Dec. 26, 1933. R. S. MOORE 1,940,690

CRANE

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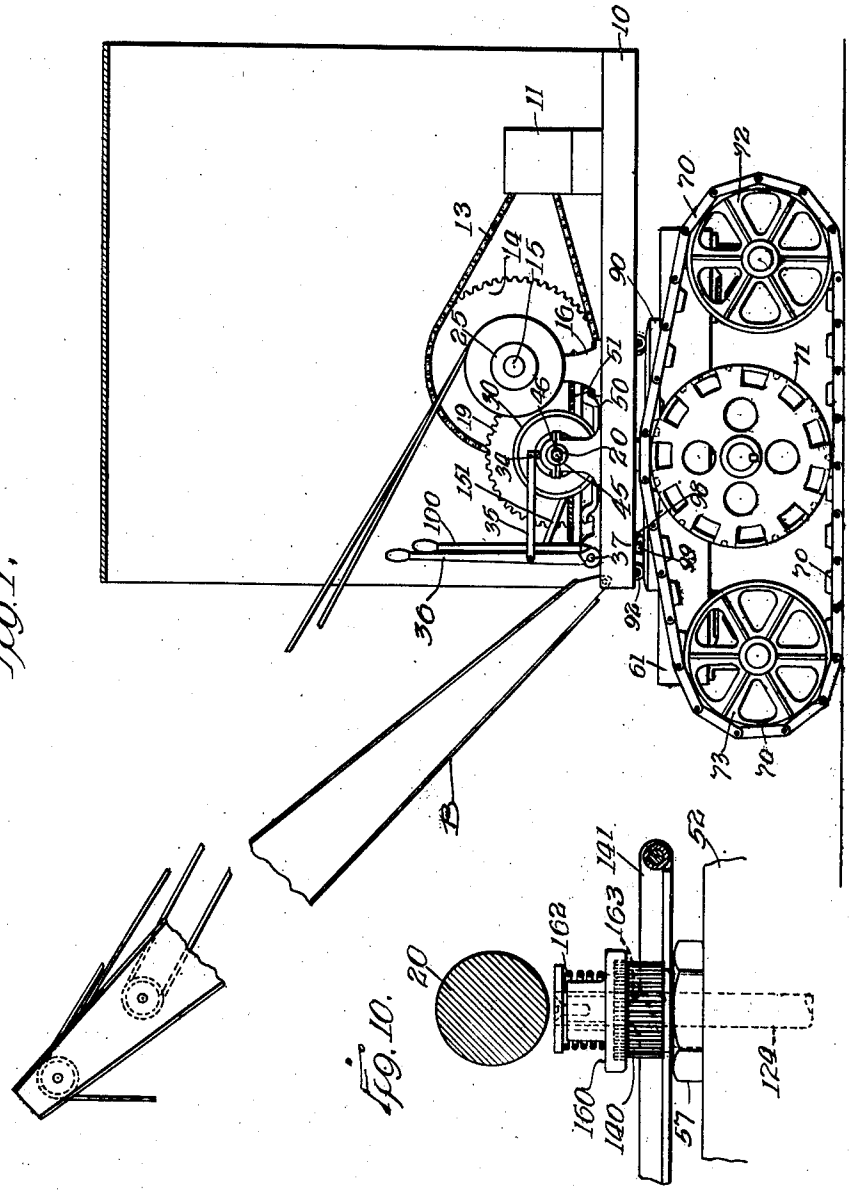


Fig. 1.

Fig. 10.

Witnesses:
Harry R. L. White
Robert Cremer

Inventor:
Roy S. Moore
By Arthur L. Sprinkle
Atty

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Filed Feb. 20, 1930 4 Sheets-Sheet 2

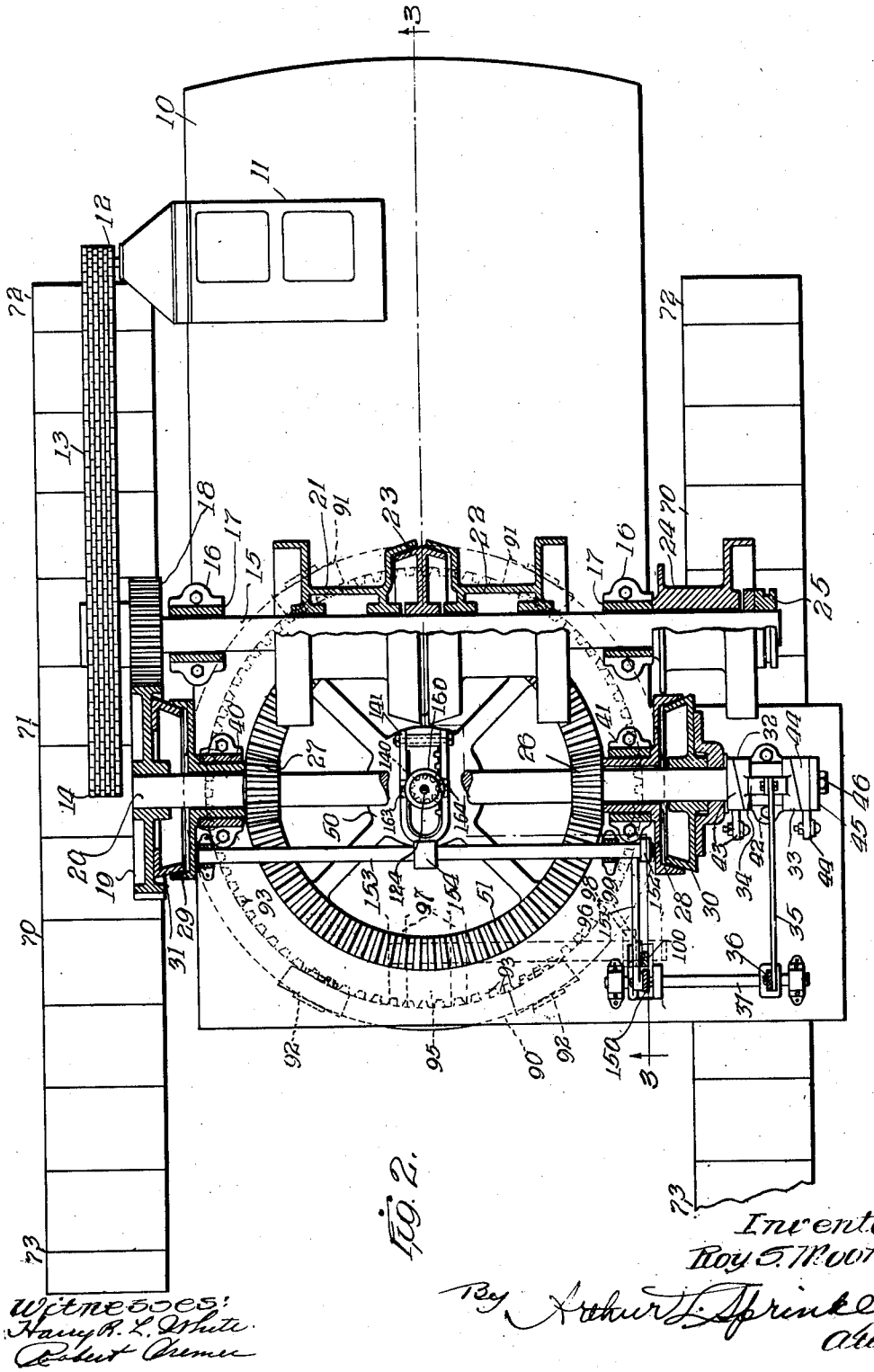


FIG. 2.

Witnesses:
Harry R. L. White
Robert Cremer

Inventor:
Roy S. Moore
By Arthur L. Sprinkle
Atty

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CRANE

Filed Feb. 20, 1930 4 Sheets-Sheet 3

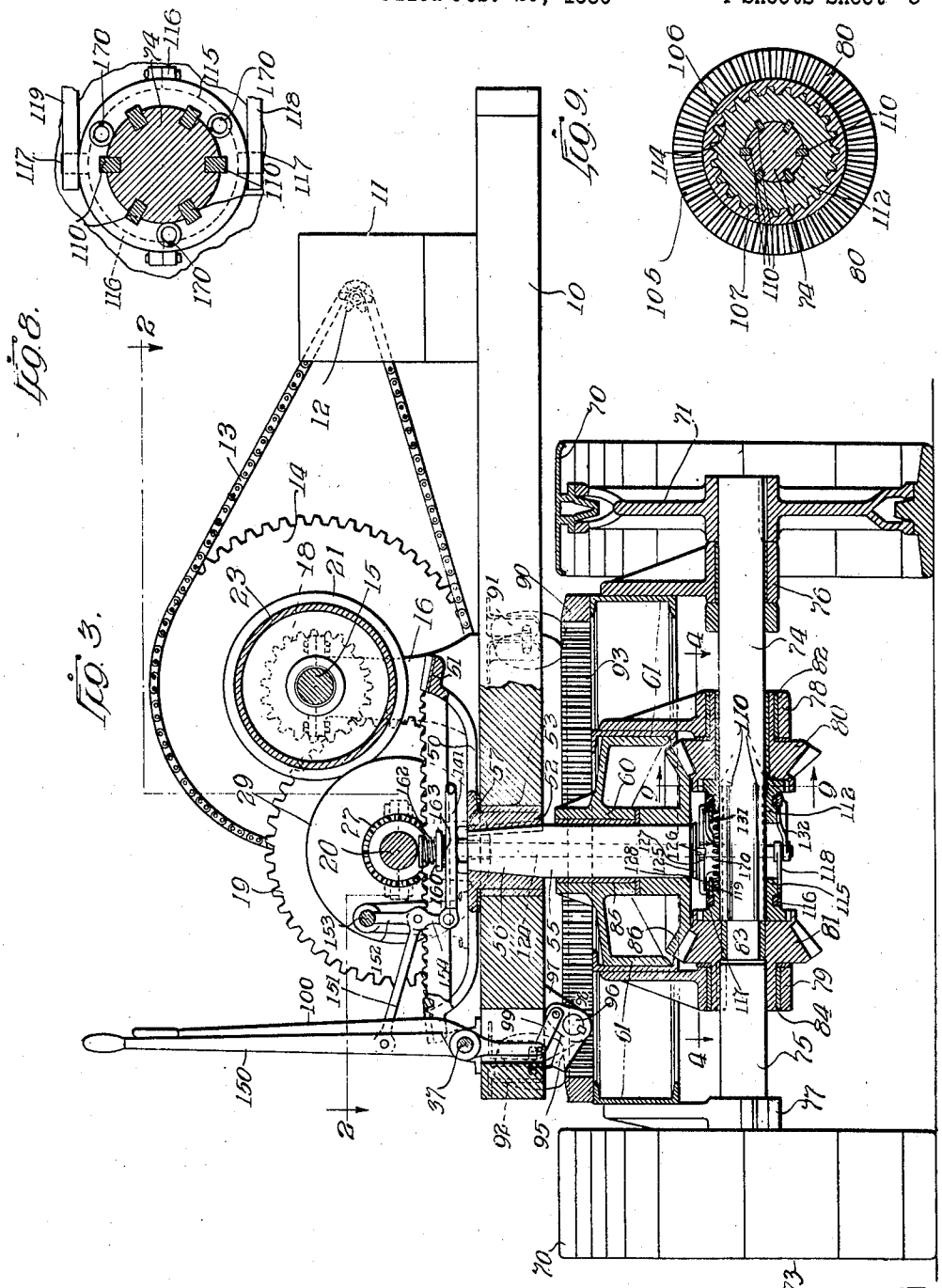


Fig. 8.

Fig. 9.

Witnesses:
Harry R. L. White
Robert Cramer

Inventor:
Roy S. Moore
By Arthur L. Sprinkle
Atty.

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CRANE

Filed Feb. 20, 1930 4 Sheets-Sheet 4

Fig. 4.

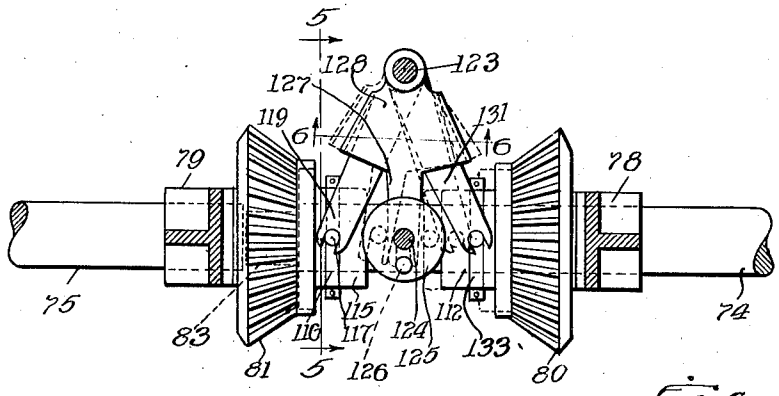


Fig. 5.

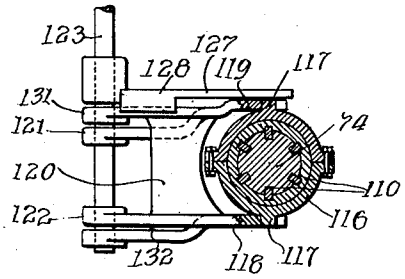


Fig. 6.

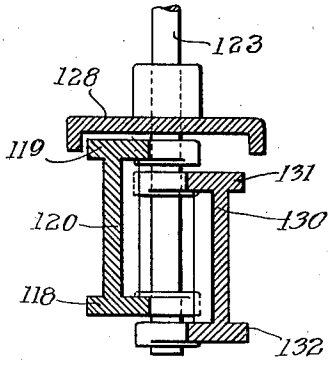
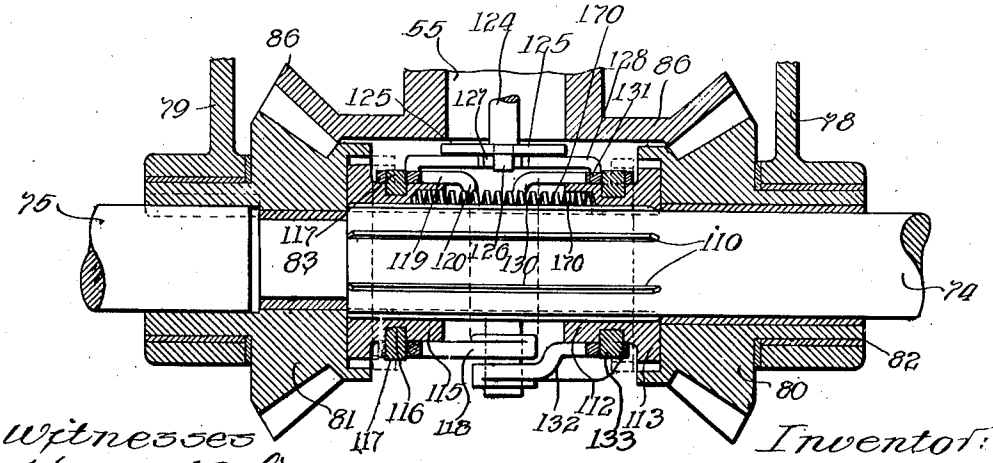


Fig. 7.



Witnesses
Harry R. L. White
Robert Cramer

Inventor:
Roy S. Moore.
By Arthur L. Sprinkle
Atty.

Patented Dec. 26, 1933 1,940,690

UNITED STATES PATENT OFFICE

1,940,690

CRANE

Roy S. Moore, Chicago, Ill.

Application February 20, 1930. Serial No. 429,843

17 Claims. (Cl. 180—9.2)

The invention relates to cranes adapted to be equipped with various power operated material handling devices and in the specific form of the device shown, the invention is embodied in a crane provided with a swing body mounted upon a travel body, which is carried by endless belt traction devices.

In cranes of this character the source of power for operating the swing body and material handling devices usually carried thereby, as well as for affording traction, is mounted upon the swing body, and in the present embodiment power is shown as supplied by a suitable power unit as a gas or gasoline motor supplying power to tool operating mechanism and to mechanism which may be alternately connected with the source of power either to operate the swing body on its pivotal connection with the truck body or to operate the traction devices of the truck body for travel purposes.

It is the primary object of the invention to improve and simplify the construction of the mechanism for imparting pivotal body movement on a vertical axis to the swing body and for applying power from the power unit carried by the swing body to the traction devices on the truck body.

It is a further object of the invention to provide in a traction crane having a swing body pivotally mounted on a vertical axis upon a truck body, improved means mounted and operable upon the swing body for controlling the traction devices on the truck body with respect to both the application of power to the traction devices as well as for steering the truck body.

It is a further object of the invention to provide improved clutch operated means for applying power for travel and swinging movements including improved reversing mechanism for reversing the direction of the application of power for the respective swinging and travel movements.

Other objects of the invention will appear from the following description which is directed to the preferred embodiment of the invention as illustrated in the accompanying drawings, the novel features being set forth in the appended claims.

The invention is particularly applicable to cranes carried upon endless belt or track laying devices, sometimes called crawlers or creepers, which present peculiar and individual steering problems.

In the said drawings,

Fig. 1 is a side elevation of a machine embodying the invention, the swing body being shown partly broken away and in section to disclose details of mechanism carried thereon and the boom carrying the usual operating tools, which latter are not shown, partly broken away.

Fig. 2 is a plan view of the machine with some of the parts broken away and some in section to better disclose details of construction of the mechanical devices carried upon the swing body.

Fig. 3 is an end elevation view of the machine with the swing body shown in a position approximately at right angles to the longitudinal axis of the truck body, parts of both swing body and the truck body being shown in section or broken away to disclose details of construction.

Fig. 4 is a broken detail view of the main driving axle of the truck body.

Fig. 5 is a detail sectional view taken approximately on line 5—5 of Fig. 4, looking in the direction indicated by the arrows.

Fig. 6 is a broken detail sectional view taken approximately on line 6—6 of Fig. 4, looking in the direction indicated by the arrows.

Fig. 7 is a broken detail sectional view of the gear and clutch mechanism for applying power and for obtaining steering control of the endless belt traction devices on the truck body, the view being similar to that shown in Fig. 3 but considerably enlarged.

Fig. 8 is a sectional view through the main truck drive shaft taken approximately on the plane midway between the sides of the truck body and shows the detail of the arrangement of the clutch operating springs on the main drive shaft for operating the travel devices.

Fig. 9 is a sectional view through the same shaft taken on the line 9—9 of Fig. 3 looking in the direction indicated by the arrows.

Fig. 10 is an enlarged broken detail view of a portion of the mechanism for operating the rotatable shaft on the center of the vertical pivotal axis between the swing body and the truck body for controlling the travel clutch mechanism on the truck body from the operator's position on the swing body.

In the embodiment of the invention illustrated, reference character 10 designates generally the frame of the swing body carrying the motive power unit, which may be a gas or gasoline engine, as indicated at 11, the application of power being through a sprocket 12 and drive chain 13 to a large driving gear 14 keyed to a drive shaft 15 mounted upon suitable bearing brackets 16. The shaft 15 is carried in bearings 17 and has keyed thereto a gear 18 in engagement with a gear 19 keyed to the swing and travel shaft 20. The shaft 15 may be termed a drum shaft because it carries the us-

ual cable drums 21, 22, engageable by end sliding movement with a common clutch member 23 keyed to the shaft 15. The shaft 15 also carries the boom hoist drum 24 being operably connectible thereto by clutch 25. The swing and travel shaft 20 through the gears 26, 27 supplies the power for causing rotation of the swing body upon its vertical pivot and for supplying power down through this vertical pivotal connection to the traction devices on the truck body. The gears 26 and 27 are connected by suitable sleeves with one element of two-part clutches as indicated at 28, 29. The clutch elements 28, 29 engage the companion elements 30, 31 secured to the gear 19 and the shaft 20, respectively. The clutch elements 28, 29, 30 and 31 are set so that upon longitudinal movement of the shaft 20 in one direction, one of the clutches will be operative while a longitudinal movement in the opposite direction will free this clutch and cause the other clutch to engage. This makes a very simple construction for clutch operation, necessitating, of course, a longitudinal or endwise movement of the shaft 20, which is accomplished by means of a pair of wedge collars 32, 33 attached to a yoke or fork 34 and adapted to be oscillated by a link 35 connected to a hand lever 36 mounted at some convenient and accessible point for the operator upon the swing body, as the shaft 37 which also carries the levers for operating the devices for controlling the swing and travel movements. The shaft 20 is supported by the spaced bearings 40, 41 and 42. The bearing 42 is interposed between the wedge collars 32, 33 and stationary wedge collars 43, 44 are also placed around the shaft 20 on the outsides of the wedge collars 32, 33. The wedge collars 43, 44 may be adjustable, but are anchored to the swing body while the wedge collars 32, 33 on the yoke 34 are free to turn when the lever 36 is oscillated, thus imparting a reciprocating or longitudinal movement to the travel and swing power shaft 20. 45 is a metal retaining cap secured by a bolt or screw 46 in the end of the shaft 20.

It will be seen from the foregoing description of the shaft 20 that the entire shaft will be free to move longitudinally in its bearings and that the gear 19 with the clutch part 31 will be rigidly attached to the shaft, the teeth of the gear 19 meshing wih gear 18, permitting a longitudinal movement between the gears as the shaft is given a limited movement in either direction for clutch operation under the control of the hand lever 36.

The travel and swing operations are completely under the control of the two gears 26 and 27 on the shaft 20. I will now describe the mechanism for imparting travel and swinging movements to the machine through the power transmission or clutch shaft 20 and the bevel gears 26 and 27 thereon. 50 is a large substantial gear mounted co-axially on the vertical axis of swing between the truck body and the swing body. This gear is provided with a bevel toothed upward facing periphery 51 simultaneously engaging the aforesaid bevel gears 26 and 27. The gear 50 has a large substantial downwardly extending hub 52 of a length preferably approximating the normal thickness of the frame of the swing body to afford a substantial bearing for the gear in a bushing 53 in the swing body, the hub portion and the bushing both being preferably approximately cylindrical. 55 is a substantial king pin or pivot pin of approximately cylindrical form having at its upper end, preferably, a conical portion 56 adapted to co-operate with a conical axial opening in the hub portion 52 of the gear 50. The preferred conical shape of the upper end of this shaft permits easy removal of the gear from the hub of the shaft. 57 is a polygonal nut that engages a threaded upper extension (not shown) on the upper end of the pivot pin 55 for locking the hub of the gear 50 upon the pivot pin. It is desirable that the pivot pin be keyed in the hub of the gear 50, as indicated in dotted lines in Fig. 3, or otherwise suitably secured so that the pivot pin and the gear must rotate together.

The salient features of my invention reside in the construction of the gearing and the power transmission devices for obtaining the swinging and travel movements, and I have shown these devices embodied in a swing body and a truck body merely of conventional design, the truck body being made of a plurality of structural metallic forms and castings suitably joined together although it will be apparent that the invention is susceptible of embodiment in a unitary cast truck frame. The pivot or king pin 55 from the swing body extends downwardly into an ample supporting bearing 60, which is suitably bushed to permit rotation of the shaft in the frame 61. The frame 61 will be of any suitable design to support the necessary shafts and sprockets for carrying the usual endless belt track laying devices now generally preferred for the trucks of cranes and similar machines.

No attempt has been made to illustrate the details of the truck aside from the fact that the endless track laying devices or belts are generally designated by the reference character 70 and are shown carried on suitable driving sprocket wheels 71, preferably, although not necessarily about centrally of the sides of the truck. Near the ends of the truck (see Fig. 1) the endless belt track devices may be supported upon idler sprockets 72 and 73 rotatably mounted on the truck body. Power is applied only to the driving sprockets 71 through the divided shafts 74 and 75, the latter being carried in suitable bearing brackets 76, 77, depending from the truck frame near the outer longitudinal side edges thereof. The divided axial shaft portions 74 and 75 are further supported by the bearings supported in brackets 78 and 79, such bearings being formed by causing the respective inner ends of the shafts 74 and 75 to project through the extended hub portions of the two similar beveled gears 80, 81. The hub portion of the bevel gear 80 is centrally bored and provided with a suitable bushing to take the shaft 74 and permit relative rotation therebetween. The hub portion of the bevel gear 80 is rotatably secured in the bearing 78 and a suitable bushing may be interposed between these parts as indicated at 82, Fig. 3. The bevel gear 81 is constructed somewhat similarly to the bevel gear 80 except that it is keyed, as indicated, to the shaft 75, so as always to rotate therewith. Furthermore, the shafts 75 and 74 will be seen to be cut or parted about midway of the hub portion of the gear 81 so that the keyed portion of the shaft 75 will extend only a part of the distance in the hub of this gear. The remainder of the central opening of the gear may be bushed, as indicated, to take the slightly reduced inner end 83 of the shaft 74, thus forming a pilot bearing for permitting relative rotation between the gear 81 and the shaft 74. The hub portion of the gear 81 will be mounted to have relative rotation in the bearing member 79 supported on the truck frame, and a suitable bushing, as indicated by 84, may be provided. The bearing 60 of the king pin or shaft may be suitably bushed as indicated at 85

in the drawing, Fig. 3, and to the lower end of the shaft 55 will be keyed the bevel gear 86 having teeth of a character to mesh with the teeth of the gears 80 and 81.

An important feature of my invention is that the bevel gear 86 and the co-operating gears 80 and 81 on the travel shafts 74, 75 serve the double function of imparting travel movements to the truck and, when properly locked by adjustments provided, to lock the pivot pin or king pin together with the large gear 50 secured thereto against rotational movements in relation to the truck body. The bevel gear 86 and its companion travel gears 80 and 81 have the further function, as controlled by the mechanism hereafter to be described, of imparting driving movements to the truck body of a character that enables the operator to properly steer or direct the direction of travel of the truck body. These gears, in the manner hereinafter described, also have the function of imparting driving movements to the endless belt track laying devices 70 of the machine in opposite directions at the same time, whereby one belt will be travelling in a forwardly direction and the other belt in a rearwardly direction, making it possible to turn the truck approximately on the axial connection between the swing body and the truck body or any variations or modifications of such turning movement, all of which will be well within the control of the operator.

Around the upper side of the truck frame 61 is the usual roller path 90 provided with suitable bearings or track for receiving the usual rotating supporting rollers 91, 92, Fig. 3. A plurality of spaced teeth 93 may be provided around the inner periphery of the roller path member 90 to be engaged by some suitable locking device upon the swing body for locking the swing body in any position of rotation that may be desired in relation to the truck body. Any suitable locking device may be used to be preferably operated from the operator's position on the swing body, as, for example, the locking dog 95 having one or more teeth adapted to engage the inwardly extending teeth 93 on the track 90. The dog 95 is carried on the pivotally mounted shaft 96 carried in suitable depending brackets 97 on the swing body frame 10, the shaft 96 being rotated by an arm 98 pivotally connected to link 99 and a hand lever 100 carried by the shaft 37. The locking dog 95 plays an important part not only in locking the swing body against rotation during the travel movements but in insuring the proper transmission of power from the power source on the swing body to the power applying devices on the travel body, as will be hereinafter described.

I will now describe the manner in which the application of power through the pivotal shaft 55 and bevel gear 86 carried thereby to the gears on the respective driving shafts results in complete steering control and reversal of travel movements to the truck body.

In the sectional view Fig. 9 the details of the toothed side of the gear 80 are shown and except for the fact that the hub of the gear 81 must be keyed to rotate with its shaft 75, the constructions of the two gears 80 and 81 are similar. The gear 80 (Fig. 9) will be seen to be provided around its outer periphery with spaced teeth 105 adapted to engage corresponding teeth on the driving bevel gear 86 on the pivot shaft. This gear is also provided with a circular flange 106 just on the inside of the teeth 105, and this circular flange 106 is provided with spaced inwardly extending clutch teeth 107, thus forming of the gear one part of a two-part clutch, and the same thing is true of the gear 81, the details of both of which will be seen most clearly from the enlarged sectional view Fig. 7.

From the construction of the driving bevel gear 86 and the gears 80 and 81 as related to their respective driving shafts 74 and 75, as thus far described, it will be seen that the shafts 74 and 75 are mounted to have independent or differential rotational movements. In order that the respective track laying devices on each side of the truck frame may be under complete control of the operator on the swing body during all desired travel movements, the following additional clutching and control features are provided. On the inner end of the driving shaft 74 adjacent the reduced bearing portion or trunnion 83 thereon I provide a plurality of peripherally spaced elongated ribs which may take the form of metallic inserts 110, rectangular in cross section, in the form of bars or keys inserted in corresponding elongated peripheral grooves in the shaft 74 and designed to co-operate with similar grooves formed peripherally around the central opening in a clutch member 112, which is in the form of a cylinder having a toothed clutch gear 113 at one end thereof provided with suitable teeth 114 for engaging the teeth 107 of the before described clutch member 106 on the gear 80. The gear 81, keyed to shaft 75 which carries the clutch part comprising clutch teeth 107 similar to the clutch teeth formed on the before described companion gear 80, is similar in all details of construction, except for being keyed to its shaft as noted, to the gear 80, and the gear 81 likewise has a corresponding companion clutch member 115 constructed just like the before described clutch member 112 having the peripheral clutch teeth 114 thereon adapted to engage the corresponding clutch teeth of the gear. Both clutch members 112 and 115 are provided with peripheral grooves adapted to take two-part clutch rings, one of which is shown in the sectional view, Fig. 5, and designated by reference character 116, and being provided with diametrically arranged trunnions 117 engaging the branches 118, 119 of a webbed forked member 120. The member 120 has two spaced branches 121, 122 pivotally mounted upon a vertical shaft 123 which is secured to the lower side of the truck frame adjacent the clutch shifting mechanism on the divided driving axle.

The pivot pin or shaft 55 is centrally bored to take a rotatable shaft 124 (Figs. 2, 3, 4 and 7) for operating the clutches in controlling the steering and travel movements of the truck from the operator's position upon the swing body. The rotatable axle shaft 124 carries at its lower extremity immediately over the axial member 74 and between the sliding clutch members 112, 115 a disc or arm 125 carrying a crank pin 126 engaging a slot in an arm 127 protruding from a shroud 128 which is pivoted upon the shaft 123 and which has radially extending depending sides overlying the sides of the upper arms of the pivoted member 120 which operates the shiftable clutch member 115. For operating the shiftable clutch member 112 a second pivoted clutch shifting forked member 130 is provided, this being formed substantially like the member 120, one of said members being formed to telescope over the other so as to avoid interference in their pivotal movements adjacent their points of pivotal connection with the shaft 123. The member 130 will be provided with an upper slotted forked arm 131 and a lower slotted forked arm 132 engaging

trunnions on a ring 133 similar to the ring 116 engaging the peripheral slot in the sliding member 112 of the two-part clutch for controlling the travel shaft 74. The shrouding member 128 connecting the clutch shifter forks 119 and 131 is shown in the plan and sectional views Figs. 4 and 6, from which it will be seen that this member merely acts as a connection to prevent more than a predetermined amount of relative movement between these shifter forks and because of this limitation this member 128 when operated to the limits of its pivotal movements on the shaft 123 will shift either one or the other of said movable clutch members out of engagement with the respective clutch part. This is accomplished, as before described, by reason of the connection of the arm 127 thereon with the eccentric pivot pin 126 on the control shaft 124 which extends upwardly through the hollow central part of the king or pivot pin 55 and is provided at its upper extremity with the pinion 140 (Fig. 10) adapted to be engaged by the toothed rack member 141. The member 141 has longitudinal movement under the control of the operator from the lever 150 pivotally connected on the shaft 37 and having operative connection through the pivoted link 151, which is pivotally connected through the arm 152 (Figs. 2 and 3), with the rotatable shaft 153 mounted on the frame of the swing body and carrying the operating lever 154, which pivotally engages the aforesaid forked rack member 141, the reciprocation of which imparts rotary movement through the pinion 140 to the travel and steer devices on the truck frame.

The detail of the operating connection between the reciprocating rack bar 141 and the rotary vertical shaft 124 for travel and steering movement is best seen from Figs. 2 and 10. The reciprocating member 141 is forked so that one branch of the fork extends on each side of the pinion 140. Only one branch of the reciprocating member 141 is toothed. The pinion 140 is loosely mounted upon the shaft 124 but adapted to be secured thereto by clutching member 160, which is in the form of a disc, having at one side an internally toothed peripheral portion, the teeth of which are adapted to telescope or slide into the teeth on the gear 140. The member 160 is slidably mounted by being keyed or splined to the shaft 124 and it is held normally into toothed engagement with the gear 140 by means of a coiled spring 162 interposed around an upwardly extending hub on the clutch member 160. The upper end of the shaft 124 will be grooved or splined so that the member 160 will be slidably secured thereon but must at all times rotate therewith. 162 is a coiled spring interposed between the clutch member 160 and a suitable expanded plate secured to the upper end of the shaft 124. The forked reciprocating member 141 is provided on the upper side of both branches thereof with intermediate projections 163, 164 (Figs. 2 and 10). The purpose of these projections is to free the operative relation of the pinion 140 from the shaft 124 when the swing body is in a position for rotating in relation to the truck body, otherwise a swing movement of the rotating bed would result in imparting a rotary motion to the shaft 124 and operate the clutch devices for controlling the travel and steering operations of the truck whenever swinging occurred, which might result disastrously to the steering and travel mechanism. Therefore, whenever the lever 150 is operated to cause the travel and steering mechanism to become operative, the same movment of the locking lever 150 will carry in a clockwise direction the lever 100, first rendering the clutch operative to impart rotation to the axial control shaft 124 and subsequently to operate the travel and st :er- ing control clutches.

While the maner of the operation of the above described mechanism will probably be understood from the foregoing description, it may be further stated that the machine with respect to travel and swing operations will operate as follows:

Assuming the application of power from the motor 11 to be of a continuous nature, the shafts 15 and 20 will have continuous rotation and always in the same direction from the prime mover or source of power. Throughout the several views of the drawings the various parts of the mechanism are shown at all times in condition for swinging movements of the swing body which is one of the normal functions of the machine while at work as a crane or equipped for drag line, clam shell, shovel or other analogous work. Therefore, when performing any of its usual functions, not including travel or steering operations involving the travel mechanism, the various mechanisms will be substantially in the positions shown throughout the several views of the drawings and particularly as illustrated in Fig. 3.

In this condition the clutch connecting the gear 140 with the steering and travel operating shaft 124 will be substantially in the position of the parts shown in Fig. 10 so that any desired amount of swinging movement of the swing body can take place without having any effect upon the clutches and other mechanism for controlling the travel and steering movements. as the travel and steering movements will be obviously out of control until such time as the clutch at the top of the shaft 124 is restored to an engaging position. With the swing lock 95 out of engaging position and the respective parts, as shown for example in Fig. 3, swinging movements to the swing body will be imparted as follows:

The normal rotation of shaft 20 will impart rotation to gears 26 and 27 according to the manner in which the pivoted lever 36 is operated in shifting the longitudinally movable shaft 20. When shifted in one direction the clutch members 29 and 31 will engage and impart rotary movement to the gear 27 which engages the large co-operating gear 50 which must be locked rigidly in relation to the truck body to insure proper swinging movement to the swing body. Swinging movement in the opposite direction from the shaft 20 will be imparted to the swing body with the large gear 50 locked against turning in relation to the truck body whenever the clutch members 28 and 30 are caused to engage by the clutch lever in shifting the shaft 20 to the limits of its movement in the opposite direction. With the swing body lock 95 disengaged for doing work involving swinging movements of the swing body by reason of the fact that whenever the reciprocating forked rack member at the top of the shaft 124 is in a position where the pinion is disengaged from the clutch on the shaft, both the gears 80 and 81 on the driving shafts 74 and 75 will be positively clutched or locked to the shaft 74. This is due to the fact that both the movable clutch members 112 and 115 co-operating with the clutch portions on the gears 80 and 81 are splined or keyed to the shaft 74 and are normally pressed into engaging relation with their respective clutch parts 80 and 81 by a plurality of interposed compression springs 170 ar-

ranged around the periphery of the splined shaft 74. The coil springs 170 may be secured at their extremities in holes or housings in the opposing ends of the movable clutch members 112 and 115, as illustrated in Figs. 7 and 8. The tendency of the coil springs 170 will be to cause the engagement of the clutch members 112 and 115 with their co-operating parts on the gears 80 and 81, and therefore it will be seen that whenever the clutch controlling shaft 124 is rotated so that the pin 126 is in the position shown in full lines in Fig. 4, both the clutch members will engage their respective gears 80 and 81, locking these gears to the same shaft 74 and hence locking the gear 86 and the large king pin shaft 55 and the gear 50 carried thereby against rotation, thus making the large gear 50 in effect a part of the truck body so that whatever power is applied to the large gear 50 through either of the pinions 26 or 27 will be transferred into a turning movement applied to the swing body, the direction of which will be determined by whichever of the clutches on the shaft 20 is operated. At the same time it will be seen that the truck body will be effectively locked against any travel movement in a backward or forward direction and since no differential movement can occur between the different sections of the travel shaft, no turning or twisting movement of the truck body will be possible while the machine is being normally operated to rotate the swing body.

When the operator desires to have the travel and steer mechanism function he should, as a first requirement, operate the swing locking device 95 through moving the lever 100 in a clockwise direction and cause the locking device 95 to engage the locking teeth 93 of the roller path on the truck body. With the swing body locked against rotation the operator is free to move the lever 150 which will cause the forked rack member to function, and when moved off center to free the clutch member 160 whereupon movement of the rack bar 141 in either direction will have the effect of rotating the shaft 124 correspondingly and opening one or the other of the clutch members 112, 115 against the action of the springs 170. Whichever clutch member will be operated will depend upon the direction of movement given by the operator to the lever 150. If the member 112 be freed from its clutch part on the gear 80 then the effect will be to lock for rotation together the shafts 74 and 75 so that shafts 74 and 75 will operate together through the medium of the gear 81 rigidly connected to the shaft 75 and the gear 86 on the vertical pivot shaft. If the lever be operated in the opposite direction to free the clutch member 115 the effect will be to leave the clutch member 112 in engagement so that the rotation of the gear 86 will operate the shaft 74 in one direction and the shaft 75 in the opposite direction, this being a manner of operation found to be very beneficial in turning movement and in operating the truck body on curves. The foregoing description of the method of steering presupposes adjustment of the lever 36 controlling the longitudinal movement of the power shaft 20 as described so as to operate the large bevel driving gear 50 in the normal direction for travel ahead. Movement of the lever 36 in the opposite direction will, as before described, reverse the normal direction of the gear 50 under which conditions the mechanism will operate the endless belt treads in the reverse direction and while so operated, the operator may in the manner before described, by shifting the lever 150, positively drive both of the endless traction devices in like manner for reverse movement or in the manner described, he may drive one of these traction devices in the forward direction and the other in the reverse direction to effect a turning movement even when the driving gear 50 is operating in the reverse direction to normally drive the machine in a reverse direction.

From the foregoing description, it will be seen that I provide a simplified construction of gearing in which I combine the ordinary reversing swing and travel bevel gear and the ordinary rotating rack gear, thus dispensing with the usual intermediate rack gear and its reduction operating train together with the usual reduction operating train of travel gears. This, of course, necessitates the making of the reversing bevel gear 50 and its king pin shaft 55 of very substantial proportions, which may be done at a great saving of construction expense and at the same time greatly simplify the mechanism and its mode of operation by reason of the reduced number of moving parts and bearings as heretofore used in the swing and travel mechanisms of excavating machines.

I claim:

1. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body and mounted for selective rotation independently of either the swing body or the car body for imparting travel movements to the car body, means for selectively locking the pivot shaft against rotation in relation to the car body, means for selectively locking the swing body against rotation relative to the car body on said pivot shaft as an axis, a gear secured to the pivot shaft, a power shaft carried by the swing body adjacent the said gear on the pivot shaft, a pair of gears on the power shaft, both of which mesh with the gear on the pivot shaft, clutch devices for selectively controlling the operation of said pair of gears on the power shaft for imparting travel movements to the car body and swinging movements to the swing body, and means for driving said power shaft.

2. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body adapted to be operatively connected with the traction means thereon, a gear mounted to rotate in relation to the swing body and being fixedly secured to rotate with the pivot shaft, driving mechanism on the swing body for operating said gear to impart both travel movements to the machine and swinging movements to the swing body, means for locking the pivot shaft against rotation in relation to the car body whereby the operation of said driving mechanism upon said gear will impart the normal swinging movements to said swing body in relation to said car body, and means for locking the swing body against swinging movement in relation to the car body when the traction devices are to be operated.

3. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot and power transmission shaft connecting the swing body with the car body, said pivot shaft being rotatably mounted in both said car body and said swing body, gearing in the car body operatively connected with said pivot shaft for imparting movement to the traction means on the car body,

means for locking said gearing whereby to selectively lock said pivot shaft against rotation in relation to said car body, a gear mounted to rotate in relation to the swing body and secured to the pivot shaft, driving mechanism on the swing body for operating said gear whereby said traction means may be selectively operated through said gear and said pivot shaft, and whereby when said traction gearing is selectively locked swinging movements may be imparted to said swing body by reason of the co-operation of the driving mechanism on the swing body with said gear on the locked pivot shaft, and means for locking the swing body in relation to the car body when the traction devices are to be operated.

4. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot and power transmission shaft connecting the swing body with the car body, said pivot shaft being rotatably mounted in both said car body and said swing body, gearing in the car body operatively connected with said pivot shaft for imparting movement to the traction means on the car body, means for locking said gearing whereby to lock said pivot shaft against rotation in relation to said car body, a gear mounted to rotate in relation to the swing body and secured to the pivot shaft means for selectively locking the swing body against rotation in relation to the car body, and driving mechanism between said motor and said gear whereby said traction means may be operated from said motor through said gear and said pivot shaft when the swing body is locked in relation to the car body, and whereby a swinging movement will be imparted to said swing body in relation to the car body when the swing body lock is released and when the said pivot shaft and said gear are locked against rotation in relation to the car body.

5. In an excavating machine, the combination of a car body and traction devices thereon, a swing body mounted on the car body, a pivot and power transmission shaft connecting the swing body with the car body and being operatively connected with said traction devices, means for selectively locking both the swing body and the said pivot shaft against rotation in relation to the car body, a gear mounted to rotate in relation to the swing body and being fixedly secured to the pivot shaft, and driving mechanism on the swing body for operating said gear whereby normal travel movements may be imparted to said traction means on the car body through the said pivot shaft when the swing body is locked against swinging movement in relation to the car body and whereby normal swinging movements may be imparted to the swing body when the said pivot shaft is locked against rotation in relation to the car body.

6. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body, a locking device for securing the pivot shaft against rotation in relation to the car body, a locking device for securing the swing body against rotation in relation to the car body, a gear mounted to rotate in relation to the swing body and secured to the pivot shaft, driving mechanism for operating said gear, and interrelated means for operating the said locking device for the pivot shaft on the car body and the said locking device for the swing body in relation to the car body whereby when one of said locking devices is in operative position the other will be in inoperative position.

7. In an excavating machine, the combination of a car body and traction means thereon comprising two endless belt carrying devices, sprockets connected to each of said endless belt carrying devices, shafts for said sprockets, said shafts being mounted for rotation in said car body on a common axis but divided to have independent rotation, a bevel gear connected to rotate with one of said shafts at a point adjacent the other shaft, a second bevel gear mounted to rotate freely in relation to said other shaft, a swing body mounted on the car body, a vertical pivot shaft connecting the swing body with the car body, a gear on the lower end of the pivot shaft meshing with the said bevel gears on the traction shafts, clutch devices adjacent said bevel gears for locking said bevel gears in relation to each other to lock said pivot shaft against rotation in relation to the car body and for locking said traction shafts to have synchronous rotation through one of said bevel gears from the pivot shaft, a gear mounted to rotate in relation to the swing body and being secured to the pivot shaft, driving mechanism on the swing body for operating said gear, a device for locking the swing body against rotation in relation to the car body, means for operating the last said locking means, and means operable from the swing body for operating the said clutch mechanism on the car body to control the traction and swing movements of the machine.

8. In an excavating machine, the combination of a car body and traction means thereon comprising endless belt traction devices and divided operating shafts therefor co-axially mounted in end to end relation, bevel gears on the respective shafts, a swing body mounted on the car body, a vertical pivot shaft connecting the swing body with the car body and being mounted for independent rotation in relation to both said car body and said swing body, clutches adjacent the aforesaid bevel gears on the travel shafts in the car body operable to lock said bevel gears together and to lock said travel shafts to rotate in unison with each other under the impelling force of one of said bevel gears, a bevel gear secured to the lower end of the vertical pivot shaft engaging the said bevel gears on the said travel shafts, means for operating the clutch devices on the travel shafts, means for locking the swing body against rotation in relation to the car body, a gear mounted to rotate in relation to the swing body and secured to the upper end of the pivot shaft on the swing body, and driving mechanism on the swing body for operating said gear.

9. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body, a gear mounted to rotate in relation to the swing body and being secured to the pivot shaft, driving mechanism for operating said gear for driving said gear at will in either of two directions, a bevel gear connected to the lower end of said pivot shaft, a pair of travel shafts for operating the said traction means, said shafts being coaxially arranged in end to end relation adjacent each other, a pair of bevel gears on said shafts engaging the gear on the lower end of the pivot shaft on diametrically opposite sides thereof, means for locking the said bevel gears together to prevent rotation of said pivot shaft, means for locking said travel shafts together whereby they

may have synchronous rotation for imparting travel movement to the car body through the gear on the pivot shaft, and clutch means for causing each of said bevel gears to be free to operate said travel shafts synchronously in opposite directions under power through the adjacent gear on the pivot shaft to impart turning movements to said traction means on the car body.

10. In an excavating machine, the combination of a car body and traction means thereon comprising spaced apart endless belts, sprocket wheels for supporting said belts, travel shafts supporting said sprocket wheels, said shafts being journalled in the car body on a common axis in end to end relation, bevel gears on the respective shafts, means for securing the said bevel gears to their respective shafts, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body power supplying means on the swing body operatively connected with said pivot shaft, a bevel gear on the pivot shaft engaging the aforesaid bevel gears on the travel shafts whereby one of the said endless belt traction devices will be driven in one direction and the other in the opposite direction through the rotation of the pivot shaft to impart turning movements to the car body, and means for locking one of the bevel gears to its shaft and for locking the said shafts together to have synchronous rotation for imparting travel movements to the car body in substantially a straight line in either direction through the power supplied to the traction means by rotation of said pivot shaft.

11. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a vertical pivot shaft connecting the swing body with the car body, a gear mounted to rotate in relation to the swing body and being secured to the pivot shaft, driving mechanisms on the swing body for operating said gear, a pair of travel shafts for operating said traction devices journalled in the car body in end to end relation, a bevel gear keyed to one of said shafts, a clutch for connecting said bevel gear with the other of said shafts, a bevel gear on the last said shaft, and a clutch device for connecting the last said bevel gear to said shaft whereby turning movements may be imparted to said car body through said vertical pivot shaft from the swing body to produce turning movements to the car body.

12. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a vertical pivot shaft connecting the swing body with the car body, a gear mounted to rotate in relation to the swing body and being secured to the pivot shaft, driving mechanism on the swing body for operating said gear, a pair of travel shafts for operating said traction devices journalled in the car body in end to end relation, a bevel gear keyed to one of said shafts, a clutch for connecting said bevel gear with the other of said shafts, a bevel gear on the last said shaft, a clutch device for connecting the last said bevel gear to said shaft whereby turning movements may be imparted to said car body through said vertical pivot shaft from the swing body to produce turning movements to the car body, and a second clutch device for locking the said shafts together to have synchronous turning movements through one of said bevel gears when the other of said bevel gears is unlocked from its shaft.

13. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a vertical pivot shaft connecting the swing body with the car body, the said vertical pivot shaft having a central opening therein, means for locking the pivot shaft against rotation in relation to the car body, a gear mounted to rotate in relation to the swing body and secured to the hollow pivot shaft, driving mechanism on the swing body for operating said gear, said traction means comprising endless belt traction devices, and co-axial driving shafts therefor arranged in end to end relation, bevel gears engaging said shafts, clutches engaging said bevel gears, a bevel gear secured to the lower end of the hollow pivot shaft engaging said bevel gears on the co-axial driving shafts, a shaft rotatably mounted in the hollow body of the pivot shaft and extending therethrough, a gear operatively connected with the upper end of said shaft, hand operated means for operating said gear and said shaft, and connections between the lower end of said shaft and said clutch devices for controlling the said bevel gears on the travel shafts.

14. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted on the car body, a pivot shaft connecting the swing body with the car body, a gear mounted to rotate in relation to the swing body and secured to the pivot shaft, driving mechanism on the swing body for operating said gear, said traction means comprising endless belt traction devices, a pair of driving shafts for operating said endless belt traction devices journalled in the car body in coaxial end to end relation, a bevel gear keyed to one of said shafts and provided with a concentric opening adapted to receive the end of the other shaft, a second bevel gear mounted on the last said shaft, a bevel gear on the lower end of the pivot shaft, both said bevel gears on the travel shafts engaging the bevel gear on the pivot shaft, and clutch means operable from the swing body for locking the said shafts to rotate together in unison while one of the bevel gears is free to rotate idly in relation to its supporting shaft, said clutch means comprising jaw clutches keyed to their supporting shaft and having longitudinal movement thereon under the separating influence of expansible springs.

15. The combination with a supporting frame of a pair of spaced-apart endless belt traction devices revolubly mounted in relation to said frame, a pair of divided traction shafts for operating said endless belt traction devices, said shafts being mounted on a common axis in end to end relation, a beveled gear secured to rotate with one of said shafts, a second beveled gear mounted to rotate freely in relation to the other said shaft, a third beveled gear simultaneously meshing with said beveled gears on the traction shafts and being operatively connected to a suitable power source, clutch devices related to said divided traction shafts and to the said beveled gears thereon, and means for selectively operating said clutch devices whereby to cause said traction shafts to rotate simultaneously in the same direction to impart travel movements to said endless belt traction devices and in opposite directions with respect to each other whereby to operate one of the endless belt traction devices reversely with respect to the other said endless belt traction device for steering the said frame.

16. In an excavating machine, the combina-

tion of a car body and traction devices thereon, a swing body mounted on the car body, a pivot and a power transmission shaft extending between the swing body and the car body on the axial connection therebetween and being operatively connected with said traction devices, means for selectively locking both the swing body and the said pivot shaft against rotation in relation to the car body, a gear mounted to rotate in relation to the swing body and being fixedly secured to the pivot shaft, and driving mechanism on the swing body for operating said gear whereby normal travel movements may be imparted to said traction means on the car body through the said pivot shaft when the swing body is locked against swinging movement in relation to the car body and whereby normal swinging movements may be imparted to the swing body when the said pivot shaft is locked against rotation in relation to the car body.

17. In an excavating machine, the combination of a car body and traction means thereon, a swing body mounted to have swinging movement on a vertical axis on the car body, a combination swing and travel gear mounted in the swing body and connected to the traction means in the car body on the said vertical axis between the swing body and the car body, means for selectively locking the combination swing and travel gear against rotation in relation to the car body, means for selectively locking the swing body against rotation in relation to the car body, and power means on the swing body adapted to be operatively connected to the said combination swing and travel gear, for imparting swinging movements to the swing body and travel movements to the car body at the will of the operator, and upon the selective operation of the said swing body and travel locking devices.

ROY S. MOORE.