March 24. 1970 G. E. DAVIS ET AL 3,502,301

REVERSING CONTROL

Filed Aug. 16, 1967 2 Sheets-Sheet 1

FIG. 1

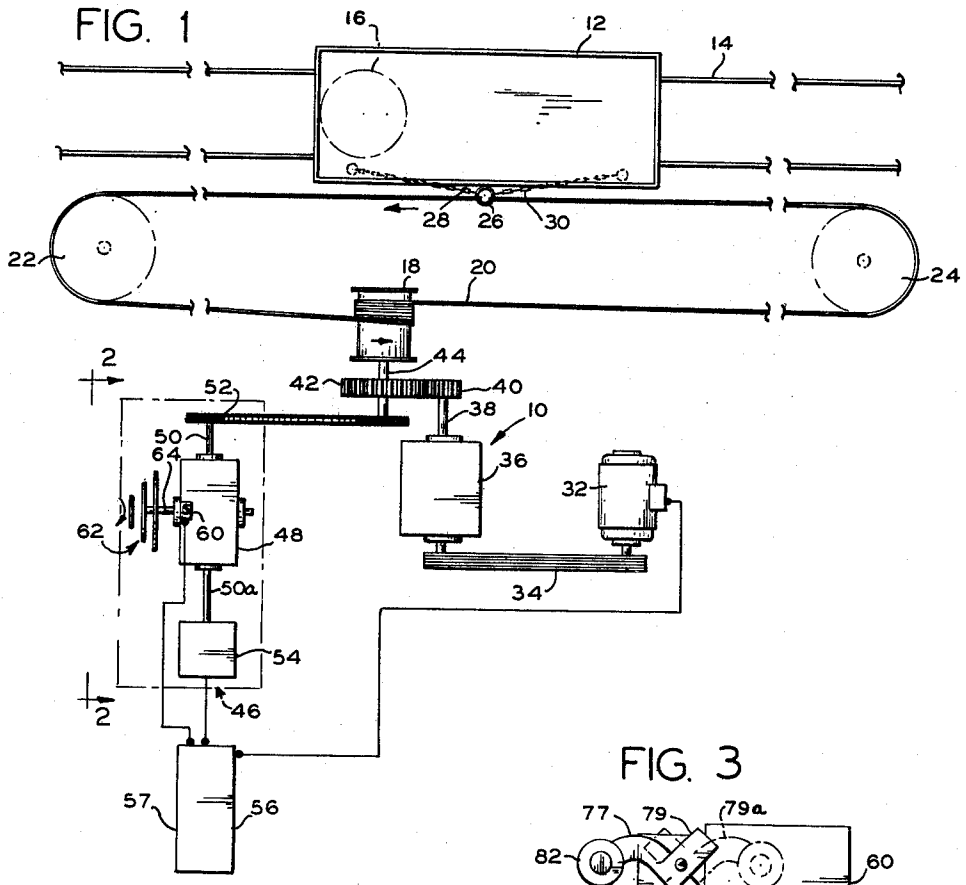

FIG. 3

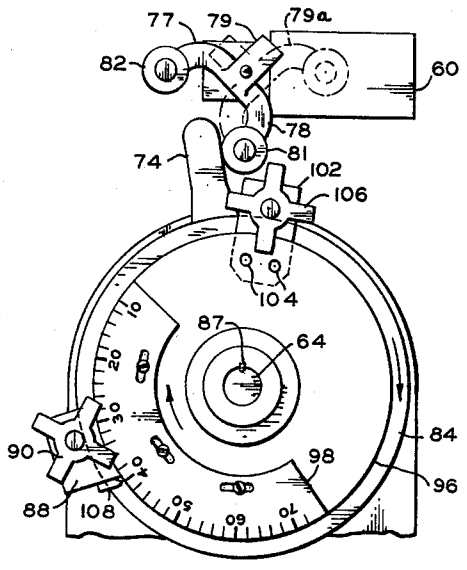

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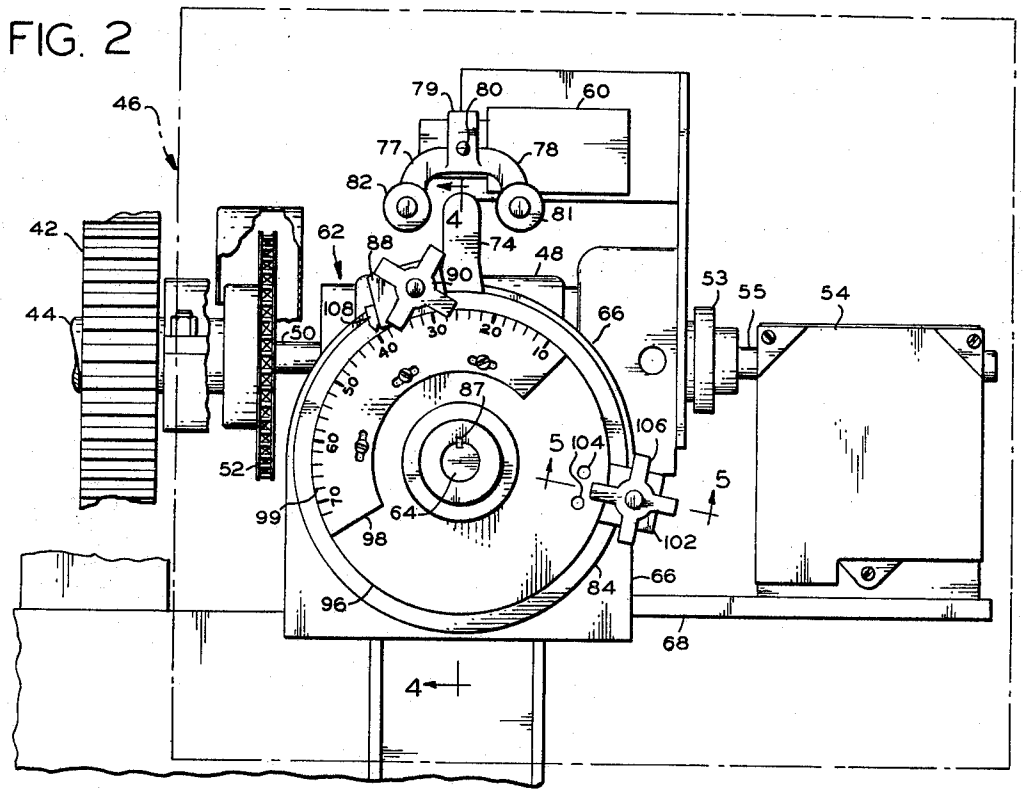
FIG. 2



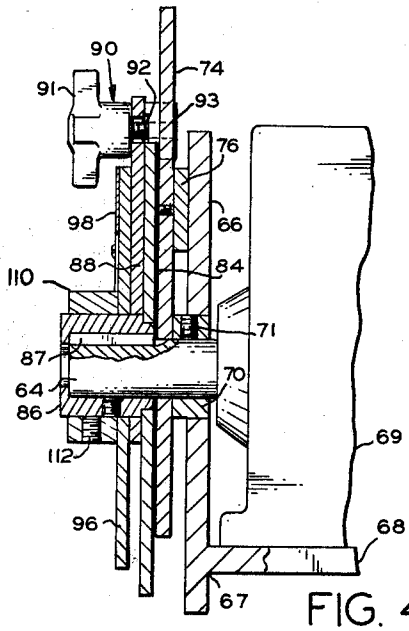


FIG. 4

FIG. 5

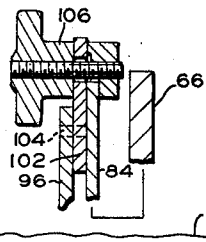
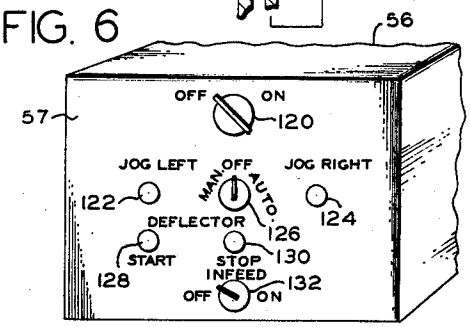


FIG. 6



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REVERSING CONTROL

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U.S. Cl. 254—173 7 Claims

ABSTRACT OF THE DISCLOSURE

A mechanical reversing control for controlling the distance through which a car-pulling mechanism pulls a railroad car along a section of track in one direction before automatically reversing the direction of pull. The mechanism includes a motor-driven winch drum with a cable anchored to the car so that rotation of the drum in opposite directions reciprocates the car along the track. The reversing control includes a speed reducer (48) driven off the winch drum drive. The output shaft (64) of the speed reducer has an actuating lever (74) movable into contact with one of two arms (82, 81) of a two-position, motor-reversing limit switch (60). The same output shaft (64) loosely mounts a pair of adjustably spaced tripping bars (88, 102). Both bars can be selectively clamped to a plate (84) rotatable with the shaft to rotate the bars with the shaft. When the trip bars rotate through a certain distance in one direction, one of them forces the actuating lever (74) against one of the two switch arms (82, 81) of the reversing switch (60) to reverse the electric motor and thus the direction of movement of the winch drum, railroad car and output shaft of the gear reducer. Since the speed of the output shaft is proportional to the speed of the car-pulling mechanism, adjustment of the distance between the two tripping bars is used to control the distance through which a railroad car will be reciprocated by the car-pulling mechanism.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a reversing control for providing a reciprocating or oscillating movement and more particularly to a control for regulating the distance through which a body is reciprocated or oscillated.

Description of the prior art

Prior reversing controls for controlling the distance through which a car puller pulls a railroad car in one direction before reversing its direction have taken primarily two forms. In one form photoelectric cell devices have been positioned beyond opposite ends of the railroad car in positions which determined the distance through which the railroad car would move before being reversed. However, the use of photocells had disadvantages in that often sunlight would falsely trigger the reversing mechanism of the photocells to reverse the car-pulling mechanism prematurely. Moreover, the distance between the photocell units at opposite ends of the track section was not readily adjustable to vary the stroke of reciprocation, and such devices were costly.

The second common prior form of reversing control was a clamping bar device which was clamped to portions of the winch cable extending in opposite directions from the winch drum. Such clamping devices would alternately actuate a limit switch adjacent the winch drum as they approached the drum after a preselected amount of cable had been wound on the drum in a given direction, thereby reversing the rotation of the drum. However, adjusting the reciprocation distance by this means

was largely a trial and error procedure that required a great amount of time in physically adjusting the positions of the cable clamps along the winch cable.

SUMMARY OF THE INVENTION

The present invention overcomes the difficulties of the prior art by providing a simple, direct dial adjustment of the distance through which a device is reciprocated on a control device provided on the slow speed output shaft of a speed reducer driven off the winch drum drive shaft. The control may be positioned next adjacent the control panel from which the car filling operation is controlled so that the operator can quickly and easily change the distance through which a rail car is reciprocated while remaining at or very close to the control panel.

Principal objects of the invention are to provide:

(1) A reversing control which is simple to manufacture and operate;

(2) A reversing control which is easily and quickly adjustable to change the distance through which a body is reciprocated;

(3) A reversing control which can be operated and adjusted at a position remote from the reciprocating mechanism itself;

(4) A reversing mechanism which is relatively foolproof in operation; and

(5) A reversing control which is relatively inexpensive to make; operate and maintain.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the present invention will become more apparent from the following detailed description which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a schematic plan view of a railroad car pulling apparatus incorporating a reversing control in accordance with the invention;

FIG. 2 is an enlarged front view of the reversing control of FIG. 1 taken approximately along the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2 of a portion of the reversing control in a different position than that in FIG. 2 to illustrate a different phase of the operation of the control;

FIG. 4 is a vertical sectional view taken on a slightly larger scale than FIG. 2 along the line 4—4 of FIG. 2;

FIG. 5 is a sectional view on the same scale as FIG. 4 taken along the line 5—5 of FIG. 2; and

FIG. 6 is a perspective view of the control panel used in conjunction with the reversing control.

DETAILED DESCRIPTION

With reference to the drawings, FIG. 1 illustrates a typical car pulling mechanism, indicated generally at 10, for reciprocating an open top railroad car 12 along a section of track 14 beneath an overhead feed hopper 16 used to feed grain, wood chips or other material from a storage bin into the railroad car. The car puller is used to reciprocate the railroad car beneath the hopper through a distance such that the material being fed into the car will be distributed evenly throughout the length of the car. However, since railroad cars vary in length, it is desirable to have means for varying the reciprocating distance, or stroke. Quite often hopper 16 itself will incorporate mechanism (not shown) for reciprocating or orbiting the hopper transversely of the direction of reciprocation of the railroad car, so that the car will be filled evenly from side to side as well as from end to end.

The car puller includes means for inducing movement of car 12 along the track, including a horizontally disposed winch drum 18 mounted alongside the track op-

posite hopper **16**. A winch cable **20** has a central section wound about the drum so that opposite end sections extend in opposite directions from the drum generally parallel to the track and then about sheaves **22, 24** secured to deadmen (not shown) anchored alongside opposite ends of track section **14**. The opposite ends of cable **20** proceed from the sheaves toward one another and are both connected to a pull ring **26** attached to the railroad car by chain sections **28, 30**. Thus, it will be apparent that rotation of the drum in a clockwise direction will move railroad car **12** along track **14** to the left, whereas rotation of the winch drum in the opposite direction will move the car toward the right, as viewed in FIG. 1.

Winch drum **18** is driven by a reversible electric motor **32** through a transmission which includes a belt and pulley **34** interconnecting the motor and a speed reducer unit **36**. Speed reducer **36** includes an output shaft **38** mounting a pinion gear **40** which engages bull gear **42** on the winch drum drive shaft **44**, so that the winch drum is driven at a considerably slower speed and higher torque than motor **32**.

The car puller as described thus far is conventional, but the reversing control means about to be described is believed to be unique. The reversing control means includes those components of FIG. 1 shown within the dashed line rectangle **46** of FIG. 1. Such components include a high speed reducer **48** having an input shaft **50**, which is driven by a chain and sprocket drive **52** from winch drum drive shaft **44**.

Input shaft **50** extends longitudinally through the speed reducer housing, and its opposite end **50***a* is coupled by a coupler **53** to the shaft **55** (FIG. 2) of a rotary limit switch **54** which shuts off electric motor **32** in the event the automatic reversing control should fail to function. Most of the electrical circuitry for both the car puller and feed hopper is housed within a control housing **56**, on the front face of which is a control panel **57**, as shown best in FIG. 6.

Speed reducer **48** mounts motor reversing means, including a reversing switch **60** and a system **62** of plates and levers mounted on a slow speed output shaft **64** of the reducer. This reversing means is disclosed in detail in FIGS. 2 through 5, and includes specifically a stationary base plate **66** which is fixed at **67** to a base member **68** mounting the speed reducer housing **69**. The base plate is positioned at the inner end of output shaft **64** and has a central opening into which a spacer collar **70** extends. Spacer collar **70** is fixed by set screw **71** to the inner end of the output shaft to rotate with the shaft, as base plate **66** remains stationary while the shaft rotates. An actuating lever **74** is loosely mounted on output shaft **64** and spaced just outwardly of base plate **66** by collar **71**. A permannet magnet **76** is affixed to the rear face of lever **74** and engages the front face of base plate **66** to hold lever **74** against base plate **66** with sufficient force to prevent uncontrolled movement of the actuating lever and yet permit selective movement of the lever along the base plate. As shown in FIG. 2, actuating lever **74** is positioned between opposed switch arms **77, 78** of a yoke type switch actuator **79** pivoted at **80** for actuating limit switch **60**. In FIG. 2 the switch arms are shown in their neutral positions, but in FIG. 3 the arms are shown in one of their two actuated positions, with the other of their two positions being indicated by dashed lines **79***a* of FIG. 3. The switch arms are pivoted to their actuated positions by movement of lever **74** to the right or left of its neutral position of FIG. 2 into engagement with one of rollers **81, 82** at the lower ends of the switch arms. A slight pivoting movement of one of the switch arms from its neutral position causes the arms to swing upwardly to one of their two actuated positions to reverse the direction of rotation of motor **32**.

A clamping plate **84** is fixed to output shaft **64** to rotate with the shaft just outwardly of actuating lever **74** by a hub portion **86** which is keyed to the shaft at **87** and extends outwardly from the clamping plate throughout the remaining length of the output shaft. Mounted loosely on hub **86** just outwardly of the clamping plate **84** is a tripping bar **88**. The tripping bar carries at its outer end a screw clamp **90**, including a handle portion **91**, screw portion **92** and nut portion **93**, for selectively clamping the bar to the clamping plate **84** so that the bar can be made to rotate with the plate and output shaft.

A dial plate **96** is mounted loosely on hub **86** just outwardly of tripping bar **88**. As shown in FIG. 2, the dial plate has calibrated dial face **98** carrying peripheral markings **99** indicating in feet, the distance through which pull ring **26** on the winch cable, or the railroad car itself, will move through a given rotation of the dial plate when rotated with output shaft **64**. A second tripping bar **102** is fixed to dial plate **96** by rivets **104**, as shown in detail in FIG. 5, and carries a screw clamp **106** similar to the screw clamp on first-mentioned tripping bar **88**, for selectively clamping the bar **102** and thus the dial plate to clamping plate **84**. The entire assembly of lever, plates and trip bars in retained on shaft **64** by a retainer collar **110** which slips over the outer end of hub **86** and is held to the hub by a set screw **112**.

The fixed trip bar **102** is positioned at the zero point of the dial plate, considering the position of the dial face **98**. That is, with the dial plate positioned as it would be at the end of its counterclockwise rotation, as shown in FIG. 3, wherein fixed trip bar **102** has justed forced actuating lever **74** against the left hand switch arm **77** to pivot the arm upwardly, and with the adjustable trip bar **88** with its dial pointer **108** set on the 40 foot mark of the dial face **98**, the electric motor will be reversed and will move the pull ring **26** and thus the connected railroad car through a total distance of 40 feet before trip bar **88** will again reverse the car movement by forcing actuating lever **74** against the right hand switch arm **78**.

Referring to FIGS 4 and 5, the rear nut portion **93** of clamp **90** on trip bar **88** and the corresponding portion of clamp **106** of the other trip bar **102** extend into the space between base plate **66** and clamping plate **84** occupied by actuating lever **74**. Thus when both bars are clamped to clamping plate **84** and when the plate is rotated by output shaft **64**, one or the other of the trip bars will eventually strike the actuating lever and push it against one of the two switch arms to reverse the electric motor. The spacing between trip bars will thus determine the distance through which car **12** will be moved in one direction before being reversed. By knowing the exact speed reduction between the pull ring **26** and the output shaft **64** of gear reducer **48**, the distance through which the periphery of the dial plate and the trip bars move in a given time interval can be correlated to the distance through which pull ring **26** moves in the same time interval, as indicated on the dial face **98**. On the illustrated die face, the interval between each calibration **99** represents two linear feet of movement of the railroad car. Therefore, by setting the pointer **108** of adjustable trip bar **88** at the desired calibration on the dial face, the reciprocation stroke of the car can be determined directly.

As indicated in FIG. 1, the reversing control just described is positioned conveniently near the control panel **57** shown in FIG. 6, so that a single operator at the control panel can quickly and easily change the control distance through which the rail car is reciprocated. The control panel incorporates all of the controls necessary to operate the rail car puller and the hopper feed mechanism other than the adjustable reversing control. The upper dial **120** of the control panel is an on-off switch controlling the flow of electrical power to the remaining switches and circuitry from the primary input line. The "jog left" button **122** on the control panel is a manual override button which, when pressed, will override the reversing switch **60** and permit the railroad car **22** to be moved to the left, as shown in FIG. 1, beyond the normal reversing point as set on the dial face of the reversing

control, so long as the button remains depressed. The "jog right" button **124** on the control panel has a function similar to that of the "jog left" button for moving the car to the right in FIG. 1. The center dial switch **126** on the control is a three-position switch, including a center "off" position, a "manual" position and an "automatic" position. When it is desired to operate the car puller by means of the automatic reversing control, dial switch **126** is turned to the automatic position. However, when it is desired to operate the car puller manually by means of the "jog left" or "jog right" buttons, the switch **126** is turned to the manual position.

The remaining three buttons on the control panel control the operation of the hopper feed **16**. The "start" button **128** when depressed starts the gyratory or reciprocatory movement of the hopper unit. By depressing stop button **130**, the transverse motion of the feed hopper **16** can be stopped. Infeed of grain, chips or other material that is to be fed into the railroad cars from the feed hopper **16** is commenced by turning a dial switch **132** from its off position to its on position, as shown on the control panel.

Various components of the overall arrangement disclosed have not been described in detail since they form no part of the present invention or because they are standard purchased items well known in the field of machine controls. Thus, the electrical circuitry is not described in detail since any electrician could devise the necessary circuitry to carry out the functions of the various switches described on the control panel, the limit switch **54** and the reversing switch **60**. The rotary extreme limit switch **54** had not been described in detail because it is used in conjunction with other types of reversing controls and is a standard purchased item. A suitable rotary limit switch for the purpose as described, however, is a General Electric brand rotary limit switch Model No. CR115E 422121. Similarly, the gear reducer **48** has not been described in detail since it is a conventional purchased component. However, a suitable gear reduction unit for the illustrated purpose and one that has been successfully used is a Winsmith brand No. 3 worm gear unit having a 24½-to-1 reduction.

OPERATION

Assuming that winch drum **18** when started will rotate in a clockwise direction indicated by the arrow in FIG. 1, output shaft **64** of the gear reducer **48** and the plates fixed thereto will be rotated in a clockwise direction as viewed in FIG. 3. Thus the winch cable **20** will tend to move the railroad car to the left in FIG. 1, so that, relatively speaking, feed hopper **16** will tend to move toward the opposite end of the car from which it is shown.

With the car and hopper in the positions shown, switch arms **77** and **78** are pivoted to their left hand positions as shown in FIG. 3, and actuating lever **74** is positioned against roller **81** of the downwardly pivoted switch arm **78**. Then with clamp **106** of the right hand trip bar **102** loosened, trip bar **102** is moved into abutment against the right hand edge of actuating lever **74** as shown in FIG. 3 from its position as shown in FIG. 2, and then clamped tight against clamping plate **84**.

Then clamp **90** is loosened and trip bar **88** moved to a position at which pointer **108** will indicate the estimated number of feet on dial indicator **98** through which the car should be moved toward the left in FIG. 1 before reversing its direction. Of course, with an inexperienced operator, this estimated distance might have to be reset after the first cycle to correct for slight errors in the initial estimate. After the pointer **108** is set at the estimated distance, clamp **90** is tightened so that trip bar **88** will rotate with the clamping plate and output shaft of the gear reducer.

It will be noted from FIG. 3 that the estimated distance through which car **12** should be pulled in one direction is 40 feet. With the reversing control set as shown in FIG. 3, the operator turns switch **120** to the "on" position, turns switch **126** to the "automatic" position, presses "start" button **128**, and turns the infeed switch to the "on" position. With this done, electric motor **32** starts, rotating winch drum **18** in a clockwise direction so that cable **20** pulls car **12** toward the left in FIG. 1. At the same time, output shaft **64**, and thus clamping plate **84**, dial plate **96** and trip bars **88** and **102**, rotate in a clockwise direction. Accordingly, trip bar **88** approaches and eventually engages actuating lever **74**, ushing the lever toward the right in FIG. 3 until it pivots switch arm **78** upwardly to the dashed line position **79***a*, thereby actuating limit switch **60** to reverse electric motor **32** and the rail car.

Thereafter, the entire sequence just described is repeated with the various components on the output shaft rotating in a counterclockwise direction until trip bar **102** strikes actuating lever **74** and pushes the lever against switch arm **77** to again reverse the direction of the motor and thus the rail car. In this manner, trip bars **88** and **102** alternately push actuator lever **74** against the opposite switch arms to periodically reverse the direction of movement of car **12**.

When the rail car is finally filled to capacity after several reciprocations, infeed switch **132** is switched to its "off" position, the deflector stop button **130** is pushed, and the car puller control button **126** is switched from the "automatic" to the "manual" position. When this is done, rail car **12** can be moved by means of either the jog left or jog right button on the control panel out of vertical alignment with the feed hopper **16**, and another connected car can be positioned beneath the hopper in its place. However, if there is no other car connected to car **12**, car **12** can be moved to one extreme end of the track section **14** and then switched to a parallel track section, after which another car can be connected to the car puller **26** in its place and the entire operation repeated.

With apparatus as described, it will be apparent that a reversing control is provided that is easily and quickly adjustable to control the distance through which a body such as a railroad car is reciprocated. The control is completely automatic in operation, and virtually foolproof, and readily integrated with the more conventional components of a car puller and feed system, as indicated in FIG. 1.

Having illustrated and described a preferred embodiment of the invention, it should be apparent to those having skill in the art that the same permits of modification in arrangement and detail.

We claim:

1. An adjustable control for a motion-reversing apparatus including motion-inducing means for inducing motion along a first predetermined path, said control comprising:

engagement-responsive reversing means for reversing the direction of motion along said first path,

actuator means for actuating said reversing means,

said actuator means including a pair of actuating members adjustably spaced apart on opposite sides of said reversing means,

said actuator members being movable in response to operation of said inducing means, together and in the same direction along second predetermined paths leading to said reversing means and at speeds proportionate to the speed of motion along said first path, so that upon operation of said inducing means said members will alternately engage said reversing means and thereby effect an alternating movement along said first path, the length of which can be varied by adjusting the distance between said actuating members,

said reversing means including a two-position arm means and lever means for moving said arm means into either one of said two positions,

said actuator members being positioned on opposite sides of said lever means with their paths of travel being aligned with said lever means, whereby upon operation of said motion-inducing means one or the other of said actuator members will approach and engage said lever means to move said arm means into one of its two operative positions.

2. An adjustable control for a motion-reversing apparatus including motion-inducing means for inducing motion along a first predetermined path, said control comprising:

engagement-responsive reversing means for reversing the direction of motion along said first path,

actuator means for actuating said reversing means,

said actuator means including a pair of actuating members adjustably spaced apart on opposite sides of said reversing means,

said actuator members being movable in response to operation of said inducing means, together and in the same direction along second predetermined paths leading to said reversing means and at speeds proportionate to the speed of motion along said first path, so that upon operation of said inducing means said members will alternately engage said reversing means and thereby effect an alternating movement along said first path, the length of which can be varied by adjusting the distance between said actuating members,

speed reducer means driven by said inducing means, including an input shaft connected to said inducing means and an output shaft rotatable at a slower speed than said input shaft,

a clamp plate on said output shaft rotatable with said shaft,

said actuator members being mounted on said shaft for rotation relative to said shaft,

each of said actuator members including clamping means for selectively clamping said member to said clamp plate so that said members can be rotated with said output shaft,

an actuating lever for said reversing means mounted on said output shaft for movement relative to said shaft between said pair of actuator members,

said lever being engageable by one of said actuator members upon rotation of said output shaft in one direction and by the other of said actuator members upon rotation of the shaft in the opposite direction with said members clamped to said clamping plate, whereby first one and then the other of said members will move said lever into actuating engagement with said reversing means to effect a reciprocating or oscillating movement along said first predetermined path.

3. An adjustable control for a motion-reversing apparatus including motion-inducing means for inducing motion along a first predetermined path, said control comprising:

engagement-responsive reversing means for reversing the direction of motion along said first path,

actuator means for actuating said reversing means,

said actuator means including a pair of actuating members adjustably spaced apart on opposite sides of said reversing means.

said actuator members being movable in response to operation of said inducing means, together and in the same direction along second predetermined paths leading to said reversing means and at speeds proportionate to the speed of motion along said first path, so that upon operation of said inducing means said members will alternately engage said reversing means and thereby effect an alternating movement along said first path, the length of which can be varied by adjusting the distance between said actuating members,

speed reducer means driven by said inducing means, including an input shaft connected to said inducing means and an output shaft rotatable at a slower speed than said input shaft,

a clamp plate on said output shaft rotatable with said shaft,

said actuator members being mounted on said shaft for rotation relative to said shaft,

each of said actuator members including clamping means for selectively clamping said member to said clamp plate so that said members can be rotated with said output shaft,

an actuating lever mounted on said output shaft between said actuating members for movement relative to said shaft,

said actuating members when clamped to said plate so as to be rotated by said output shaft being movable alternately into engagement with said lever,

said reversing means including a reversing switch means and a pair of switch arms extending on opposite sides of said lever and engageable alternately by said lever to reverse the motion of said inducing means, whereby operation of said inducing means will alternately cause first one of said actuating members to push said lever against one of said switch arms and then cause the other of said actuating members to push said lever against the other of said switch arms to effect an alternating movement of said inducing means in opposite directions.

4. An adjustable control for a motion-reversing apparatus including motion-inducing means for inducing motion along a first predetermined path, said control comprising:

engagement-responsive reversing means for reversing the direction of motion along said first path,

actuator means for actuating said reversing means,

said actuator means including a pair of actuating members adjustably spaced apart on opposite sides of said reversing means,

said actuator members being movable in response to operation of said inducing means, together and in the same direction along second predetermined paths leading to said reversing means and at speeds proportionate to the speed of motion along said first path, so that upon operation of said inducing means said members will alternately engage said reversing means and thereby effect an alternating movement along said first path, the length of which can be varied by adjusting the distance between said actuating members,

speed reducer means driven by said inducing means, including an input shaft connected to said inducing means and an output shaft rotatable at a slower speed than said input shaft,

a clamp plate on said output shaft rotatable with said shaft,

said actuator members being mounted on said shaft for rotation relative to said shaft,

each of said actuator members including clamping means for selectively clamping said member to said clamp plate so that said members can be rotated with said output shaft.

5. Apparatus according to claim 4 wherein said control includes a dial plate mounted on said output shaft for rotational relative to said shaft, one of said actuator members being fixed to said dial plate so that by clamping said one member to said clamp plate, said dial plate can be rotated with said output shaft.

6. Apparatus according to claim 5 wherein a peripheral edge portion of said dial plate is calibrated to indicate the distance in one direction through which a body is induced to move by said inducing means, and wherein the other of said actuator members is movable relative to said dial plate and includes an indexing means whereby the distance through which a body will be moved by said inducing means before being reversed can be varied by adjusting the clamped position of said other actuator member along the calibrated portion of said dial plate.

7. Apparatus according to claim 4 wherein said inducing means includes a winch drum, cable pulling means wound about said drum and extending in opposite directions therefrom for connection to a common body to be pulled alternately in opposite directions, reversible motor means, and transmission means transmitting rotary power from said motor means to said drum,

said input shaft of said speed reducer means being operatively connected to said drum so that said output shaft will be rotated at a speed proportionately slower than the speed of rotation of said drum.

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HARVEY C. HORNSBY, Primary Examiner

U.S. Cl. X.R.

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