Jan. 15, 1929.

1,698,748

E. J. WILSON

POWER SHOVEL STRUCTURE

Filed June 16, 1926

3 Sheets-Sheet 1

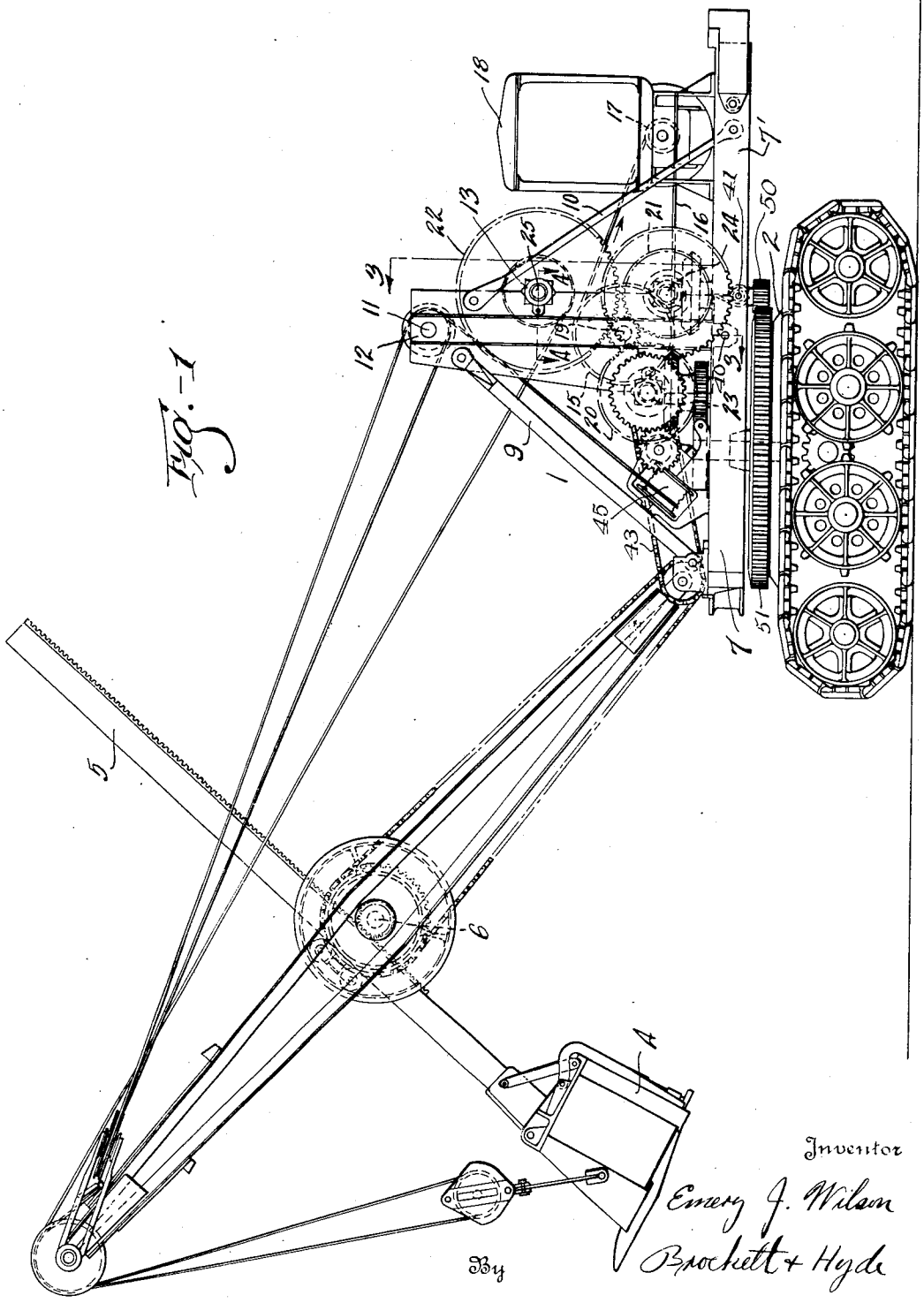


Fig. 1

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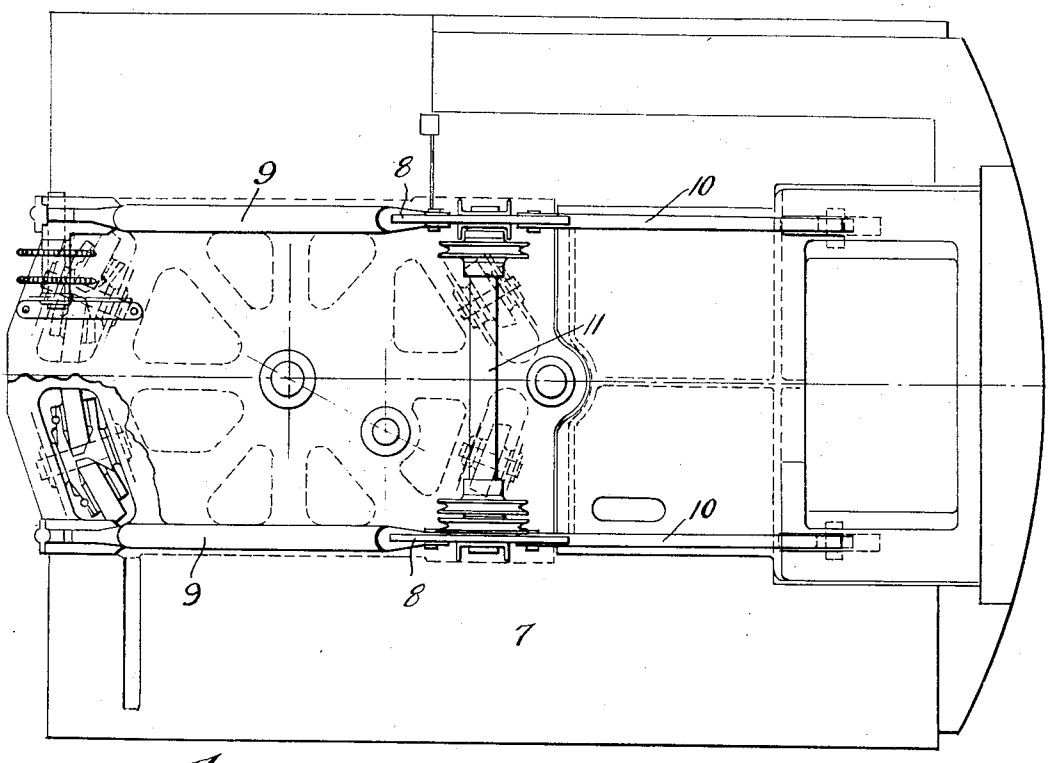


Fig.-2

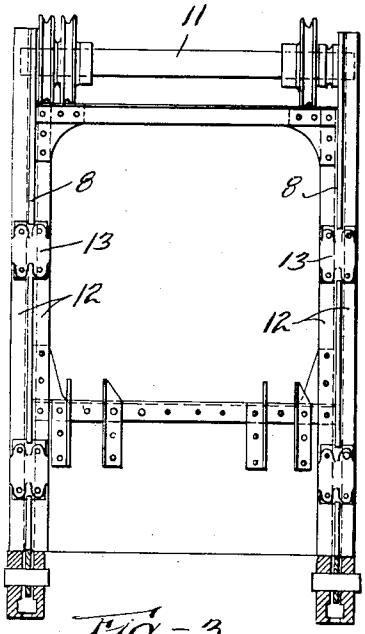


Fig.-3

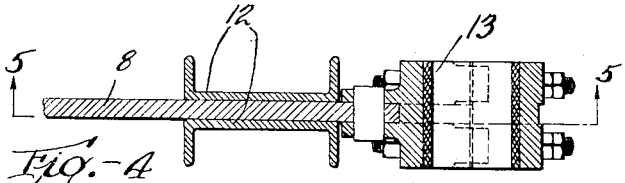


Fig.-4

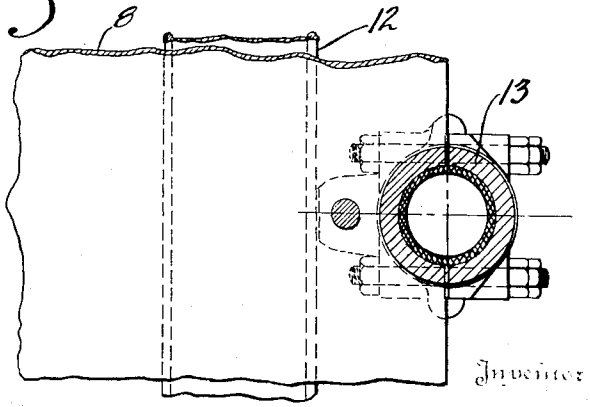


Fig.-5

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POWER SHOVEL STRUCTURE

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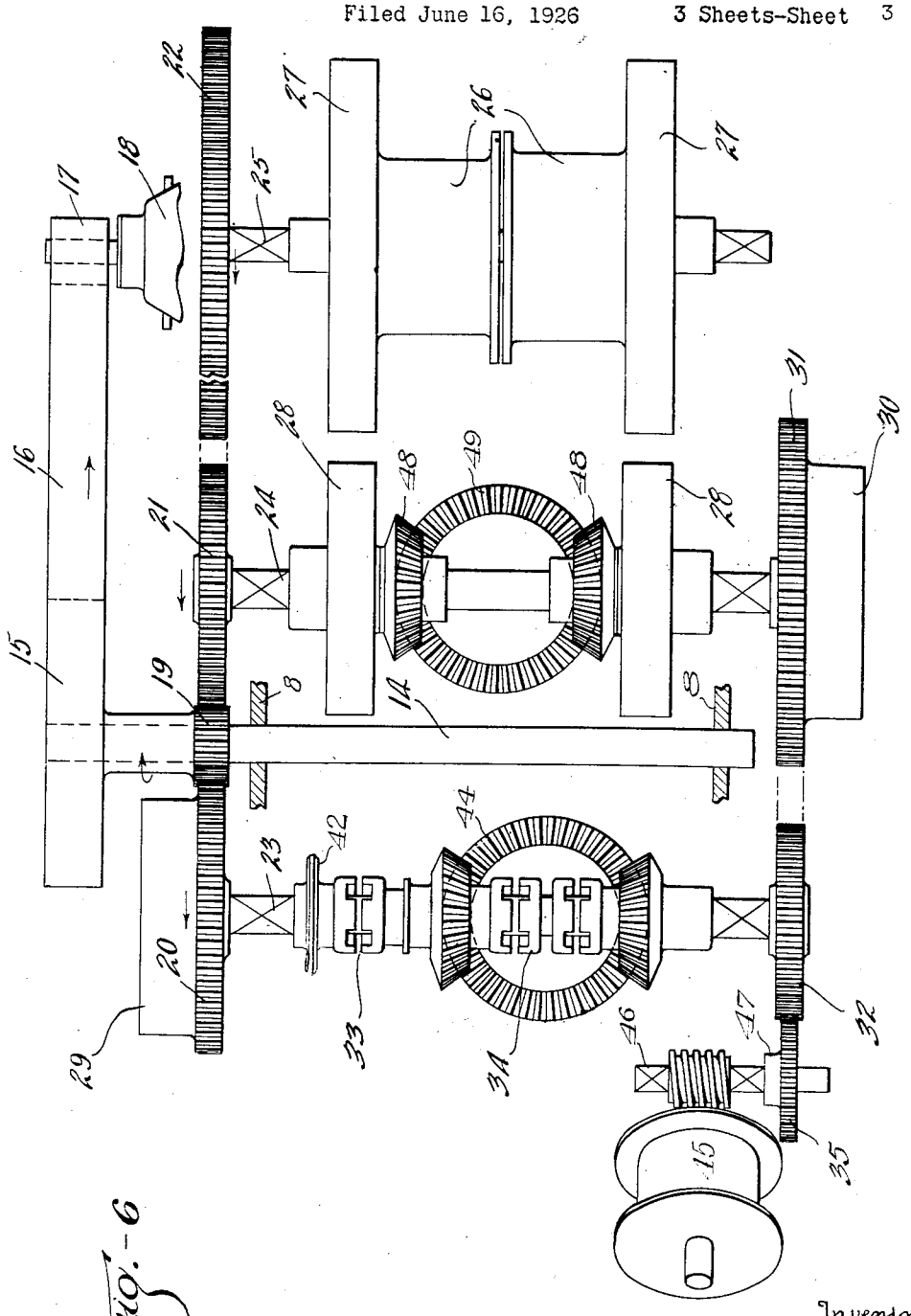


FIG. 6

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Patented Jan. 15, 1929. 1,698,748

UNITED STATES PATENT OFFICE.

EMERY J. WILSON, OF CLEVELAND, OHIO, ASSIGNOR TO THE THEW SHOVEL COMPANY, OF LORAIN, OHIO, A CORPORATION OF OHIO.

POWER-SHOVEL STRUCTURE.

Application filed June 16, 1926. Serial No. 116,404.

This invention relates to excavating and load handling machines commonly known as power shovels, in which a rotatable superstructure carrying a boom is mounted upon a truck, and more particularly has to do with the design and arrangement of co-operating parts in the driving or operating unit of such a shovel which uses a single source of power, with suitable gearing and friction clutches for transmitting power for the various shovel operations:

Driving the rope drums; rotating the superstructure in either direction; crowding and retracting the dipper stick in shovel operation; propelling the truck in either direction; hoisting and lowering the boom.

The first three operations must be entirely independent of each other and therefore require independently operated clutches.

Since it is unnecessary to propel the truck or hoist the boom while crowding, the last three operations may be properly controlled by one set of reversible friction clutches. It is further very desirable to provide two speeds for each of these three operations; a slow speed with maximum torque for crowding the dipper into the work, or traveling up steep grades, or hoisting the boom; and a high speed with less torque for retracting the dipper, or fast traveling, or quick lowering of the boom.

A fundamental object of the invention is to provide a simplified and improved arrangement of the power mechanism, comprising gears, shafts, clutches, etc., which will transmit the power most directly from the motor to the work with the consequent increase in efficiency, better accessibility and reduced cost of manufacture. Three main power shafts have their driving gears compactly grouped around a common driving pinion in such a manner that the drive is direct from the pinion to each of the gears.

Another object of the invention is to provide an improved construction for the housing supporting these three main shafts, and to use this housing, in conjunction with forward struts, to form the main post members of an A-frame for carrying the boom line sheaves at the top thereof. This arrangement permits an easy and definite analysis of the loads and stresses throughout the structure, and the housing with its shaft assemblies forms a unit which can be built up independently and attached to the base by simple pin connections.

Still another object is to take advantage of the increased compactness afforded by such an arrangement in obtaining a balance of parts superior to that possible of attainment with prior constructions.

The exact nature of my invention will be apparent from the following description and drawings in which Fig. 1 is a side view of a complete shovel, (although with the usual cab not shown,) embodying my invention and showing the arrangement of the entire mechanism; Fig. 2 is a plan view of the rotatable base of the shovel including a top view of the frame; Fig. 3 is a side view of the frame taken along the line 3—3 of Fig. 1; Fig. 4 is a section along the line 4—4 Fig. 1 showing in detail the manner of mounting the bearings, for the various drum shafts in the upright members of the frame; Fig. 5 is a section along the line 5—5, Fig. 4; and Fig. 6 is a developed gear diagram showing the operative relation between the various shafts and the general driving arrangement, and all of the operating shafts being shown as in the plane of the common drive pinion rod, for the purpose.

The principal parts of the shovel are the truck 2, upon which is rotatably mounted a driving assembly generally indicated by the reference numeral 1 and carrying the dipper 4 by means of the dipper stick 5 carried upon the shipper shaft 6 and supported at its dipper end by a suitable tackle; these parts and their general arrangement being well known in the art.

The driving assembly 1 includes a frame comprising essentially a sectional base, a pair of uprights 8 connected with the forward section 7 of the base as by pins 40, supported by the struts 9, and connected at the top by a shaft 11 carrying sheaves over which pass suitable cables leading to the boom; and a rear base section 7′, connected to the forward base section as by pins 41 and supported by tie rods 10 leading to the uprights. Between these uprights 8 are mounted the driving shafts of the mechanism, carrying suitable clutches and drums as indicated, and rearward of the uprights upon the base is mounted a power source such as the internal combustion engine diagrammatically illustrated.

The uprights 8 are formed of metal plates, reinforced centrally as by the channels 12 which extend downwards to the connection with the base effected by the pins 40. Upon the edges of the plates are cut semi-circular notches co-axial with the shafts to be carried by the uprights. These shafts are journalled in bearings 13 split as is usual, and each provided upon one of its members with an annular groove of width and diameter to correspond with notches in the upright plate. Each of the grooved journalled members is provided with a pair of perforated ears, adapted for connection by means of a pin with corresponding perforations in the plate, for the purpose of maintaining the bearing in the notches of the plate.

A rod 14 is mounted between the uprights, and projects beyond one of them to carry the sprocket 15 in driven connection by the chain 16 with the driving pinion 17 upon the engine 18. Fast with sprocket 15 and rotatable therewith, upon the rod 14 is a pinion 19. Meshing directly with this pinion, and carried each by one of the shafts mounted between the uprights as described, are gears 20, 21 and 22 upon the crowd and travel shaft 23, the swing shaft 24, and the hoist shaft 25, respectively.

It will be noticed that by this arrangement since each of the principal operating shafts of the shovel is driven directly from the common pinion 19, the tooth load upon the pinion is lower than would be the case were any of these shafts driven by the pinion through another of the shafts. All of the shafts being mounted in the common upright members, proper alignment and clearances of the driving gears is insured.

Moreover, by the vertical spacing of the shafts 24 and 25 the longitudinal dimension of the driving unit is very much reduced. In fact the compactness of this arrangement is such as to make practicable the positioning of all of these parts behind the center of rotation of the base, resulting in increased stability.

The hoist drums 26 are controlled by the usual friction clutches conventionally represented at 27; the swing mechanism by left and right clutches 28; and the crowd and travel shaft 23 is controlled by clutch 29 for slow speed operation in one direction, and clutch 30 through gears 31 and 32 for high speed in the opposite direction as indicated by the arrows.

Jaw clutches 33 and 34 and gear 35 slidable on jack shaft 46 by shifting collar 47, serve to connect the crowd sprocket 42 over which runs the crowd chain 43, travel bevel gear 44 and boom hoist drum 45 respectively, to the shaft 23.

It will be noted that by the A-frame construction described while the struts 9 are in compression and the tie rods 10 in tension the uprights 8 being merely pinned at their lower extremities are relieved of all bending moment other than the relatively slight forces applied through the shafts carried thereby.

From the description above, operation will be seen to be as follows assuming the drive shaft of the engine 18 rotating in a clockwise direction Fig. 1, and driving the belt 16 in the direction of the arrows, Figs. 1 and 6. The pinion 19 will constantly rotate during operation of the engine in the clockwise direction Fig. 1 actuating the gears 20, 21 and 22 continuously in counter clockwise direction, Fig. 1, so that the parts just named are normally maintained in operation as indicated by the arrows Fig. 6.

Operation of the drums 26 may be effected at any time therefore by engagement of their respective clutches 27, the usual automatic brakes being provided whereby upon release of either of the clutches 27 the corresponding drum will be automatically maintained stationary. To switch the boom to right or left the proper clutch 28 is engaged which actuates the pinion 50 which has planetary relation with the fixed gear 51, the drive being from the pinion 19, through the gear 21, shaft 24, clutch 28, bevel pinion 48, bevel gear 49 to the pinion 50.

For crowding the dipper stick, hoisting the boom, or traveling under low speed conditions, the proper jaw clutch 33, 34 is engaged whereupon by engagement of the clutches 29 the shaft 23 is set in motion to produce the desired movement.

For retracting the dipper, lowering the boom, or traveling at high speed the clutch 29 being released the clutch 30 is engaged whereupon drive of the shaft 23 is effected from the pinion 19 through the gear 21, shaft 24, gear 31 and gear 32.

The boom hoist is controlled by engagement of the gear 35 with the gear 32 the engagement being effected by the grooved shifting collar 47.

What I claim is:

1. In a machine of the class described, paired uprights forming posts of an A-frame and carrying a plurality of geared shovel actuating shafts extending therebetween and driven by a common pinion carried on said uprights.

2. In a machine of the class described, paired uprights forming posts of an A-frame and carrying a plurality of geared shovel actuating shafts extending therebetween and driven by a common pinion, said pinion being mounted for rotation upon a rod carried by said uprights.

3. In a machine of the class described, paired uprights forming posts of an A-frame and carrying a plurality of geared shovel actuating shafts extending therebetween and driven by a common pinion, said pinion be-

ing mounted for rotation upon a rod carried by said uprights, all of said parts being carried upon a rotatable base and behind the axis thereof.

4. In a machine of the class described, a bearing having a groove, a supporting plate having a notch adapted to fit said groove, and means for securing said parts in assembly with said groove seating in said notch.

5. In a machine of the class described, a bearing having a groove, a supporting plate having a notch adapted to fit said groove, an extension upon said bearing, and a member passing through said extension and said plate to secure said bearing upon said plate.

6. In a machine of the class described, paired uprights comprising plates centrally reinforced, and a plurality of shafts extending between said uprights and positioned therein by notches in said plates.

7. In a machine of the class described, paired uprights comprising plates centrally reinforced, and a plurality of vertically and horizontally spaced shafts extending between said uprights, and positioned therein by notches in said plates.

8. In a machine of the class described, paired uprights comprising plates centrally reinforced, and a plurality of vertically and horizontally spaced shafts extending between said uprights and positioned therein by notches in said plates, a rod supported by said uprights, a pinion on said rod and gears upon said shafts meshing with said pinion.

9. In a machine of the class described, an operating unit comprising a base, paired uprights pivotally mounted thereon and made fast therewith by struts and tie rods, a plurality of vertically and horizontally spaced shovel actuating shafts extending between said uprights and positioned therein, a rod supported by said uprights, a pinion on said rod, gears upon said shafts meshing with said pinion, and means upon said base for actuating said pinion.

10. In a machine of the class described, an operating unit comprising a rotatable base, paired uprights pivotally mounted thereon and made fast therewith by struts and tie rods, a plurality of vertically and horizontally spaced shovel actuating shafts extending between said uprights and positioned therein, a rod supported by said uprights, a pinion on said rod, gears upon said shafts meshing with said pinion, and means upon said base for actuating said pinion, all of said shafts being positioned behind the axis of said base.

11. In an article of the class described, a dipper stick control mechanism, travel mechanism and boom control mechanism operable from a common shaft, swing mechanism operable from a second shaft and hoist drums operable from a third shaft, a power driven pinion, a gear upon each of said shafts meshing directly with said pinion whereby said shafts may be driven therefrom, each of said mechanisms being operable from its respective shaft by engagement therewith through a clutch, and a second gear upon said second shaft meshing with a second gear upon said first named shaft and clutches on said first and second shafts whereby said first named shaft may be driven directly from said pinion, or through said second shaft.

12. In an article of the class described, a dipper stick control mechanism, travel mechanism and boom control mechanism operable from a common shaft, swing mechanism operable in either direction from a second shaft and hoist drums operable from a third shaft, a power driven pinion, a gear upon each of said shafts meshing directly with said pinion whereby said shafts may be driven therefrom, each of said mechanisms being operable from its respective shaft by engagement therewith through a clutch, and a second gear upon said second shaft meshing with a second gear upon said first named shaft and adapted to drive said first named shaft through said second shaft and in an opposite direction and at a higher speed than when driven directly by said pinion and clutches on said first and second shafts whereby said first named shaft may be driven directly from said pinion, or through said second shaft as described.

13. In a machine of the class described, a base, a pair of uprights having pin connection therewith and carrying a plurality of shovel actuating shafts, and bracing members extending between said base and upper portions of said uprights.

14. In a machine of the class described, a base, a pair of uprights having pin connection therewith and carrying a plurality of shovel actuating shafts, gears on said shafts, a rod carried by said uprights, a pinion on said rod meshing with each of said gears.

15. In a machine of the class described, a base comprising a pair of pin connecting sections, a pair of uprights having pin connection with one of said sections and secured therewith by struts and carrying a plurality of shovel actuating shafts, power means on the other of said sections and having driving connection with said shafts, and tension members between said other section and the upper portions of said uprights.

In testimony whereof I hereby affix my signature.

EMERY J. WILSON.