revolution but as the last tooth on the gear 19 disengages the pinion, the pinion remains stationary while the gear 19 completes its cycle and again assumes its initial position as shown in Fig. 5. The period of time from when the gate starts to open until it is closed is sufficient to clear that section of the wharf.

As heretofore mentioned, the gates open in sequence, and for convenience the foregoing description of Figs. 5, 6, 7 and 8 may be considered to apply to gate A although all the gates are similar in construction and operation.

Fig. 9 shows the position of the cams 15, for gate A, corresponding to the relative position of the gate and the gears shown in Fig. 5, at the start of the opening of the gate. The position of the cams for gate B is shown in Fig. 10 which allows a delayed opening of B relative to A.

Fig. 11 shows the position of the cams for gate C which are in a delayed position relative to gate B.

Fig. 12 shows the position of the cams for gate D relative to gate C. Due to the different angular positioning of the cams, it will be ovious that each succeeding gate will start to open at a delayed period relative to the preceding gate.

Continuing with the second unit of which E is the first gate, the cams are located on the cam shaft in the same positions as shown in Figs. 9, 10, 11 and 12. With the pinion 18 positioned as shown in Fig. 5 the gear 19 is set about 45° in a backward direction relative to the arrow, from the position of the same gear for the first unit. This provides a lapse, during which time, the cam shaft for the second unit is inoperative until gate D of the first unit is in its half-opened position. Thus the gates of the second unit will follow the movement of those of the first unit in consecutive order. Other units may be added by locating the driving gear 19 angularly backward on the driving shaft relative to the driving gears of the preceding units.

With all the gates closed, the coke may either be pushed directly from the ovens and quenched on the wharf, or it may be dumped on the wharf from a car on which it had previously been quenched. When sufficiently cooled to be transferred to the conveyer, the attendant starts the motor 22 by means of suitable control apparatus. The speed of the motor is reduced by means of a commercial reduction gear 21 driving a worm gear 23. Suitable flexible couplings 17 are introduced between the motor and the reduction gear and between the reduction gear and the worm drive. A shaft with a flexible coupling connects the worm drive with main drive shaft 20. Keyed to the drive shaft are the driving gears 19 which actuate the cam shaft 16 through pinions 18. As the cams 15 are revolved in the direction indicated by the arrows, they contact with rollers 14 which are carried in brackets 13 attached to the frames 6 of the gates. This causes a rocking of the gates about their pivots 5 which lifts the bars 12 from the wharf and allows the passage of the coke from the wharf to the conveyer which is actuated by suitable power means, not shown. The gate A will be the first to open, followed by the others in succession. This provides for the cleaning of the wharf and the loading of the conveyer, starting at one end and progressing towards the other, eliminating the possibility of a rush or oversupply of coke to the conveyer at any point as may happen in hand operated gates. The conveyer carries the material to the screens or handling plant.

Although the apparatus as described is particularly adapted for the handling of coke, it may readily be adapted to handle other materials, such as coal, stone, gravel, or the like, by slightly modifying the barrier features of the gates, and while we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art, or as, are specifically set forth in the appended claims.

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

1. A gate operating mechanism for coke wharves including in combination, a plurality of gates to be opened and closed in timed relation, a motor, one or more cams for each gate, a cam shaft, a driving shaft operatively connected to said cam shaft and said motor, and means adapted to be operated by said cams for opening and closing the gates in timed relation.

2. A gate operating mechanism for coke wharves including in combination, a plurality of gates to be automatically opened and closed in timed relation, a motor, and means operatively connecting said motor and said gates including cams driven by a shaft, the angular relationship of the cams to each other determining the order of movement of the gates.

3. A gate operating mechanism for coke wharves including in combination, a plurality of gates to be automatically opened and closed in timed relation, a motor, and means operatively connecting said motor and said gates including a driving gear having interrupted teeth, a lay shaft, a pinion having interrupted teeth mounted on said shaft and driven by said gear, cams mounted on said shaft, the angular relationship of the cams to each other and to the position of the teeth of said gear and pinion to determine the order of movement of the gates.

4. A gate operating mechanism for coke wharves including in combination, a plurality of gates to be automatically operated in timed relation, a motor, and means operatively connecting said gates and said motor including a driving gear, and a pinion driven by said gear, said gear and said pinion having blank portions on their faces to cause a lapse of movement of the pinion relative to the gear to determine the order of movement of the gates.

5. In a material handling apparatus, the combination with a wharf, of a plurality of oscillatory gates, a shaft carrying a series of cams mounted at relatively different angles and operably engaging said gates, means to rotate said shaft, whereby all of said gates may be oscillated at different periods to cause

a continuous flow of material from the wharf.

6. In a material handling apparatus, in combination, a wharf, a power shaft, a plurality of gates, a lay shaft, multilated gearings intermediate said shafts, cams mounted on said lay shaft operably engaging said gates, and means to operate said power shaft.

7. In a material handling apparatus, in combination, a wharf, a plurality of gates having rollers attached thereto, a shaft, cams mounted at relatively different angles on said shaft operably engaging said rollers, and means to operate said shaft, whereby said gates may be opened or closed in step-like formation and at relatively different periods.

8. In a material handling apparatus, in combination, an inclined wharf, a plurality of gates arranged along the lower edge of the wharf, a conveyor below said wharf, a motor operable independently of said conveyor, mechanism driven by the motor and permanently connected thereto for progressively opening and closing said gates in step-like formation, whereby the material on the wharf may be continuously and uniformly discharged therefrom to the conveyor in a progressive manner throughout the length of the wharf.

9. In a material handling apparatus, in combination, an inclined wharf, a plurality of gates arranged along the lower edge of the wharf, a motor, mechanism driven by the motor for progressively opening and closing said gates in step-like formation, said mechanism comprising a shaft, cams mounted on said shaft at relatively different angles and operably engaging said gates, whereby a series of adjacent gates may be in open position at the same time but to different degrees of opening.

10. In a material handling apparatus, in combination, an inclined wharf, a plurality of gates arranged in series along the lower edge of the wharf, a motor, mechanism driven by the motor for progressively opening and closing said gates in step-like formation, said mechanism comprising a power shaft, a lay shaft, multilated gearing intermediate said shafts, cams mounted at different angles on said lay shaft and operably engaging said gates, whereby a series of adjacent gates will be in the act of closing while another similar series of gates are being opened.

11. A material handling wharf having an inclined bed and a series of gates arranged along the lower edge thereof, and a manually controlled unitary power driven mechanism adapted to automatically open the gates sequentially to cause a progressive discharge of the material from the wharf.

12. A gate-operating mechanism for inclined wharves comprising a plurality of gates, a conveyor and means for operating said gates in a predetermined sequence with a predetermined time interval therebetween independently of the speed of said conveyor, said means comprising a motor and mechanism driven thereby and operatively connected to each of said gates.

13. A gate-operating mechanism for inclined wharves comprising a plurality of gates, a conveyor for receiving material from said wharves, and means for operating said gates in a predetermined sequence with a predetermined time interval therebetween independently of the speed of said conveyor, said means comprising a motor, rotatable members permanently connected to said motor and actuating means driven by said rotatable members for opening said gates in said sequence.

14. A gate-operating mechanism for inclined wharves comprising a plurality of gates, a conveyor for receiving material from said wharves, and means for operating said gates in a predetermined sequence with a predetermined time interval therebetween independently of said conveyor, said means comprising a manually-controlled motor, means for operatively connecting said motor to said gates for opening of said gates successively upon rotation of said motor.

15. Gate-operating mechanism comprising a plurality of gates, a conveyor for receiving material passing through said gates and means for opening and closing said gates in a predetermined sequence and with a predetermined time interval therebetween independently of said conveyor, said means comprising a manually-controlled motor and means permanently connected to said motor for actuating said gates and releasing them at different points in the rotation of said motor.

16. A gate-operating mechanism for coke wharves including in combination, a plurality of gates to be opened in sequence, a motor, actuating means corresponding to each gate, the respective actuating means being mounted on rotatable members operatively connected to the motor and angularly spaced from each other and means adapted to be successively operated by said actuating means for opening the gates sequentially.

17. A gate-operating mechanism for coke wharves including in combination, one or more series of gates to be automatically opened and closed in timed relation, a motor, and means operatively connecting said motor and said gates including driving gears having interrupted teeth and rotatable about a common axis, the angular relation of the interrupted teeth of the different gears to each other determining the order of movement of the gates of each series.

18. A gate-operating mechanism for inclined wharves comprising a plurality of gates and means for operating said gates in a predetermined sequence, said means comprising a motor, and mechanism driven by

said motor and intermittently connected to the respective gates successively upon rotation of said motor.

19. A gate-operating mechanism for inclined wharves comprising a plurality of gates and means for operating said gates in a predetermined sequence, said means comprising a motor and mechanism driven by said motor and intermittently connected to the respective gates successively when the latter are in closed positions whereby certain of the gates may be manually opened during the operation of said mechanism.

20. In a material-handling apparatus, the combination with a wharf, of a plurality of gates, a conveyor beyond said gates adapted to receive the material discharged from said wharf, and means comprising a manually controlled motor operatively connected to said gates for automatically and successively opening and closing said gates in a predetermined timed relation.

21. In a material-handling apparatus, the combination of an inclined wharf, a conveyor positioned below said wharf to receive the material discharged therefrom, a series of gates arranged along the lower edge of the wharf to be automatically opened and closed in timed relation to each other, a motor operable independently of said conveyor, and mechanism driven by the motor for initiating the operation of the gates singly and in sequence.

22. In a material-handling apparatus, the combination of an inclined wharf, a conveyor positioned below said wharf to receive the material discharged therefrom, a series of normally closed gates arranged along the lower edge of the wharf to be automatically opened and closed in timed relation to each other, a motor operable independently of said conveyor, and mechanism driven by the motor for initiating the opening of the gates singly and successively.

23. In a material-handling apparatus, the combination of an inclined wharf, a plurality of gates arranged along the lower edge of the wharf, actuating mechanism for automatically opening and closing said gates to cause a progressive and continuous discharge of the material on the wharf throughout its length, manually-controlled motive means for operating said mechanism, and a movable conveyor for receiving the material as discharged from the wharf.

In testimony whereof we hereunto affix our signatures.

CHARLES E. UNDERWOOD.
CHARLES E. LEHR.