T. S. WATSON.

CONTROLLER FOR HOISTING APPARATUS.

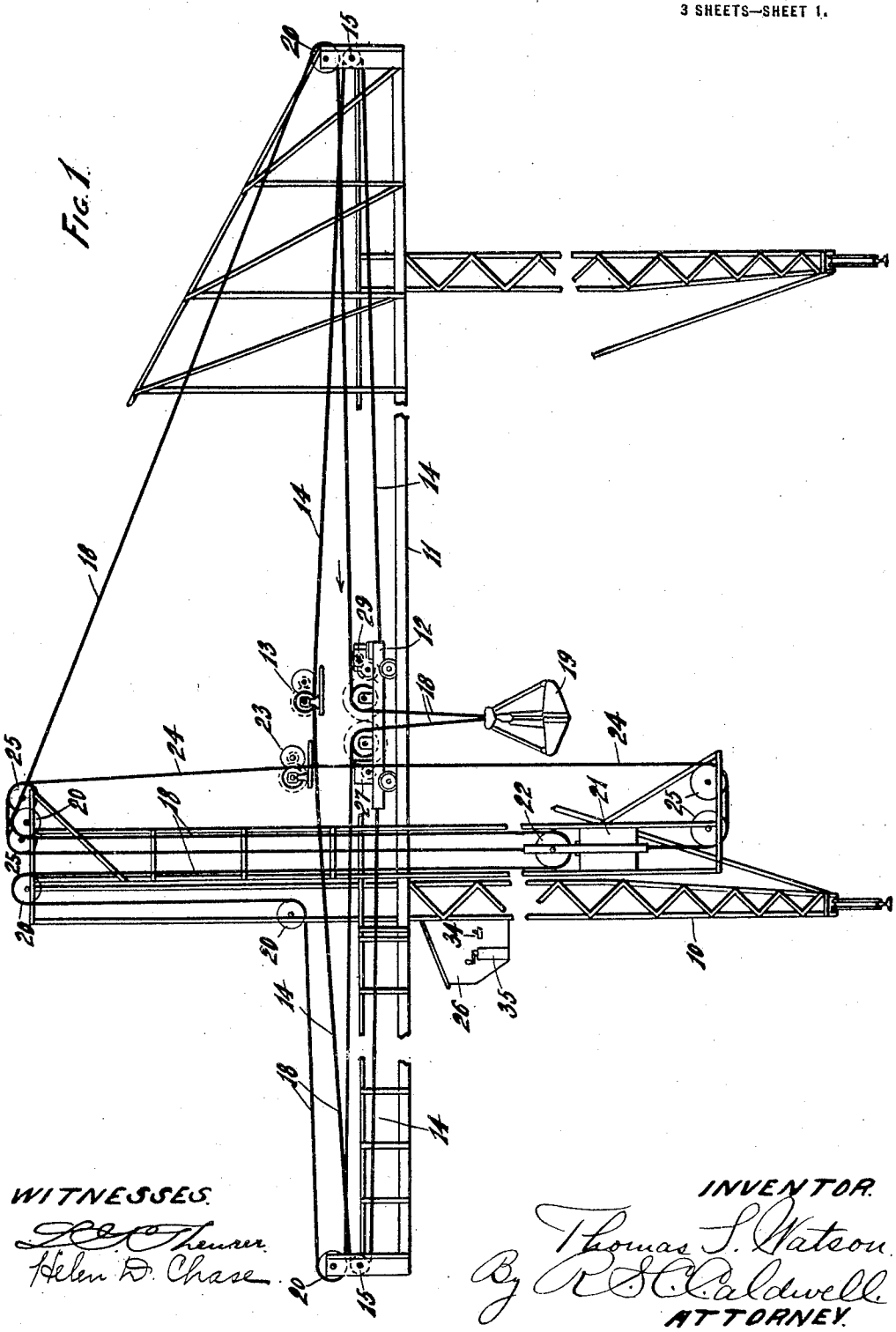
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1,358,128.

Patented Nov. 9, 1920.

3 SHEETS—SHEET 1.

FIG. 1.



WITNESSES.

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3 SHEETS—SHEET 2.

FIG. 2.

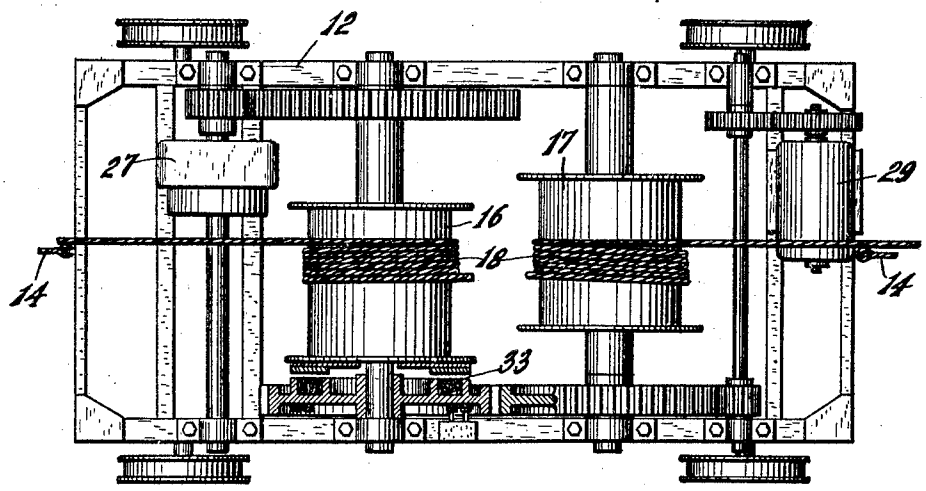
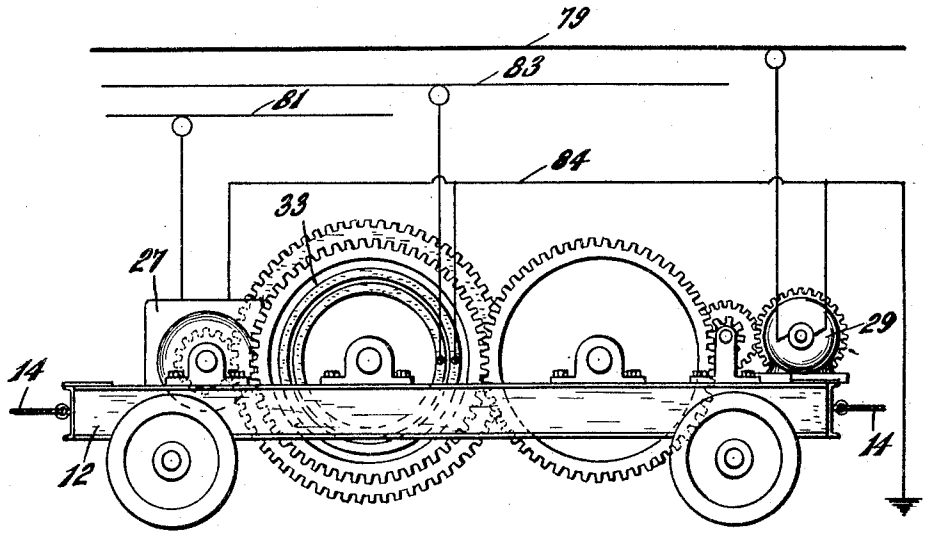


FIG. 3.



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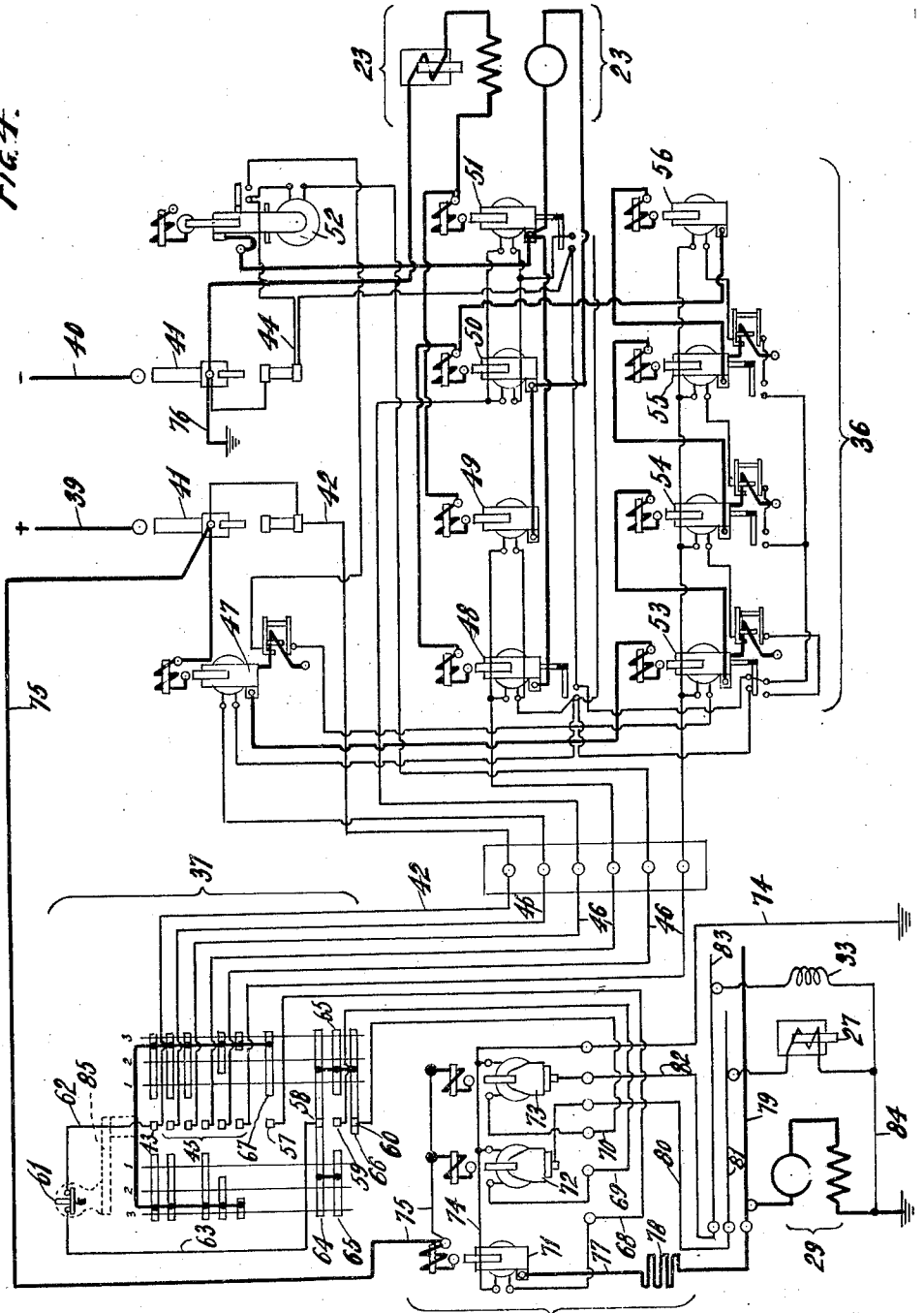
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3 SHEETS—SHEET 3.

FIG. 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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CONTROLLER FOR HOISTING APPARATUS.

1,358,128. Specification of Letters Patent. Patented Nov. 9, 1920.

Application filed March 24, 1917. Serial No. 157,220.

To all whom it may concern:

Be it known that I, THOMAS S. WATSON, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Controllers for Hoisting Apparatus, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

This invention has for its object to provide a single controlling means for effecting the raising and lowering of a clam shell bucket, and the opening and closing thereof.

Heretofore separate agencies have been employed for controlling the various motors, brakes, etc., required in the operation of clam shell buckets, and the attendant was required to operate them individually or jointly or successively as the occasion required, and a failure to properly operate the controlling means involved the danger of the bucket closing while being dropped, thus causing delay in the operation, or of the bucket opening and dropping its contents where they might cause damage or injury.

The present invention combines in a single drum controller the regulation of the hoisting motor for raising and lowering the bucket, the control of a clutch for establishing a connection between the hoisting drum and the closing drum, the control of an electric brake for holding the holding drum against rotation, and the control of a slack motor for accelerating the turning of the closing drum to take up the slack in the closing line while the bucket is being opened or lowered. The control of the slack motor, the clutch and the brake is such that their functions are automatically performed in the different positions of the controller for the various speeds of the hoisting motor in raising and lowering the bucket. A push button is provided on the handle of the controller for effecting the opening or closing of the clam-shell bucket in one position or another of the controller handle, such push button affecting the supply of current to the magnetic clutch and brake for this purpose.

With the above and other objects in view the invention consists in the controller for hoisting apparatus as herein claimed and all equivalents.

Referring to the accompanying drawings, in which like characters represent the same parts in different views:

Figure 1 is a side elevation of a coal handling bridge such as is covered by my Patent No. 1,220,804, dated March 27, 1917, and equipped with the controller of this invention.

Fig. 2 is a plan view of the carriage thereof with parts sectioned.

Fig. 3 is a diagram showing the various electrically controlled parts on the traveling carriage and their trolley connections with the controller; and,

Fig. 4 is a diagram showing the electrical connections of the controller for the hoisting motor and including the features constituting the present invention.

In these drawings 10 indicates a bridge structure of usual construction, and 11 the track thereof on which the bucket supporting truck or carriage 12 travels. The carriage is propelled by a racking motor 13 suitably positioned on the bridge structure and having a cable 14 wound around its drum with its two ends passing respectively around idle pulleys 15 at the opposite ends of the bridge and connected with the ends of the carriage.

Mounted on the carriage 12 is a hoisting drum 16 and a closing drum 17 around which are wound the respective ends of a cable 18, the cable end depending from the hoisting drum 16 serving to suspend a clam-shell bucket 19, while the cable end depending from the closing drum 17 connects with the opening and closing mechanism of such clam-shell bucket. The cable 18 after passing around the drums 16 and 17 extends in opposite directions in the line of travel of the carriage and around idle pulleys 20 to a vertical guideway in which a counterweight 21 travels, there being a pulley 22 on the counterweight receiving a loop of said cable 18 so that the clam-shell bucket is counterbalanced by the counterweight. For raising and lowering the clam-shell bucket provision is made for lowering and raising the counterweight, and as shown it consists of a hoisting motor 23 with a cable 24 wound around its drum passing around idle pulleys 25 at the top and bottom of the vertical guideway with its ends connected to the counterweight.

A cab 26 is suitably located on the bridge

for the operator who controls the various motors by means of a switch 34 controlling the racking motor 13 to cause the carriage to travel back and forth and a full reverse drum controller 35 for controlling the operation of the hoisting motor 23 to cause the clam-shell bucket to be raised and lowered. Other electrical devices on the traveling carriage are also operated by this controller, communication being had therewith by means of suitable trolley connections shown in the diagram. Thus an electrical brake 27 has a gearing connection 28 with the hoisting drum 16 and a small accelerating motor 29 has a gearing connection 30 with a large gear wheel 31 on the shaft of the closing drum 17, while another large gear wheel 32 loosely mounted on the shaft of the holding drum 16 and meshing with the gear wheel 31 carries an electrical clutch 33 for coupling the holding drum 16 to said gear wheel 32, thus directly gearing together the drums 16 and 17 by means of said gears 32 and 31.

In operation the clam-shell bucket may be raised or lowered by the movements of the counterweight as previously explained, and as long as the holding drum remains geared to the closing drum both ends of the cable will move together so that the bucket remains opened or closed as the case may be. Furthermore, the electrical brake 27 will be effective for holding the bucket in any position whether opened or closed, the gearing connection between the drums serving to make the brake effective for the closing drum as well as for the holding drum. The gearing connection between the drums may be rendered ineffective for this purpose, however, by releasing the magnetic clutch so that the magnetic brake is effective for the holding drum only, to give slack to the closing end of the cable and permit the bucket to open when the magnetic brake is applied while the motor is running as if to lower the bucket or to remove slack therefrom to close the bucket when the magnetic brake is applied while the motor is running as if to raise the bucket. The accelerating motor is provided to control the slack in the cable end during the operation at high speed and serves to prevent the slack becoming excessive by speeding up the opening drum 17.

Though the hoisting motor 23 may be of any suitable type, it is here shown as a series wound motor with relay control as such is considered to be best adapted for the purpose. Much of the diagram of Fig. 4 represents the relay control of the hoisting motor 23 which forms no part of the present invention except in combination but such parts are shown in order that the controller functions may be understood, as the controller parts of the present invention are combined with the controller parts for the relay control of hoisting motor 23. For convenience the relay control for hoisting motor 23 is indicated as a whole by the reference character 36, while the controller as a whole is indicated by the reference character 37, and the relay control of the carriage mechanism is indicated by the reference character 38.

The line wires 39 and 40 are brought into the relay control system 36 through a suitable main switch 41 from one side of which a wire 42 leads to one finger 43 of the controller 37, while the other side is connected by a wire 44 with the various relay switches to be operated by the movements of the controller for effecting the different motor connections for three speeds forward and reverse. Other fingers 45 of the controller by engaging their respective segments in the different positions of the controller handle establish circuits through the wires 46 leading therefrom to the various relays of the motor controlling system 36, as usual for closing the motor circuit by means of relay 47, for changing the direction of flow of current through the armature of the motor by means of relays 48, 49, 50 and 51, for controlling the shunt resistance around the armature of the motor by means of the relay 52 and for effecting the introduction and exclusion of resistance units in the motor circuit by means of relays 53, 54, 55 and 56. The details of the wiring connections of the controller and its relay system for controlling the speed and direction of operation of the hoisting motor 23 are not essential to an understanding of the present invention, the same being an ordinary and well-known system of control and only being illustrated to show the association and cooperation therewith of the controlling features constituting this invention. It may be sufficient to note that the controller handle has three positions for regulating the speed of the motor in hoisting the clam-shell bucket and three positions for regulating the speed of the motor in lowering the same.

In order to equip this motor control system for simultaneous and automatic control of the trolley connected parts on the traveling carriage, whereby the opening and closing of the bucket is effected under any conditions, four fingers 57, 58, 59 and 60 are added to the controller. A push button 61, preferably located in the handle 85 of the controller, shown in dotted lines, is connected by a wire 62 with the finger 43 in direct connection with line wire 39 through the wire 42, while a wire 63 connects said push button with the controller finger 58. The push button 61, which is normally closed, serves to control the supply of current to the brake controlling finger 59 and the clutch controlling finger 60 in any of the operative positions thereof, the contact ring 64 of the

finger 58 being continuous so as to be engaged thereby in all positions of the controller handle, while the segments 65 for finger 59 and the single segment 66 for finger 60 are electrically connected therewith in the usual manner. Brake finger 59 has its contact segments 65 in position to be engaged thereby in any of the operative positions of the controller handle, but not in the neutral or "off" position while the clutch finger 60 has its single contact segment in position to be engaged thereby in the neutral or "off" position of the controller handle as well as in any of the positions for lowering the clam-shell bucket, but not necessarily in the positions for raising the same. The accelerating motor finger 57 has its single contact segment 67 in position to be engaged thereby in any of the operative positions of the controller handle for lowering the clam-shell bucket and such contact segment is in electrical connection with the contact segments which effect the control of the hoisting motor 23. Thus the current supply to the accelerating motor finger 57 is not dependent upon the push button 61 as with the fingers 59 and 60 for the brake and clutch respectively.

The controller fingers 57, 59 and 60 are connected by wires 68, 69 and 70 with the magnet windings of relays 71, 72 and 73 respectively, the other terminals of which magnet windings are connected in common to a ground wire 74.

Current for operating the accelerating motor, the brake and the clutch is brought to one terminal of each of the relay switches 71, 72 and 73 by a wire 75 from one side of the main switch 41 from the line wire 39, while the other side of main switch 41 from line wire 40 is grounded by a ground wire 76. The other terminal of accelerating motor relay switch 71 is connected by a wire 77 containing a resistance 78 and with a trolley wire 79 on which the trolley of the accelerating motor 29 travels. A wire 80 connects the other terminal of the brake relay switch 72 with a trolley wire 81 on which the trolley of the brake 27 travels. A wire 82 connects the other terminal of the clutch relay switch 73 with a trolley wire 83 on which the trolley of the clutch 33 travels. The accelerating motor 29, the brake 27 and the clutch 33 have a common ground wire connection 84.

In operation the movements of the controller handle 85 to raise or lower the clam-shell bucket by means of the hoisting drum 23 at the same time effects the control of the accelerating motor, the brake and the clutch accordingly, the control of the accelerating motor 29 being independent of the push button 61 and causing said motor to operate in any position of the controller handle for lowering the clam-shell bucket, but not in any positions for raising the bucket. The control of the brake 27 and the clutch 23, however, is made through the push button 61 and is such that during the time that said push button remains closed the brake and clutch will be effective for keeping the clam-shell bucket either opened or closed whether it is being raised or lowered or held at a fixed elevation.

It must be understood that the opening and closing of the clam-shell bucket 19 depends upon the relative tension on the two ends of the cable 18 by which it is suspended. The cable end from the hoisting drum 16 is usually known as the holding line, while the cable end from the closing drum 17 is known as the closing line. When the closing cable is under tension, as will normally be the case because of the weight of the bucket being supported by the cable 18 as a whole, the bucket remains in its closed condition, but, upon the weight of the bucket being supported entirely or mainly from the holding line so that slack is produced in the closing line, the bucket opens automatically by the weight of its parts in the well-known manner. The accelerating motor 29 is only a light motor which tends to rotate the closing drum 17 at an increased speed during the opening of the bucket in order that the slack may be taken out of the main portion of the cable 18 and maintained in the closing line.

With the controller handle in the neutral or "off" position and the hoisting motor 23 therefore statonary, as when the loaded bucket is being conveyed by the carriage from one end of the bridge to the other, the bucket is held closed at a fixed elevation by the influence of the brake 27 which is set to prevent the turning of the hoisting drum 16, and the influence of the clutch 33 which is also set, locking the closng drum 17 in gear with the hoisting drum so that it also is held by the brake against rotation. When the bucket reaches the discharge position the push button 61 is depressed and the controller handle is moved to a position as if to lower the bucket. This causes the counterweight 21 to rise, while the brake 27 remains set, and the clutch is released and consequently slack is produced in the closing line which will permit the bucket to open and discharge its contents. The controller handle is only held in the lowering position momentarily or until the bucket is open and then it is returned to the neutral position and the push button is released, leaving the bucket in its open condition with brake and clutch set while it is returned to the loading position. The controller is again moved to the lowering position, causing the open bucket to descend into the hold of a vessel or into a pile of material and when the bucket rests on the material the controller handle is thrown to the hoisting

position and the push button is depressed which, by lowering the counterweight 21, will first close the clam-shell bucket causing it to scoop up its load of material and then lift it. During the lowering of the bucket in its open condition the brake is released and the clutch remains set. During the closing operation the clutch is no longer engaged, thus allowing a preliminary travel of the closing line to close the bucket before both lines move together to hoist it.

It will thus be seen that the controlling means for the accelerating motor, the clutch and the brake is so arranged with respect to the controller for the hoisting motor that the clutch is engaged at all times except when the bucket is being closed or lifted and the accelerating motor is operated while the bucket is being opened or lowered and the brake is always applied in the neutral position of the controller handle, the operation of the push button serving to apply the brake in any position of the controller whether the bucket is being raised or being lowered and serving to release the clutch to open the bucket when it is being lowered and to close the bucket when it is being raised. By this invention the control of the parts on the carriage is made automatic and the opening or closing of the bucket is effected by merely pressing the button 61 while the hoisting motor is operating to raise or lower the bucket. This simplifies the operation of the machine by the attendant, making it possible for him to operate the racking motor with one hand and the hoisting motor with the other and dispensing with the necessity for the use of treadles or additional switches as heretofore.

What I claim as new and desire to secure by Letters Patent is:

1. The combination with a motor controller for regulating a clam-shell hoisting motor, of a brake and clutch controlling means for the hoisting and closing drums associated with the motor controller for operation therewith and a push button on the motor controller handle for opening the circuit through the brake and clutch controlling means.

2. The combination with a drum controller for regulating the speed and direction of a clam shell hoisting motor, of a brake and clutch controlling means for the holding and closing drums comprising supplemental switch fingers and contact segments on the drum controller, and a separate switch for opening the circuit of said controlling means.

3. The combination with a motor controller for controlling the speed and direction of a clam-shell hoisting motor, of a controlling means for controlling a magnetic clutch between the hoisting and opening drums and for controlling a brake for the hoisting drum, said controlling means being associated with the motor controller for operation therewith.

4. In a hoist, a holding drum and a closing drum, a magnet controlled clutch for connecting them together, a magnet controlled brake for the holding drum, a hoisting motor for raising and lowering the clam-shell bucket, a motor controller for controlling the hoisting motor and controlling means for the clutch and brake associated with the motor controller for operation therewith.

5. In a hoist, a holding drum, a closing drum, a magnet operated clutch for connecting them together, a magnet operated brake for the holding drum, a clam-shell bucket suspended from the drums, a hoisting motor for raising and lowering the clam-shell bucket, a motor controller for the hoisting motor and controlling means for the brake and clutch associated with the motor controller for operation therewith and capable of independent operation.

6. In a hoist, a holding drum, an opening drum, a magnet operated clutch for connecting them together, a magnet operated brake for the holding drum, a clam-shell bucket suspended from the drums, a hoisting motor for raising and lowering the clam-shell bucket, a motor controller for the hoisting motor, a controlling means for the brake and clutch associated with the motor controller for operation therewith and a separate switch for controlling the circuit of the controlling means.

7. A coal handling bridge, having a traveling carriage, a holding drum and a closing drum thereon, a cable passing around both drums, a clam-shell bucket suspended thereby, a hoisting motor for raising and lowering the clam-shell bucket, a magnet operated clutch for connecting the drums together, a magnet operated brake for the holding drum, an accelerating motor for the closing drum, a motor controller for controlling the hoisting motor, controlling means associated with the motor controller for controlling the accelerating motor and the brake and the clutch, and a separate switch for opening the circuit of the controlling means for the brake and the clutch.

8. In a coal handling bridge, a traveling carriage, a holding drum and a closing drum thereon, a counterweighted cable passing around both drums, a clam-shell bucket suspended thereby, an accelerating motor for the closing drum, a magnet operated clutch for connecting the drums together, a magnet operated brake for the holding drum, a hoisting motor connected with the cable for raising and lowering the clam-shell bucket, a motor controller for the hoisting

motor, controlling means associated with the motor controller for controlling the accelerating motor and the brake and the clutch, and a push button on the handle of the motor controller for opening the circuit of the brake and clutch.

In testimony whereof I affix my signature in the presence of two witnesses.

THOMAS S. WATSON.

Witnesses:

R. S. C. CALDWELL,

H. D. CHASE.