June 24, 1930. G. R. HOFFMAN 1,767,525

LUMBER GRAPPLE

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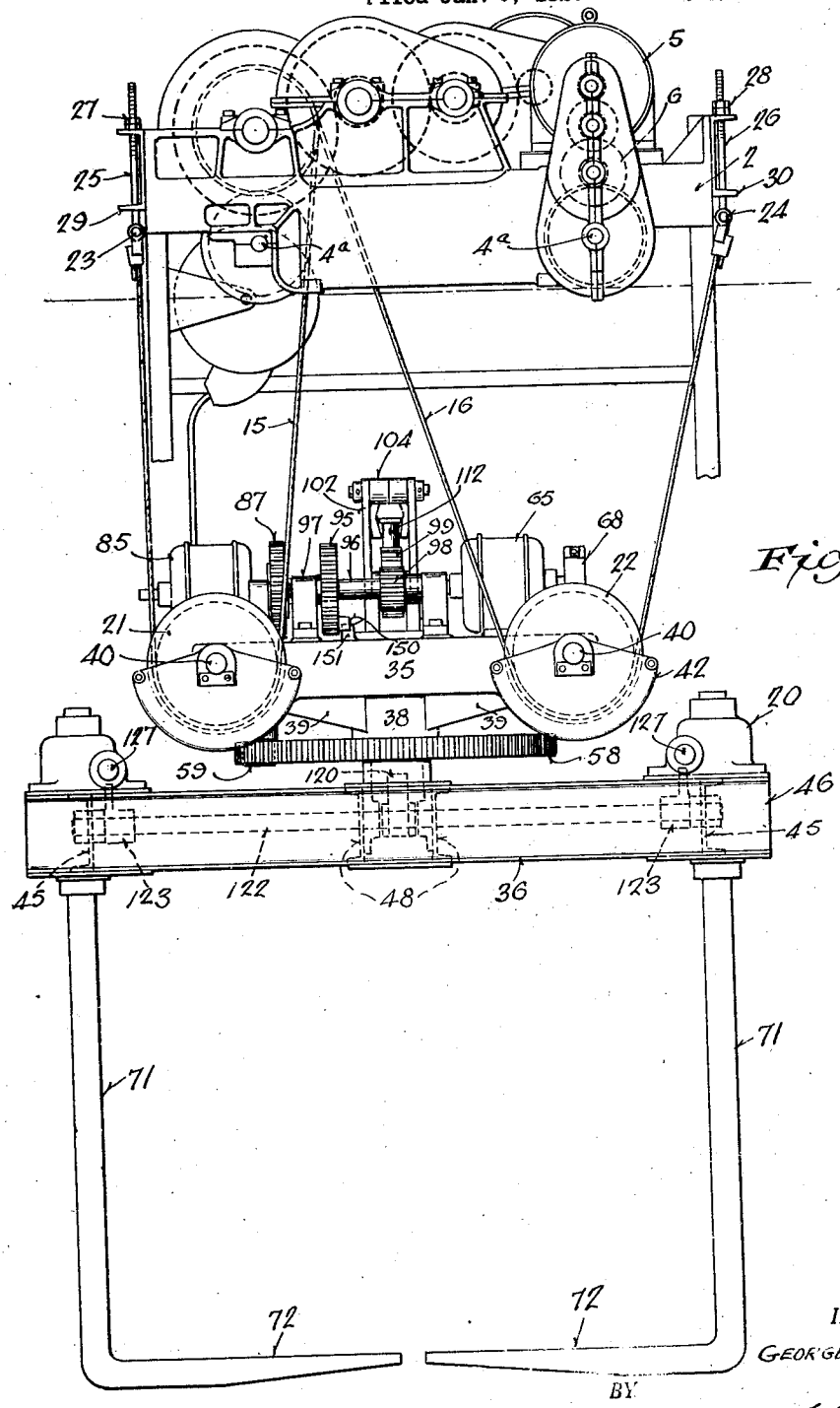


Fig. 1.

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LUMBER GRAPPLE

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Fig. 2.

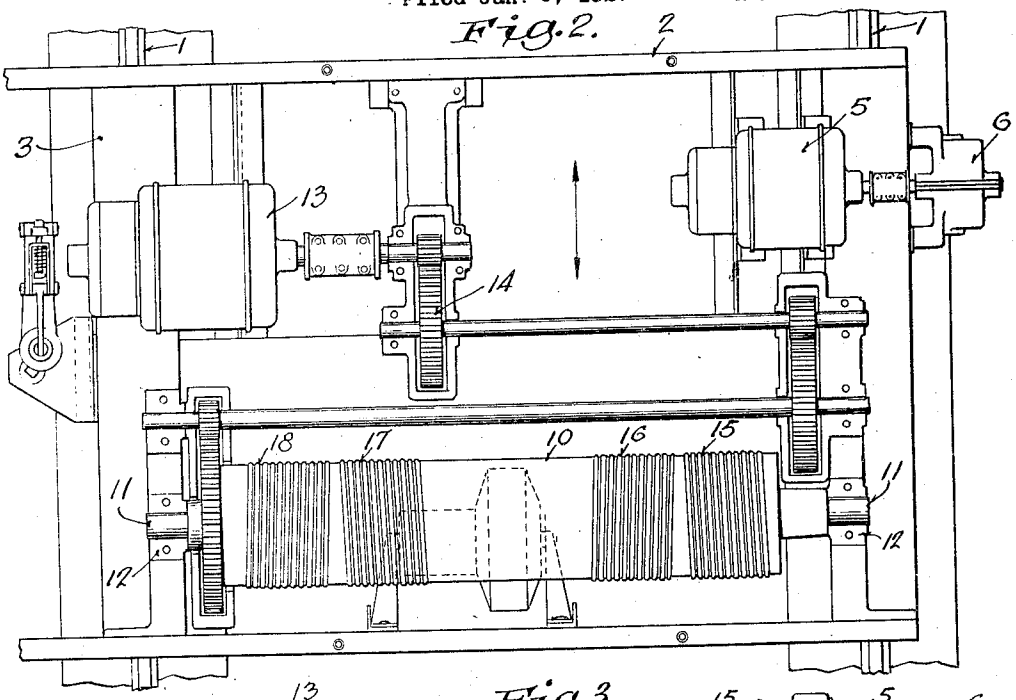
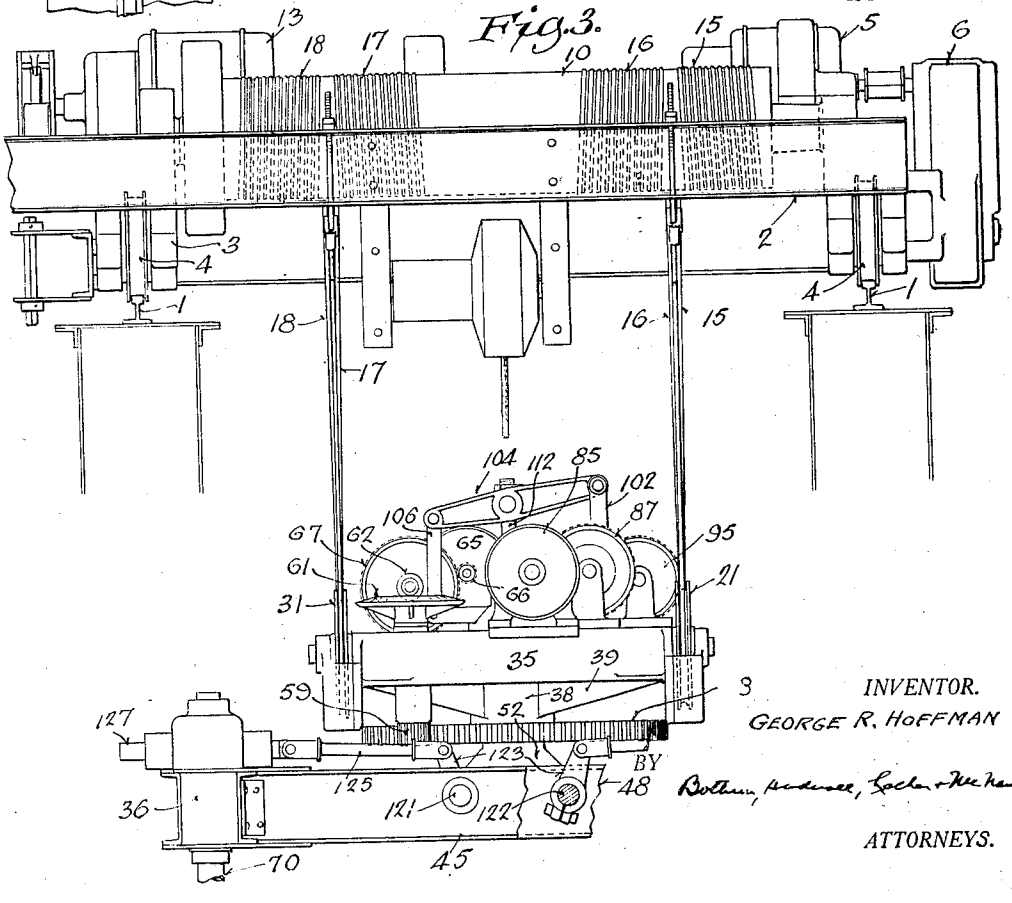


Fig. 3.



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Fig. 4.

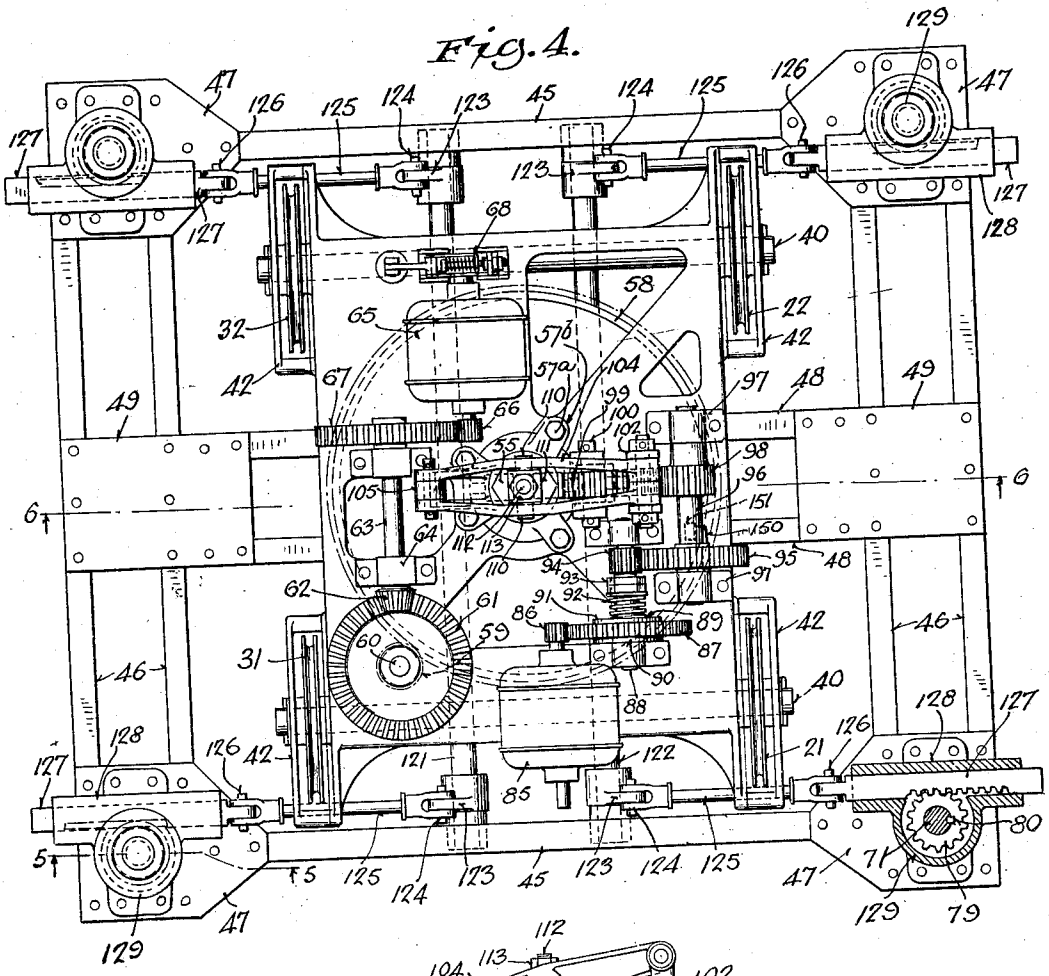
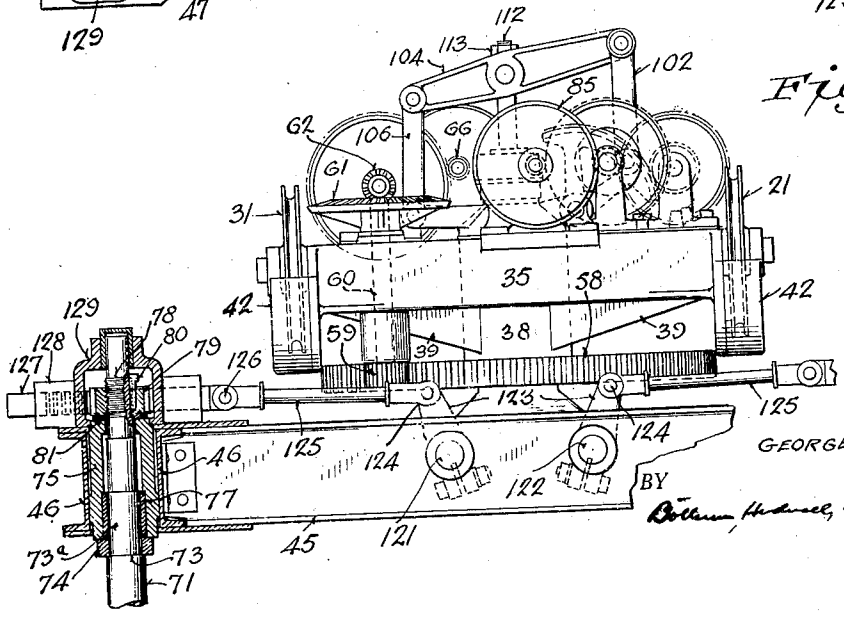


Fig. 5.



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Fig. 6.

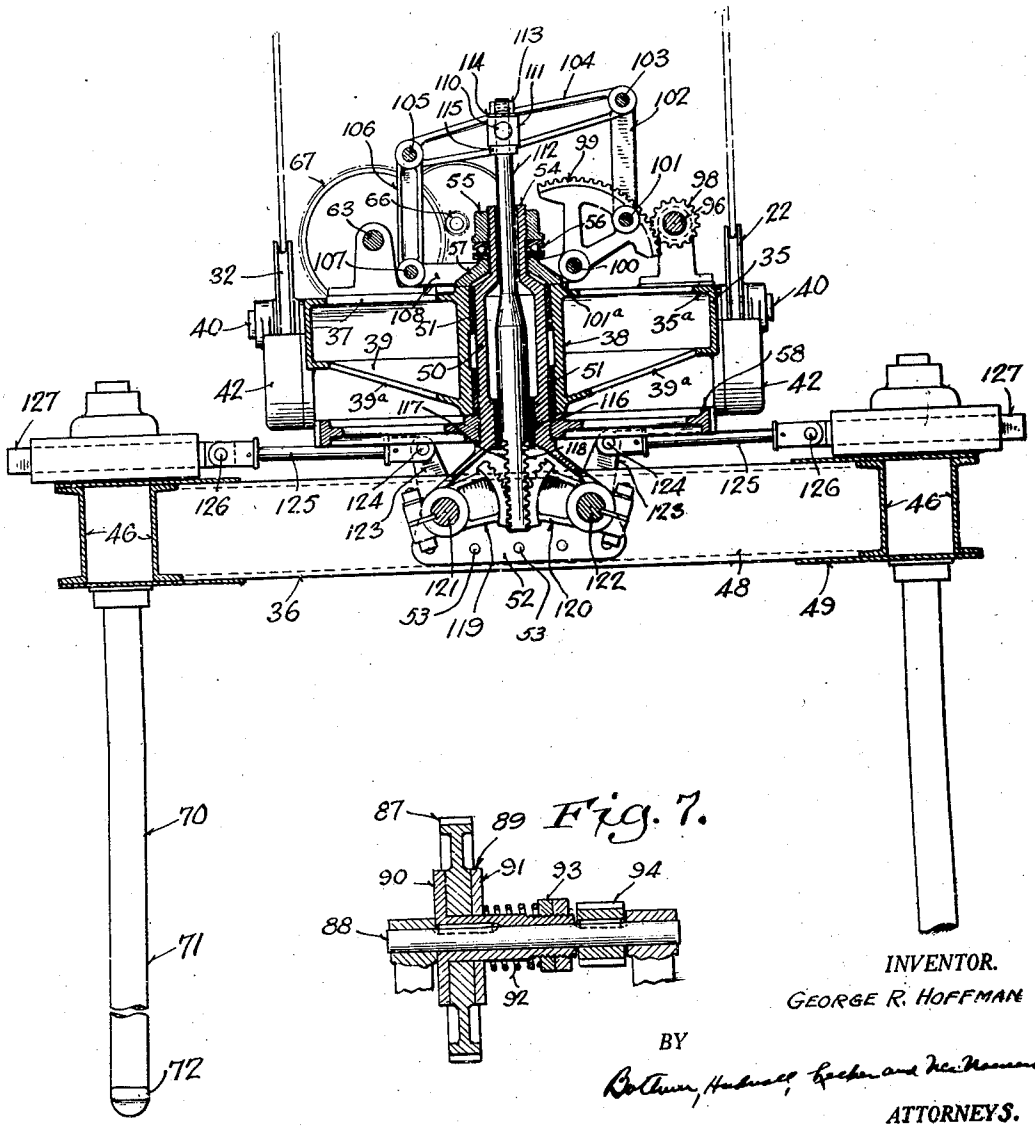


Fig. 7.

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UNITED STATES PATENT OFFICE

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LUMBER GRAPPLE

Application filed January 5, 1927. Serial No. 159,037.

This invention relates to an improved lumber hoist crane of the type embodying a power operated lumber grapple suspended from a traveling crane in such manner as to be movable vertically with respect thereto and movable bodily therewith horizontally.

One object of the invention is to provide a device of this character having a novel and effective suspension means on the crane for the lumber grapple whereby the lumber grapple has a four-point suspension from the crane, although raised and lowered from a single drum operated by a single motor. This organization precludes tipping of the lumber grapple thereby preventing loss of lumber therefrom and in general it enhances stability of the grapple and consequently of the load thereon while greatly simplifying the mechanism for controlling and operating the grapple from the crane.

Another object is to provide a novel lumber grapple embodying an upper frame suspended from the crane and a lower grapple carrying frame pivotally mounted on the upper frame for rotation about a vertical axis and wherein the means for rotating or angularly adjusting the lower frame is mounted entirely and directly on the upper frame while having an effective operative connection with the lower frame.

Another object of the invention is to provide means, which means is directly mounted on and carried by the upper frame and operatively connected with the lumber grapples of the lower frame for rotating and controlling the angular adjustment of the lumber grapples of the lower frame.

Another object of the invention is to provide a lumber grapple having a lower frame so mounted and controlled as to be completely rotatable through 360 degrees thereby facilitating the handling of the lumber and making it easy and convenient to reverse the load of lumber end for end or place it in various angled positions relative to the path of movement of the crane and yet eliminating the necessity of transferring current from the upper to the lower frame.

A further object of the invention is to provide a lumber grapple wherein all of the mechanism for operating and controlling the position of the grapples and operating and controlling the position of the grapple carrying frame is located in a convenient and accessible position on the upper frame which not only makes it easy to effect lubrication, adjustment, replacement and repair, but which eliminates collector rings or other means that might otherwise be necessary were this mechanism carried on a lower frame. Another advantage of this arrangement is that the grapple carrying frame is easier to operate and control as it is lighter and consequently does not have an undesirable degree of inertia that must be overcome in the starting and stopping of this lower frame.

Another object is to provide a device of the character specified which is of simple and durable construction, reliable and effective in operation and easy and comparatively inexpensive to manufacture.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification and in which:

Figure 1 is a view in end elevation showing one embodiment of the invention;

Fig. 2 is a plan view;

Fig. 3 is a fragmentary view of the device in side elevation;

Fig. 4 is a plan view of the lumber grapple with a portion broken away and shown in horizontal section to illustrate the means employed for operating the lumber grapple;

Fig. 5 is a fragmentary view partly in longitudinal vertical section on line 5—5 of Figure 4 and partly in side elevation;

Fig. 6 is a view in transverse vertical section on line 6—6 of Figure 4; and

Fig. 7 is a fragmentary detail view in section illustrating the slip clutch.

Referring to the drawings and more particularly to Figures 2 and 3, the numeral 1 designates a pair of elevated rails constituting a track or runway on which a traveling crane designated generally at 2 is mounted.

The traveling crane comprises a suitable truck 3 having flanged wheels 4 which engage the rails 1. The flanged wheels 4 are fixed on suitable axles 4ª journaled in bearings provided therefor on the truck and at least one of which is driven from an electric motor 5 through suitable gearing 6. On the platform of the truck 3 a single drum 10 is provided and has trunnions 11 rotatably mounted in bearings 12 provided on the platform of the truck. The drum 10 is rotated in either direction from a reversible electric motor 13 having its armature shaft geared to the drum by reduction gearing 14. Of course the gearing employed throughout the machine may be suitably encased or housed. The drum 10 is provided with four spaced spiral grooves, two oppositely directed spiral grooves being located at each end of the drum. These grooves are designed to receive hoist cables 15, 16, 17 and 18. In lieu of cables, ropes or any flexible lines may be employed. Each of these cables is made fast to the drum in any suitable manner at one end and after wrapping around the drum is passed downwardly from the traveling crane to a lumber grapple designated generally at 20. As shown in Fig. 1, the cables 15 and 16 pass around sheaves 21 and 22 rotatably mounted on the frame of the grapple 20 and then extend back up to the crane 2 where they are dead-ended by being pivotally fastened as at 23 and 24 to eye bolts 25 and 26 adjustably connected as at 27 and 28 to channels 29 and 30 securely fastened to the structure of the truck 3. The cables 17 and 18 are passed around similar sheaves 31 and 32 and are also dead-ended on the truck of the frame like the cables 15 and 16. With this arrangement a single drum is employed for raising and lowering the lumber grapple and this advantage is had along with a four-point suspension.

The lumber grapple is shown in detail in Figures 4, 5 and 6 and in operative association with the traveling crane in Figures 1 and 3. As shown in the drawings, this lumber grapple has an upper frame 35 and a lower frame 36, the lower frame being rotatably supported on the upper frame. The upper frame is fixed against rotary movement in a horizontal plane although it may be raised and lowered since it is at the corners of this upper frame that the sheaves 21 and 22 and 31 and 32 are rotatably mounted.

The frame 35 is made up of a marginal frame member 35ª of channel section and the top flange of the channel is integrally formed with or otherwise rigidly connected to a top plate 37 which constitutes a platform. Centrally the frame 35 is provided with a tubular bearing member 38, the bearing member 38 preferably being integral with the top plate 37 and also integral with webs 39 which are also integral with the marginal frame member 35ª and extend radially between the marginal frame member 35ª and the tubular bearing member 38. Flanges 39ª are integrally formed with the webs and with the lower flanges of the marginal frame member 35ª to strengthen and stiffen the same.

As indicated in Fig. 4, the guide sheaves 21 and 22 and 31 and 32 are mounted on shafts 40. The shafts 40 are journaled in suitable bearings provided therefor in the marginal channel frame 35ª. Guards 42 are provided around the sheaves 21 and 22 and 31 and 32.

The lower frame 36 includes spaced side frame members 45 of channel shape and pairs of end frame members 46 united with the side frame members 45 by connecting plates 47 riveted or otherwise suitably secured to the frame members 45 and 46. The members of each pair of end frame members 46 are of channel form and are oppositely disposed and held in spaced relation with respect to each other. This lower frame also has a pair of longitudinally extending intermediate frame members 48, the frame members 48 preferably being symmetrically disposed with the longitudinal axis of the machine. Connecting plates 49 are riveted or otherwise suitably secured to these intermediate frame members 48 and to the end frame members 46 to secure these parts together in assembly.

As shown in Fig. 6, the lower frame 36 is suspended on the upper frame member 35 by means of a sleeve hanger 50 which extends through the tubular bearing member 38 of the upper frame 35 and rotatably fits within bushings 51 provided in the tubular bearing 38. The lower end of this sleeve hanger 50 is enlarged and has integrally formed therewith spaced wings 52 which are riveted as at 53 or otherwise suitably secured to the intermediate frame members 48 of the frame 36. The upper end of the sleeve hanger 50 is provided with a reduced extension 54 which extends up above tubular bearing member 38 and has its upper extremity threaded to receive a nut 55. The nut 55 serves to hold a thrust bearing 56 in proper adjustment on the extension 54 of the sleeve hanger 50 and this thrust bearing 56 in turn engages a cap 57 resting on the upper end of the tubular bearing 38 and of a size gradually decreasing or reducing upwardly as shown in Fig. 6 to afford a proper seat for the thrust bearing 56. The cap 57 is held in place by bolts 57ª (see Fig. 4) which coact with apertured ears 57ᵇ integral with the cap 57 and which fasten the cap to the top plate 37 of the frame 35. With this construction the sleeve hanger and tubular bearing and associated parts provide not only for the proper support and suspension of the lower frame on the upper, but also afford a king pin structure whereby the lower frame is constrained to rotate about a vertical axis located centrally of

the upper frame when the lower frame is angularly adjusted relative to the upper frame.

For the purpose of turning or angularly adjusting the lower frame 36 relative to the upper frame 35 a relatively large gear wheel 58 is fixed to the sleeve hanger 50 just below the tubular bearing 38. The teeth of this gear wheel 58 mesh with a pinion 59 (see Figures 3 and 5), the latter being fixed to the lower end of a shaft 60 rotatably mounted in suitable bearings provided therefor on the upper frame 35. The upper end of the vertical shaft 60 projects above the frame 35 and has a beveled gear wheel 61 fixed thereto, the beveled gear wheel 61 meshing with a beveled pinion 62 fixed to one end of a shaft 63 journaled in bearing 64 provided on the platform 37 of frame 35 and driven from an electric motor 65 through a pinion 66 fixed to the armature shaft of the motor and meshing with a large gear wheel 67 fixed on the shaft 63. An electromagnetic brake 68, preferably of the clam shell type, is operatively associated with the armature shaft of the motor to hold its armature shaft in any adjustment. With this arrangement the electric motor 65 may be energized to cause the lower frame 36 to be rotated relative to the upper frame 35 and this lower frame may be rotated through a complete circle or through the entire 360 degrees of angular adjustment. This advantage is had without necessitating the use of commutator rings or other means for transmitting electric current from the upper frame to the lower frame. This advantage results from mounting the electric motor 65 on the upper frame and gearing it to the lower frame in the manner set forth and in this arrangement there is involved the additional advantages of making all of the parts readily accessible and relieving the lower frame of weight.

At the corners of the lower frame lumber grapple means shown as comprising grapple hooks 70 are provided, each grapple hook 70 having a vertical shaft or shank 71 and an inturned or horizontally extended lower end constituting a bill or foot 72. The shaft of each grapple hook has its upper end rotatably mounted on the lower frame, the upper end of the shank of each grapple hook being stepped to afford shoulders and clearances necessary to accomplish this purpose and to adapt the grapple hook to be controlled as to its angular adjustments. As illustrated in Fig. 5, the lower step 73 at the upper end portion of each grapple hook provides a shoulder against which a collar 74 abuts. The collar 74 engages the lower end of a bearing sleeve 75 which is secured to the frame 36 between the frame members 46 thereof. The portion 73a of the shank 71 just above the shoulder 73 has a snug rotatable fit in a bushing 77 fitted in the bearing sleeve 75. Above the bearing sleeve 75 the shank 71 has an externally threaded portion 78 with which an internally threaded hub of a pinion 79 is engaged. The pinion 79 is also keyed as at 80 to the shank 71, a washer 81 being interposed between the pinion and the upper end of the bearing sleeve 75. By threading the pinion 79 on the shank 71 the pinion may be used as a nut to draw up the shank 71 as far as may be desirable to secure and maintain the proper engagement of the collar 74 with the shoulder 73 and the lower end of the bearing sleeve 75, as well as to tighten the pinion 79 against the washer 81 and the washer 81 against the upper end of the bearing sleeve. The key 80 maintains the adjustment. In this way the grapple hook is held against vertical or axial movement but is mounted for free radial movement about its vertical axis. This enables the grapple hook to be turned so as to have its foot engaged with the pile of lumber or to be turned to move its foot out of engagement with the pile of lumber.

Means is provided for moving the grapple hooks to position the bills or feet thereof to engage the pile of lumber or to disengage the same as may be desirable and this means comprises an electric motor 85 mounted on the platform 37 of the frame 35, and having a pinion 86 fixed to its armature shaft and meshing with a large gear wheel 87 loosely mounted on a shaft 88 though normally constraining the shaft 88 to rotate therewith through a slip clutch designated at 89. The slip clutch 89 may be of any suitable type but is shown as comprising a friction disk 90 having an elongated sleeve-like hub extension snugly fitted on and fixed to the shaft 88. One face of the disk 90 engages one face of the gear wheel 87 which is rotatably mounted on the hub extension of the disk 90, the opposite face of the gear wheel 87 being engaged by friction disk 91 splined on the hub extension of the friction disk 90 and forced against the gear wheel 87 by a spring 92 encircling the shaft 88 and tensioned by nuts 93 threaded on the hub extension of the disk 90 and engaging the spring 92. A pinion 94 is fixed to the shaft 88 and meshes with a gear wheel 95 fixed on a countersunk shaft 96 journaled in bearings 97 provided on the platform 37. This shaft 96 carries a pinion 98 which meshes with a gear segment 99 pivotally mounted as at 100 on suitable bearing lugs 101a integral with the bearing cap 57, the gear segment 99 being pivotally connected as at 101 to the lower end of a pair of links 102, the latter being pivotally connected as at 103 to one end of a rocker 104, the rocker having its opposite end pivotally connected as at 105 to the upper end of a link support 106 pivotally mounted as at 107 to suitable mounting lugs 108 integral with the bearing cap 57. Intermediate its ends the rocker 104 is provided with transversely alined openings to receive the trunnions 110 of a bearing block 111

which has a vertical opening therethrough to receive the upper reduced end of a sliding shaft 112, the shaft 112 being fastened to the block 111 by a nut 113 threaded on the upper end of this shaft 112 and bearing against a washer 114 interposed between the nut 113 and the block 111. Below the block 111 a washer 115 is interposed between the block and a shoulder on the shaft 112. The shaft 112 has its intermediate portion enlarged and slidably fitted in a bushing 116 mounted in the sleeve hanger 50. The lower end of this shaft 112 is provided with opposed racks 117 and 118 which mesh with gear segments 119 and 120 keyed and clamped or otherwise suitably fixed to rock shafts 121 and 122 extending longitudinally of and journaled in bearings provided therefor in the lower frame 36. The shaft 121 is utilized to adjust the grapple hooks on one side of the machine to the shaft 122 to operate the grapple hooks on the other side of the machine. Each of the shafts 121 and 122 has a crank arm 123 fixed thereto adjacent each end and each crank arm is pivotally connected as at 124 to one end of a connecting rod 125, the opposite end of the connecting rod 125 being pivotally connected as at 126 to a sliding rack bar 127 mounted for sliding adjustment in guide or bearing 128 provided in a housing 129 which encases the upper end of the shank 71 of the grapple hook with which it is associated. Each sliding rack bar 127 meshes with the pinion 79 of its grapple hook.

With this arrangement when it is desired to adjust the grapples or grappling hooks 70 angularly, the electric motor 85 is started and the rotation of its armature shaft rotates the shaft 88 through the gears 86 and 87 and slip clutch 89. The shaft 88 transmits motion through the shaft 96, through the gears 94 and 95 and the shaft 96 in turn moves the gear segment 99 through its pinion 98. The swinging of the gear segment 99 rocks the rocker 104 by virtue of the link connection 102. Due to the mounting of its rocker 104 on the pivoted supporting link 106, the rocker imparts a straight line motion to the sliding shaft 112 until the sliding shaft 112 has been moved up or down (depending on the direction of rotation of the electric motor) as far as it may be. This motion of the sliding shaft 112 swings the gear segment 119 and 120, rocks the shafts 121 and 122 and consequently the crank arms 123 to cause the connecting rods 125 to slide the racks 127 whereby to impart the proper degree of rotation in the proper direction to all of the grapple hooks simultaneously. After the sliding shaft 112 is moved up or down as far as it may be the slip clutch permits the motor 85 to spin without imparting any motion to the grapples. The gear wheel 95 has a lateral stop 150 fixed thereon and preferably cast integral therewith and this stop 150 engages a stop lug 151 fixed to or cast integral with the top plate 37 of the frame 35. These stops 150 and 151 (see Fig. 4) engage at the proper time in the cycle of operation to limit the movement imparted to the grappling hooks. Of course the operator turns off the motor as soon as this occurs. This organization makes all of the parts of the grapple hooks controlling and operating means readily accessible for adjustment, replacement and repair and has the electric motor 85 and most of the gearing between this motor and the grapple hooks positioned on the upper frame.

The invention claimed is:

1. In a lumber handling apparatus, a lumber grapple comprising an upper frame, a lower frame suspended on the upper frame for rotary movement and means directly mounted on and carried entirely by the upper frame and operatively connected with the lower frame for adjusting the lower frame angularly.

2. In a lumber handling apparatus, a lumber grapple comprising a horizontally disposed upper frame, a horizontally disposed lower frame suspended on the upper frame for rotary movement, means directly mounted on the upper frame and operatively connected with the lower frame for adjusting the lower frame angularly, grapple hooks adjustably mounted at spaced points on the lower frame and designed to straddle and hoist a pile of lumber and means directly mounted on the upper frame and operatively connected with the grapple hooks for adjusting the same.

3. In a lumber handling apparatus, an upper frame, a lower frame, suspension means between the upper frame and the lower frame whereby the lower frame is suspended on the upper frame, grappling hooks adjustably mounted on the lower frame, an electric motor mounted on the upper frame, a sliding shaft extending through the suspension means and shiftable back and forth, motion transmission means between the sliding shaft and the grappling hooks including rock shafts mounted on the lower frame and geared to the sliding shaft, a rack and pinion associated with each grappling hook and means for actuating the racks and pinions from the rock shafts.

4. In a lumber handling apparatus, an upper frame, a lower frame, suspension means between the upper frame and the lower frame whereby the lower frame is suspended on the upper frame, grappling hooks mounted on the lower frame, an electric motor mounted on the upper frame, a sliding shaft extending through the suspension means and shiftable back and forth, a rocker connected with the sliding shaft, a link supporting one end of the rocker, a swinging member geared to the motor, a link between the swinging member and the rocker and

motion transmission means between the sliding shaft and the grappling hooks.

5. In a lumber handling apparatus, an upper frame having a tubular bearing, a lower frame, lumber grappling elements mounted on the lower frame a sleeve hanger connected to the lower frame and rotatably fitted in the tubular bearing of the upper frame, means between the upper end of the sleeve hanger and the tubular bearing for supporting the sleeve hanger on the tubular bearing against downward displacement while permitting relative rotation of these parts and means for rotating the lower frame relative to the upper frame including a motor mounted on the upper frame, a vertical shaft journaled in the upper frame and geared to said motor, said vertical shaft projecting below the upper frame and having a pinion on its lower end and a gear wheel fixed to the sleeve hanger and meshed with said pinion.

6. In a lumber handling apparatus, an upper frame having a tubular bearing, a lower frame, a sleeve hanger connected to the lower frame and rotatably fitted in the tubular bearing of the upper frame, means between the upper end of the sleeve hanger and the tubular bearing for supporting the sleeve hanger on the tubular bearing against downward displacement while permitting relative rotation on the lower frame, lumber grappling hooks mounted adjacent the corners of the lower frame, and means for rotatably adjusting said grappling hooks including a sliding shaft fitted in the sleeve hanger, means on the upper frame for sliding said shaft back and forth, and motion transmission means between the lower end of the sliding shaft and the grappling hooks.

7. In a lumber handling apparatus, an upper frame having a tubular bearing, a sleeve hanger rotatably fitted in the tubular bearing and having spaced wings at its lower end fastened to the lower frame and means between the upper end of the sleeve hanger and the tubular bearing for supporting the sleeve hanger on the tubular bearing against downward displacement while permitting relative rotation on the frames.

8. In a lumber handling apparatus, a frame having a sleeve bearing, a grappling hook having a shank rotatably mounted in the sleeve bearing, means coacting with the shank of the grappling hook and the lower end of the bearing for limiting the upward movement of the shank through the bearing, a pinion threaded on the upper end of the shank and cooperable with the upper end of the bearing to hold the grappling hook against downward displacement and means for locking the pinion in adjusted position on the shank.

9. In a lumber handling apparatus, a lumber grapple comprising an upper frame, a lower frame, lumber grappling elements mounted at spaced points on the lower frame, means for suspending the lower frame on the upper frame for rotary movement throughout a complete circle and means directly mounted on the upper frame and geared to the lower frame for rotating the lower frame through any angular adjustment.

10. In a lumber handling apparatus, a horizontally disposed upper frame, a horizontally disposed lower frame of generally rectangular form suspended on the upper frame for angular adjustment, lumber grapples adjustably mounted adjacent the corners of the lower frame, an electric motor mounted on the upper frame, gearing between said motor and the lower frame whereby the lower frame may be angularly adjusted by said motor, and means mounted on the upper frame and operatively connected with the lumber grappling elements for adjusting the same.

11. A lumber handling apparatus comprising an upper frame, a lower frame, suspension means between the upper frame and the lower frame whereby the lower frame is suspended on the upper frame, lumber grappling hooks adjustably mounted on the lower frame, means for adjusting said lumber grappling hooks including a motor mounted on the upper frame, a shiftable element extending through the suspension means, means for shifting said shiftable element from said motor and including a slip clutch and a gear driven through the slip clutch and connected to the shiftable element, cooperating stop means on the gear element and on the lower frame for limiting the motion of the gear element, and motion transmission means between the shiftable element and the grappling hooks.

12. In a lumber handling apparatus an upper frame, a lower frame, suspension means between the upper frame and the lower frame whereby the lower frame is suspended on the upper frame for angular adjustment, means carried by the upper frame and cooperatively connected with the lower frame for shifting the lower frame angularly, lumber grappling hooks mounted adjacent the corners of the lower frame, each lumber grappling hook including a shank extending vertically downward from the lower frame and terminating in a bill, said shanks being rotatably mounted on the lower frame, and motor driven means mounted on the upper frame and operatively connected with the shanks of the hooks for imparting rotative adjustment thereto.

13. A lumber handling apparatus comprising a horizontally disposed upper frame, a horizontally disposed lower frame of generally rectangular form, means coacting with the central portions of the frames for suspending the lower frame on the upper frame

for rotary adjustment, means carried by the upper frame and coacting with the lower frame for imparting rotative adjustment thereto, adjustable lumber grappling hooks mounted on the corners of the lower frame, operating means carried by the lower frame and operable when actuated to adjust said hooks, a motor mounted on the upper frame and motion transmission means between the motor and said operating means.

14. A lumber handling apparatus comprising a horizontally disposed frame of generally rectangular form, pairs of lumber grappling hooks, there being one lumber grappling hook adjacent each corner of the frame, each lumber grappling hook including a shank extending vertically downward from the frame and terminating in a bill, means for supporting the upper ends of the shanks on the frame for rotary movement, a pinion fixed to each shank, a rack meshed with each pinion, guide means for the racks carried by the frame, a rock shaft for each pair of grappling hooks, motion transmission means between each rock shaft and the racks of the grappling hooks with which it is associated, a single reversible motor and motion transmission means between the motor and both rock shafts.

15. A lumber handling apparatus comprising a horizontally disposed frame of generally rectangular form, pairs of lumber grappling hooks, there being one grappling hook adjacent each corner of the frame, each lumber grappling hook including a shank extending vertically downward from the frame and terminating in a bill, means for supporting the shanks for rotary movement on the frame, a pair of rock shafts mounted on the frame, there being one rock shaft for each pair of lumber grappling hooks, motion transmission means between each rock shaft and its pair of lumber grappling hooks and motor driven means for rocking said rock shaft.

16. A lumber handling apparatus comprising a frame, a plurality of lumber grappling hooks rotatably supported at spaced points on said frame, each lumber grappling hook including a shank extending downward from the frame and terminating in a bill, a motor and motion transmission means between the motor and all the lumber grappling hooks whereby the motor may be operated to turn all of said lumber grappling hooks.

17. A lumber handling apparatus including an upper frame, a lower frame located below and in spaced relation to the upper frame and suspended on the upper frame for angular adjustment, lumber grappling elements carried by the lower frame, a motor mounted on the upper frame and gearing between the motor and the lower frame including a gear wheel fixedly connected with the lower frame about the axis of suspension and disposed below the upper frame and a pinion rotatably mounted on the upper frame and meshed with said gear wheel.

In witness whereof, I hereto affix my signature.

GEORGE R. HOFFMAN.