Aug. 28, 1956 M. C. ADDICKS Re. 24,201

DEVICE FOR HANDLING GRANULAR MATERIAL

Original Filed Feb. 2, 1951 5 Sheets-Sheet 1

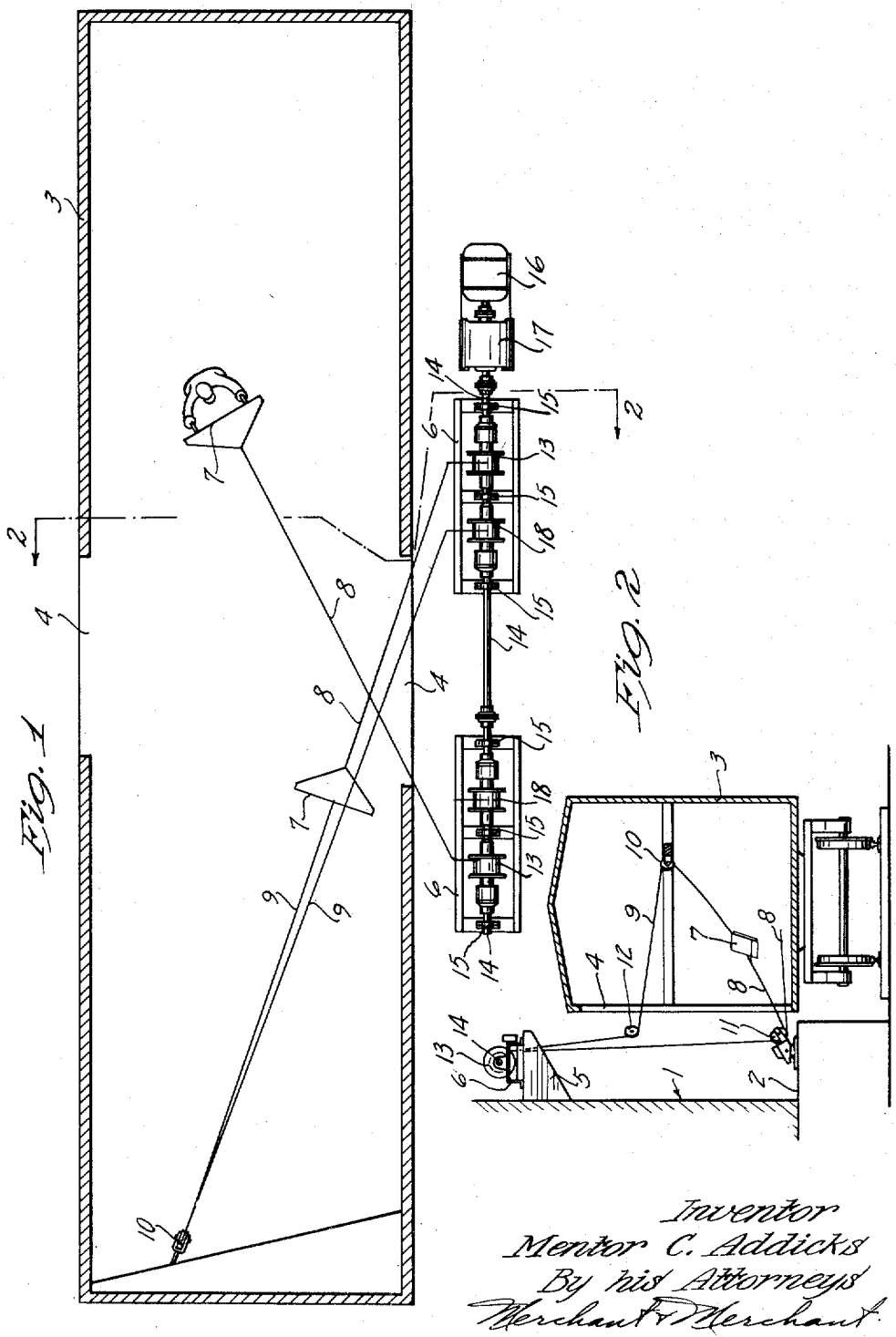


Fig. 1

Fig. 2

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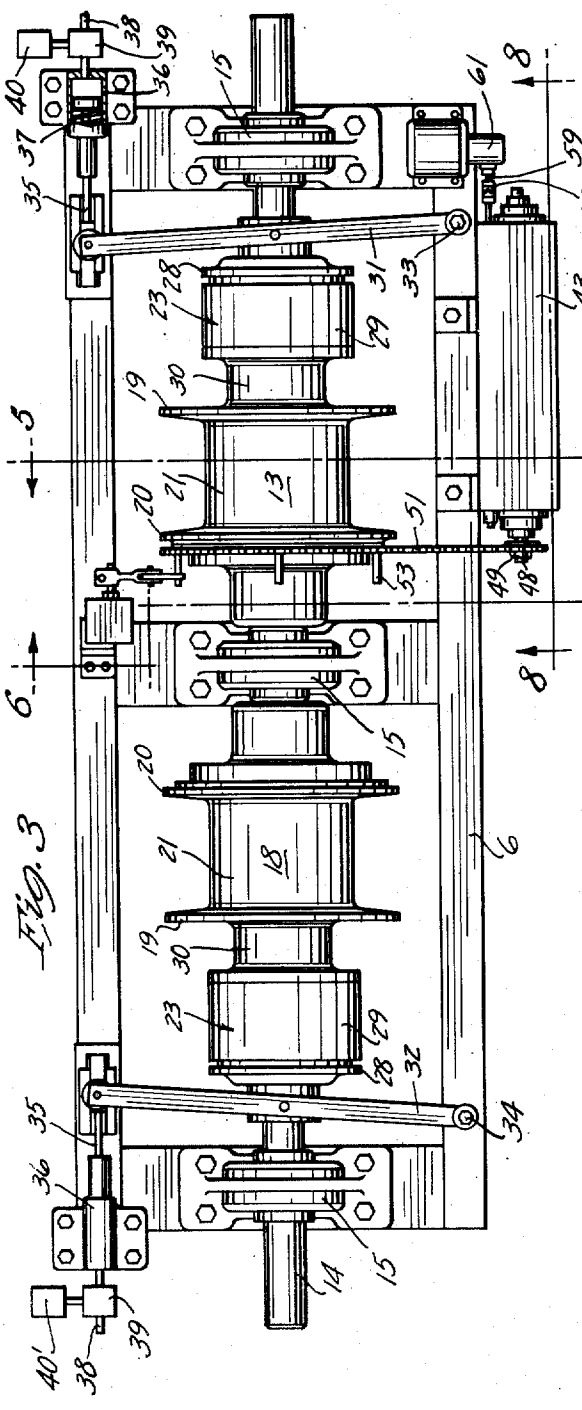


Fig. 3

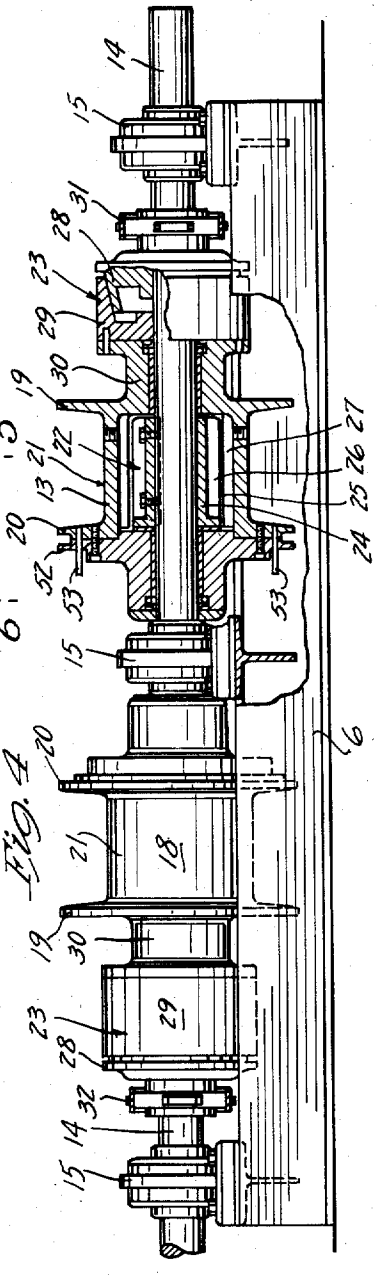


Fig. 4

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Fig. 5

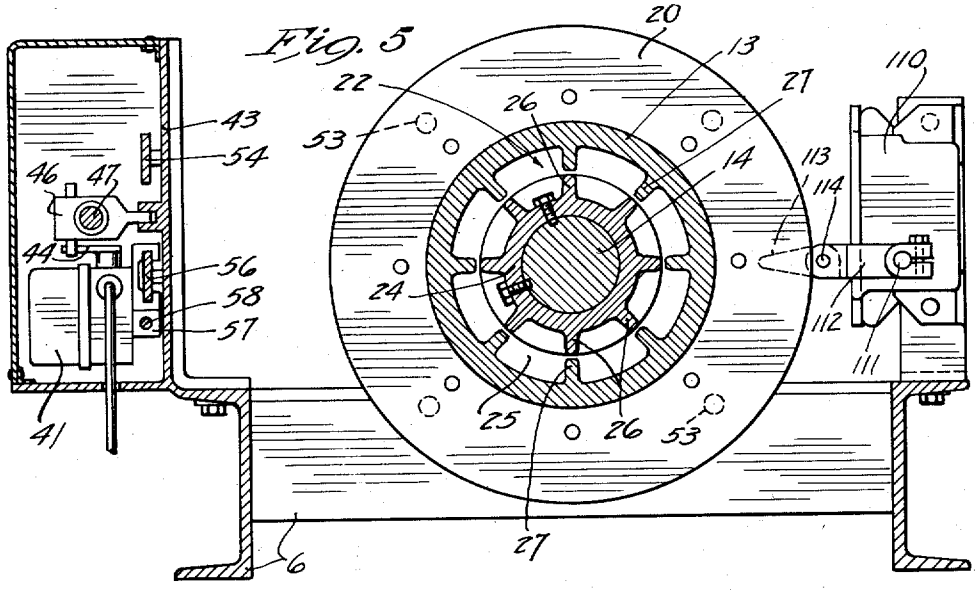


Fig. 6

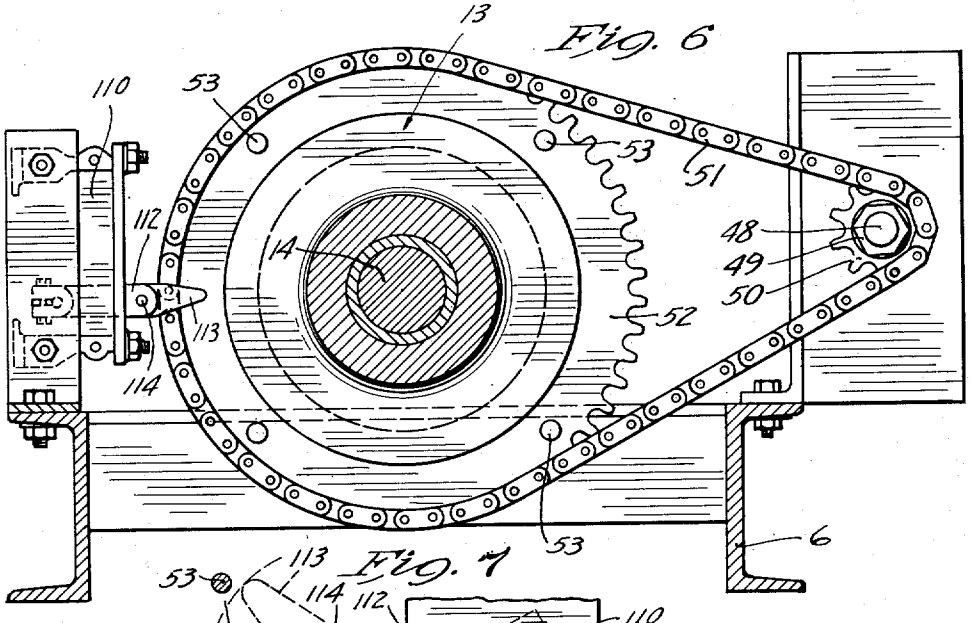
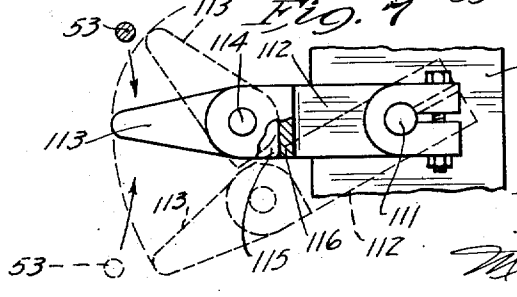


Fig. 7



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Fig. 8

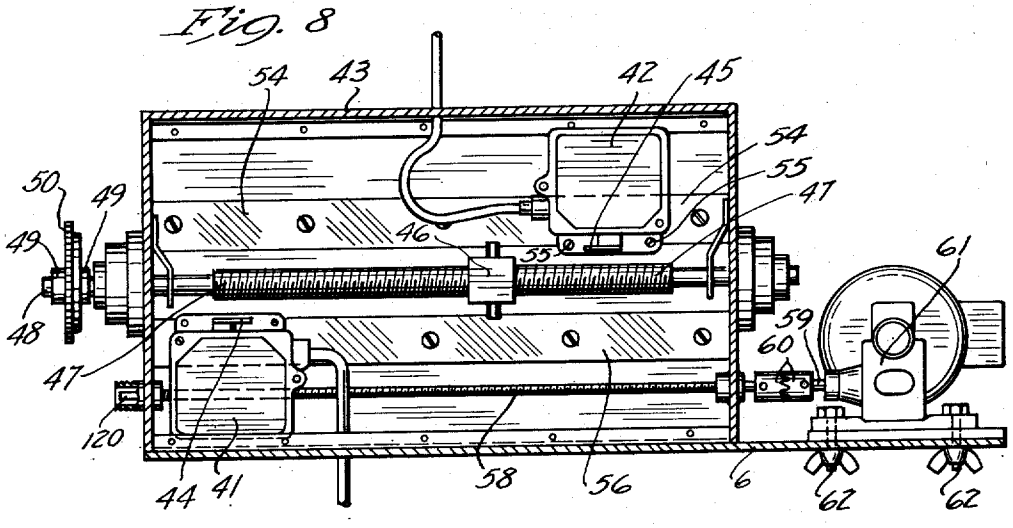


Fig. 10

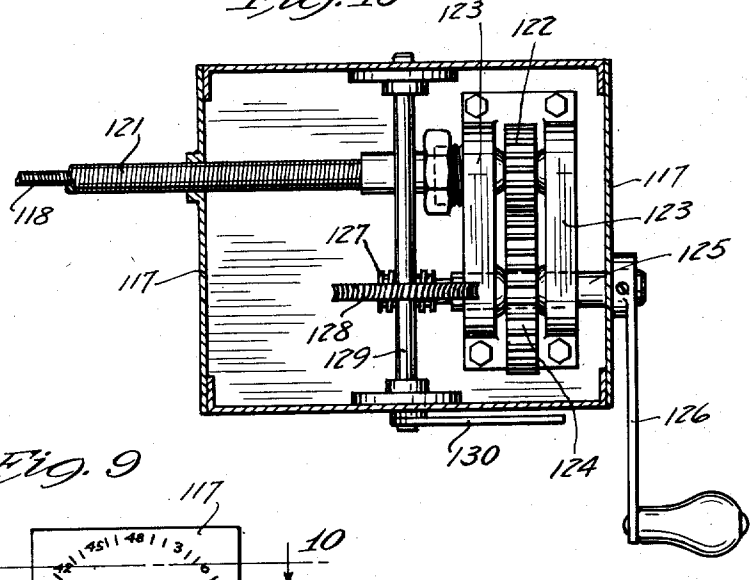
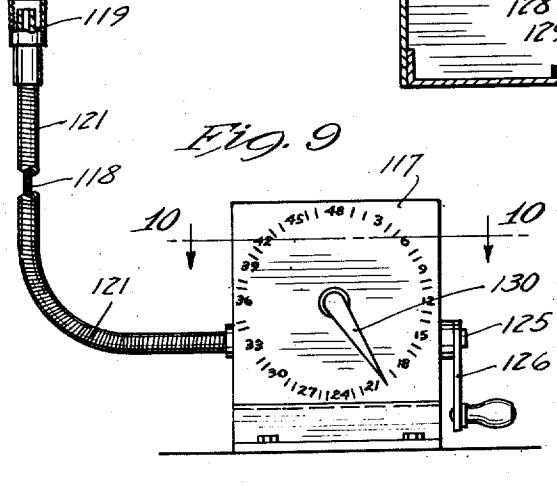


Fig. 9



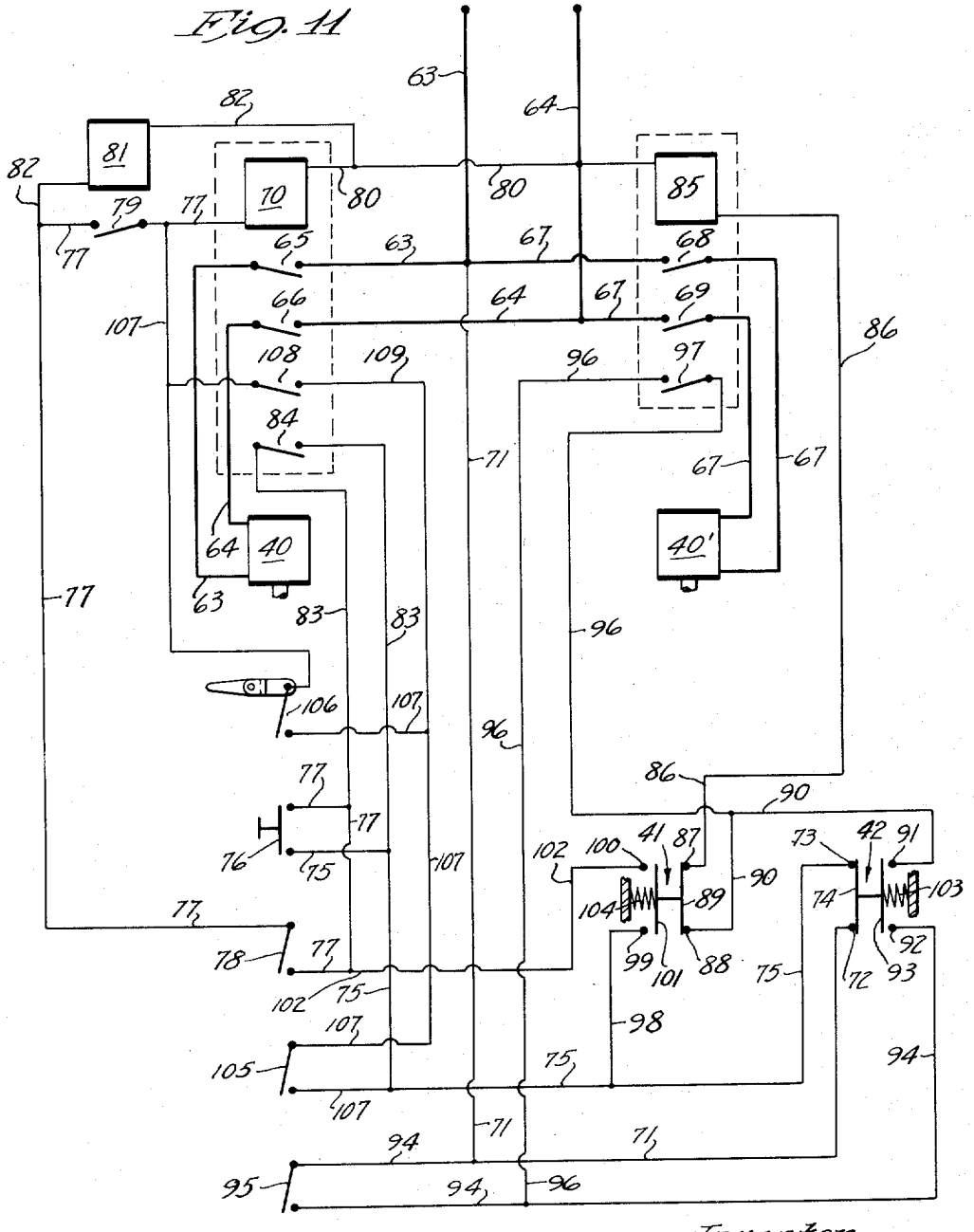
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Fig. 11



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24,201

DEVICE FOR HANDLING GRANULAR MATERIAL

Mentor C. Addicks, Minneapolis, Minn.

Original No. 2,646,965, dated July 28, 1953, Serial No. 209,175, February 2, 1951. Application for reissue May 24, 1955, Serial No. 510,878

17 Claims. (Cl. 254—173)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

My invention relates generally to machines for handling granular or bulk material and more specifically to improved mechanisms for unloading granular material from freight cars and the like.

An important object of my invention is the provision of a machine for removing bulk material from freight or box cars and the like which, when applied to a loaded car, is entirely automatic in its operation in removing all but a minimum quantity of the material from the car.

Another important object of my invention is the provision of a car unloading machine of the type set forth which may be quickly and easily changed from fully automatic operation to manually controlled semi-automatic operation for the purpose of unloading the relatively small quantity of material remaining in the car after automatic unloading thereof is completed.

Another object of my invention is the provision of an unloading machine of the above type which precludes the necessity of an operator's presence within the car during the greater part of the unloading operation, thereby avoiding exposure of the operator to the dust stirred up in the car during the unloading thereof.

Another object of my invention is the provision of a grain shoveling machine as set forth having a traveling shovel or scoop, the extent of travel of which may be automatically varied during the unloading operation so that the scoop is caused to travel progressively further away from the point of discharge with each successive shoveling operation.

Another object of my invention is the provision of novel control means whereby the amount of travel of the shovel may be varied by the operator stationed exterior of the car or bin.

Still another object of my invention is the provision of an automatic shoveling machine comprising winding drums and a drag or scoop connected to the drums by flexible cables for reciprocatory material shoveling and return movements, in which novel means is provided for accurately maintaining the extent of reciprocatory travel of the scoop or shovel irrespective of the manner in which the cables wind upon or unwind from their respective winding drums.

Another important object of my invention is the provision of novel driving connections for the cable winding drums above mentioned whereby to prevent backlash in the cable being unwound. For this purpose, I provide novel driving connections for the winding drums which include transfer coupling means which urge the drums in a cable winding direction of rotation but which permit cable unwinding rotation of said drums.

Heretofore, in car unloading or shoveling machines where a scoop or shovel is operated by a drag line utilizing a tail sheave secured to one end of the bin or car, difficulty has been experienced when it has been necessary to move said tail sheave adjustably toward or away from the winding drums of the shoveling machine by reason

of the fact that control switches for the winding drums would have to be manually moved or adjusted to compensate for variations in distance of shovel travel, or the cable must be manually lengthened or shortened according to the position of the tail sheave without disturbing the relative positions of the winding drums and control switches therefor. These operations consume valuable time and perfect adjustment is not always possible. Another object of my invention is, therefore, the provision of a shoveling machine utilizing a tail sheave in which said tail sheave may be readily moved with respect to the winding drums without loss of time and without the necessity of adjustment of associated parts. Such movement of the tail sheave will simply cause added cable to be drawn from the drum which is used to pull the shovel in the direction of its return movement toward the tail sheave.

A still further object of my invention is the provision of a shoveling machine as set forth which is relatively simple and inexpensive to manufacture and install, which is highly efficient in operation, and which is rugged in construction and durable in use.

Other highly important objects and advantages of my invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings which illustrate the invention, and in which like characters indicate like parts throughout the several views:

Fig. 1 is a diagrammatic view in plan illustrating a preferred embodiment of my improved shoveling machine and its use in unloading a freight car or the like;

Fig. 2 is a vertical section taken substantially on the line **2—2** of Fig. 1;

Fig. 3 is a view in plan of my novel shoveling machine, some parts being removed;

Fig. 4 is a view in side elevation of the structure of Fig. 3, some parts being removed, some parts being broken away, and some parts shown in section;

Fig. 5 is an enlarged transverse section taken substantially on the line **5—5** of Fig. 3;

Fig. 6 is an enlarged transverse section taken substantially on the line **6—6** of Fig. 3;

Fig. 7 is an enlarged fragmentary detail of a portion of Fig. 5, illustrating the operation of the trip switch operating lever of my invention;

Fig. 8 is an enlarged view partly in front elevation and partly in section taken substantially on the line **8—8** of Fig. 3 and illustrating a preferred form of control mechanism of my invention;

Fig. 9 is a fragmentary view in front elevation of a modified form of control device adapted to be used in connection with a portion of the control mechanism of Fig. 8;

Fig. 10 is an enlarged view in section taken substantially on the line **10—10** of Fig. 9; and

Fig. 11 is a wiring diagram.

Referring with greater detail to the drawings and particularly to Figs. 1 and 2, the numeral **1** indicates a suitable building such as a grain elevator or the like having a receiving platform **2** adjacent a pair of tracks upon which moves and is adapted to rest a conventional box car or the like **3**. The receiving platform **2** is conventional in nature and is adapted to receive granular material such as grain or the like from the car **3** as the grain is shoveled or otherwise moved through the customary opening **4** in the side of the car **3** and at its central portion. Mounted on the building **1** and carried by suitable brackets or the like **5** is a supporting structure or frame **6** having mechanism therein for imparting reciprocatory grain shoveling and return movements to a scoop or shovel **7** which is adapted to be moved between one

end portion of the car **3** and the intermediate door opening **4** thereof. The shovel **7** is of the type commonly used to move grain or like bulk material from one part of a room such as a grain bin to another, or as shown, unloading grain or like material from a box car. The scoop is connected to the shoveling machine for movements in a car unloading direction by a flexible cable **8** and to the shoveling machine for return movements by a second cable **9** which runs over a tail sheave shown diagrammatically in Figs. 1 and 2 and indicated at **10**. The tail sheave is of the type commonly used for this purpose and may be secured to either end portion of the box car in a suitable and well known manner. For the purpose of clarity, the cable **8** will be hereinafter designated as the pull-forward cable and the cable **9** as the return cable.

Inasmuch as the shoveling machine mounted in the supporting structure **6** is preferably mounted above the level of the door opening **4** of the box car **3**, see Fig. 2, suitable pulleys for guiding the pull-forward cable **8** and the return cable **9** are provided at convenient locations and suitably secured in positions to properly guide said cables. One of the guide pulleys, indicated at **11**, is mounted closely above the level of the floor of the car **3** while the pulley for the return cable **9** is mounted at a level above the pulley **11**, by suitable means not shown, this second pulley being indicated by **12**.

The pull-forward cable **8** has its free end secured to a cable winding drum **13** that is journalled on a power driven shaft **14** which is in turn journalled in suitable bearings **15** in the supporting structure of the frame **6**. Rotary movement is imparted to the shaft **14** by a prime mover such as an electric motor **16** through conventional speed reduction gearing not shown but contained within a housing **17**. The free end of the return cable **9** is secured to a second cable winding drum **18** which is also journalled on the shaft **14** in axially spaced relationship to the winding drum **13**. The drums **13** and **18** are in the nature of spools having radially outwardly projecting end flanges **19** and **20** and, as clearly shown in Figs. 3 and 4, have relatively smooth cable-engaging surfaces **21** over which the cables **8** and **9**, respectively, are wound. As indicated in Figs. 1 and 2, both the pull-forward cable **8** and the return cable **9** are wound on their respective drums **13** and **18** in the same direction of rotation for a purpose which will hereinafter become apparent.

The drums **13** and **18** are each coupled to the drive shaft **14** by power transmission mechanism comprising a low torque transfer coupling **22** and a releasable high torque transfer coupling **23**. The low torque transfer coupling of each drum comprises a central tubular member **24** rigidly secured to the drive shaft **14** within an annular chamber **25** defined by the shaft **14** and the winding drum. The tubular chamber **24** is provided with a plurality of longitudinally extending axially outwardly projecting blades or vanes **26** which terminate radially inwardly of an arc defined by the radially inner edges of a plurality of circumferentially spaced vanes or blades **27** integrally formed with and projecting radially inwardly from the intermediate portion of each of the drums **13** and **18**. The chamber **25** is at least partially filled with suitable liquid such as lubricating oil or hydraulic brake fluid which acts as a lubricant for the bearings **15** in addition to providing a driving medium between the blades **26** of the sleeve **24** and the vanes **27** integral with the drums. Rotation of the shaft **14** being relatively slow, a low torque is imparted to the drums **13** and **18** in a direction to wind the cables thereon. When the cable is drawn from either of the drums **13** or **18**, said drums rotate in a direction opposite that of the drive shaft **14** thereby causing a greater speed differential between the unwinding drum and the drive shaft **14** and causing a greater drag to be placed upon the unwinding drum. This arrangement prevents any overrunning of either of the drums in a direction to unwind the cable therefrom and consequent possible backlash or entanglement of the unwinding cable. In other words, both the pull-forward cable **8** and return cable **9** are always maintained under relatively low tension during rotation of the drive shaft **14**.

The high torque transfer coupling unit for each winding drum comprises a pair of clutch elements **28** and **29** the former of which is keyed or otherwise secured to the drive shaft **14** for common rotation therewith and for axial sliding movements with respect thereto, and a clutch element **29** rigidly secured to an axially extended portion **30** of one of the drums **13** and **18**. The clutch elements **28** are each independently moved by shifter levers **31** and **32** pivotally mounted on the supporting structure or frame **6**, as indicated at **33** and **34**, respectively. The shifter levers **31** and **32** are preferably pneumatically controlled each being connected at their free ends to one of a pair of guided piston plungers **35** each of which is mounted for extending and retracting movements in a fluid pressure cylinder **36** and biased by spring means **37** in a direction to disengage the clutch elements **28** and **29**. Air under pressure is supplied selectively to the cylinders **36** through conduits **38** from a source of pressure, not shown, and control thereof is effected by conventional valves **39** operated by actuators in the nature of solenoids **40** and **40'**. The solenoid **40** controls the action of the clutch **23** associated with the forward pull drum **13** whereas the solenoid **40'** controls the action of the clutch **23** associated with the return drum **18**.

When the novel shoveling machine is used for automatic unloading of a freight car or the like, the extent of rotary movement of the winding drums **13** and **18** is controlled by the positioning of a pair of limit switches **41** and **42** mounted in a casing or the like **43**. The switches **41** and **42** are provided with operating arms **44** and **45**, respectively, which are adapted to be engaged by a tripping member **46** which has screw-threaded engagement with a lead screw or the like **47** journalled in opposite ends of the casing **43** and having a diametrically reduced outer end **48** which extends outwardly of the casing **43** and which is threaded to receive clamping nuts **49** one each disposed on opposite sides of a sprocket wheel or the like **50** slidably mounted on the shaft end **48**. The sprocket wheel **50** is adapted to be rotated by an endless link chain **51** running thereover and a relatively large sprocket wheel **52** anchored to the flange **20** of the drum **13** by pins or the like **53**. The switch **42** is slidably mounted on a mounting bar or plate **54** and clamped thereto by means of clamping screws or the like **55**, whereas the switch **41** is mounted for sliding movements on an elongated mounting plate or bar **56**, see particularly Figs. 5 and 8. The switch **41** is provided with a threaded lug **57** which has threaded engagement with an adjusting screw **58** journalled in the opposite ends of the casing **43**. With particular reference to Figs. 3 and 8, it will be seen that a projected end of the adjusting screw **58** is coupled to a drive shaft **59** by means of a shaft coupling **60**, the drive shaft **59** projecting outwardly from a conventional motorized gear reducer **61** slidably mounted on the supporting structure **6** and clamped in position by wing-nut-equipped clamping screws or the like **62**.

As illustrated in Fig. 1, a pair of my novel car shoveling machines may be used to advantage to quickly unload bulk material from the box car **3**. As there shown, one of the shoveling machines is used to function automatically while the other thereof is used semi-automatically, the return cable **9** being disconnected from the scoop **7** and an operator manually moving the scoop toward one end of the car **3** for the final clean-up operation. During the automatic unloading period it is desirable to move the scoop or shovel **7** in relatively short operational cycles or strokes and gradually lengthen said strokes toward the tail sheave **10** at the end of the car **3** as the car becomes partially emptied. This gradual lengthening of the shovel stroke is accomplished through the movement of the limit switch **41** in a direction from the right to the left with respect to Fig. 8. Obviously, as the distance

between the switches **41** and **42** increases, the tripping member **46** must travel a greater distance between the switches thereby causing the winding drums to execute a greater number of turns between the operation of one switch by the operating member **46** and the operation of the other switch thereby. The motorized speed reducer **61** which rotates the adjusting screw **58** for the limit switch **41** may be controlled by any suitable means, not shown, or by manually operated switches, if desired.

Electrical control means is diagrammatically illustrated in Fig. 11 and comprises the switches 41 and 42, the solenoids 40 and 40' and apparatus now to be described. The solenoid **40** is interposed in an electrical circuit which includes a pair of power leads **63** and **64** and a pair of serially connected normally open relay operated switches **65** and **66**. The solenoid **40'** is interposed in a circuit including a portion of the power lead **63**, a lead **67**, and a portion of the power lead **64**. A pair of normally open serially connected relay operated switches **68** and **69** are also interposed in the lead **67** on opposite sides of the solenoid 40'. The switches **65** and **66** are adapted to be closed by energization of a relay coil **70** contained in a circuit comprising a portion of the power lead **63**, a lead **71** which terminates in a contact **72** of the switch **42** which is normally connected to a switch contact **73** therein by a switch arm **74**, a lead **75** extending from the switch contact **73** to one side of a manually operated starting and reset switch **76**, a lead **77** extending from the other side of the reset switch **76** to the relay coil **70** and in which is interposed a manually operated master switch **78** and a time delay relay operated switch **79**, and a lead **80** extending from the opposite side of the relay coil **70** to the power lead **64**. The switch **79** is operated by a time delay relay **81** the winding of which is contained in a lead **82** shunting the switch **79** and the relay coil **70**. A holding circuit for the relay **70** comprises a lead **83** one end of which is connected to the lead **75** and the other of which is connected to the lead **77** between the reset switch **76** and the master switch **78**, and a normally open switch **84** closed by energization of the relay winding **70**.

The normally open switches **68** and **69** for energizing the solenoid **40'** are closed by energization of a relay winding **85** in a circuit including a portion of the power lead **64**, a lead **86** extending therethrough from said lead **64** and therefrom to a switch contact **87** of the switch **41** and normally connected to a cooperating switch contact **88** by a contact arm **89**, a lead **90** extending from the contact **88** to a contact **91** in the switch **42** normally out of electrical engagement with a cooperating switch contact **92** and adapted to be connected therewith by a contact arm **93** mounted for common movements with the contact arm **74**, a lead **94** extending from the switch contact **92**, a portion of the lead **71**, and a portion of the power lead **63**. A manually operated master switch **95** is interposed in the lead **94**. A holding circuit for the relay coil **85** includes a lead **96** extending from the lead **90** to the lead **94** and a holding switch **97** interposed in said lead **96**, said holding switch **97** being closed responsive to energization of the relay coil **85**. In order that the controls may be automatically reversed once the cycle of automatic operation has been initiated by closing of the starting and reset switch **76**, a circuit is provided which shunts out the switch **76** and which circuit comprises a lead **98** extending from the lead **75** to a switch contact **99** that is in normal switch open relationship to a cooperating switch contact **100** and adapted to be connected therewith by a switch arm **101** mounted for common movements with the switch arm **89**, and a lead **102** extending from the switch contact **100** to the lead **77** between the reset switch **76** and the master control switch **78**. With further reference to Fig. 11, it will be noted that coil springs **103** and **104** bias their respective switch arms **93** and **101** toward switch open positions and their respective switch arms **74** and **89** toward switch closed positions.

Automatic shoveling operation

When it is desired to use my shoveling machine to automatically unload grain or the like from a freight car, the operator fastens the tail sheave **10** to the interior of the car **3** in the conventional manner and adjacent one end thereof. Assuming that constant rotation is being imparted to the drive shaft **14** by the motor **16** and that the control switches **41** and **42** and the switch operating element **46** are initially located properly with respect to each other within the casing **43**, the operator manually closes the master control switches **78** and **95** and the starting and reset switch **76** thus completing a circuit between the power leads **63** and **64** and the time delay relay winding **81** through the lead **71**, the switch contacts **72** and **73**, the leads **75**, the starting and reset switch **76**, lead **77**, the master control switch **78**, part of the lead **77**, the lead **82**, and a portion of the lead **80**. Energization of the time delay relay **81** closes the switch **79** and causes the relay **70** to be energized whereby to close the switches **65** and **66** and energizing the winding of solenoid **40**. As hereinbefore described, energization of the solenoid **40** admits fluid under pressure to the cylinder **36** associated with the forward pull drum **13** so that the piston-equipped plunger rod **35** and the lever **31** will be moved in a direction to cause the clutch elements **28** and **29** of the clutch **23** associated with the forward pull drum **13** to be operatively engaged whereby high torque rotary cable winding movement will be imparted to the drum **13**. This rotation will pull the scoop **7** forwardly in the direction of the door opening **4** of the car **3** and a quantity of grain or like material moved toward the opening **4** thereby. As above indicated, cable winding movement of the drum **13** will cause rotary movement of the lead screw **47** in a direction to move the switch operating member **46** toward the operating lever **45** of the switch **42**. This engagement will cause the contact arm **74** to move out of engagement with the contacts **72** and **73**, and the contact arm **93** to move into operative engagement with the contacts **91** and **92** whereby to de-energize the relay **70** and complete a circuit through the winding of relay **95** to energize the same. Energization of the relay **85** will cause the switches **68** and **69** to close and complete a circuit from the power leads **63** and **64** through the solenoid **40'** to cause high torque coupling engagement of the return pull drum **18**. Obviously when the relay **70** is de-energized, the switches **65** and **66** are opened, de-energizing the solenoid **40** and disengaging the high torque coupling associated with the forward pull drum **13**. Cable winding rotation of the return drum **18** moves the scoop **7** in a return direction toward the tail sheave and causing the forward pull drum **13** to unwind against action of the low torque transfer coupling **22** until the switch operating member **40** is moved under reverse rotation of the drum **13** to a point where it engages the operating lever **44** of the switch **41**. With reference to Fig. 2, it will be seen that the return cable **9** is secured to the rear side of the scoop **7** adjacent its upper edge portion and that the forward-pulling cable **8** is attached to the scoop **7** adjacent the lower edge thereof. This arrangement permits the scoop to slide over the material in the car on its return movement and to dig into the material during the forward unloading movement thereof. It should further be noted that when the switch operating member **46** leaves the switch **42** during the return movement of the shovel, the energizing circuit for the relay **85** is broken through the switch connections **91**, **92**, and **93** by the spring **103**. However, a holding circuit for the relay **85** has been set up through the switch **97** so that the solenoid **40'** will be energized until the operating arm again reaches the switch **41**. When the shovel has reached its predetermined limit of travel in a return direction, the switch operating member **46** will engage the switch operating arm **44** to cause disconnecting of the contacts **87** and **88** by the contact arm **89** thereby de-energizing the relay **85** and the solenoid **40'**. Substan-

tially simultaneously, the contact arm **101** engages the contacts **99** and **100** to energize the time delay relay **81**. The relay **81** consumes sufficient time before closing the switch **79** to permit scoop **7** to dig itself into the material in the car before the solenoid **40** is re-energized to cause the scoop again to be pulled forwardly toward the car door opening **4**. The operating cycle is then repeated until that portion of the car traversed by the scoop **7** is substantially cleaned.

It should be borne in mind that during this operation, the motorized gear reducer **61** is operated to cause the switch **41** to be very slowly moved in a direction away from the switch **42** so that each succeeding return movement of the scoop **7** terminates in more closely spaced relationship to the tail sheave **10** than did the preceding return travel of the scoop **7**. This is a feature of the invention which avoids overloading of the scoop **7** and consequent excessive strain on the cable **8** and other working parts of the machine. It should also be noted that initially, the forward pull cable **8** and the return cable **9** are evenly wound upon their respective drums **13** and **18**. My novel arrangement of operation of the mechanism for operating the switches **41** and **42** is not affected by uneven piling up of the pull-forward cable **8** on the drum **13** for the reason that the forward pull drum **13** must make an equal number of rotations in a cable unwinding direction to operate the switch **41** as it made to operate the switch **42**, notwithstanding the fact that the cable return drum **18** rotates a greater number of times than does the drum **13** in the event that cable piles up unevenly on the drum **13**. This is a feature of my invention which overcomes a difficulty long experienced in the art.

When it is desired to locate or relocate the tail sheave **10** in the car to a point of greater distance with respect to the drum **18**, it is necessary for the operator to merely pull the sheave against the urging force of the low torque transfer coupling **22** of the pull back drum **18** to the desired location where said tail sheave is again made fast. If the sheave **10** is to be relocated at a point nearer the shoveling machine, the low torque transfer coupling **22** of the pull back drum will cause rotation of said drum **18** in a cable winding direction to immediately take up the slack in the cable **9**. The relatively low torque of the low torque transfer coupling **22** of the drum **18** allows the operator to relocate the sheave **10** without uncoupling the cable **9** from the scoop or shovel **7**. The weight of the scoop **7** together with the torque of the low torque transfer coupling in the drum **13** will prevent the scoop **7** and cable **8** from moving, thereby permitting only the cable **9** to be lengthened or shortened when relocating the tail sheave **10**.

It will be appreciated that the low torque transfer couplings **22** tend to rotate the drums **13** and **18** in a cable winding direction when said drums are stationary, this tendency being even greater when either of said drums are rotating in a cable unwinding direction by reason of the fact that the differential of speed of rotary movement between the blades **26** and the vanes **27** is greater. It is this feature of the invention which prevents overrunning of the unwinding drum when the scoop **7** has reached either limit of movement within the car **3** and consequent backlashing of the cable. It should also be obvious that when it is desired to stop the shoveling operation at any time or for any reason, it is merely necessary that the operator open the master control switches **78** and **95**. The invention further contemplates conventional safety switch means, not shown, for shutting off the motorized gear reducer **61** when the limit switch **41** is moved a predetermined distance away from the switch **42** whereby to prevent the scoop **7** from striking the tail sheave **10** during its return movements. The several manually operated switches such as the master control switches **78** and **95** and the starting and reset switch **76** are preferably located conveniently to the operator and exterior of the car **3** so that the operator need not enter the car except to initially place or later reset the tail sheave **10**, or when using my novel machine semi-automatically for cleaning up operations now to be described. This arrangement obviates the necessity of undue exposure of the operator to the obnoxious influence of dust stirred up in the car during the unloading operation.

Adaptation to semi-automatic operation

When it is desired to operate my novel shoveling machine to clean up the relatively small quantity of material left in the car **3** from the automatic unloading thereof, the master control switches **78** and **95** are left open and a master control switch **105** is closed and a mechanically operated trip switch **106** utilized. The control switch **105** and the trip switch **106** are serially connected in a circuit which includes part of the power lead **63**, the lead **71**, the contacts **72** and **73** of switch **42**, part of the lead **75**, a lead **107**, part of the lead **71** between the time delay relay operated switch **79**, the relay **70**, the lead **80**, and part of the power lead **64**, switches **105** and **106** being interposed in series in the lead **107**. A holding circuit for the relay **70** includes a holding switch **108** which is interposed in a lead **109** which shunts out the trip switch **106**. With reference to the diagram of Fig. 11, it will be seen that the solenoid **40'** which controls winding operation of the drum **18** is rendered inoperative during the semi-automatic operation of the machine due to the open condition of the master control switches **78** and **95**.

The trip switch **106** is contained within a housing **110** mounted on the supporting structure **6** and is provided with an operating shaft **111** which projects laterally outwardly of the housing **110** and to which is rigidly secured a trip lever **112**. A trip dog **113** is secured to the free end of the lever **112** for pivotal movements with respect thereto, as indicated at **114**. The trip dog **113** is provided with an abutment portion **115** that engages a shoulder portion **116** on the lever **112** to limit swinging movements of the dog **113** with respect to the lever **112** in one direction. With reference to Figs. 3 and 5 to 7, inclusive, it will be seen that the free end portion of the trip dog **113** lies in the path of rotary travel of the extended ends of the pins **53** on the drum **13**. The trip switch **106** is normally open and remains open as long as the drum **13** is stationary with the pins **53** thereof being out of engagement with the trip dog **113**, or when the drum **13** is rotating in a cable unwinding direction. As shown in Fig. 7, rotation of the drum **13** in a cable unwinding direction will cause the pins **53** to engage the trip dog **113** and swing the same with respect to the trip lever **112** without affecting the trip switch **106**. However, when the drum **13** is rotating in a cable winding direction, the pins **53** will engage the opposite side of the trip dog **113** causing it to move the trip lever **112** in a direction to close the trip switch **106** thereby energizing the relay **70** and causing energization of the solenoid **40** to effect engagement of the clutch **23** associated with the winding drum **13**.

Semi-automatic operation

As above indicated, when it is desired to utilize my novel shoveling machine in a semi-automatic condition for cleaning up the grain remaining in the car **3**, the master control switches **78** and **95** are opened and the master control switch **105** closed. The return cable **10** is then disconnected from the scoop **7** and together with the tail sheave **10** is removed from the car and permitted to wind up on the drum **18**, the end thereof being made fast to any suitable location to prevent the drum **10** from spinning idly under influence of the low torque transfer coupling associated therewith. The operator then reenters the car **3**, and grasping the scoop by the handles normally provided thereon, pulls the scoop manually toward the end of the car **3** against the tendency of the low torque transfer coupling associated with the pull forward drum **13**, the unwinding direction of rotation of

the drum 13 having no effect upon the trip switch 106 except to cause relative movement between the trip dog 113 and the trip lever 112. When the scoop has been manually brought to the end of the car 3, the operator moves the scoop slightly in the direction of the shoveling machine whereupon the low torque transfer coupling 22 associated with the winding drum 13 will cause said drum 13 to rotate in a cable winding direction to take up the slack in the cable 8. Rotation of the drum 13 in a cable winding direction and for a very short distance will bring one of the pins 53 into engagement with the trip dog 113 and move the same in a direction to close the trip switch 106 whereby the relay 70 is energized, in turn causing energization of the solenoid 40 and consequent engagement of the elements of the high torque transfer coupling 23 associated with the winding drum 13. The winding drum 13 then pulls the scoop 7 forwardly under guidance of the operator until the scoop 7 has reached the door opening 4, whereupon the switch operating member 46 will engage the operating arm 45 of the switch 42 and cause said high torque transfer coupling 23 to uncouple the drum 13 from high torque engagement with the drive shaft 14. The operator then draws the scoop 7 toward the end of the car 3 and the cycle is repeated until the car is clean.

In Fig. 1, I have shown a pair of my novel shoveling machines being coupled together in tanden relationship and being driven from the single motor 16. With this arrangement, a single operator can set up one machine to automatically unload one end of car 3 while the other machine is being set up to unload the other end portion of the car. Then, while the second half of the car is being automatically unloaded, the operator can quickly and easily adapt the first machine to semi-automatic operation and clean out one half of the car, after which the second half may be cleaned by changing over the other shoveling machine to semi-automatic operation. I have found that by utilizing my novel machine in this manner, a car can be emptied of grain by a single operator in at least the same time that it has heretofore taken two or three men with prior art machines. Both halves of the car may be automatically unloaded simultaneously, and in the event that two operators are available, each machine may be used semi-automatically to clean up both ends of the car simultaneously, each operator manipulating a different shovel for the cleaning up operation.

The modified form of control, shown in Figs. 9 and 10, is designed to be used as a substitute for the motorized gear reducer 61, so that the operator may manually and remotely control the extent of return movement of the scoop 7. The control comprises a casing 117 from which extends a flexible cable or the like 118 having at its free end a coupling head 119 which is adapted to be connected to a coupling element 120 on the free end of the adjustment screw 58 which extends outwardly of the casing 43. The flexible shaft 118 is encased within a tubular casing 121 and is connected at its end contained within the casing 117 to a gear 122 journalled in a frame 123 suitably mounted in the casing 117. The gear 122 has meshing engagement with a gear 124 mounted on a shaft 125 which is journalled in the frame 123 and one end of which extends outwardly of the casing 117. A hand crank or the like 126 is rigidly secured to the outwardly extended end of the shaft 125, manipulation of which will cause rotation of the adjusting screw 58 and resultant movement of the switch 41 with respect to the switch 42. The inner end of the shaft 125 is provided with a worm 127 that has meshing engagement with a worm wheel or gear 128 that is mounted fast on a shaft 129 journalled in suitable bearings in the casing 117. One end of the shaft 129 extends through the casing 117 and has mounted thereon an indicating pointer 130 which cooperates with suitable indicia on the adjacent outer wheel of the casing 117 to indicate the extent of travel of the scoop 7 between its set limits of movement. The flexible shaft 118 may be of sufficient length to permit mounting of the above described controller in any convenient location, or the controller may be easily carried about by the operator in the vicinity of the shoveling machine.

My improved shoveling machine has been thoroughly tested and found to be completely satisfactory for the accomplishment of the objectives set forth; and, while I have shown and described a preferred embodiment and a single modification, it will be understood that the same is capable of further modification and that such modification may be made that does not depart from the spirit and scope of the invention as defined in the claims.

What I claim is:

1. In a device of the class described, a supporting structure, a cable winding drum journalled for rotation on the supporting structure, a drive shaft, power transmission mechanism connecting said drive shaft to said winding drum, said power transmission mechanism including a low torque transfer coupling unit comprising relatively rotary driving and driven elements the former of which is connected to the drive shaft and the latter of which is connected to the drum, a releasable high torque transfer coupling unit connecting the drive shaft to the drum, an actuator for the high torque transfer coupling unit operative to set and release the same, and control means for said actuator responsive to low torque transfer coupling unit imparted rotary movement of said drum in a cable winding direction to render said actuator operative to set the high torque transfer coupling unit, said control means including mechanism responsive to predetermined rotation of said drum in a cable winding direction to release said high torque transfer coupling unit.

2. In a device of the class described, a supporting structure, a continuously operating constant speed drive shaft journalled in said supporting structure, a cable winding drum journalled on said drive shaft, power transmission mechanism connecting said drive shaft to said winding drum, said power transmission mechanism including a low torque transfer coupling unit comprising relatively rotary driving and driven elements the former of which is connected to the drive shaft and the latter of which is connected to the drum, a releasable high torque transfer coupling unit connecting the drive shaft to the drum, an actuator for the high torque transfer coupling unit operative to set and release the same, and control means for said actuator responsive to low torque transfer coupling unit imparted rotary movement of said drum in a cable winding direction to render said actuator operative to set the high torque transfer coupling unit, said control means including mechanism responsive to predetermined rotation of said drum in a cable winding direction to release said high torque transfer coupling unit.

3. In a device of the class described, a supporting structure, a cable winding drum journalled for rotation on the supporting structure, a drive shaft, power transmission mechanism connecting said drive shaft to the winding drum, said power transmission mechanism including a low torque transfer coupling unit comprising relatively rotary driving and driven elements the former of which is connected to the drive shaft and the latter of which is connected to the drum, a releasable high torque transfer coupling unit connecting the drive shaft to the drum, an electrically operated actuator for setting and releasing the high torque transfer coupling unit, a power circuit including said actuator, and control means for said circuit including a switch responsive to low torque transfer coupling unit imparted rotary movement of said drum in a cable winding direction to render said actuator operative to set the high torque transfer unit and a limit switch operative responsive to predetermined rotation of said drum in a cable winding direction to release said high torque transfer coupling unit.

4. In a device of the class described, a supporting

structure,] *A cable winding machine, comprising* a pair of cable winding drums [journalled for rotation on said supporting structure], a drive shaft, power transmission mechanism connecting the drive shaft to each of said winding drums, said power transmission mechanism including [a pair of low torque transfer coupling units one each associated with each of said drums and each comprising relatively rotary driving and driven elements, the former of which is connected to the shaft and the latter of which is connected to a respective drum,] a pair of independent releasable [high torque transfer coupling] *clutch* units each [connecting] *adapted to connect* the drive shaft to a different drum, actuators for said [high torque transfer coupling] *clutch* units independently operative to set and release the same, and control means for said actuators responsive to predetermined rotation of one of the drums in a cable winding direction to release the [high torque transfer coupling] *clutch* unit associated with said one of the drums and to set the [high torque transfer coupling] *clutch unit* [units] associated with the other of said drums, said control means being operative responsive to [equal] rotation of said one of the drums in the opposite direction to release the [high torque transfer coupling] *clutch* unit associated with said other drum and to set the [high torque transfer coupling] *clutch* unit for said one of the drums.

5. In a device of the class described, a supporting structure, a continuously operating constant speed drive shaft journalled in said supporting structure, a pair of cable winding drums journalled on said drive shaft in axially spaced relationship, power transmission mechanism independently connecting the drive shaft to each of said winding drums, said power transmission mechanism including a pair of low torque transfer coupling units one each associated with each of said drums and each comprising relatively rotary driving and driven elements the former of which is connected to the shaft and the latter of which is connected to a respective drum, a pair of independent releasable high torque transfer coupling units each connecting the drive shaft to a different drum, an actuator for each high torque transfer coupling unit independently operative to set and release the same, and control means for said actuators responsive to predetermined rotation of one of the drums in a cable winding direction to release the high torque transfer coupling unit associated with said one of the drums and to set the high torque transfer coupling [units] *unit* associated with the other of said drums, said control means being operative responsive to equal rotation of said one of the drums in the opposite direction to release the high torque transfer coupling unit associated with said other drum and to set the high torque transfer coupling unit for said one of the drums.

6. In a device of the class described, a supporting structure, a pair of cable winding drums journalled for rotation on said supporting structure, a drive shaft, power transmission mechanism connecting the drive shaft to each of said winding drums, said power transmission mechanism including [a pair of low torque transfer coupling units one each associated with each of said drums and each comprising relatively rotary driving and driven elements the former of which is connected to the shaft and the latter of which is connected to a respective drum,] a pair of independent releasable [high torque transfer coupling] *clutch* units each connecting the drive shaft to a different drum, an electrically operated actuator for each [high torque transfer coupling] *clutch* unit independently operative to set and release the same, a power circuit including said actuators, and control means for said circuit including switch mechanism responsive to predetermined rotation of one of the drums in a cable winding direction to cause one of the actuators to release the [high torque transfer coupling] *clutch* unit associated with said one of the drums and to cause the other of said actuators to set the [high torque transfer coupling] *clutch* unit associated with the other of said drums, said switch mechanism being operative responsive to equal rotation of said one of the drums in the opposite direction to cause the other of said actuators to release the [high torque transfer coupling] *clutch* unit associated with said other drum and to set the [high torque transfer coupling] *clutch* unit for said one of the drums.

7. The structure defined in claim 6 in which said switch mechanism includes a pair of spaced control switches and a switch actuator operatively associated with one of said drums and movable in opposite directions between said control switches responsive to rotation of said one of the drums in opposite directions to operate said control switches.

8. The structure defined in claim 6 in which said switch mechanism includes a pair of spaced control switches and a switch actuator operatively associated with said drum and movable in opposite directions between said control switches responsive to rotation of said one of the drums in opposite directions to operate said control switches, and in further combination with means mounting one of said control switches for movements toward and away from the other thereof, and mechanism for imparting said movements to said one of the switches whereby to increase or decrease the extent of high torque coupled rotary movement to said drums.

9. In a device of the class described, a supporting structure, a continuously operating [constant speed] drive shaft journalled in said supporting structure, a pair of cable winding durms journalled on said drive shaft in axially spaced relationship, power transmission mechanism independently connecting the drive shaft to each of said winding drums, said power transmission mechanism including a pair of low torque transfer coupling units one each associated with each of said drums and [each comprising relatively rotary driving and driven elements the former of which is connected to the shaft and the latter of which is connected to a respective drum,] a pair of independent releasable high torque transfer coupling units each connecting the drive shaft to a different drum, an electrically operated actuator for each high torque transfer coupling unit independently operative to set and release the same, a power circuit including said actuators, control means for said circuit including a pair of spaced control switches and a switch actuator operatively associated with one of said drums and movable in opposite directions between said control switches responsive to rotation of said one of the drums in opposite directions to operate said control switches, one of said control switches being operative to cause one of the coupling unit actuators to release the high torque transfer coupling unit associated with said one of the drums and to cause the other of said coupling unit actuators to set the high torque transfer coupling unit associated with the other of said drums responsive to predetermined rotation of said one of the drums in a cable winding direction, the other of said switches being operative to set the high torque transfer coupling unit associated with said one of the drums and to release the high torque transfer coupling unit associated with the other of said drums responsive to equal rotation of said one of the drums in the opposite direction, means mounting one of said control switches for movements toward and away from the other thereof, and mechanism for imparting said movements to said one of the switches to increase or decrease the extent of high torque coupled rotary movement of said drums, said last mentioned mechanism comprising a lead screw coupled to said one of the switches and having threaded engagement with said movable switch, and power driven means for rotating said lead screw.

10. The structure defined in claim 6 in which said switch mechanism includes a pair of spaced control switches and a switch actuator, said switch actuator being operatively associated with said drum and movable in opposite directions between said control switches, and in further combination with means mounting one of said

control switches for movements toward and away from the other thereof, and manually operated means for imparting said movements to said one of the switches whereby to increase or decrease the extent of high torque coupled rotary movement, the means for mounting said one of the control switches including a lead screw, said manually operated means comprising a control unit remote from said switch and a flexible shaft connecting said control unit to said lead screw.

11. A cable winding machine, comprising a cable winding drum, a driven shaft for rotating said drum, power transmission means connecting the shaft and the drum including a power operated clutch, a two position actuator operatively connected to the clutch to set and release the same, and means for operating said actuator including a first control device operatively connected to said actuator to effect movement of the same to one of its positions, a second control device operatively connected to said first control device and said actuator and operative to effect movement of the actuator to its other position and also render the first control device operative, and a member driven by the rotative movement of the drum relative to one of said control devices and adapted to actuate said control device.

12. A cable winding machine, comprising a cable winding drum, a driven shaft for rotating said drum, power transmission means connecting the shaft and the drum including a power operated clutch, a two position actuator operatively connected to the clutch to set and release the same, and means for operating said actuator including a first control device operatively connected to said actuator to effect movement of the same to one of its positions, a second control device responsive to movement of the drum operatively connected to said first control device and said actuator and operative to effect movement of the actuator to its other position and also render the first control device operative, and a member driven by the rotative movement of the drum and adapted to actuate said second control device.

13. A cable winding machine, comprising a cable winding drum, a driven shaft for rotating said drum, power transmission means connecting the shaft and the drum including a power operated clutch, a two position actuator operatively connected to the clutch to set and release the same, and means for operating said actuator comprising a circuit including said actuator, a first switch in said circuit operatively connected to said actuator and actuated by the rotative movement of the drum, a second switch in said circuit effective to de-energize the first switch, and a driven member movable relative to the second switch by the rotative movement of the drum for actuating said second switch after a predetermined extent of movement of the drum.

14. A cable winding machine, comprising a cable winding drum, a driven shaft for rotating said drum, power transmission means connecting the shaft and the drum including a power operated clutch, a two position actuator operatively connected to the clutch to set and release the same, and means for operating said actuator including a first control device operatively connected to said actuator and actuated by the rotative movement of the drum, a second control device operatively connected to the first control device and adapted to render said first control device inoperative to release the clutch, and a driven member movable relative to the second control device by the rotative movement of the drum and adapted to render said second control device operative after a predetermined extent of movement of the drum, said second control device adapted for movement relative to said driven member to vary the extent of travel of the driven member relative to said second control device.

15. A cable winding machine, comprising a pair of cable winding drums, a driven shaft, power transmission means connecting the shaft with each of said drums including a pair of independent power operated clutches each adapted to connect the shaft to a different drum, actuators for each of the clutches, and means for controlling said actuators comprising a circuit including both of said actuators, a first switch in said circuit which when actuated energizes one of said actuators, a second switch in said circuit which when actuated de-energizes said one actuator and energizes the other actuator, a member driven by the movement of one of said drums adapted to alternately actuate said first and second switches, and means for varying the position of one of said switches relative to said driven member.

16. A cable winding machine, comprising a pair of cable winding drums, a driven shaft, power transmission means connecting the shaft with each of said drums including a pair of independent power operated clutches each adapted to connect the shaft to a different drum, actuators for each of the clutches, and means for controlling said actuators comprising a circuit including both of said actuators, a first switch in said circuit which when actuated energizes one of said actuators, a second switch in said circuit which when actuated de-energizes said one actuator and energizes the other actuator, and a member driven by the movement of one of said drums adapted to alternately actuate said first and second switches, one of said switches adapted for movement relative to the other switch and the driven member to vary the position of said last named switch relative to the driven member.

17. A cable winding machine, comprising a pair of cable winding drums, a driven shaft, power transmission mechanism connecting the driven shaft to each of said winding drums, said power transmission mechanism including a pair of independent releasable clutch units each adapted to connect the driven shaft to a different drum, actuators for said clutch units independently operative to set and release the same, and control means for said actuators responsive to rotation of one of the drums in a cable winding direction to release the clutch unit associated with said one of the drums and to set the clutch unit associated with the other of said drums, said control means being operative responsive to rotation of said one of the drums in the opposite direction to release the clutch unit associated with said other drum and to set the clutch unit for said one of the drums.

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