Oct. 7, 1930. E. H. REMDE 1,777,475

LOAD HANDLING MECHANISM

Filed Dec. 10, 1923 5 Sheets-Sheet 1

Fig. 1

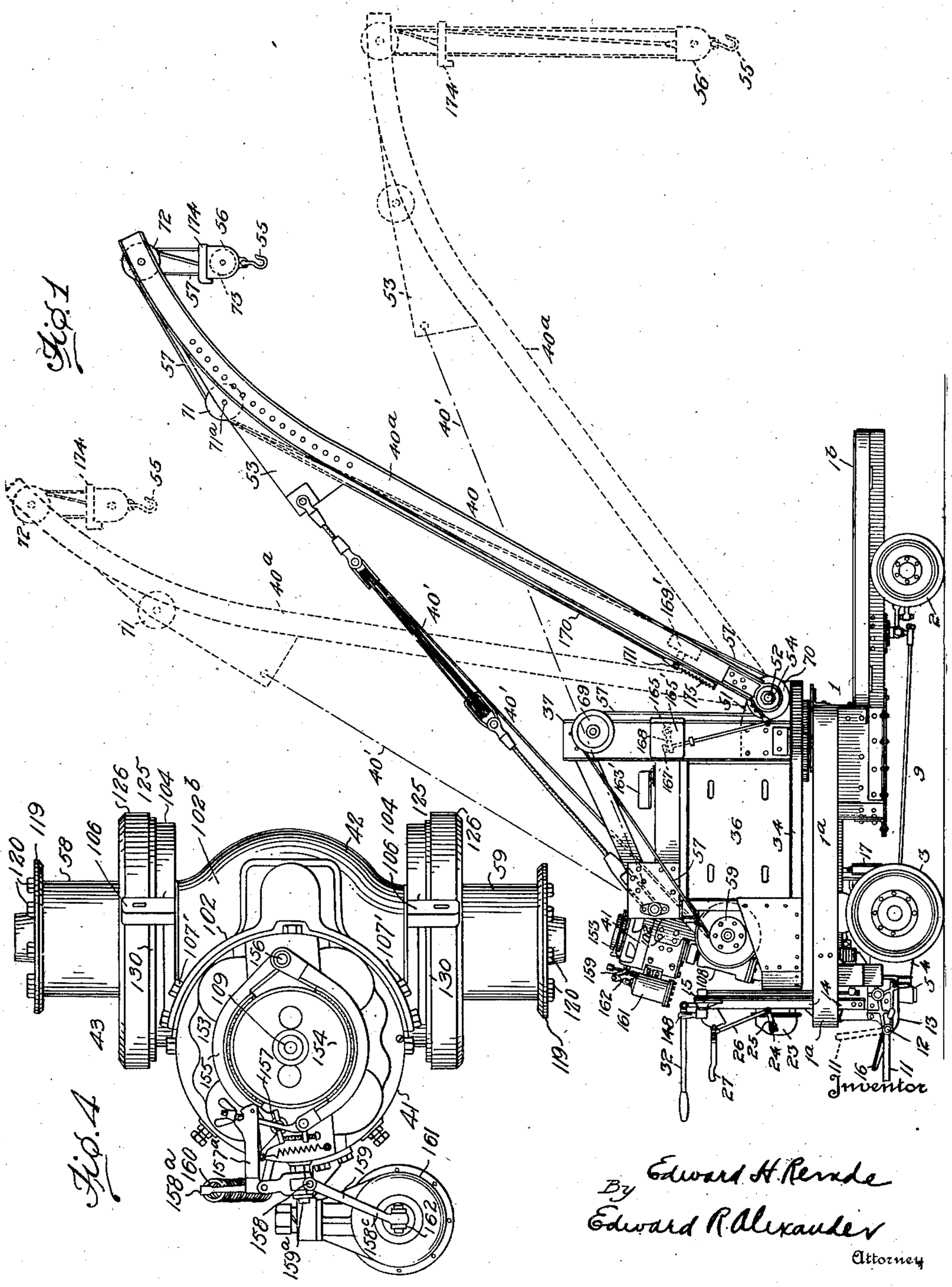

Fig. 4

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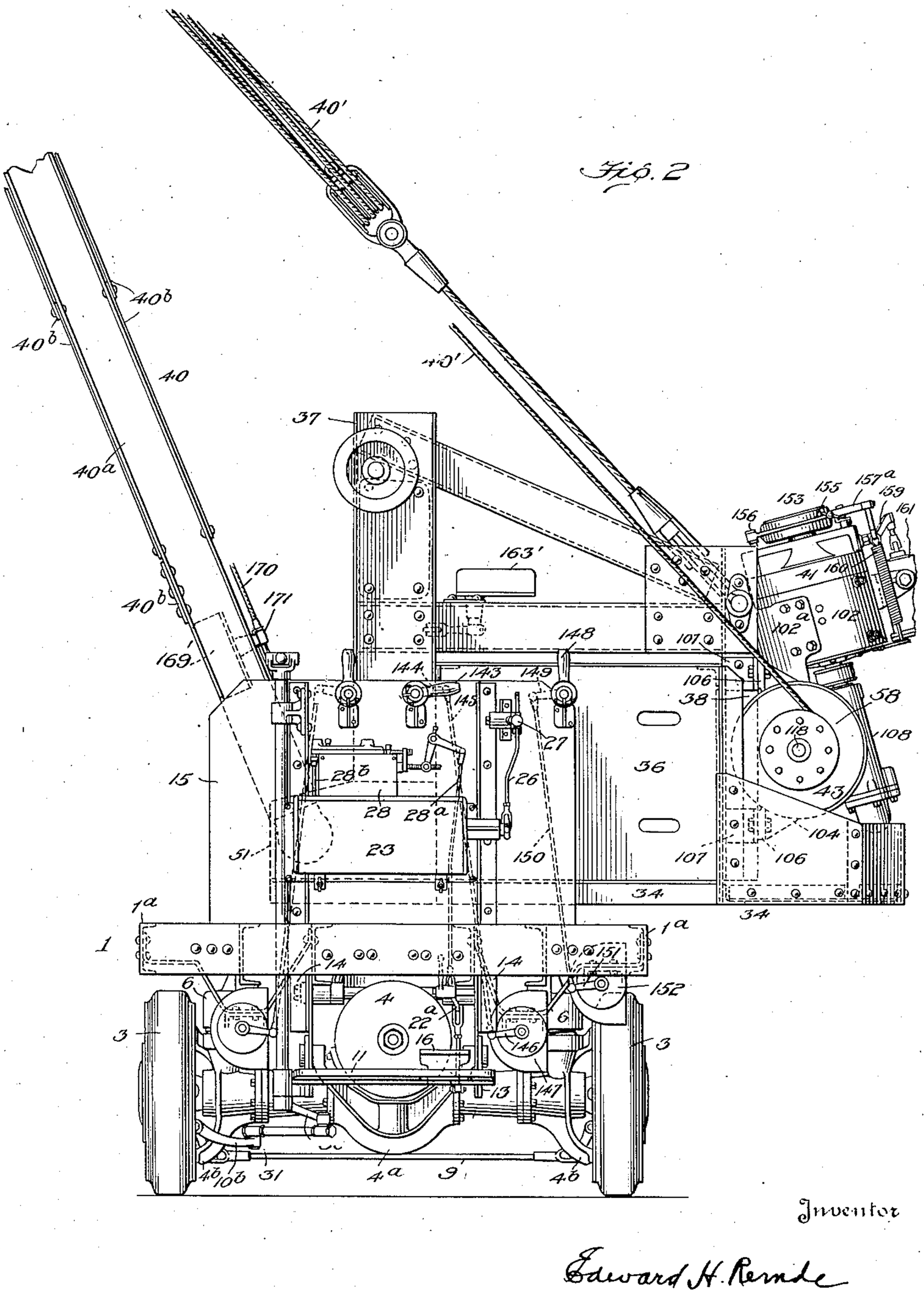
Oct. 7, 1930. E. H. REMDE 1,777,475

LOAD HANDLING MECHANISM

Filed Dec. 10, 1923 5 Sheets-Sheet 2

Fig. 2



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Oct. 7, 1930. E. H. REMDE 1,777,475

LOAD HANDLING MECHANISM

Filed Dec. 10, 1923 5 Sheets-Sheet 3

Fig. 7

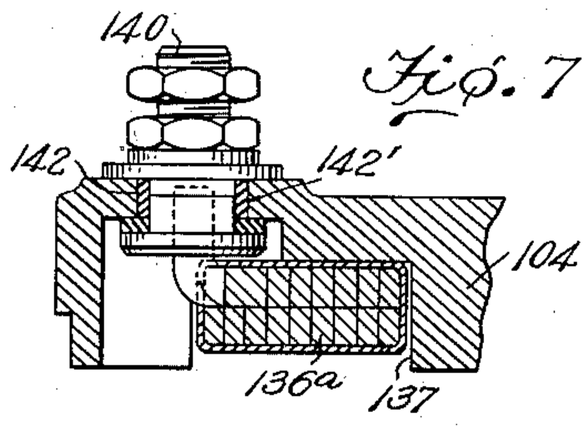

Fig. 8

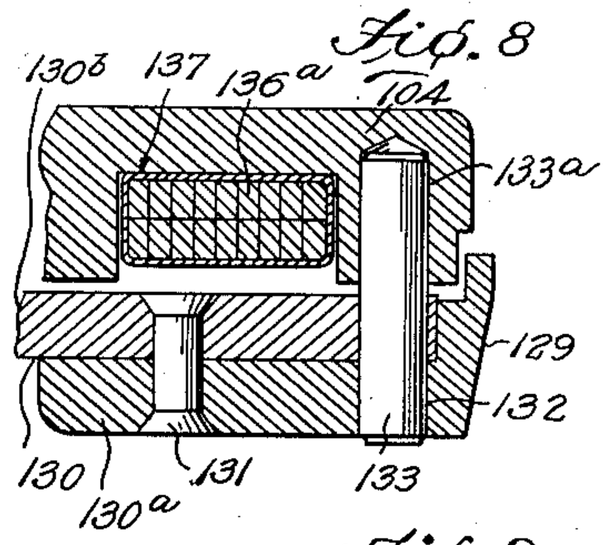

Fig. 9.

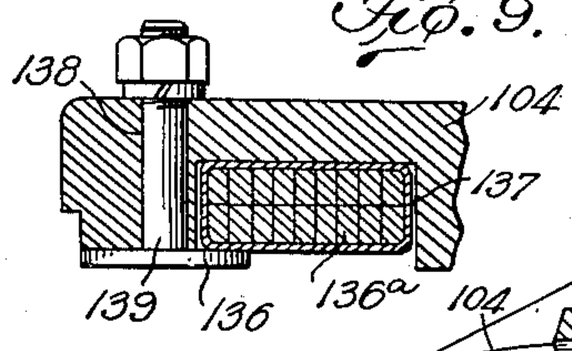

Fig. 3

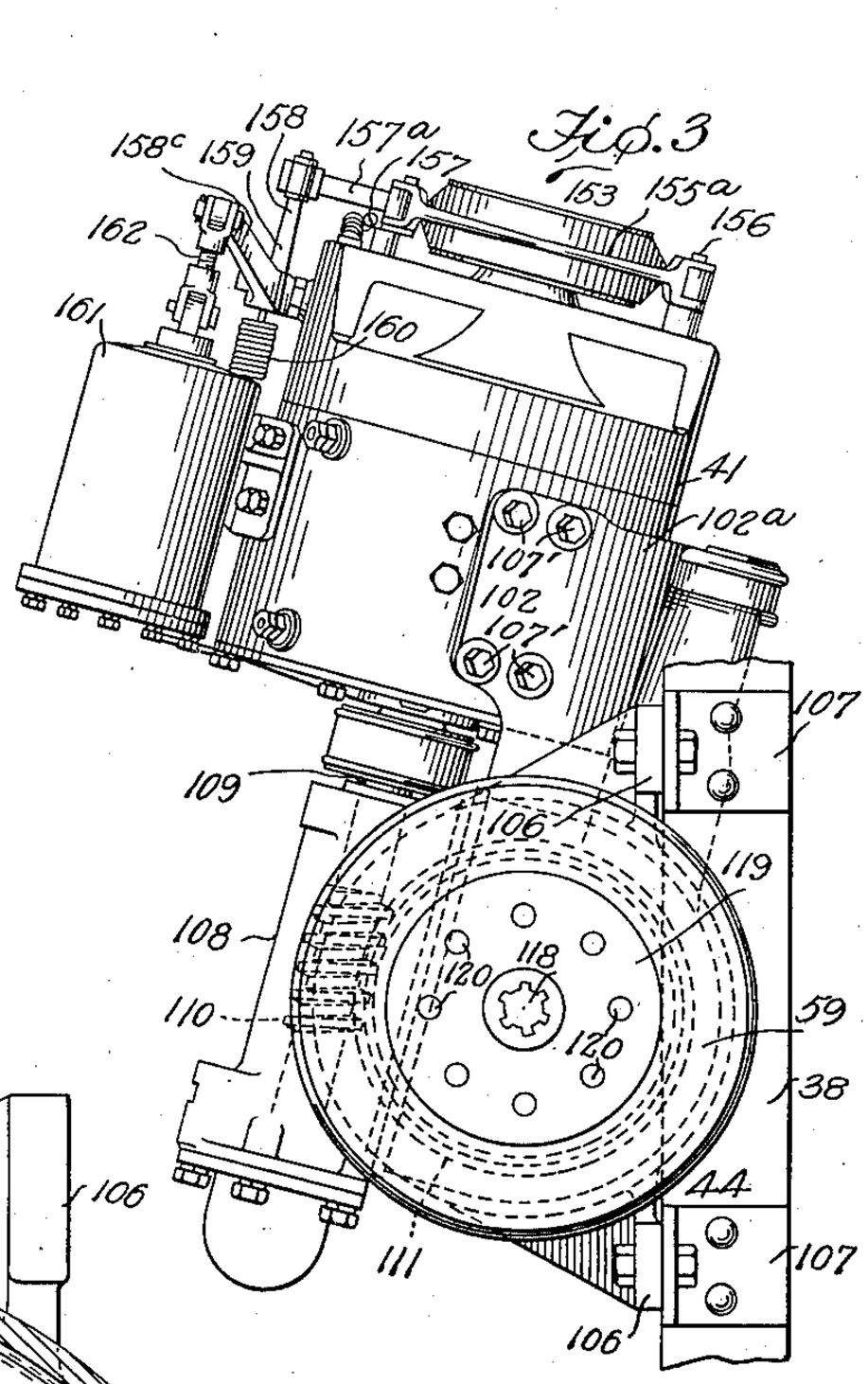

Fig. 6

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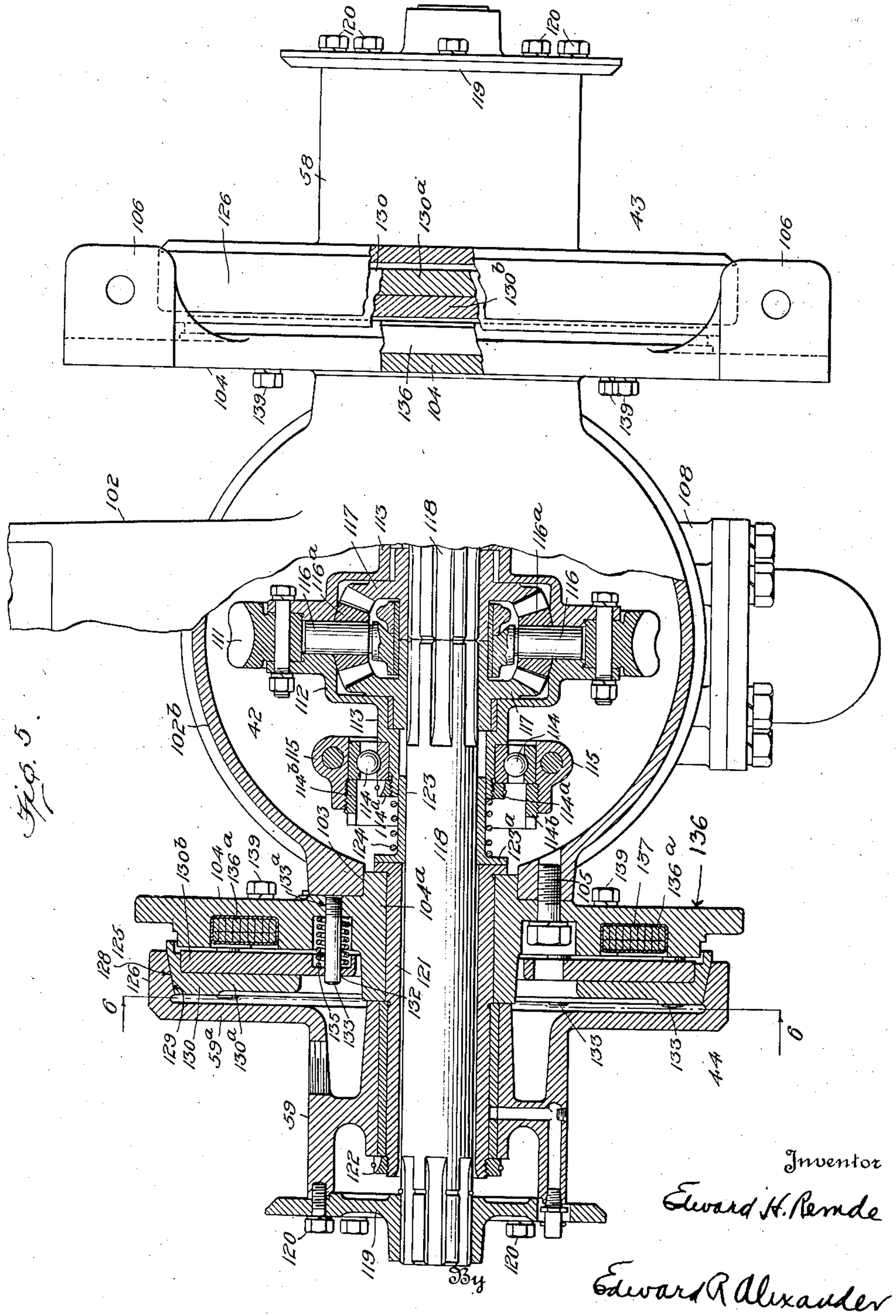
LOAD HANDLING MECHANISM

Filed Dec. 10, 1923 5 Sheets-Sheet 4

Fig. 5.



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LOAD HANDLING MECHANISM

Filed Dec. 10, 1923 5 Sheets-Sheet 5

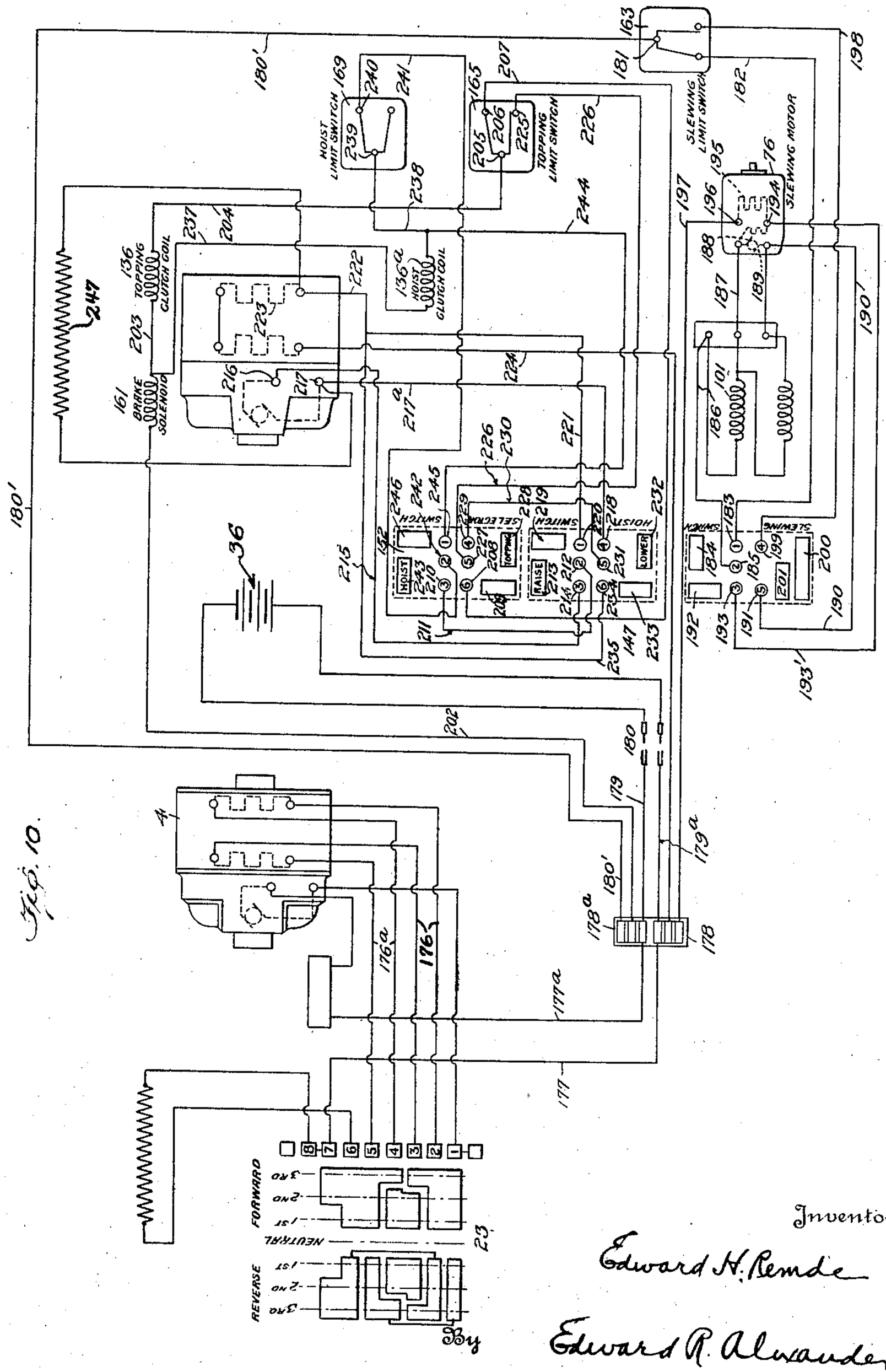

Fig. 10.

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Patented Oct. 7, 1930 1,777,475

UNITED STATES PATENT OFFICE

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LOAD-HANDLING MECHANISM

Application filed December 10, 1923. Serial No. 679,605.

This invention relates to a load handling mechanism, whereby a load or loads may be readily raised and lowered, or transported from one place to another, and discharged.

One object of the invention is to construct an apparatus of this character of relatively simple construction and capable of being operated rapidly and economically.

Another object of the invention is to provide a load handling mechanism having improved means for engaging and moving a load in different directions, at will, for dumping, transporting or elevating purposes.

Another object of the invention is to provide, in a load handling mechanism having a crane and a hoisting or load engaging device, improved means for operating the crane and hoisting device independently of each other from a single motor and power transmitting mechanism.

Another object of the invention is to combine with a load handling mechanism having a crane and a hoisting device operated by a pair of drums, improved driving means for the drums, whereby the operations of the crane and device may be readily controlled and carried out.

Another object of the invention is to combine with a load handling mechanism having a crane and a hoisting device operated by a pair of drums, a differential mechanism for operating the rope or cable drums and to provide improved means for controlling the operation of the differential mechanism, whereby a single motor operating therethrough may be utilized to operate the crane or hoisting device at will.

A further object of the invention is to provide an improved truck having a load handling mechanism and novel means for operating the load handling mechanism in a simple and rapid manner.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a side elevation of a truck and a load handling mechanism embodying my invention.

Fig. 2 is an end elevation of the truck and load handling mechanism (with parts broken away), the latter being shown slewed or swiveled about its pivot to one operative position to illustrate its manner of use.

Fig. 3 is a fragmentary side view of the motor, power transmitting mechanism and operating means for the crane and hoisting device operating ropes.

Fig. 4 is a top plan of the mechanism and parts shown in Fig. 3.

Fig. 5 is front elevation of the operating mechanism and cable drums and the holding and release means for the latter, parts being broken away.

Fig. 6 is a section on the line 6—6 of Fig. 5.

Figs. 7, 8 and 9 are sections on the lines 7—7, 8—8 and 9—9 respectively of Fig. 6.

Fig. 10 is a diagram showing the electric circuits for the motor which drives the operating mechanism, the means which release the drum holding means and the traction motor, and the controllers or switch devices for closing the circuits.

In the drawings, 1 indicates a frame of any desired shape and form, preferably constructed from channel and angle bars suitably connected by rivets or otherwise. In the illustrated form of construction the frame 1 comprises a main portion 1^a on which the mechanisms for raising and lowering loads and moving the load carrying member, to be later referred to, are supported, and a platform portion 1^b, on which loads may be placed; this latter frame portion serving as a supplemental support for a load, especially where it is necessary to transport the load to a distant point by the driving or operation of the truck. In this connection, it will be understood that the platform portion 1^b may be rigidly connected to the frame 1^a and it may be a continuation thereof or disposed in a plane therebelow, as shown in the drawings; or the platform portion 1^b may embody or have incorporated in or associated with it a superposed platform, which may be raised or lowered relative to the frame 1. Where the frame is constructed as shown in the drawings, I preferably provide a pair of relatively small trailing wheels

2 below the platform portion 1^b and a pair of relatively large wheels 3 below the main frame portion 1^a.

4 indicates a motor, the shaft of which through a suitable power transmitting mechanism drives the wheels 3 in either direction, such mechanism being shown enclosed in a suitable housing 4^a. 5 indicates a suspension mechanism to permit of relative movements between the motor and housing and the frame 1 incident to the driving of the truck, such mechanism being similar to that shown in Letters Patent No. 1,628,145 granted to John H. Hertner and myself jointly. 6 indicates pairs of casing elements enclosing suitable springs between the frame 1 and housing 4^a.

By preference, the pairs of wheels 2, 3, are mounted on knuckles whereby, through the connections indicated at 9 and steer handle 32, they may be simultaneously steered. 11 indicates a platform for an operative suitably supported on the frame 1. 14 indicates uprights rigidly connected to the frame 1 and forming a support for a dash 15. The dash 15 preferably supports the levers for operating certain of the controlling or operating elements for the truck and the load supporting and engaging member, whereby the several operations of driving, steering and handling the load and load carrying member are effected. 16 indicates a foot pedal associated with the platform 11, and arranged to control the release and application of a brake mechanism, indicated as an entirety at 17, the latter being normally biased by a spring (not shown) into engagement with an element driven directly by the motor 4, as will be understood from Fig. 1.

23 indicates as an entirety a controller for the motor 4. The shaft 24 of the controller is operated through an arm 25 and link 26 by a lever 27, which is pivoted on the dash 15. 28 indicates as an entirety a switch mechanism (1) connected by a rod 28^a with the brake mechanism 17, whereby movement of the pedal 16 opens or closes the motor circuit, the purpose being to prevent operation of the motor 4 by means of the controller if the latter is moved from its "off" position in either direction when the brake is in its applied position; and (2) interconnected with the controller by means of a link 28^b to prevent closing of the circuit in the event the controller lever is in or is moved to an "on" position and attempt is made to release the brake.

34 indicates a frame for supporting the batteries (enclosed in a sheet metal casing 36) a load supporting member, such as a boom 40, a motor 41, a power transmitting mechanism 42 and operating means 43, 44, which will later be described. The frame 34 is mounted on a suitable vertically arranged shaft disposed between uprights 37 and provided with a gear 47 which serves as a suitable element by means of which the frame or support 34 is rotated in either direction about the shaft by suitable power means (not shown).

51 indicates a pair of vertically disposed plates on the frame 34 and formed with aligned openings, preferably reinforced by hollow bosses, to form bearings for a pivot pin 52.

The boom 40 preferably comprises a pair of channel members 40^a secured together in spaced relation by a plurality of cross-pieces 40^b. The lower ends of the channel bars 40^a are provided with suitable knuckles through which the pivot pin 52 extends, the opposite ends of the pin being provided with nuts 54 to prevent the pin from moving endwise in the knuckles. The boom 40 is raised and lowered about the pivot pin 52 by any suitable means, but preferably by means of a cable or other flexible connection 40′ connected to the operating means 43.

55 indicates as an entirety a load engaging member such as a clam shell bucket or a platform, but for illustrative purposes I have shown such member as comprising a hook depending from a casing 56, which in turn is supported or suspended from the free end of the boom 40 by a cable or other flexible connection 57, connected with the operating means 44 as will be later described.

The operating means 43, 44, comprise a pair of drums 58, 59, on which the cables 40′, 57, respectively, wind and unwind, for swinging the boom 40 about its pivotal support and for raising or lowering the load engaging member 55. The drums 58, 59, are rotated independently of each other in either direction in the manner to be later set forth, to swing the boom 40 and raise or lower the member 55. The cable 40′ may be connected at its inner end to the drum 58 in any desired manner. From the drum 58, the cable 40′ leads to and reeves through and around a plurality of sets of sheaves 60, 61, 62, supported in suitable blocks 60^a, 61^a, 62^a, respectively, the opposite or outer end of the cable being carried down and preferably connected or anchored to the block 61^a. Each of the block sheaves connected in any well known manner to the boom 40 and frame 34, the free end of the cable being suitably anchored.

The cable 57 is connected at its inner end in any suitable manner to the drum 59. From the drum 59, the cable 57 runs around a guide sheave 69, supported on the adjacent upright member 37, and then around a sheave 70 loosely mounted on one of the reinforcing bosses. From the sheave 70 the cable 57 extends over a sheave 71, mounted on a shaft 71^a, which is supported at its opposite ends by the plates 53. From the sheave 71 the cable reeves around a sheave 72 supported in the free end of the boom 40, then around a

sheave 73 mounted in the casing 56, and then around a second sheave supported on the shaft 72ª, the outer end of the cable being carried down and connected by a socket and loop to the shaft of the sheave 73.

102 indicates as an entirety a casting shaped and constructed to form a cradle 102ª for the motor 41 and a housing section 102ᵇ for the power transmitting mechanism 42. The end walls of the housing section 102ᵇ are formed with openings 103 through which the driving means for the drums 58, 59, extend, as will be hereinafter described. The end walls of the housing 102ᵇ form suitable seats for a pair of annular supporting disks or members 104. and such walls and members are formed with aligned openings to receive cap screws 105 which rigidly secure them together and the members 104 are provided with integral extensions to provide feet 106, each of which is secured to an angle 107 carried by an adjacent portion of the frame 34. The feet 106 operate through the disks or members 104 and the housing and cradle casting 102 to support the motor 41 and power transmitting mechanism 42 in fixed relation upon the support 34 and in operative relationship to each other. The motor 41 is fixed to the cradle 102ª by a plurality of screws 107′. 108 indicates a housing section shaped to fit upon the open end of the housing section 102 and be clamped thereto and also to enclose the propeller shaft 109 connected to the shaft of the motor 41. The housing section 108 is adapted to support a pair of spaced bearings for the propeller shaft. Between the propeller shaft bearings, the shaft is provided with a worm 110 which meshes with and drives a gear 111 forming one of the elements of the power transmitting mechanism 42.

The power transmitting mechanism 42 for the operating means 43, 44, may be of any desired construction. I prefer to use some form of gear mechanism and accordingly show for illustrative purposes a well known type of differential mechanism, such as is commonly used for driving the wheels of automobiles. Preferably, such mechanism is similar in construction to the differential mechanism used by me for driving the wheels 3 from the motor 4. By the use of a differential mechanism a single motor may be employed to operate either operating means through the co-operation of certain devices and means, to be later described, for holding or releasing the driven elements of the differential mechanism, whereby either drum will be rotated in a simple manner. In the illustrated form of construction, the differential mechanism comprises the main gear or worm gear 111, already referred to, connected to a casing 112 having oppositely extending hubs 113. The hubs 113 are mounted in suitable bearings 114 seated in pillow blocks 115, carried by the housing sections 102ᵇ, 108, and secured together in any well known manner. As shown in Fig. 5, the hubs 113 are reduced to form seats for the inner races of the bearings 114. 114ª, 114ᵇ, indicate ring nuts screw threaded to the pillow blocks 115 and free ends of the hubs, and engaging the races of the bearings to hold them in place. The casing 112 supports a plurality of stud shafts 116, on which loosely rotate bevel pinions 116ª. The pinions 116ª mesh with bevel gears 117 to drive them. 118 indicates axle sections keyed at their inner ends to the hubs of the bevel gears 117 and connected to the drums 58, 59, to rotate them, preferably through the interposition of cap plates 119, keyed upon the free ends of the axle sections 118 and connected to the peripherial edges of the drums 58, 59, by cap screws 120. 121 indicates sleeves surrounding the axle sections 118 their inner free ends having flanges which abut against the inner end wall of the hubs 104ª to prevent movement of the sleeves outwardly. The outer ends or extended portions of the sleeves serve as bearings for the drums 58, 59, to rotate on, bushings being mounted on the sleeves to provide suitable bearing surfaces. The outer free ends of the sleeves 121 are provided with screw threads to receive nuts 122, which engage the ends of the hubs for the drums to hold them in position on the sleeves 121. The hubs of the drums preferably have a width equal to the length of the extended portions of the sleeves so that the drums are held between the nuts 122 and outer ends of the hubs 104ª of the disks or members 104 to prevent movement of the drums endwise of the sleeves 121. 123 indicates a dust sleeve loosely fitting each axle section 118 and interposed between the adjacent hub 113 of the casing 112 and inner end of the adjacent sleeve 121. The inner end of each dust sleeve fits within the end of the adjacent hub 113 and its opposite end is flanged at 123ª to abut the flange of the sleeve 121. 124 indicates a coiled spring surrounding each dust sleeve 123 and engaging the free end of the adjacent hub 113 and the flange 123ª and arranged to act on the latter to maintain it in close engagement with the flange of the sleeve 121.

125 indicates as an entirety means for holding, locking or connecting each drum 58, 59, to the adjacent disk or member 104 which, being fixed to the frame 34 in the manner already described, serves to prevent rotation of the drum by the power transmitting or differential mechanism 42 when the motor 41 is operated. As the holding means 125 for the drums 58, 59, are similar in construction, the description of one of them will suffice for both. Each said holding means 125 preferably comprises a lock, preferably of the friction type, one element of which is carried by the drum

and the other element of which is carried by the adjacent supporting disk or member 104. The movable element of the lock may be carried by the drum or by the disk, as desired, but I have chosen to show such element as carried by the latter to insure simplicity in construction. One element of the lock comprises a rim 126 extending laterally from and surrounding the periphery of the drum flange 59ª, being preferably formed integrally therewith. The inner surface of the rim 126 is of conical shape to form a friction engaging surface 128 with which the friction engaging surface or wall 129 of the movable lock element 130 engages. The lock element 130 is of annular shape so as to extend entirely around the lock element 126. The lock element 130 preferably comprises a pair of rings 130ª, 130ᵇ, connected together, preferably in face to face relation, by any suitable means, for example, rivets 131. The ring 130ª is preferably formed from bronze and carries at its outer peripherial edge a flange portion which forms the wall 129 which engages the lock element 126; the ring 130ᵇ is formed from soft iron, so that it may serve as an armature to effect separation of the lock elements in the manner to be later described. By forming the ring 130ª of bronze, that wall of the lock element 130 which engages and disengages the lock element 126 will freely disengage the latter, since the metal of which it is formed is non-magnetic, and hence it will not stick to the lock element 126 when the armature is acted upon, as will later appear. 132 indicates a set of openings formed in the lock element 130 and spaced from each other therearound and arranged to receive supporting and guiding pins 133 supported in openings 133ª formed in the supporting disks 104. The openings 132 are of a size to permit the lock element 130 to freely slide on the pins 133. The openings 132 and pins 133 are preferably disposed in outer and inner annular series, so that the lock releasing means may be disposed substantially midway between the outer and inner edges of the lock element 130. 135 indicates springs coiled around certain of the pins 133 and disposed between the lock element 130 and inner face of the disk or member 104. The springs 135 normally operate to move the lock element 130 laterally on the pins 133 into engagement with the lock element 126, so that the drum to which the rim is connected and the adjacent disk or member 104 will be connected together, the purpose of which is to hold or lock the drum against rotation.

Of the releasing means, indicated as an entirety at 136, 136ª, indicates windings or coils carried by the disks or members 104 and arranged, when energized to attract the lock rings or armatures 130ᵇ and thus move the rings 130ª away, or to effect disengagement thereof, from the lock elements 126. As both releasing means are similar in construction, but one thereof need be described. As shown in the drawings, the coil 136ª is preferably of ring shape and fits into an annular recess 137 formed in the face of the supporting disk 104. 138 indicates openings formed in the disk 104 and spaced therearound to receive bolts 139, the heads of which over-lie the coil 136ª to hold it in the recess 137. The inner face of the disk 104 is countersunk to receive the heads of the bolts 139 and the recess 137 is formed deep enough to receive the coil and permit the bolt heads to engage its outer surface. The arrangement prevents the bolt heads from projecting beyond the inner face of the disk 104 and also prevents the armature from actually contacting with the coil 136ª. 140, 141 indicate the terminals of the ends of the coils, each terminal being mounted in an insulating bushing 142 which in turn is mounted and fixed in an opening 142′ formed in the disk 104. The terminals are connected to the batteries 36 by leads in the manner to be later described. From the foregoing description it will be understood that the lock elements are normally engaged, through the action of the springs 135, so that both drums 58, 59, are normally locked or held against rotation in either direction, since the lock elements 130 are connected to or carried by the frame 34. In carrying out my invention, I utilize suitable gearing, preferably of the type wherein the power of its driving means may be transmitted to one driven element of a pair of driven elements when the other driven element is locked or held against movement. Accordingly, it will be seen that if the releasing means 136 for one lock is operated to disengage the elements thereof and the motor 41 is set in motion, the power thereof will be transmitted through the power transmitting or differential mechanism 42 to rotate the drum which has been released and thus effect the winding of the rope 40′ or 57 thereon or therefrom accordingly as the motor is driven in one direction or the other.

The circuits to the coils 136ª may be closed by separate switch devices to energize the coils independently and a separate circuit for the motor 41 closed by a suitable controller, may be provided; but to simplify the construction of the mechanism, as well as to simplify and increase the speed of operation of the load supporting and engaging devices, I so arrange the circuits for the coils 136ª and the switch and control devices therefor, that either coil may be connected in series with the motor, whereby the operation of the controller to drive the motor in either direction will simultaneously effect the operation of either releasing means and the unlocking of the lock acted on thereby to permit operation of the adjacent operating means 43 or 44. As a result either drum 58, 59, may be rotated in one direction or the other to swing

the boom 40 about its pivot pin 52 or to raise or lower the load engaging device 55, as desired. To carry out these operations, I provide (1) a lever 143, pivotally mounted on the dash 15 and connected through an arm 144 and link 145 with a crank arm 146, which is connected to the shaft of a controller indicated as an entirety at 147; and (2) a lever 148, pivotally mounted on the dash 15, and connected through an arm 149 and a link 150 with a crank arm 151 which is connected to the shaft of a controller or switch device 152. The purpose of the controller 147 is to supply current to the motor 41 to drive it in either direction, such operation being dependent upon the movement of the lever 143 to either side of its neutral position, as shown in Fig. 2. The purpose of the switch device 152 is to select or connect either one of the coils 136ª, dependent upon which one of the drums is to be operated, in series with the motor 41, so that upon the operation of the controller lever 143, the selected drum will be rotated in one direction or the other, according to the direction of movement of the lever.

The selector lever 148 is shown in a neutral position in Fig. 2, that is, that position in which neither coil 136ª is connected in the circuit of the motor and batteries, but by movement of the lever to the right or left, one of the coils may be connected in the circuit as already described. This arrangement insures the complete cutting out of one coil and its de-energization before the other coil can be connected to it. The operation of the levers 143 and 148 and the controllers 147, 152, operated thereby, respectively, will be more clearly understood from the diagrammatic view (Fig. 10), which will be later described.

The motor 41 is preferably of the electric type in order that it may be operated from batteries and co-operate with the operation of the means for releasing the drum holding means herein illustrated and described; but it will be understood that the holding means and the motor may be operated in some other manner without departing from the scope of the invention. The motor 41 may be of of any desired construction. It preferably has associated with it a brake mechanism, indicated as an entirety at 153, to stop the rotation of its shaft and elements driven thereby following the opening of the motor circuit. Of the brake mechanism 153, 154 indicates a brake wheel fixed to the motor shaft, which is extended beyond the upper end of the motor casing for this purpose. 155, 155ª, indicate brake shoes pivoted at corresponding ends upon a shaft 156 mounted in a boss on the adjacent end of the motor casing. The opposite ends of the shoes are connected to a pair of levers 157, 157ª, which are so connected to each other that upon the movement of the latter in one direction the levers will operate to clamp the shoes against the brake wheel. The lever 157ª is connected to one arm 158 of a lever 159, which is mounted upon a shaft 159ª suitably supported by the motor casing. The arm 158ª of the lever 159 is connected to one end of a spring 160. The spring 160 operates to move the lever 157ª in that direction which applies the brake shoes and thus normally keeps the latter in braking position. To release the brake shoes, the lever 159 is rocked about the pivot or shaft 159ª in the opposite direction, this operation being preferably effected by a solenoid 161, the core of which is connected by a link 162 with the arm 158ᶜ of the lever 159. The winding on the solenoid is connected in series with the circuit to the motor as will later be set forth in connection with Fig. 10 so that when the circuit is closed the solenoid is energized and automatically effects the release of the brake shoes; likewise, upon the opening of the motor circuit the solenoid winding is de-energized and thus permits the spring 160 to automatically actuate the brake shoes to clamp the brake wheel.

As will be understood from the foregoing description, the load is raised and lowered by winding the rope 57 on or unwinding it from the drum 59, the boom 40 is swung upwardly or downwardly by winding the rope 40′ on or unwinding it from the drum 58 and the support 34 is swung or rotated about the shaft 33 by the operation of a suitable motor (not shown). The movement of each of these elements is automatically stopped when moved in either direction (except in the downward movement of the load engaging element 55) at a predetermined position by a mechanism which opens the circuit to the motor that operates such element. The mechanisms for stopping the movements just referred to may be similar in construction, each being preferably similar in construction to the mechanism which forms the subject matter of my copending application Serial No. 610,791. The mechanism for stopping the swinging or rotation of the frame 34, comprises a switch means enclosed in a casing 163′; the mechanism for stopping the movement of the boom 40 comprises a switch means enclosed in casing 165′; and the mechanism for stopping the raising of the load engaging member or element 55 comprises a switch means enclosed in a casing 169′ carried by the boom 40, a flexible connection 170 connected at one end to the arm 171 of the switch means and leading over sheaves mounted on the boom 40 and connected at its opposite end to a weight 174, which is disposed in the path of movement of the casing 56. The arm 171 is connected to a spring 175 which tends to swing the arm in one direction—that direction which will operate the switch means to open the circuit. The arm is moved in the other direction—

that direction which operates the switch means to close the circuit—by the weight 174, so that if the casing 56 is elevated far enough to lift the weight, the spring 175 will move the arm 171 and thru it effect the opening of the circuit thru the switch means. As a result, the motor 41 will be automatically stopped.

Referring to Fig. 10: the traction motor 4 is connected with the terminals of the controller 23 by leads constituting the circuits 176, 176ª, to control the direction of rotation of the motor and leads 177, 177ª, to the terminals of terminal blocks 178, 178ª and through wires 179, 179ª with the opposite sides of the batteries 36. 180 indicates a connection in the circuit leads 179, 179ª, which permits the batteries to be connected with the terminals or with a charging plug to recharge the batteries.

The circuit for the motor 76 may be traced as follows: from the terminal 178ª by the lead 180′ to the terminal 181 of the switch means 163; if the frame 34 is to be rotated to the right, the circuit is through the lead 182 to terminal 183, across contact 184 to terminal 185, lead 186, winding of brake solenoid, lead 187 to brush 188, from brush 189 to lead 190, terminal 191, contact 192, terminal 193, lead 193′, terminal 194, field coil 195, terminal 196 and lead 197 to terminal 178. If the frame 34 is to be rotated to the left as shown in Fig. 2, the circuit is traced as follows: terminal 178ª, lead 180′, terminal 181, lead 198, terminal 199, contact 200, terminal 191, lead 190, brush 189, brush 188, lead 187, winding of brake solenoid, lead 186, terminal 185, contact 201, terminal 193, lead 193′, terminal 194, field coil 195, terminal 196 and lead 197 to terminal 178.

If the boom 40 is to be raised, the circuit for the motor 41 and the electro-magnet to be connected in series with the motor 41 so as to release the clutch 130 which holds the drum 58, is traced as follows: from terminal 178ª, through lead 202, winding of brake solenoid, lead 203, winding 136ª of magnet 136 adjacent the drum 58 (see Fig. 5), lead 204, terminal 205 of switch means 165, terminal 206, lead 207, contact 208, contact 209, terminal 210 of the selector switch 152, lead 211, terminal 212 of the controller 147, contact 213, terminal 214, lead 215, terminal 216, motor brushes, terminal 217, lead 217ª, terminal 218, contact 219, terminal 220, leads 221, 222, field coils 223 and lead 224 to terminal 178; if the boom 40 is to be lowered, the circuit is as follows: from terminal 178ª, through lead 202, winding of the brake solenoid, lead 203, winding 136ª of magnet 136, lead 204, terminal 205 of switch means 165, terminal 225, lead 226, terminal 227 of the selector switch 152, contact 228, terminal 229, lead 230, terminal 231 of the controller 147, contact 232, terminal 218, lead 217ª, terminal 217, motor brushes, terminal 216, lead 215, terminal 214, contact 233, terminal 234, lead 235, lead 222, field coils 223 and lead 224 to terminal 178.

If the load engaging element 55 is to be raised, the circuit may be traced as follows: from the terminal 178ª, through lead 202, winding of the brake solenoid, lead 237, winding 136ª of the releasing means 136 adjacent the drum 59, lead 238, terminal 239 of switch means 169, terminal 240, lead 241, terminal 242, contact 243, terminal 210, lead 211, terminal 212, contact 213, terminal 214, lead 215, terminal 216, brushes of motor 41, terminal 217, lead 217ª, terminal 218, contact 219, terminal 220, leads 221, 222, field coils 223 of motor and lead 224 to terminal 178. If the load engaging element is to be lowered, the circuit may be traced as follows: from terminal 178ª through lead 202, winding of brake solenoid, lead 237, winding 136ª of the releasing means 136, lead 244, terminal 245, contact 246, terminal 229, lead 230, terminal 231, contact 232, terminal 218, lead 217ª, terminal 217, brushes of motor, terminal 216, lead 215, terminal 214, contact 233, terminal 234, lead 235, lead 222, field coils 223 and lead 224 to terminal 178.

247 is a resistance arranged to be connected in shunt with the motor circuit when the motor is operated to lower the boom 40 or the load engaging member 55, to prevent acceleration in the speed of the motor shaft.

From the foregoing description it will be seen that I have provided a load handling mechanism in which the load may be moved or operated in any one of a plurality of directions in a rapid and simple manner, for example, by a raising or lowering of the load engaging member, and by a raising or lowering of the boom; such operations being effected by providing locking means for certain elements through which the power of the motor is transmitted to driven means and causing a release of one of such elements accordingly as one movement of the load or another is desired. While I have shown an electrically operated means for operating—that is, releasing—either clutch, it will be understood that other types of release means may be employed.

In my construction I am enabled to effect the various operations of the load engaging member and the boom from a single motor and a unitary driving or power transmitting mechanism, which tends toward economy and simplicity as well as compactness of the construction. While I have shown the driven means as directly connected to the driven elements of the power transmitting mechanism, this is merely for the purpose of illustrating the preferred embodiment of the invention as adapting it to a construction in which the loading engaging member is controlled in its vertical and topping movements by flexible members wound on and off the drums.

It will also be noted that the selector handle and the controller actuated thereby are arranged to be set at a neutral position, at which time neither electro-magnet winding is energized, and that they must be moved in one direction or the other to effect the operation (release) of the desired clutch elements. By this arrangement I insure the de-energizing of one magnet winding prior to the energizing of the other magnet winding, so that proper operations of the load engaging member and boom to handle the load as desired are effected in a rapid and positive manner.

To those skilled in the art to which my invention relates many alterations in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope thereof. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In apparatus of the class described, the combination with a frame and a source of power supply thereon, of a motor, connections between said motor and said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, separate means between said frame and each of said mechanisms for normally holding the latter against movement, and means for releasing each of said holding means, and means for selectively connecting either of said holding means into the connections between said motor and said source of power, whereby the latter operates one of said holding means when the motor is operated.

2. In apparatus of the class described, the combination with a frame and a source of power supply thereon, of a motor arranged to be connected with said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, separate means between said frame and each of said mechanisms for normally holding the latter against movement, and means for selectively releasing either of said holding means, the operation of said releasing means being dependent upon the supply of power to said motor, but independent of its direction of rotation.

3. In apparatus of the class described, the combination with a frame and a source of electric power supply thereon, of an electric motor arranged to be connected with said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, separate means between said frame and each of said mechanisms for normally holding the latter against movement, means for connecting said motor with said source of power supply to drive it in either direction, separate magnetic means for releasing each of said holding means, and a selective mechanism arranged to connect either of said magnetic means in the motor circuit, whereby one of said means is operated when the motor is started.

4. In apparatus of the class described, the combination with a frame, of a source of electric power supply, an electric motor arranged to be connected with said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, means between said frame and each of said mechanisms for normally holding the latter against movement, and means for releasing either of said holding means and connecting said motor to said source of power supply, the last said means comprising magnetic releasing devices for each said holding means having leads for connection in the motor circuit, in series with said motor, a selector for connecting any of said leads into the motor circuit and a circuit closer for said motor circuit.

5. In apparatus of the class described, the combination with a frame and a source of power supply, of a motor arranged to be connected with said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, means between said frame and each of said mechanisms for normally holding the latter against movement, means dependent upon the supply of power to said motor for releasing either of said holding means, and a selective means for effecting operation of one of said releasing means when the motor is connected to said source of power supply.

6. In apparatus of the class described, the combination with a frame and a source of power supply thereon, of a motor, connections between said motor and said source of power supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning a load, spring operated means between said frame and each of said mechanisms for normally holding the latter against movement, means for connecting said motor with said source of supply to drive it in either direction, releasing means for each of said holding means arranged to operate simultaneously with the completing of the connection between said motor and said source of power supply, and means for selectively connecting either of said releasing means with said connections between said motor and said source of power supply.

7. In apparatus of the class described, the combination with a frame and a source of electric current supply thereon, of an electric motor arranged to be connected with said source of supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning loads, means between said frame and each of said mecha-

nisms arranged to normally hold the latter against movement, magnetically operated means for releasing each of said holding means, and selective means for connecting either of said magnetically operating means in the circuit between said motor and said source of supply, whereby said releasing means are actuated and the motor driven in one direction.

8. In apparatus of the class described, the combination with a frame and a source of electric current supply, of an electric motor arranged to be connected with said source of supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning loads, means between said frame and each of said mechanisms arranged to normally hold the latter against movement, magnetically operated means for releasing each of said holding means, means for connecting said motor with said source of supply, and means for selectively connecting in series in the circuit between said motor and said source of supply either of said magnetically operating releasing means, whereby the connection of said motor with said source of supply will simultaneously effect the operation of one of said releasing means.

9. In apparatus of the class described, the combination with a frame and a source of electric current supply, of an electric motor arranged to be connected with said source of supply, a plurality of mechanisms connected in driving relation with said motor for handling and positioning loads, means between said frame and each of said mechanisms arranged to normally hold the latter against movement, magnetically operated means for releasing each of said holding means, means for connecting said motor with said source of supply to drive it in either direction, and means for selectively connecting in series in the circuit between said motor and said source of supply either of said magnetically operating releasing means irrespective of the direction of rotation of said motor, whereby the connection of said motor with said source of supply will simultaneously effect the operation of one of said releasing means.

10. In apparatus of the class described, the combination with a frame and a source of power supply thereon, of a motor arranged to be connected with said source of power supply, a differential mechanism having a main gear connected in driving relation with said motor, separate means connected respectively in driving relation with the driven elements of said mechanism for handling and positioning a load, devices between said frame and each of said means for normally holding the latter against movement, means for connecting said motor with said source of power supply to drive it in either direction, means for releasing either of said holding means, and selective means for connecting either of said releasing means in the connecting means between said motor and source of power supply.

11. In apparatus of the class described, the combination with a frame, and a source of electric power supply thereon, of a motor, a circuit between said motor and said source of power supply, a differential mechanism having a main gear connected in driving relation with said motor, separate operating means respectively connected in driving relation with the driven elements of said mechanism for handling and positioning a load, devices between said frame and each of said operating means for normally holding the latter against movement, means for connecting said motor with said source of power supply to drive it in either direction, means for releasing each of said holding devices, said releasing means being arranged to operate simultaneously with the completing of the circuit between said motor and said source of power supply, and selective means for connecting either of said releasing means in the circuit in series with said motor.

12. In apparatus of the class described, the combination with a frame and a source of electric current supply, of an electric motor arranged to be connected with said source of supply, a differential mechanism having a main gear connected with and driven by said motor, separate operating means respectively connected with the driven elements of said mechanism for handling and positioning loads, brake devices between said frame and each of said operating means arranged to hold the latter against movement, magnetically operated means for releasing either of said brake devices, means for connecting said motor with said source of supply, and means for selectively connecting in series in the circuit between said motor and said source of supply either of said magnetically operating releasing means, whereby the connection of said motor with said source of supply will simultaneously effect the operation of one of said releasing means.

13. In apparatus of the class described, the combination with a frame and a source of electric current supply, of an electric motor arranged to be connected with said source of supply, a differential mechanism having a main gear connected with said motor, separate operating means respectively connected with the driven elements of said mechanism for handling and positioning loads, devices between said frame and each of said operating means arranged to hold the latter against movement, magnetically operated means for releasing either of said holding devices, means for connecting said motor with said source of supply to drive it in either direction, and means for selectively connecting in series in the circuit between said motor and

said source of supply either of said magnetically operating releasing means irrespective of the direction of rotation of said motor, whereby the connection of said motor with said source of supply will simultaneously effect the operation of one of said releasing means.

14. In apparatus of the class described, the combination with a frame and a source of electric current supply, of an electric motor arranged to be connected with said source of supply, a differential mechanism having a main gear connected to said motor, a pair of drums connected to the driven elements of said differential mechanism, load handling members, movable relative to said frame and each other and each connected by a flexible member with one of said drums, devices between said frame and each drum and arranged to hold the latter against movement, magnetically operated means for releasing each of said holding devices, means for connecting said motor with said source of supply, and means for selectively connecting in series in the circuit between said motor and said source of supply either of said magnetically operating releasing means, whereby the connection of said motor with said source of supply will simultaneously effect the operation of one of said releasing means.

In testimony whereof, I have hereunto subscribed my name.

EDWARD H. REMDE.