

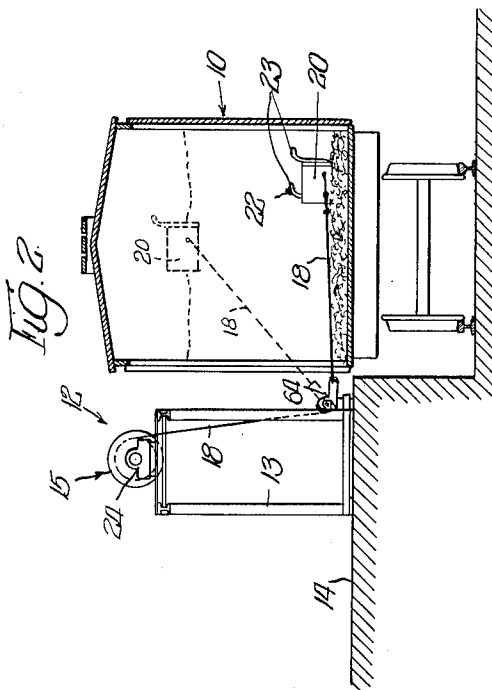
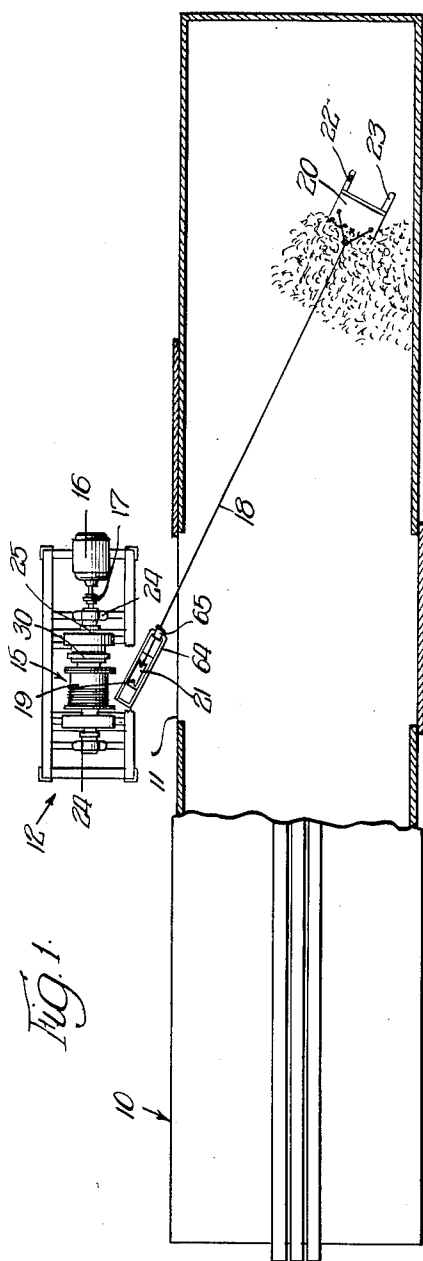
Dec. 2, 1952

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POWER SHOVEL

2,620,161

Filed June 26, 1947

5 Sheets-Sheet 1



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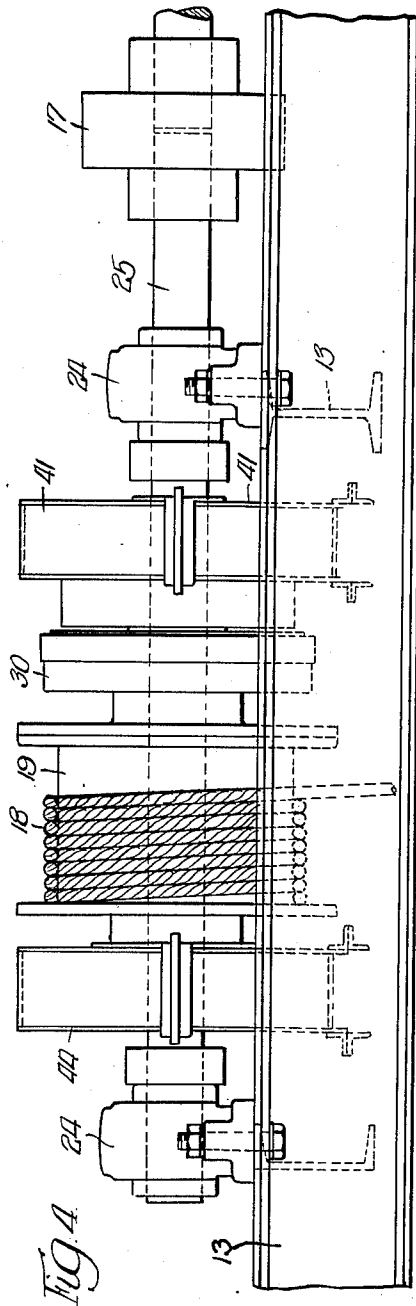
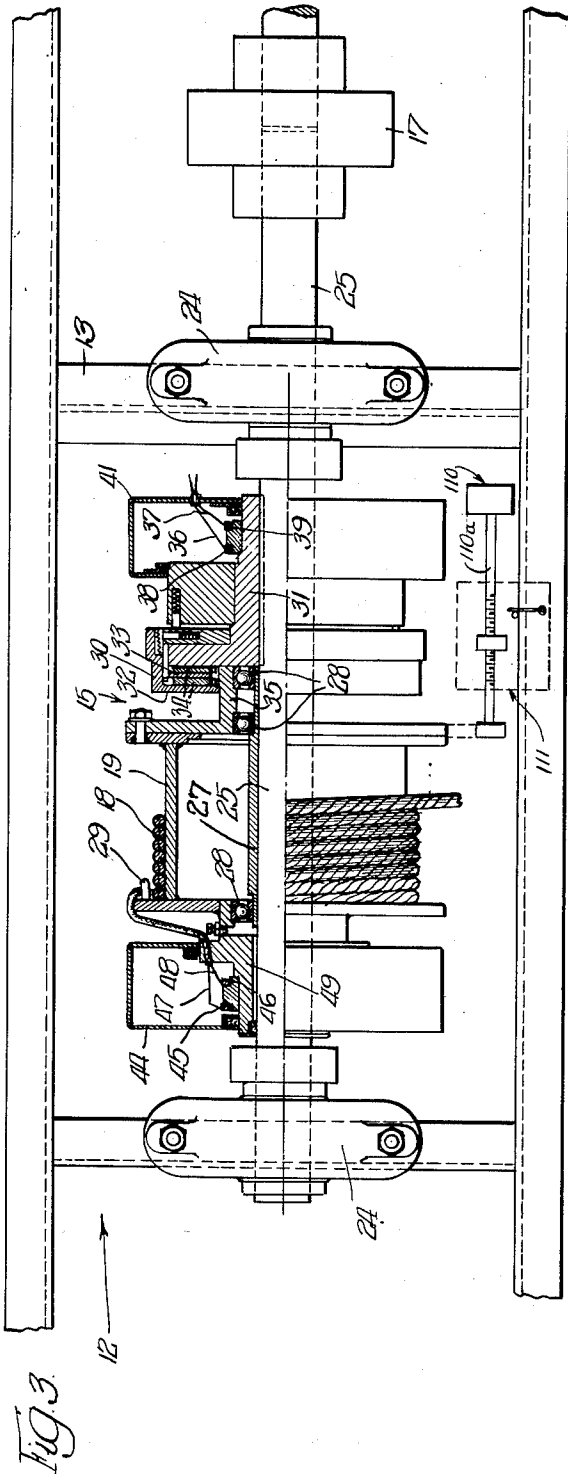
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5 Sheets-Sheet 2



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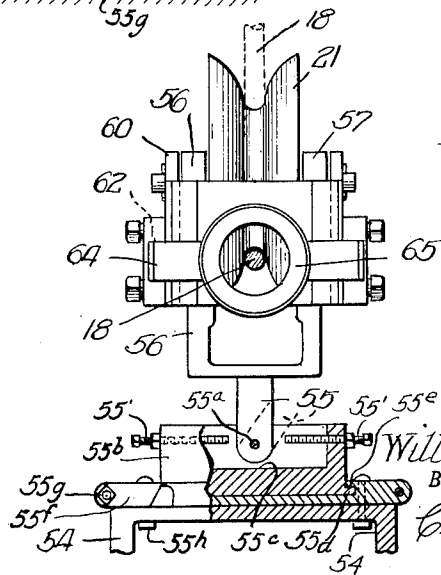
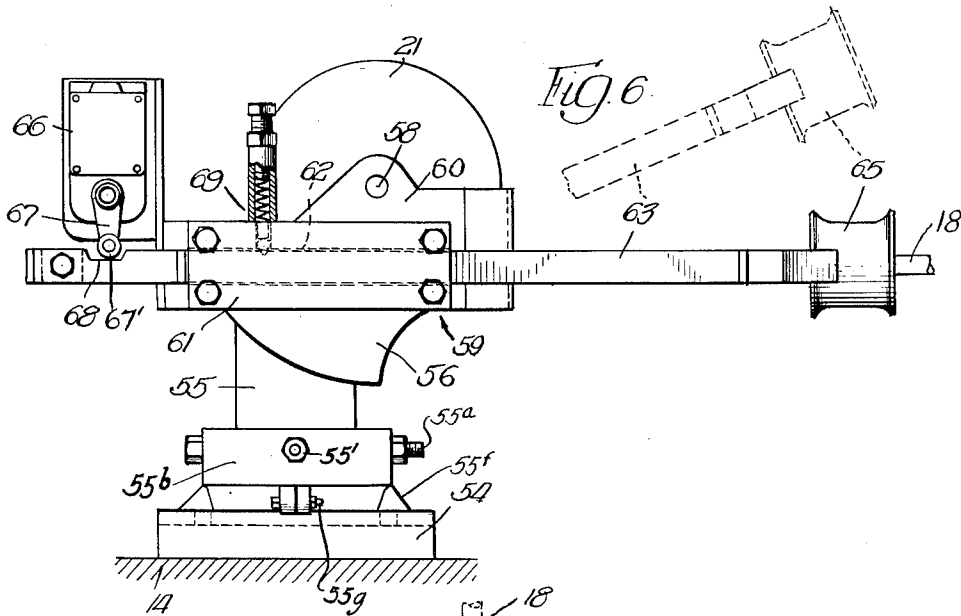
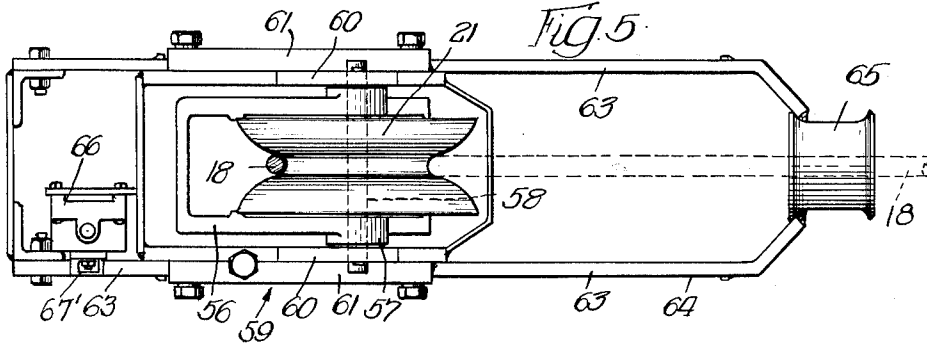
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POWER SHOVEL

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5 Sheets-Sheet 4

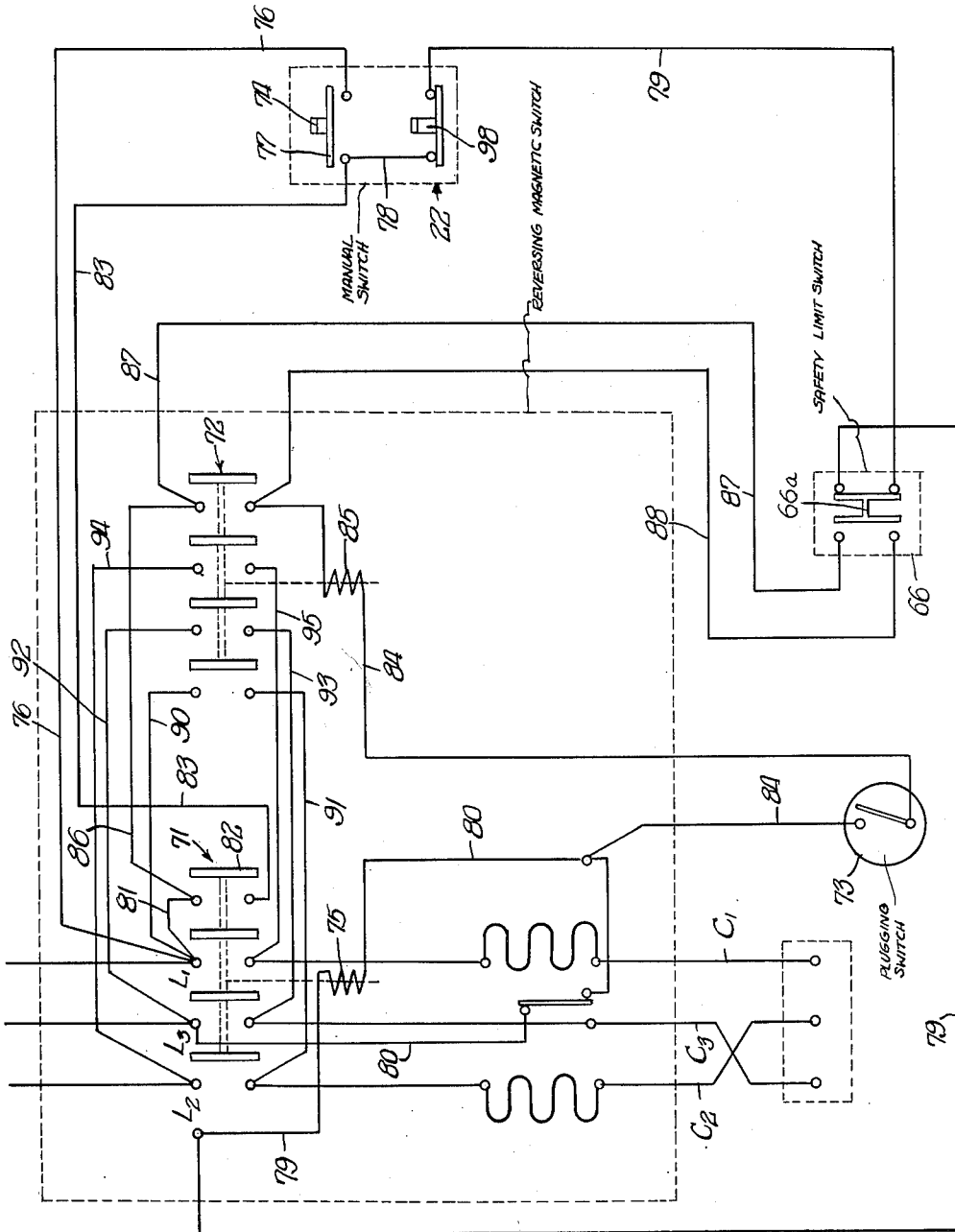


Fig. 8.

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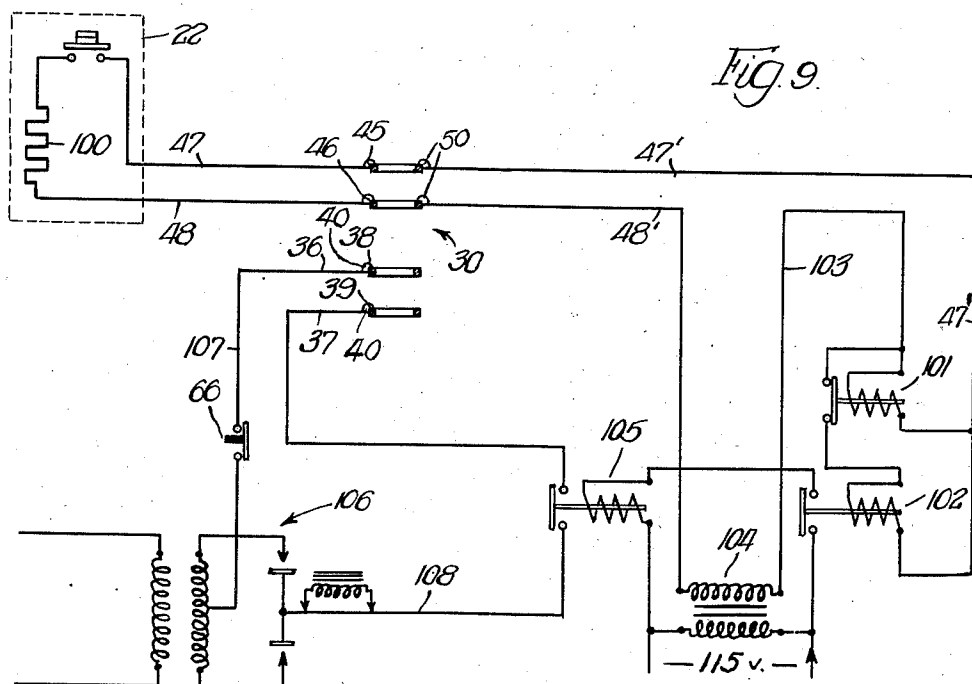
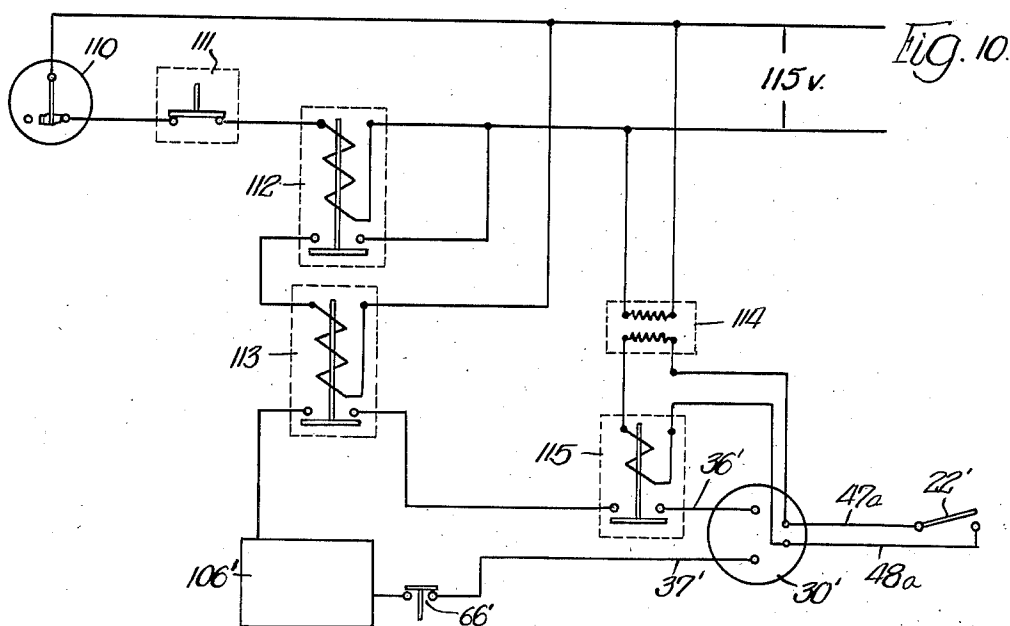
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UNITED STATES PATENT OFFICE

2,620,161

POWER SHOVEL

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26 Claims. (Cl. 254—173)

1

This invention pertains particularly to power shovels of the type commonly utilized to unload grain or other loose materials shipped in box cars, although it may also be employed in connection with draft devices generally, for moving bulk or other materials or for any other purpose.

Various methods have been employed in unloading, at the destination, grain, crushed rock, sand, gravel or like substances from box cars or trucks in which they are shipped. According to one system, this may be done by providing equipment for picking up the entire railroad car, turning it on its side and pouring the contents out the door. Obviously, an extremely high initial installation cost is an objectionable factor in most cases in which this system would be practical. The cars may also be unloaded by hand shovel, which is a relatively slow and costly procedure from a labor standpoint.

A third method, with which the present invention deals, employs a power shovel that is guided by hand by an operator; said shovel generally resembling a conventional shovel or scoop save for the fact that it has two short handles instead of the customary single handle. The shovel scoop is secured to an elongated rope or flexible draft cable, which is in turn attached to a power winch, usually located outside the car but adjacent the door thereof. The operation involves the dragging of the scoop by the operator into the interior of the car, pulling the attached rope or cable along with it, "biting" the shovel into the grain or other material to be unloaded, and operating the winch to draw in the scoop, thereby plowing the material forward toward the door. In conventional practice, two shovels are employed simultaneously in the unloading of a car, one being operated at each end by a laborer. With standard devices up to three cars an hour can be unloaded in this manner.

A detailed description of existing shovel assemblies of the type referred to above need not be set forth at this point, in view of the description of the improved apparatus to follow. However, in general, these devices normally employ a winding drum controlled in its connection to a suitable source of power by a jaw clutch, said drum winding up the shovel rope or cable when clutch-connected to said source. A second drum is also involved, which receives a control chain adapted to disengage the clutch after the shovel is pulled forward a predetermined distance. Certain further drum, counterweight and associated mechanical control elements are also employed to enable the shovel to be again withdrawn into the

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car interior for a succeeding stroke when the cable drum is disconnected from the power source, and to re-connect the drum with the power source.

Shovels of the above general type are definitely not accident-proof, for occasionally a worn or inoperative element will result in failure of the jaw clutch to disconnect, allowing the scoop to be drawn into the winch. Inadvertent or unintentional commencement or continuation of operation of the winch drum, due to improper or defective condition or due to loss of control by the operator, may cause the operator to be caught in a coil of the draft cable and drawn against a winch or sheave, and I am aware of at least one instance of an operator suffering the loss of a leg due to such an accident.

Furthermore, present shovel assemblies are uniformly heavy and cumbersome in their drum and control parts, which results in excessive cost and a definite lack of desired speed and responsiveness in effecting control operations, to say nothing of the danger inherent in a lag in the control of the drum and other heavy parts. Still other objections from the standpoints of insufficient safety, unsatisfactory operation or low efficiency characterize shovel-type power unloaders now employed.

Accordingly, it is an object of the invention to provide a hand guided power shovel of the type described, wherein the operator's control over the shovel or scoop is improved and wherein the operator and the equipment are safeguarded against damage or injury, either by reason of an operative failure of any of the parts or because of any other dangerous condition arising inadvertently.

More specifically it is an object to provide a power shovel assembly of the foregoing type including a prime mover driven winch for the shovel draft cable, adapted to draw said cable about a guide pulley, in combination with means to automatically halt said winch and/or prime mover in the event an object is caught in the cable and drawn thereby against the pulley.

A further object is to provide a power shovel assembly including a draft cable and winding winch or drum of the type described wherein said drum is actuated in an improved manner through a magnetic clutch, said clutch being controlled manually by switch means installed on the shovel scoop through flexible electrical conductors woven into the cable and connecting with said clutch and switch means.

Yet another object is to provide a shovel as-

sembly of the foregoing type, including means embodied in the electrical circuit employed to energize said clutch and/or the prime mover of the assembly to maintain control of the scoop in the event the conductors in the draft cable become short circuited.

Yet another and more specific object is to provide a shovel assembly adapted to be controlled by electrical switch means associated with and on the shovel for ready manipulation by the operator, in which the switch and control circuit embodies relays of predetermined sensitivity to govern and safeguard the apparatus in the event of shorting of said circuit.

A still further object is to provide a power shovel assembly including a power winch, draft cable and scoop drawn thereby, in which said cable is guided by one or more suitable pulleys or sheaves each provided with a mechanical limit switch wired in the power or control circuit of the winch, whereby to safeguard the operator or equipment in the event that any object becoming attached to or snagged in the cable is drawn forcibly against the pulley or sheave.

A still further object is to provide a power shovel assembly of the foregoing type employing a limit switch, in combination with a magnetic reversing switch and a plugging switch to break the power supply to the cable winch or drum upon actuation of the limit switch.

A further object in accordance with one or more forms of the invention is to provide a control for a power shovel or like periodically acting draft device of the type embodying a winch actuated by a magnetic or similar clutch, said control including electrically connected motion and limit switches associated with the winch and a timing relay, and being adapted to disengage the clutch when the device has traversed a full working stroke, thereby enabling the device to be withdrawn for a succeeding stroke, and to reactivate the clutch to initiate said succeeding stroke following the lapse of a predetermined time, regulable within fairly wide limits.

In a still more general way it is an object of the invention to simplify existing conventional power shovel assemblies by the elimination of complicated jaw clutch provisions, levers, ratchets, counterweights, chains and multiple drums usually characterizing the same, thereby minimizing sources of wear and resultant failure of operation, and eliminating the need for frequent adjustment and replacement; to reduce the space requirement of conventional present installations; and to improve the ease and safety of operation and the responsivity of the shovel assembly by reducing inertia of the parts, as by the provision of an improved, light weight steel drum construction for the winch, thereby permitting ready control and quick stoppage of the drum without over-running after it is disconnected from its power source.

The foregoing statements are indicative in a general way of the nature of the invention, but other and more specific objects will be apparent to those skilled in the art upon a full understanding of the construction and operation of the device.

Several embodiments of the invention, particularly as regards the electrical shovel control circuits, are presented herein for purpose of exemplification, but it will be appreciated that the invention is susceptible of incorporation in other modified forms coming equally within the scope of the appended claims.

In the drawings:

Fig. 1 is a diagrammatic top plan view, partly broken away, conventionally illustrating elements of the present power shovel installation in operative relation to a box car to be unloaded and indicating in a general way the manner of functioning of the shovel, it being understood that only a generalized showing of the parts has been made for the sake of simplicity and clarity;

Fig. 2 is a view in transverse vertical section further illustrating the installation shown in Fig. 1;

Fig. 3 is a top plan view illustrating the winch or winding drum and clutch unit of the present invention, being shown partially in horizontal section to reveal certain details of the drum and clutch construction;

Fig. 4 is a fragmentary view in elevation further illustrating the general arrangement of the drum and clutch unit;

Fig. 5 is a plan view illustrating an improved guide sheave and safety limit switch unit for the draft cable of the shovel assembly for the purpose of protecting the operator or equipment if an object becomes entangled in the cable rope and is drawn against the sheave;

Fig. 6 is a view in side elevation of the unit shown in Fig. 5, indicating in solid and dotted lines the swing of a cable guide of said unit in operation;

Fig. 7 is an end view of said unit, as viewed from the right in Figs. 5 and 6, being partially broken away and in central vertical section;

Fig. 8 is a schematic wiring diagram illustrating a motor energizing and control circuit adapted to be employed to control the motor prime mover of the present shovel assembly, said circuit embodying a safety limit switch unit of the type shown in Figs. 5, 6 and 7 in combination with reversing and plugging switches controlling the motor operation and other manually controlled switch means;

Fig. 9 is a schematic wiring diagram of an alternative, semi-automatic, sensitive relay control circuit for the shovel; and

Fig. 10 is a further schematic wiring diagram of a still further modified, fully automatic timing and control circuit for the assembly, involving motion and limit switches in association with a timing relay.

As stated above, the present improvement pertains to semi-automatic power shovels or like material handling elements which are used at present for the unloading of grain, sand, gravel, crushed rock and bulk material normally shipped in box cars, although these devices may also be used to move bulk materials from any other container such as truck bodies, storage bins and the like. In fact, the improvements are generally applicable to any hand guided, recurrently operating tool or appliances moved on a working stroke by means of power applied thereto through a rope or flexible cable.

In the drawings and specifications to follow, details of several motor and clutch energizing and control circuits are illustrated and described with sufficient clarity to render their operation readily understood by those skilled in the art. While each of these circuits is independent, complete and operative to perform the energizing and control function or functions ascribed thereto, it is evident that they may also be combined at least in some of their parts as dictated by circumstances or the needs of the desired installation. Such combinations of features will suggest themselves

to those skilled in the art; therefore no attempt has been made to show all possible combinations of features, instrumentalities and connections which might advantageously be made. Nevertheless, it is to be understood that such obvious expedients of selection and combination are contemplated as being included in the invention.

Referring to Figs. 1 and 2, the reference numeral 10 generally designates a standard railway box car, which may be also considered to be illustrative of any other equivalent container relative to which it is desired to move or to rearrange material. As shown, the car 10 is provided with a side opening 11 through which said material is moved.

The reference numeral 12 generally designates the winch unit of the present assembly which is mounted on a suitably strong and rigid upright angle iron framework 13 supported on a loading platform or pier 14. The winch unit 12 embodies a winding drum and clutch assembly generally designated 15 which is adapted to be powered from the conventionally indicated motor 16 on framework 13, for example, by means of the flexible torque coupling 17.

A flexible rope or cable 18, hereinafter referred to by the latter term for simplicity, is secured at one end to the winding drum 19 of the drum-clutch assembly 15, in a manner to be described, and at its other end is firmly secured to the manually guided shovel scoop 20, shown inside the box car. Cable 18 is guided between the drum and scoop by means of a suitable pivoted sheave 21, details of which are shown in Figs. 5, 6 and 7 and will be later described in detail. Said sheave has free horizontal swiveling action in guiding cable 18. The cable serves as a draft means to drag scoop 20 through material to be unloaded and, in accordance with one aspect of the invention, may be of a type having flexible insulated electrical conductors woven therein and connected at one end to a push button switch means 22 shown conventionally on one of the handles 23 of scoop 20. At the other end said conductors are electrically connected in certain clutch control and power circuits in a manner impractical to show except in the wiring diagrams represented by Figs. 8, 9 and 10. For the present, it will suffice to state that the conventional switch means 22 on the scoop may be employed in association with a reversing, plugging and limit switch circuit such as is illustrated in Fig. 8 or in the magnetic clutch control circuits illustrated in Figs. 9 and 10 or in any combination of these circuit components and connections which practical expediency may dictate.

Details of the drum and clutch assembly 15 of winch unit 12 are illustrated in Figs. 3 and 4, to which attention is directed. The framework 13 supports a pair of laterally spaced bearings 24 in which the continuously rotating motor driven power shaft 25 is journaled. This shaft may be connected mechanically through a flexible coupling 17 with the motor 16, although obviously other driving arrangements are contemplated.

The winding drum 19 is of a light weight, welded steel construction to reduce its inertia and thereby increase its responsivity to control. It is mounted for free rotation relative to shaft 25 by ball bearings 28 carried on a sleeve 27 on the shaft. One of the side flanges of said drum is provided with a U-bolt 29 to anchor an end of the cable 18.

A standard magnetic clutch 30 is disposed to one side of the drum 19, said clutch including a rotatable driving hub 31 which is keyed on shaft

25 and an external housing 32 in fixed relation to said hub. A central clutch driving disk 33 is in turn key or spline-connected to the housing 32 between the driven frictional clutch disks 34 on either side thereof, which last named discs are splined on the hub 35 of drum 19, and hence function to drive said drum positively when axially engaged with disk 33, as by electrical energization of the magnetic clutch. This clutch structure is entirely conventional and needs no further description. Power to energize the same is supplied from a suitable source through conductors 36, 37 electrically connected to the respective power collector rings 38, 39 by brushes 40 on the clutch hub 31. This collector ring and brush arrangement is conventionally shown in Fig. 9 and is shielded by a suitably sealed, fixed housing 41 supported on framework 13, in the manner illustrated in Figs. 3 and 4 of the drawings.

A similar fixed housing 44 on the opposite side of drum 19 encloses the control collector rings 45, 46 through which the clutch operation is controlled when a manual push button control feature is incorporated in one of the alternative scoop control circuits to be described. As in the case of the clutch power provisions, these collector rings are brush connected electrically respectively to the conductors 47, 48, which are preferably woven into cable 18 in the manner referred to above, said conductors being brought from the rotatable drum end of the cable and through a portion of rotatable collector ring hub 49 to clutch control brush 50, by which the supply conductors 47', 48' are connected to collector rings 45, 46, in the fashion illustrated in Fig. 9. It will be noted that the hub 49 rotates with drum 19 internally of the fixed housing 44. The clutch power conductors 36, 37 are suitably led in through the fixed housing 41 on the opposite side of the drum. Further reference will be made to the operation of these clutch power and control features in connection with the description of the circuits illustrated in Figs. 8, 9 and 10.

Upon energization of clutch 30 the drum 19 is power-connected to shaft 25 to draw the cable and scoop, said cable being guided by the swiveled sheave 21. It will be appreciated that, while I have illustrated but one sheave 21 around which the cable 18 is passed in traveling between drum 19 and the scoop 20, in actual practice it is quite possible that more than one such pulley will be required. I contemplate that each such sheave or pulley be provided with a safety limit switch arrangement of the type illustrated in Figs. 5, 6 and 7, to which reference is now directed.

The purpose of this unit is to prevent injury to the operator or damage to the equipment by stopping the winch clutch or prime mover in the event a large object becomes attached to cable 18, or caught in a bight thereof, and is drawn against the pulley. An illustrative circuit for this purpose, embodying a magnetic reversing switch and a plugging switch and involving the de-energization and reversing of motor 16, is shown in Fig. 8, while the circuits of Figs. 9 and 10 operate on the principle of de-clutching the drum 19 from the power shaft 25. Inasmuch as operation by deactivation of the motor prime mover is contemplated, it will be evident that the safety sheave unit shown in Figs. 5, 6 and 7 is therefore well adapted for use in conjunction with conventional and existing types of shovels, and is not confined in its adaptability to the im-

proved, magnetic clutch type shovel assembly herein shown and described.

The assembly referred to consists of a suitable base 54 which may be attached to the platform 14 or other rigid support, on which base a vertical column 55 is internally swiveled for angular swinging movement about a vertical axis. The column 55 may be pivoted by means of a pin 55a to a swiveling foot 55b, the pin extending across the hollow interior 55c of the swiveling foot and through its circular wall, as illustrated in Figs. 6 and 7. In order to increase lateral stability at the pivot, the dimension of the column, along the length of the pivot pin 55a, is greater than its transverse dimension, shown in Fig. 7. This enables the sheave to swing about pin 55a as an axis, to and from positions indicated in dotted lines in Fig. 7. Its swinging movement in this plane is limited by the adjustable set screws 55'.

Swiveling foot 55b is provided at its bottom with a radially extending circular flange 55d, this flange being received beneath an overhanging semi-circular lip 55e of each of a pair of semi-circular retaining members 55f. These members are normally clamped together by bolts 55g, thus providing a circular retaining ring for the swiveling foot 55b. The ring, in such retaining position, is secured to the base 54 by means of bolts 55h.

The above provisions afford universal swiveling movement about a vertical axis and about a horizontal axis coinciding with pivot pin 55a. A forked support 56 is secured on column 55 and is provided at its upper end with journal bosses 57 adapted to receive the pivot pin 58 for pulley or sheave 21. A pivoted frame, generally designated 59, surrounds said member 56, said frame including the side plates 60 which are pivoted on pin 58 for swinging movement on a horizontal axis, and said plates coast with the adjacent, longitudinally grooved members 61 in defining channels 62 in which the side bars 63 of the generally rectangular sliding cable guide 64 are received for guided sliding motion.

A cable guide ring or eye 65 is secured to the forward end of the guide 64, through which the cable 18 passes to the scoop 20. Accordingly, any obstruction attached to or caught in the cable and drawn toward pulley 21 will contact guide ring or eye 65 and shift the cable guide 64 rearwardly in its guide channels 62 relative to pivoted frame 59.

At its rear end said frame 59 has secured thereto a conventional snap action toggle switch 66 having an operating arm 67 which extends downwardly and is provided with a roller 67' located in alignment with one of the side bars 63 of the cable guide 64. Said bar is notched or recessed at 68 to receive said roller, and it is evident that as the guide 64 is shifted rearwardly upon engagement by an object attached to the cable the switch 66 will be actuated to break its circuit, which will be considered to be a motor energizing circuit. The circuit can only be re-established at switch 66 by restoring the cable guide to its original forward position, and the guide is normally held in said forward position by means of the spring urged ball and recess detent device 69.

Cable guide 64 is capable of universal swinging movement upwardly, as illustrated in dotted lines in Fig. 6, and laterally about its swivel connection to base 54, so as to follow universally the direction of pull on cable 18. This limit switch

unit may be readily mounted on a conventional sheave or pulley 21 simply by removing the pivot pin, placing the guide parts of the assembly in operative relation to the sheave and inserting a longer pivot pin. Universal swinging movement of the cable guide about horizontal and vertical axes is required in order that tension on the cable 18, applied at a sharp angle to the switch actuating member, shall not result in undue frictional rubbing on the guide ring or eye 65. The life of the cable is thus prolonged. Moreover, inasmuch as the angle of the cable 18 increases sharply upwardly as the operator and shovel approach the sheave 21, or when the level of the material shoveled is high (see Fig. 2), it follows that if guide ring 65 is immovable vertically (even though freely swingable horizontally) the considerable friction imposed on the ring may shift cable guide 64 rearwardly to circuit breaking position. This is possible even though the shovel has not at that time been advanced the desired distance forwardly. The same is true with regard to horizontal sweep of the sheave and associated cable guide. It must permit access to all parts of the car interior without substantial binding of the cable at the guide ring.

A motor control circuit embodying an installation of the foregoing safety limit switch unit is illustrated in Fig. 8. The conventional on-off switch 66 of said limit switch unit is incorporated in that circuit in combination with certain automatic switches including electromagnetically operated starting and reversing switches and a plugging switch, as well as with a standard manual start-stop switch which may be considered to represent either the switch means 22 on the scoop 20, or any similar switch mounted in any convenient location on the scoop. Fig. 8 illustrates the operation of the switches 22 and 66 to halt operation of the motor 16, it being understood that this wiring diagram depicts a condition of the controls in which the motor is stopped, with both forward and reversing circuits open. Thus, the forward and reverse circuit making and breaking elements 71 and 72 are shown in a neutral position, the switch 66 of the limit switch unit is in its normal closed position and the standard plugging switch, designated 73, is open, as is normal when the motor is not running. Conductors C1, C2 and C3 are connected to the motor terminals in a conventional manner for a standard, 3-phase motor. The electrical connections illustrated in Fig. 8 will be readily understood by those skilled in the art, hence need not be described in detail, since a description of the operation of the various components and their related energizing circuits will render the control system of Fig. 8 perfectly clear and understandable.

In order to actuate motor 16, the starting button 74 of switch 22 is depressed momentarily. This closes a circuit from the power leads L1, L2, and L3 through the forward motor coil 75 as follows: Lead 76, conducting bar 77 on button 74, switch shunt 78 and lead 79 (including the conducting bar 66a of limit switch 66), forward coil 75 and return lead 80. As pointed out above, the plugging switch 73 is open at the start of motor operation, being spring urged to that position, and closes electromagnetically only when the motor is running. Hence, no current flows in the plugging switch circuit. Energization of forward coil 75 causes the circuit making element 71 to be magnetically shifted to the left against a spring (not shown), placing the power leads L1,

L2, L3 in respective electrical connection with the motor conductors C1, C2 and C3 and resulting in actuation of motor 16 in a forward direction. Coil 75 will remain energized when starting button 74 is released, by reason of current flowing therethrough in the same direction by way of a circuit including lead 91, the extreme right hand conducting cross bar 82 of element 71, the lead 83, shunt 78, lead 79, switch 66, coil 75 and return lead 89. Upon rotation of the motor, an element of plugging switch 73 rotates therewith to close said switch against the resistance of a spring (not shown); however, current still does not flow in the lead 84 to which said switch 73 is connected, since the reversing switch element 72 is in its neutral, circuit opening position.

In the event switch 66 is opened by reason of an object being pulled into contact with the safety limit switch unit, the forward motor starting coil 75 is immediately de-energized by opening of its circuit at the switch conducting bar 66a, and the reverse coil, designated 85, is energized. This is accomplished by a circuit through power lead L1, connected leads 81 and 86, lead 87, cross bar 89 of switch 63, lead 88, coil 85 and plugging switch 73, by way of the leads 84, then through a portion of the coil circuit return lead 89 to the power terminal L3. Flow or current through lead 79 is precluded by the breaking of the circuit at switch 66, hence the forward circuit making element 71 is returned to neutral position by its associated spring, upon interruption of said last named circuit.

The thus energized reversing coil 85 magnetically shifts the element 72 in a direction to effect several electrical reversing connections, as follows: lead 90, which is connected to power lead L1, is connected to motor conductor C2 through the further lead 91; lead 92, which is connected with power lead L3, is connected by lead 93 with motor conductor C3; and lead 94, which is connected to the power lead L2, is connected to the motor conductor C1 by the lead 95. Accordingly, a reversing current is applied to the motor. At the same time, the right-hand cross bar of element 72 connects lead 83 with reversing coil 85 and lead 84, thereby to short out switch 65 of the limit switch unit from the energizing circuit for the reversing coil, so that reversing current is maintained even though the limit switch referred to should be quickly reclosed. At the same time, such reclosing of the limit switch cannot restore the forward circuit, in a manner to short circuit the power lines, because the forward coil 75 cannot be energized, either by way of lead 78 or lead 83. The reason for this is that the forward circuit control element 71 has been spring-returned to neutral, open position instantaneously with the original opening of switch 66, and also the motor starting button 74 is up, opening that circuit at 77.

When the motor comes to a stop, plugging switch 73 is opened by its spring, in the absence of an electromagnetic force being generated to oppose the spring. This in turn opens the circuit through reversing coil 85, de-energizing the same and allowing element 72 to be spring-returned to neutral, circuit-opening position, and thereby breaking the motor circuit through conductors C1, C2 and C3. In order to start the motor again it is necessary to reset the limit switch by hand to its normal, closed position and then depress the starting button 74. The stopping button 98 which may be incorporated in

switch 22 merely opens the forward circuit for coil 75, to de-energize motor 16.

I have employed the terms "open" and "close" in the above description to apply to the limit switch 65 as it functions in the forward motor coil circuit, in the sense that opening of the limit switch opens the forward coil circuit, which in turn causes opening of the forward energizing circuit for the motor by spring retraction of element 71. Briefly, opening of the limit switch 65, when the motor is running and plugging switch 73 is closed, results in closing the reversing coil circuit, which in turn completes a motor reversing circuit through conductors C1, C2 and C3. When the limit switch is in the normal closed position and the motor is running, the forward motor circuit is closed and the motor reversing circuit is open.

The foregoing control system affords effective operator regulation of the prime mover for the shovel and insures instantaneous response in starting and stopping the motor upon actuation of either the switch means 22 or the limit switch 65. As an alternative system which also affords a highly desirable semi-automatic control of the winch drum through the magnetic clutch associated therewith, the circuit provisions shown in Fig. 9 may be adopted. This illustrates the use of the conductors 47, 48 woven in cable 18 and connected at their respective opposite ends to the switch means 22 on the handle of the shovel scoop 20 and to the clutch control collector rings 45, 46 respectively, in the fashion illustrated in Figs. 1, 2 and 3. In this case it is assumed that the magnetic clutch transmits power from shaft 25 to drum 19 only when the push button of switch means 22 is depressed, thereby enabling the operator to have full control of the motion of the scoop at all times.

Referring to Fig. 9 in the above connection, the conductors 47, 48 are wired in series with a resistor 100 of, say, 15 ohms, which may be built in the switch unit 22, and are connected in circuit through the collector rings 45, 46 and conductors 47', 48' with the two sensitive 6-volt relays 101, 102 in the manner illustrated in Fig. 9. The normally closed sensitive relay 101 is adjusted to operate when resistor 100 is shorted out, but not to operate so long as said resistor is in the line.

Assuming that switch means 22 is closed by the operator, a circuit is completed through conductors 47, 47', the coil of relay 101 (which does not actuate its armature until resistor 100 is shorted out), the lead 103 and the leads 48, 48'. A similar flow of current takes place through the coil of relay 102, with the result that the armature of the latter is actuated. This sensitive relay circuit is energized from a step-down transformer 104 connected to a standard 115-volt alternating source, the secondary of said transformer delivering about 6 volts.

As stated, the relay 102 operates on the current through resistor 100, closing a secondary circuit and thus energizing a further normally open relay 105 from the 115-volt source referred to above. Relay 105 in turn closes the main power circuit for the magnetic clutch 39. This power circuit is illustrated as being supplied from a 230-volt full wave rectifier unit, generally denoted by the reference numeral 106, or by another appropriate D. C. source or power pack. The latter is appropriately connected by leads 107, 108 to the clutch power conductors 36, 37 and collector rings 38, 39 referred to above.

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In the event that the switch controlled conductors 47, 48 should become short circuited, as by rupture and crossing thereof in operation, the resistor 100 is cut out of the above described sensitive relay circuit, whereupon the armature of relay 101 is actuated to open the control circuit. The relay 102 is simultaneously spring-actuated to open the power supply for the secondary relay 105, thereby disconnecting the clutch 30. Accordingly, shorting or rupture of a conductor in cable 18 results in instantaneous interruption of the power to drum 19.

If desired, this sensitive relay clutch control may be embodied with further circuit provisions of the type illustrated in Fig. 10, including motion and limit switches on the winch and a pneumatic time relay device, to effect a thoroughly automatic shovel control, as hereinafter described. Regarding the circuit of Fig. 9 as a separate entity, it contributes greatly to the safety of the shovel operator and to the protection of the equipment. Whereas the conventional shovel cannot be stopped short of its normal stroke or travel, after it has started a forward motion, the above arrangement places the shovel under the complete control of the operator at all times. It is, furthermore, more quickly responsive in operation, because the shovel commences its stroke immediately upon depression of the switch push button and need not await the movement of various counterweights, levers, latches, etc., to engage its clutch, as in existing devices. Similarly, faulty handling of the shovel or loss of control of the shovel handle, as by encountering an immovable object, results in immediate stoppage of the shovel stroke, without reliance on a time-consuming reaction of mechanical elements. Shorting of the cable conductors has the same result. Moreover, the increased compactness of the present circuit elements enable the control mechanism to be installed in a much smaller space than a conventional assembly.

It will be noted that I have conventionally illustrated a limit switch in Fig. 9, which may be of the safety pulley type illustrated in Figs. 5, 6 and 7, and is accordingly designated by the reference numeral 66. However, it will be appreciated that this limit switch may be omitted if desired or replaced by any other type of control switch adapted to open the clutch or prime mover power circuit under certain conditions.

Referring to Fig. 10, there are illustrated therein further circuit provisions for automatically governing the manipulation and travel of the power scoop 20. As stated above, this circuit may, if it is desired, be associated with a push button and sensitive relay circuit of the type shown in Fig. 9. It is the purpose of the circuit of Fig. 10 to entirely automatically control the movements of the scoop, insuring that repeated working strokes will be made after a predetermined reasonable but fixed interval following the completion of a preceding stroke. The object of this is to prevent unreasonable idling of the operator in the work of unloading material, and, to this extent, the time delay provisions of the Fig. 10 circuit may be somewhat inconsistent with the push button control provisions of Fig. 9 which enable the operator to have full control at all times. However, it may nevertheless be desirable to combine the features, under certain circumstances. Certain parts in Fig. 10 which are the same as parts in Fig. 9 are designated by the same reference numerals, primed.

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Referring to Fig. 10, the reference numeral 110 designates in a general way a standard type of motion switch and the reference numeral 111 similarly designates a limit switch. These are operatively connected to and operated by the cable drum 19, as by means of a chain drive or other suitable conventional means which it is not deemed necessary to illustrate.

Switches 110, 111 may, for example, be of the traveling nut or cam operated type and are synchronized with the movement of drum 19 whereby, when the scoop 20 is in its extreme forward position adjacent the door of the car being unloaded, with the cable wound on the drum, the limit switch 111 is open and the motion switch 110 closed. Fig. 3 diagrammatically illustrates, in a general way, a satisfactory arrangement. The conventional motion switch 110 has its contacts closed during forward motion or no motion of a contact control shaft 110a, which is suitably geared to or chain-driven by drum 19, and open upon reverse motion of that shaft. Switch 111 is a conventional traveling nut type. The thus opened circuit de-energizes the magnetic clutch 30, freeing drum 19 from the shaft and permitting the scoop to be moved to the rear of the car preparatory to a succeeding unloading stroke. This retractile movement opens motion switch 110 while it is taking place and closes limit switch 111. As soon as the backward motion of the shovel ceases, motion switch 110 also closes, causing the coil of the time delay relay 112 to be energized. Said relay is of a standard type and, after a period of time, which is readily adjustable, relay 112 closes and energizes the coil of the power relay 113. This completes the operating or power circuit of the magnetic clutch 30'.

A 115-volt alternating circuit supply line shown in Fig. 10 supplies power for the above described relays as well as the transformer 114 at which the current is stepped down to about 6 volts for the clutch control circuit including conductors 47a, 48a. Clutch 30' is supplied with power by the conductors 36', 37', under the control of the relay 115 which is energized to close the clutch power circuit when the switch means 22' is actuated.

It will be appreciated that the manual switch 22' shown in Fig. 10 is employed only in the case that the shovel scoop is actuated by a cable having the conductors 47a, 48a woven therein, and that it may be desirable in some cases to eliminate a manual switch in view of the fact that the time delay, motion and limit provisions incorporated in Fig. 10 are for the express purpose of making the shovel completely automatic in operation, rather than under the control of the operator in the timing of its operating strokes.

The clutch power circuit of Fig. 10 may be supplied from a rectified direct current source such as is illustrated in Fig. 9 and designated 106', by employing connections similar to those shown in Fig. 9. This circuit may also include the limit switch 66' shown in Fig. 9.

It is evident from the foregoing that I have provided a power shovel control which is characterized by selectively available features of (a) manual operator control; (b) a sensitive relay feature to safeguard against short circuiting of the electrical control lines; (c) safety limit switch protection at a guide pulley, in the event an object becomes attached to or snagged in the draft cable 18; and (d) further automatic winch-actuated motion and limit switches and time de-

lay relay for automatic stroke control and timing. These features are coupled with further mechanical features of improvement to afford a shovel construction of a very desirable and efficient nature.

I claim:

1. A draft assembly comprising a draft implement, an elongated flexible cable-type draft member connected at one end to said implement to actuate the same, a winding device to which the other end of said draft member is connected, a source of power for said device having electrically energizable driving and control means operatively connected thereto and adapted to be drivingly connected to said device, electrical conductor means coextensive in length with said draft member and interwoven therewith, a switch on said implement in circuit with said conductor means, the latter being electrically connected to said driving and control means to energize the same upon actuation of said switch, means electrically connected to said switch and to said driving and control means to de-energize the latter upon failure of said conductor means, a guide engaged by said draft member in the operation thereof, a control element associated with said guide and adapted to be contacted and operated by an object traveling with the draft member, and a control circuit for said driving and control means including a further switch operatively connected with said control element and actuated thereby to de-energize said last named circuit in the event of operation of the control element by an object.

2. A draft assembly comprising a draft implement, a winding drum, an elongated flexible draft cable connected to said drum and implement to actuate the latter, an electrically controlled coupling unit adapted to drive said drum, and a control circuit for said unit including electrical conductor means coextensive in length with said cable and interwoven therewith, a switch on said implement, said conductor means being electrically connected to said switch, and means electrically connected to said conductor means and operative to de-energize said coupling in the event of failure or short circuiting of said conductor means, said last named, electrically connected means comprising a resistor in series with said conductor means and a pair of sensitive relay devices connected in parallel with said resistor, said relay devices being selectively operable as controlled by said resistor in accordance with the short circuiting or non-short circuiting of said conductor means.

3. A draft assembly comprising a draft implement, a winding drum, an elongated flexible draft cable connected to said drum and implement to actuate the latter, an electrically controlled clutch adapted to drive said drum, and a control circuit for said clutch including electrical conductor means coextensive in length with said cable and interwoven therewith, a switch on said implement, said conductor means being electrically connected to said clutch and switch to control actuation of the clutch, and means including coordinated sensitive relays in said circuit to de-actuate said clutch in the event of failure or short circuiting of said conductor means.

4. A draft assembly comprising a draft implement, means for actuating the same including a winding drum, an electrically energizable power source therefor, and an elongated flexible cable connected at opposite ends thereof to said implement and drum to draw said implement upon

actuation of said drum by said source, a control switch on said implement, flexible elongated conductor means associated with said cable and electrically connected with said power source and switch, and a control circuit for said source with which said conductor means is connected, said circuit comprising an impedance and a pair of relays of coordinated sensitivity connected to said impedance in a manner to interrupt said circuit upon failure or short circuiting of said conductor means.

5. A draft implement assembly comprising a draft implement, means for actuating the same including a winding drum, an electrically energizable clutch adapted to drive said drum and an elongated flexible cable connected at opposite ends thereof to said implement and drum to draw said implement upon clutch actuation of said drum, and a control circuit for said clutch comprising a control switch on said implement, flexible elongated conductor means woven into said cable and electrically connected with said clutch and switch, and means including a pair of relays of coordinated sensitivity connected to said switch in a manner to interrupt said circuit upon short circuiting or failure of said conductor means.

6. A draft implement assembly comprising a draft implement, means for actuating the same including a winding drum, an electrically energizable clutch adapted to drive said drum and an elongated flexible cable connected at opposite ends thereof to said implement and drum to draw said implement upon clutch actuation of said drum, and a control circuit for said clutch comprising a control switch on said implement, flexible elongated conductor means woven into said cable and electrically connected with said clutch and switch, a resistor, and means including a pair of relays of coordinated sensitivity connected to said resistor and switch in a manner to interrupt said circuit upon short circuiting or failure of said conductor means.

7. In a draft assembly including a draft implement, a flexible cable connected thereto and a winding drum to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, a source of power, an electrically energizable clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a control circuit for said clutch comprising switch means operatively connected to and controlled in accordance with movement of said drum, and a time delay relay, said switch means and relay being connected in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a succeeding stroke a predetermined time interval thereafter.

8. In a draft assembly including a draft implement, a flexible cable connected thereto and a winding drum to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, a source of power, an electrically energizable clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a control circuit for said clutch comprising motion and limit switch means operatively connected to and controlled in accordance with movement of said drum, and a time delay relay, said switch means and relay being connected in series in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a suc-

ceeding stroke a predetermined time interval thereafter.

9. In a draft assembly including a draft implement, a flexible cable connected thereto and a winding drum to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, a source of power, an electrically energizable clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a cable guide disposed between said drum and implement and having a control member adapted to be engaged and operated by an object traveling with the cable, a control circuit for said clutch comprising motion and limit switch means operatively connected to and controlled in accordance with movement of said drum, a time delay relay, said switch means and relay being connected in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a succeeding stroke a predetermined time interval thereafter, and a further switch operatively connected with said clutch and adapted to be actuated by said control member upon operation of the latter, to thereby de-energize said clutch.

10. A draft assembly comprising a draft implement, a flexible cable connected thereto, a rotatable winding drum of relatively lightweight steel construction to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, a source of power, a magnetic clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a control circuit for said clutch comprising motion and limit switches operatively connected to and controlled by said drum and a time delay relay, said switches and relay being connected in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a succeeding stroke a predetermined time interval thereafter.

11. A draft assembly comprising a draft implement, a flexible cable connected thereto, a rotatable winding drum to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, anti-friction means rotatively supporting said drum, a source of power, a magnetic clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a control circuit for said clutch comprising motion and limit switches operatively connected to and controlled by said drum and a time delay relay, said switches and relay being connected in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a succeeding stroke a predetermined time interval thereafter.

12. A draft assembly comprising a draft implement, a flexible cable connected thereto, a rotatable winding drum of relatively lightweight steel construction to which said cable is connected to actuate said implement in a working stroke upon actuation of said drum, anti-friction means rotatively supporting said drum, a source of power, a magnetic clutch actuated by said source and adapted to be connected to said drum to actuate the latter, a control circuit for said clutch comprising motion and limit switches operatively connected to and controlled by said drum and a time delay relay, said switches and relay being

connected in said circuit for interrupting and renewing energization of said clutch respectively upon termination of a working stroke of said implement and upon initiation of a succeeding stroke a predetermined time interval thereafter.

13. A draft assembly comprising a draft implement, an elongated flexible cable connected at one end thereof to said implement, a winding drum, electrically controlled means adapted to drive said drum, ball bearing means for anti-frictionally mounting said drum for rotation, said cable being connected at its opposite end to said drum to be wound thereon upon rotary actuation thereof and thereby to actuate said implement in a working stroke, guide means for said cable interposed between said drum and implement, a control circuit for said drum drive means comprising connected motion and limit switches and a time delay relay for respectively de-energizing and energizing said drive means upon completion of a working stroke of said implement and upon initiation of a succeeding working stroke a predetermined time interval later.

14. A draft assembly comprising a draft implement, an elongated flexible cable connected at one end thereof to said implement, a winding drum of relatively lightweight steel construction characterized by a minimum of rotating inertia, electrically controlled means adapted to drive said drum, ball bearing means for anti-frictionally mounting said drum for rotation, said cable being connected at its opposite end to said drum to be wound thereon upon rotary actuation thereof and thereby to actuate said implement in a working stroke, guide means for said cable interposed between said drum and implement, a control circuit for said drum drive means comprising connected motion and limit switches and a time delay relay for respectively de-energizing and energizing said drive means upon completion of a working stroke of said implement and upon initiation of a succeeding working stroke a predetermined time interval later.

15. A draft assembly comprising a draft implement, an elongated flexible cable connected at one end thereof to said implement, a winding drum of relatively lightweight steel construction characterized by a minimum of rotating inertia, electrically controlled means adapted to drive said drum, ball bearing means for anti-frictionally mounting said drum for rotation, said cable being connected at its opposite end to said drum to be wound thereon upon rotary actuation thereof and thereby to actuate said implement in a working stroke, guide means for said cable interposed between said drum and implement, and a control circuit for said drum drive means comprising a limit switch operatively associated with said guide means and adapted to be engaged by an object traveling with said cable to thereby interrupt said circuit, said circuit comprising further connected motion and limit switches and a time delay relay for respectively de-energizing and energizing said drive means upon completion of a working stroke of said implement and upon initiation of a succeeding working stroke a predetermined time interval later.

16. A draft assembly comprising a draft implement, an elongated draft member connected at one end to said implement to actuate the same, a winding device to which the other end of said draft member is connected, electrically energizable driving means operatively connected to said device to drive the same, electrical conductor

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means, and means electrically connected to said conductor means and controlling said driving means, said last named means being operative in the event of failure or short circuiting of said conductor means to de-energize said driving means, said last named, electrically connected means comprising a resistor in series with said conductor means and a pair of sensitive relay devices connected in parallel with said resistor, said relay devices being selectively operable as controlled by said resistor in accordance with the short circuiting or non-short circuiting of said conductor means.

17. A draft assembly comprising a draft implement, an elongated flexible cable-type draft member connected at one end to said implement to actuate the same, a winding device to which the other end of said draft member is connected, electrically energizable driving means operatively connected to said device to drive the same, electrical conductor means co-extensive in length with said draft member and interengaged therewith, and means electrically connected to said conductor means and controlling said driving means, said last named means being operative in the event of failure or short circuiting of said conductor means to de-energize said driving means, said last named, electrically connected means comprising a resistor in series with said conductor means and a pair of sensitive relay devices connected in parallel with said resistor, said relay devices being selectively operable as controlled by said resistor in accordance with the short circuiting or non-short circuiting of said conductor means.

18. A draft assembly comprising a draft implement, a rotatable winding drum, an elongated flexible cable connected at opposite ends to said drum and implement to actuate the latter upon winding rotation of said drum, a source of power having an electrically controlled coupling unit operatively connected thereto, said unit being adapted to be drivingly engaged with said drum to rotate the same, and an electrical control circuit for said coupling unit including electrical conductor means, a switch on said implement to which said conductor means are circuit-connected, and means electrically connected to said conductor means and operatively connected to said coupling unit to interrupt driving of said drum upon failure or short circuiting of said conductor means, said last named, electrically connected means comprising a resistor in series with said conductor means and a pair of sensitive relay devices connected in parallel with said resistor, said relay devices being selectively operable as controlled by said resistor in accordance with the short circuiting or non-short circuiting of said conductor means.

19. A draft assembly comprising a draft implement, a rotatable winding drum, an elongated flexible cable connected at opposite ends to said drum and implement to actuate the latter upon winding rotation of said drum, a source of power having an electrically controlled coupling unit operatively connected thereto, said unit being adapted to be drivingly engaged with said drum to rotate the same, and an electrical control circuit for said coupling unit including electrical conductor means, said conductor means being coextensive in length with said cable and interwoven therewith, a switch on said implement to which said conductor means are circuit-connected, and means electrically connected to said conductor means and operatively connected to said

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coupling unit to interrupt driving of said drum upon failure or short circuiting of said conductor means, said last named, electrically connected means comprising a resistor in series with said conductor means and a pair of sensitive relay devices connected in parallel with said resistor, said relay devices being selectively operable as controlled by said resistor in accordance with the short circuiting or non-short circuiting of said conductor means.

20. A power operating assembly comprising an implement, an actuating device, a flexible tension member connected to said device and implement, whereby to actuate said implement upon actuation of said device, a guide sheave around which said tension member is trained, said sheave being provided with a control element past which said member passes, which element is adapted to be engaged and operated by an object traveling with said member, means pivoting said element about horizontal and vertical axes for combined vertical and horizontal swinging movement, electrically controlled means for operating said implement through said tension member and said device, an electrical control circuit for said last named means, and a switch associated with said control element to be operated thereby upon operation of said element by an object traveling with said tension member, said switch being electrically connected to said control circuit.

21. A power operating assembly comprising an implement, a winding device, an elongated flexible tension member connected at its opposite ends to said device and implement, whereby to actuate said implement upon actuation of said device, a sheave interposed between said implement and device over which said tension member is trained, said sheave being provided with a ring guide through which said member passes, said ring guide being engageable by an object traveling with said member to operate the guide, means pivoting said ring guide on said sheave about horizontal and vertical axes for combined vertical and horizontal movement, electrically controlled means for operating said implement through said tension member and said device, an electrical control circuit for said last named means, and a switch associated with said ring guide to be operated thereby upon operation of said guide by an object traveling with said tension member, said switch being electrically connected to said control circuit.

22. A power operating assembly comprising a shovel, an actuating device, a tension cable connected to said device and shovel to actuate the latter upon actuation of said device, a sheave about which said cable is trained, a control element pivoted for combined swinging movement about horizontal and vertical axes, which element is positioned for engagement and operation by an object traveling with said cable, an electrically controlled source of power including a control circuit for said device, and a switch associated with said control element and operated by the latter upon operation of said element by such an object, said switch being electrically connected to said control circuit.

23. A power operating assembly comprising a shovel, an implement, a winding device, an elongated flexible tension cable connected at its opposite ends to said device and shovel to actuate the latter upon actuation of said device, a sheave interposed between said shovel and device about which said cable is trained, a guide ring through which said cable passes, said guide ring being

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pivoted on said sheave for combined swinging movement about horizontal and vertical axes and being engageable by an object traveling with said cable, an electrically controlled source of power including a control circuit for said device, and a switch associated with said guide ring and to be operated thereby upon operation of said ring element by such an object, said switch being electrically connected to said control circuit.

24. A draft assembly comprising a draft implement, a winding drum, an elongated flexible draft cable connected to said drum and implement to actuate the latter, an electrically controlled device adapted to drive said drum, and a control circuit for said device including electrical conductor means co-extensive in length with said cable and interwoven therewith, a switch on said implement, said conductor means being electrically connected to said device and switch to control actuation of said device, and means including coordinated sensitive relays in said circuit to de-actuate said device in the event of failure or short circuiting of said conductor means.

25. For use in association with a draft implement, an actuating drum, a flexible cable member connected to said drum and implement to actuate the implement upon operation of the drum, electrically controlled means driving said drum, and an electric control circuit for said last named means, a guide sheave for said flexible cable member provided with a control element past which said cable member passes, which element is adapted to be engaged and operated by an object traveling with said cable member, means pivoting said element about horizontal and vertical axes for combined vertical and hori-

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zontal swinging movement, a switch associated with said control element to be operated by the latter upon operation of said element by an object traveling with said cable member, and means for electrically connecting said switch to said control circuit,

26. A draft assembly comprising a draft implement, a winding drum, an elongated flexible draft cable connected to said drum and implement to actuate the latter, an electrically controlled device adapted to drive said drum, and a control circuit for said device including electrical conductor means co-extensive in length with said cable and interwoven therewith, a switch on said implement, said conductor means being electrically connected to said device and switch to control actuation of said device, and means controlling actuation of said device including means responsive to short circuiting of said conductor means to interrupt said control circuit.

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