Nov. 26, 1935. E. J. WILSON 2,022,168

LOAD HANDLING AND EXCAVATING MACHINE

Filed April 12, 1934 4 Sheets-Sheet 1

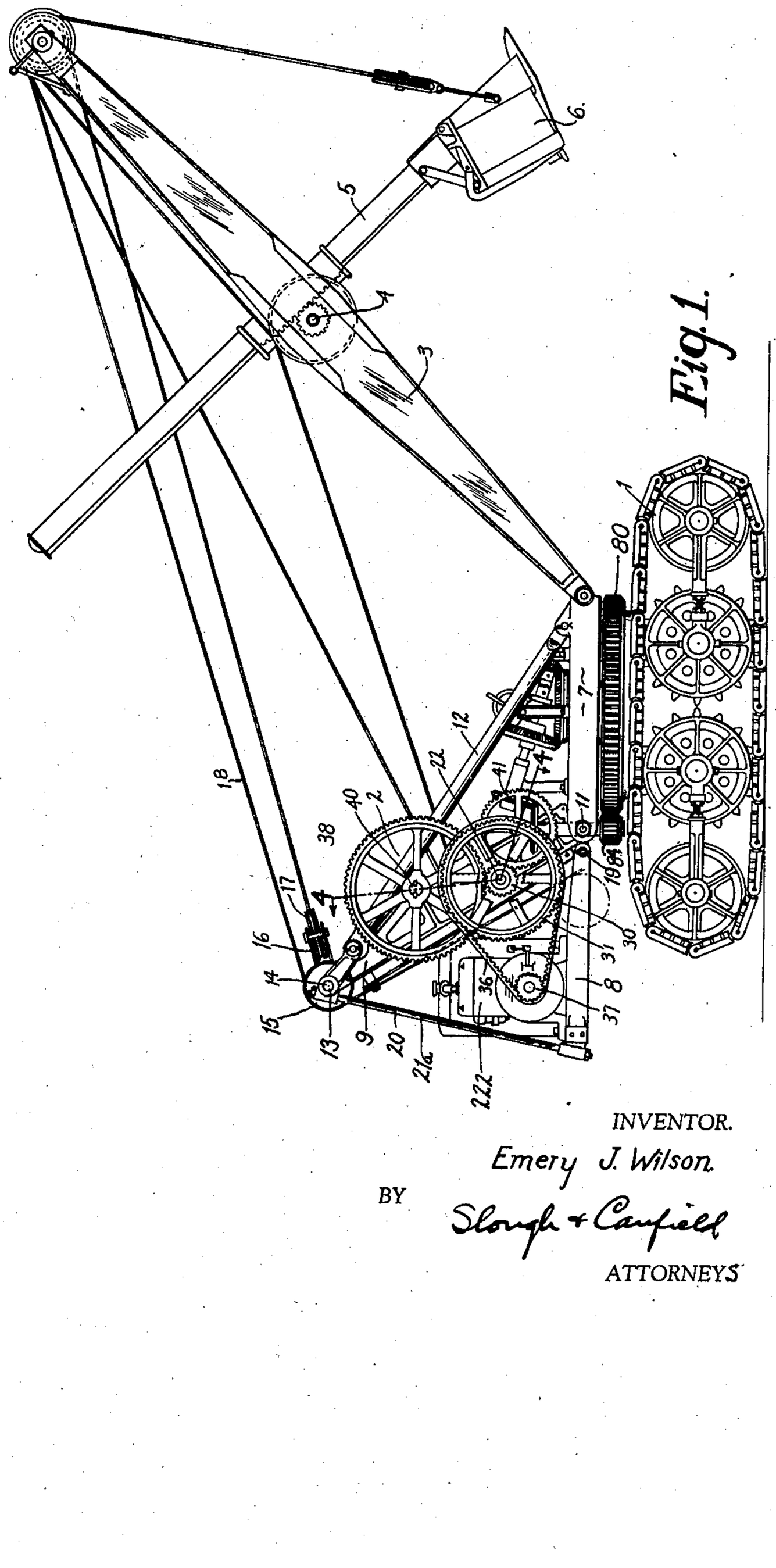

Fig. 1.

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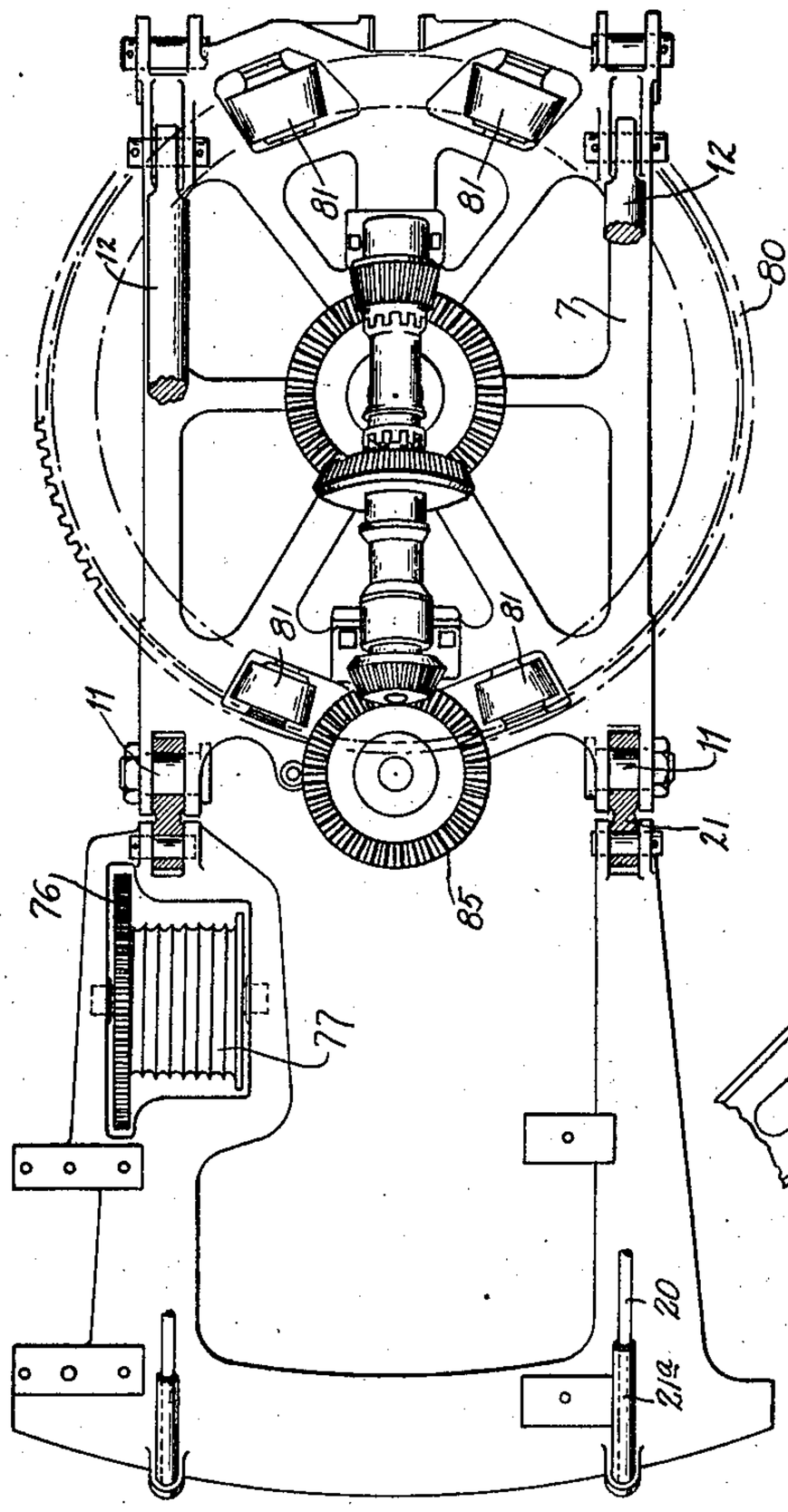

Fig 2.

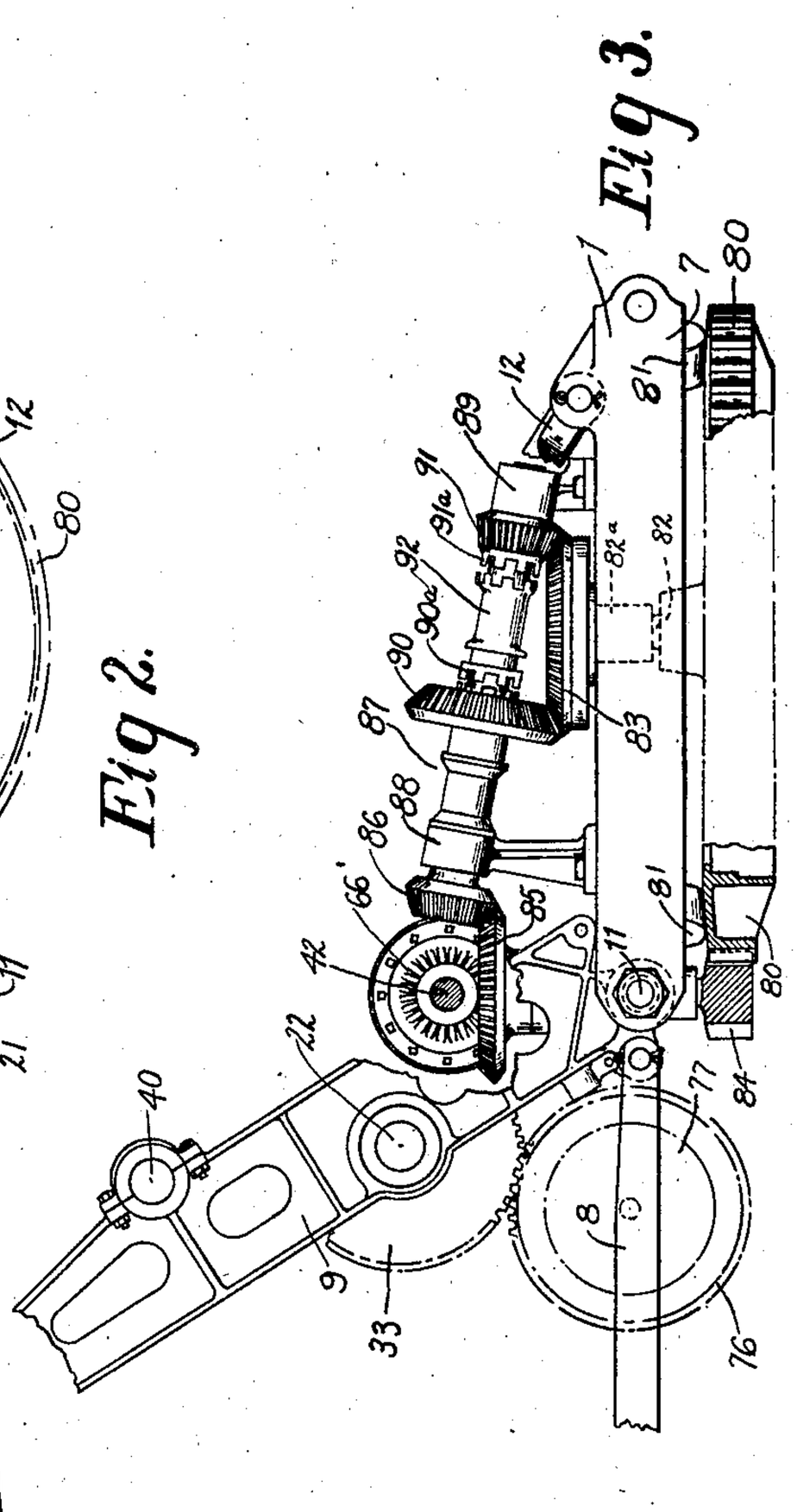

Fig 3.

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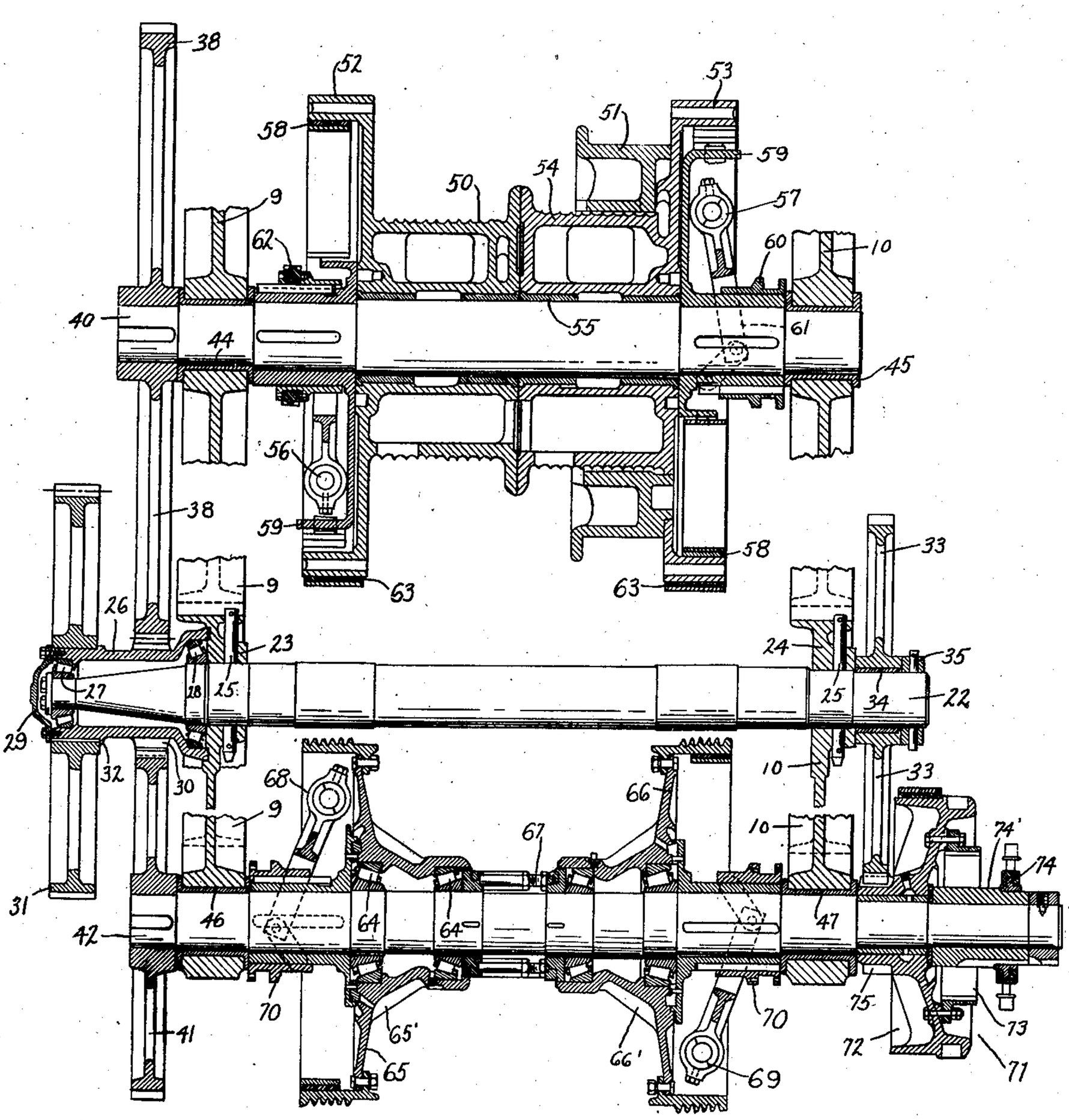

Fig 4.

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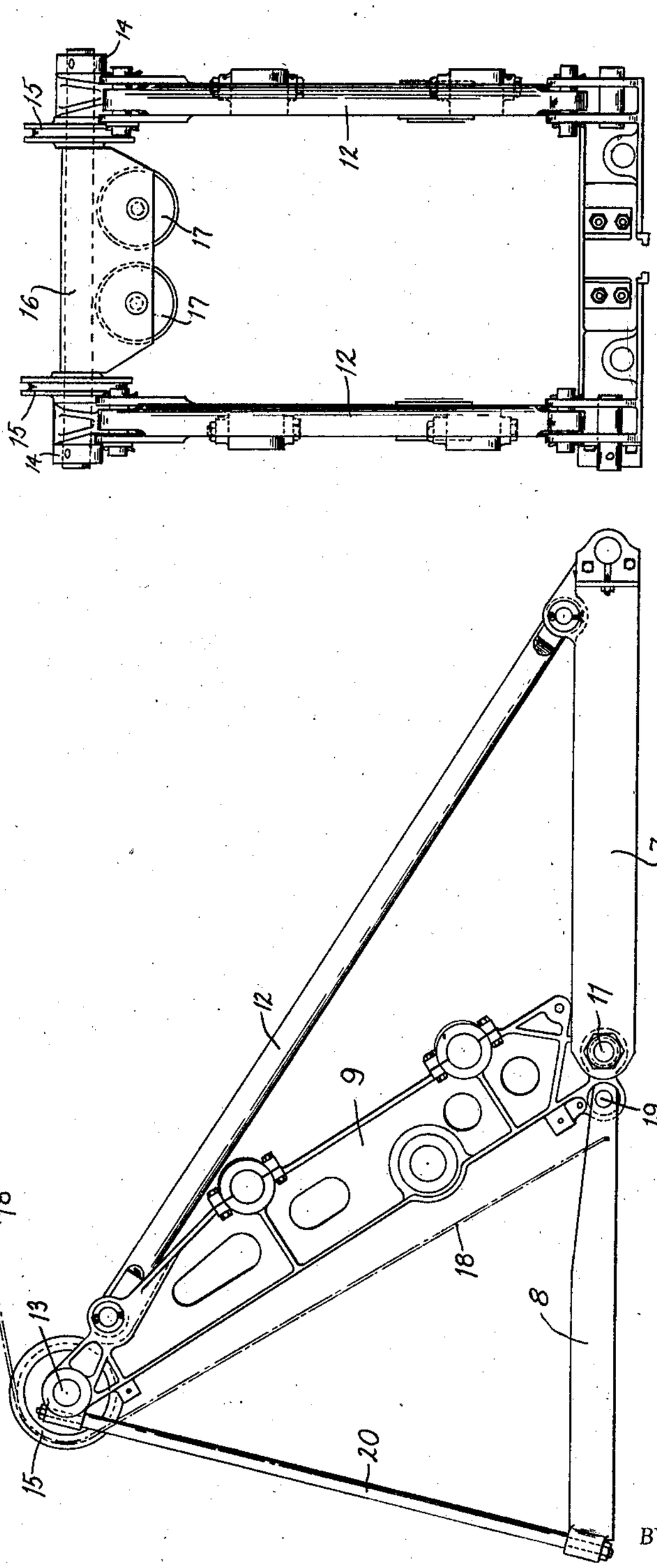

Fig. 6.

Fig 5.

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Patented Nov. 26, 1935 2,022,168

UNITED STATES PATENT OFFICE

2,022,168

LOAD HANDLING AND EXCAVATING MACHINE

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Application April 12, 1934, Serial No. 720,277

3 Claims. (Cl. 214—135)

This invention relates to improvements in load handling and excavating machines of the type comprising a base and a rotatable superstructure mounted thereon, and more particularly relates to improvements in the design and arrangement of the power mechanism of such machines.

An object of the invention is to provide, for power operated load handling and excavating machines of the type comprising a base and a superstructure revolvable thereon, an improved construction of superstructure whereby the weight of the superstructure may be utilized in an improved manner for counterbalancing purposes.

Another object of the invention is to provide, for machines of the class referred to, an improved construction for supporting the power mechanism thereof.

Another object of the invention is to provide, for counterbalanced machines of the class referred to, an improved compact power mechanism and mounting therefor having the maximum of counterbalancing effect for the minimum of weight, whereby the minimum of power is required for operating the machine and for moving it from place to place.

Another object is to provide, for machines of the class described, an improved power transmission mechanism.

Still another object of the invention is to provide an improved power transmission mechanism for a power shovel or the like which is economical of construction and which will transmit power relatively directly to the work with a maximum of efficiency.

Other objects of the invention and the invention itself will become increasingly apparent from a consideration of the following description and drawings, wherein:

Fig. 1 is an elevational view, partially diagrammatic, of a power operated shovel incorporating my invention;

Fig. 2 is a fragmentary plan view of the superstructure illustrated in Fig. 1, with parts omitted for simplicity;

Fig. 3 is an elevational view of the superstructure illustrated in Fig. 2;

Fig. 4 is a sectional view along planes including the axes of the power shafts, as indicated at 4—4 of Fig. 1;

Fig. 5 is a side elevational view of the turntable and frame members; and,

Fig. 6 is an end elevational view of the turntable and frame members.

Referring to the drawings, the principal parts of the shovel comprise the truck 1 upon which is rotatably mounted the superstructure, generally indicated at 2, including a power mechanism assembly, and a boom 3 upon which is mounted the shipper shaft 4 which carries the dipper stick 5 and dipper 6. The dipper stick 5 is supported at its end in a conventional manner as is likewise the boom, these parts and their operation constituting no essential part of my present invention.

The power mechanism assembly is supported by a frame comprising a sectional turntable bed including a front turntable bed 7 and a rear turntable bed 8, a pair of aligned posts 9 and 10 spaced transversely of the turntable and pivotally connected to the rear of the front turntable bed as by pins 11. As best illustrated in Fig. 2, the front turntable bed 7 has spaced perforated arms extending rearwardly from each side of the bed, the lower end of the posts 9 and 10 being disposed intermediate the arms and secured thereon by the pins 11 projected through the arms and a perforation in the posts, the pins being suitably secured by lock nuts or the like. Struts 12 are pin-connected to the front of the front turntable bed 7 and to the upper ends of posts 9 and 10 in a generally similar manner, the posts thus being pin-connected at all supporting points. The upper ends of posts 9 and 10 are connected by a shaft 13 projected through aligned perforations in the posts and secured in any suitable manner as by collars 14 fixed to the shaft ends outwardly of the posts. Also mounted on the shaft 13 are cable sheaves 15 maintained in spaced relation by a generally U-shaped spacing strap 16 encircling the shaft and disposed between the sheaves 15.

The strap 16 also forms the mounting for the sheaves 17 disposed at right angles to the sheaves 15. Suitable supporting cables 18 leading to the boom pass over sheaves 15 and 17. The posts 9 and 10 which are inclined rearwardly relative to the boom support the rear turntable bed 8 through pin connections 19 and tie rods 20. The rear turntable bed 8 which is generally of U form is recessed at the ends of the U legs to receive lugs 21 extending rearwardly from the foot of the posts 9 and 10, the posts and the bed 8 being pivotally connected by projecting the pins 19 through aligned perforations in the bed legs and the posts and secured therein by cotter-pins or the like.

The tie rods 20 are projected through aligned perforated lugs provided at the rear of the bed 8 and the upper end of the posts 9 and 10, and intermediately disposed spacing sleeves 21*a*, and

adjustably secured by nuts threadedly engaging the rod ends.

Between the posts are mounted the power mechanism driving shafts, carrying suitable clutches, drums and braking means and adjacent the rearward end of the rear turntable bed is mounted a prime mover 222 such as the internal combustion engine illustrated diagrammatically. Although I have illustrated an internal combustion engine, it is understood that any suitable source of power such as an electric motor may be employed.

The power mechanism is adapted to propel the truck in a forward or reverse direction and at two different speeds, crowd and retract the dipper stick in excavating operations, swing the superstructure in either direction, and raise and lower the boom. Other than concurrently propelling the truck and swinging the superstructure, these operations may be independently or concurrently effected through the provision of suitable clutches.

In effecting these operations, a center drive shaft 22, best illustrated in Fig. 4, is fixedly supported between the posts 9 and 10 by having the shaft ends projected through bearings 23 and 24, provided in the posts 9 and 10 respectively, and non-rotatably locked therein by pins 25 projected through the bearings and the shaft ends. Rotatably mounted on the center drive shaft 22 is a sleeve 26 preferably by anti-friction bearings, as indicated at 27 and 28, the inner face of the sleeve being grooved to accommodate sealing rings abutting the post 9, and the outer end of the sleeve being sealed by a cap 29 to provide a lubricant reservoir for the bearings. Integral with the sleeve 26 is a pinion 30 and keyed to the sleeve is a driving gear 31, the gear 31 being prevented from axial movement by means of a shoulder 32 on the sleeve and cap 29.

Rotatably mounted on the opposite end of the center drive shaft 22 is an idler gear 33 provided with a suitable bearing bushing 34 and secured against axial movement by means of a shoulder on the shaft and a collar 35 pinned to the shaft end.

The gear 31 is driven by means of a chain 36 from the motor pinion 37, the motor pinion 37 being coupled with the motor shaft by any suitable manually operable clutch. Thus the driving gear 31 provides the means for transmitting the power from the motor to the various power shafts to effect the shovel operations, including propulsion of the truck and swinging of the superstructure.

The pinion 30, driven by the shaft 22, meshes with a gear 38 keyed to a hoist shaft 40. The hoist shaft, in a manner to be described, effects movement of the loading and excavating mechanism supported by the boom such as the dipper stick 5 and dipper 6 in the present illustration.

The pinion 30 also meshes with a gear 41 keyed to a horizontal swing shaft 42; the shaft 42 in a manner to be described effects derricking of the boom, swinging of the superstructure, and propulsion of the truck. Both the hoist shaft 40 and horizontal swing shaft 42 are rotatably supported between the posts 9 and 10, and will be continuously rotated by means of the pinion 30 when the motor clutch is engaged. The hoist shaft is mounted by means of split bearings suitably bushed, provided in the posts 9 and 10, and indicated at 44 and 45 respectively. Similar split bearings in the posts 9 and 10, indicated at 46 and 47, are provided for the mounting of the horizontal swing shaft.

These three compactly arranged shafts, mounted on the posts, comprise the main power shafts and are driven relatively directly from the motor, affording a maximum of efficiency. The composite center of gravity of these shafts and their associated parts is disposed a substantial distance rearwardly of the fulcrum of the posts 9 and 10, as determined by pins 11, and exert a maximum counter-balancing effect on the posts, opposing the pull exerted by the boom and its supported mechanism relative to the axis of rotation of the superstructure. The disposition of the power unit rearwardly of the rear turntable 8 aids this counter-balancing effect.

Prior superstructures with which I am familiar have been provided with vertical posts for suspending the power mechanism, thereby disposing the weight of the supported parts relatively closer to the supporting base for the superstructure and relatively decreasing the counter-balancing action of these parts. Thus, a relatively greater boom load may be handled or the boom may reach relatively farther out than with prior shovels, and continual swinging of excess weight to counter-balance the load is eliminated.

The hoist shaft 40 controls the crowding and retracting of the dipper stick through a crowding drum 50 and a retract drum 51 rotatably mounted on the hoist shaft, each of said drums having integral therewith a brake wheel as indicated at 52 and 53.

The retract drum 51 is removably mounted on a drum 54 similar to the crowding drum 50, whereby the retract drum may be removed and the drum 54 utilized to operate a clam shell bucket or the like.

Drums 50 and 54 are each freely rotatable on the hoist shaft, the drums being provided with bushings of suitable material as indicated at 55, and are adapted to be coupled with the shaft by means of expanding friction clutches disposed internally of the brake wheels 52 and 53, as generally indicated at 56 and 57. The friction clutches 56 and 57 constitute no essential part of my present invention and any suitable clutches may be provided. The clutches may comprise suitably lined bands 58, supported by a spider 59 keyed to the hoist shaft, and expanded by axial movement inwardly of a sleeve 60 keyed to the spider hub and operably connected to the clutch band by link means indicated at 61. Axial movement of the sleeve 60 in a reverse direction will uncouple the drum from the shaft. The axial movement of sleeve 60 may be effected by a yoke 62 operable by a hand lever through suitable link means.

Conventional contractible brake bands 63 encircle the brake wheels 52 and 53 whereby the drums may be selectively braked preferably through foot operable link leverage means.

Rotatably mounted on the horizontal swing shaft 42, preferably by anti-friction bearings 64—64, are clutch drums 65 and 66 having bevel pinions confrontingly disposed integral therewith, as indicated at 65′ and 66′, respectively, the pinions being maintained in adjustably spaced relation by threaded studs 67 affording a means of adjustment for the bearings 64.

The clutch drums and their associated pinions are adapted to be selectively coupled to the shaft 42 by friction clutches 68 and 69 generally similar to those described in connection with the hoist shaft operable by axial movement of the

sleeves 70—70, the sleeves being controlled by hand levers through suitable link mechanism. The pinions 65′ and 66′, in a manner to be later described, transmit power for swinging the superstructure and propelling the truck.

Also, mounted on the horizontal swing shaft 42 and outwardly of the post bearing 47 is a boom hoist clutch and brake assembly generally indicated at 71, comprising a brake wheel 72 and a disc clutch 73. The brake wheel may be coupled to the shaft 42 by axial movement of a sleeve 74, slidably keyed to the clutch hub, through frictional engagement of cooperating discs secured to the brake wheel 72 and driving hub 74′. A conventional brake band encircles the brake wheel 72 and the braking force thereon may be controlled by manual lever means in any suitable manner.

Integral with the brake wheel is a pinion 75 meshing with the idler gear 33 on the center drive shaft, the idler gear 33 in turn meshing with a gear 76 integral with the boom hoist drum 77 rotatably mounted in the rear turntable bed 8 as best illustrated in Fig. 2. The drum 77 has one end of the boom derricking cable 18 anchored thereto, the cable then passing around the sheaves at the boom end and the sheaves previously described mounted on the shaft 13 at the post upper ends and the opposite cable end being anchored to the rear turntable bed as indicated in Fig. 5. Thus the boom will be raised by a winding rotative movement imparted to the drum 76 through the coupling of the pinion 75 with the horizontal swing shaft by the aforementioned clutch means and the lowering of the boom may be controlled by the manually operable brake band encircling the brake wheel 72.

It will be noted by referring to Fig. 5 that the boom hoist cable 18, in passing from the sheaves 15—15, on the shaft 13, to the turntable, is disposed in substantially parallel relation with the posts 9 and 10, whereby the posts are subjected to substantially equal or balanced loading.

Referring to Figs. 2 and 3, the truck 1 has integrally secured thereto a relatively large gear 80, the superstructure being rotatably supported upon the upper face of the gear by means of beveled rollers 81 mounted in the front turntable bed 7. The hub of the gear 80 forms a bearing for a center pin 82 having integrally secured to its upper end a gear 83, the lower end of the center pin being adapted to transmit power to the truck propelling shafts. The center pin 82, projected through the bearing 82*a* provided in the front turntable bed, thus forms the axis of rotation of the superstructure, this being effected as best illustrated in Fig. 3 by a pinion 84, rotatably mounted in the turntable by a suitable bearing, and meshing with and having planetary action relative to the gear 80.

Through suitable clutch means, the pinion 84 may be coupled to a driving bevel gear 85, the gear 85 being continuously meshed with the bevel pinions 65′ and 66′ mounted on the horizontal swing shaft, whereby as the pinions are selectively and rotatably coupled with the shaft as hereinbefore described, the gear 85 may be caused to rotate in reverse directions to reversibly swing the superstructure.

The gear 85 also is continuously meshed with a beveled pinion 86 fixed to the upper end of an inclined travel shaft 87 whereby the shaft 87 may be caused to rotate in reverse directions dependent upon whether the pinion 65′ or 66′ is coupled with the horizontal swing shaft 42.

The travel shaft is rotatably mounted on the front turntable bed 7 by means of spaced bearings, indicated at 88 and 89. Loosely mounted on the shaft 87 are spaced bevel pinions 90 and 91, each meshed with a gear 83 which transmits power to the truck propulsion mechanism. The pinions 90 and 91 are each provided with an integral clutch face, as indicated at 90*a* and 91*a*, respectively, the clutch faces being adapted to be engaged by clutch segments of a jaw clutch element 92 keyed to the travel shaft, the element 92 being movable axially of the travel shaft by suitable manually operable link means. The truck may thus be propelled in reverse directions and at two different speeds through the previously described clutch and transmission mechanism.

The power mechanism described affords a compact arrangement of power shafts driven from a common driving pinion mounted with their axes a substantial distance rearwardly of the axis of rotation of the superstructure to provide a maximum counter-balancing action with a minimum of excess weight. Power is transmitted relatively directly from the prime mover to the work, and truck travel or swinging of the superstructure is effected independently of the various shovel operations.

Although I have chosen to illustrate my invention as applied to a power shovel, it is understood that it is equally adaptable to any load handling or excavating machine rotatable upon a base such as a crane, clam shell, back digger, and the like, and numerous departures may be made from the embodiment described without departing from the spirit of my invention, and the scope of the appended claims.

Having thus described my invention, what I claim is:

1. In a machine of the class described comprising a rotatable turntable and a boom, the turntable comprising front and rear beds, paired posts pivotally connected to the rear of the front turntable bed and inclined upwardly and rearwardly relative to the bed, struts connecting the upper ends of the posts and the front of the front turntable bed, the struts being substantially twice the length of the posts, the rear turntable bed being pivotally supported at the lower ends of the posts, struts connecting the rear turntable bed and the upper ends of the posts, geared shovel actuating shafts supported between the posts having their axes disposed rearwardly of the front turntable bed and operable from one of said shafts, a motor supported upon the rear turntable bed substantially beneath the upper ends of the posts, and driving means interconnecting the motor and said operable shafts.

2. In a machine of the class described, comprising a rotatable turntable having front and rear separable beds, drum supporting means comprising rearwardly and upwardly inclined posts pivotally secured to the turntable generally centrally thereof and of a length substantially greater than half the turntable length, a pair of laterally disposed struts pivotally secured to the front end of the turntable and the upper ends of said posts, and a second pair of laterally disposed struts secured to the rear of the turntable and the upper end of said posts, the forward pair of struts being of substantially the length of the turntable and twice the length of the rear pair of struts.

3. In a machine of the class described, a front turntable bed rotatably supported, a pair of upwardly and rearwardly inclined posts pivotally

connected to the rear end of the front turntable bed, a pair of laterally spaced struts pivotally connected to the upper end of the posts and the front of the front turntable bed, a rear turntable bed pivotally engaging the foot of said posts rearwardly of the point of engagement of the posts with the front turntable bed and of substantially the length of the front bed, and a pair of struts interconnecting the upper ends of the posts and the rear of the rear bed, said struts being substantially one-half the length of the first mentioned struts.

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