May 12, 1931. D. J. SHELTON 1,804,816

CRAWLING TRACTION MECHANISM

Filed Feb. 13, 1925 4 Sheets-Sheet 1

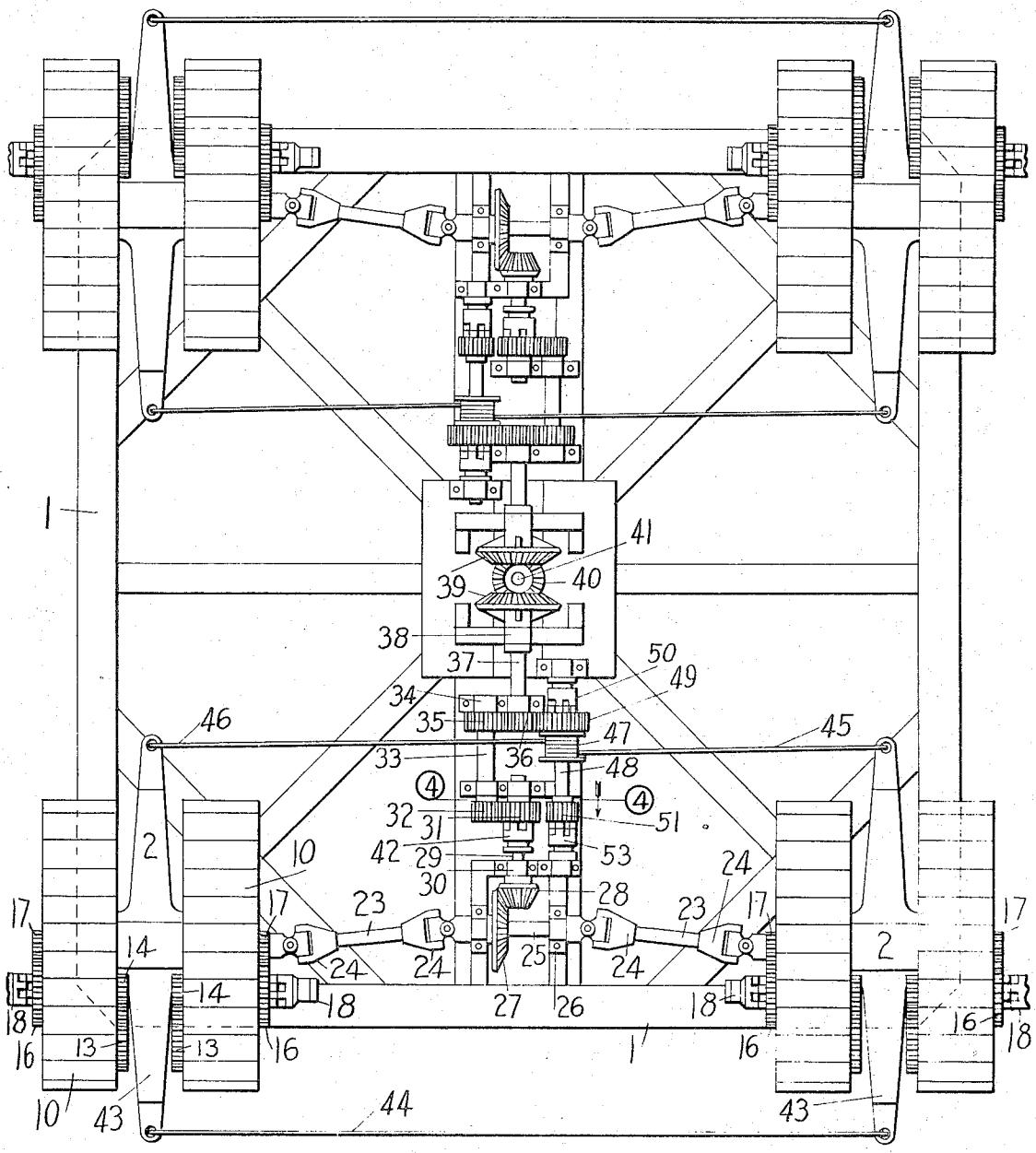


Fig. 1.

INVENTOR.
D. J. SHELTON.
By Edward Reed
ATTORNEY.

May 12, 1931. D. J. SHELTON 1,804,816

CRAWLING TRACTION MECHANISM

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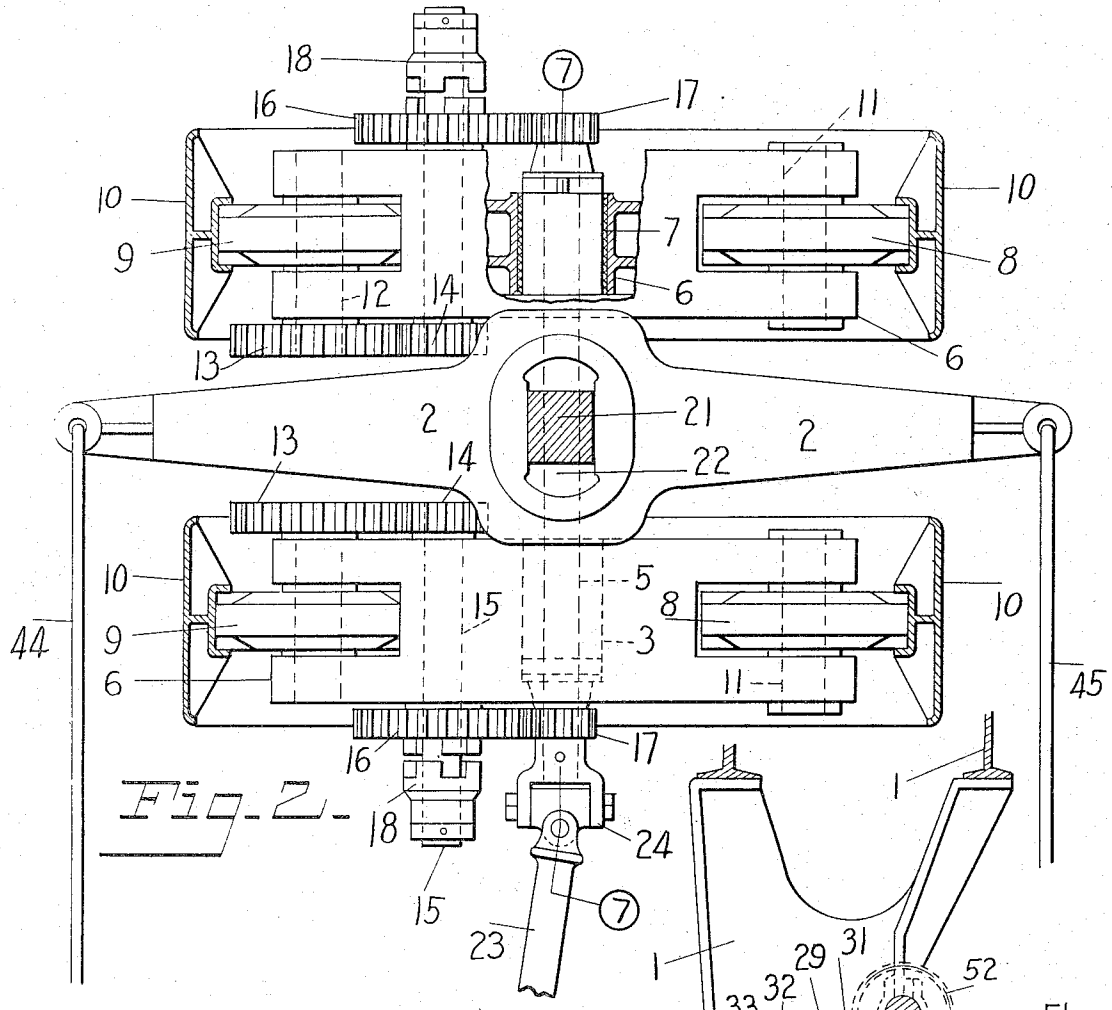


Fig. 2.

Fig. 4.

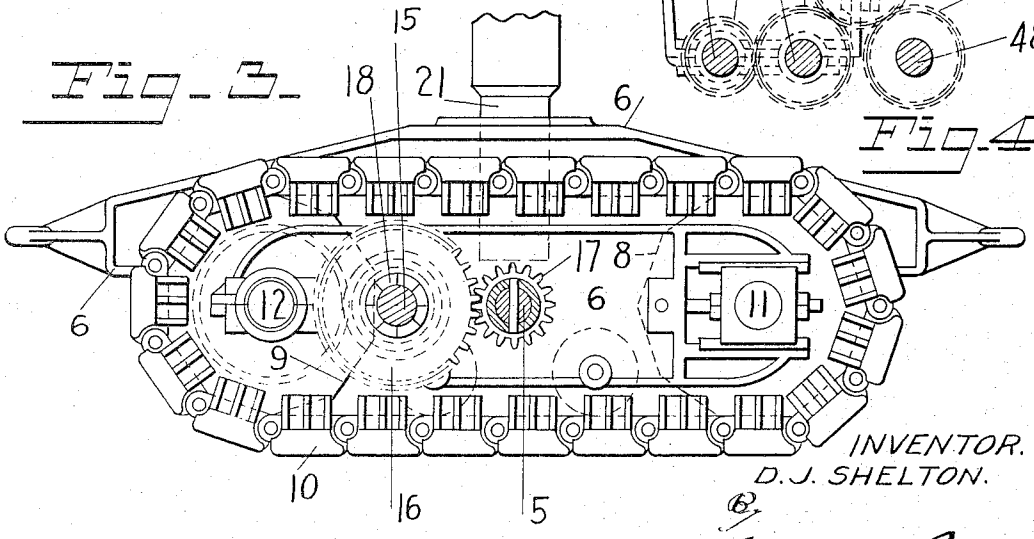


Fig. 3.

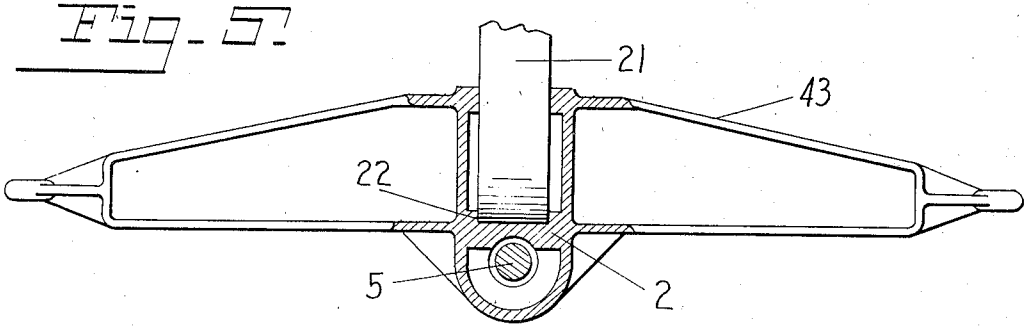
INVENTOR.
D. J. SHELTON.
BY
Edmund Reed
ATTORNEY.

May 12, 1931. D. J. SHELTON 1,804,816

CRAWLING TRACTION MECHANISM

Filed Feb. 13, 1925 4 Sheets-Sheet 3

Fig. 5.



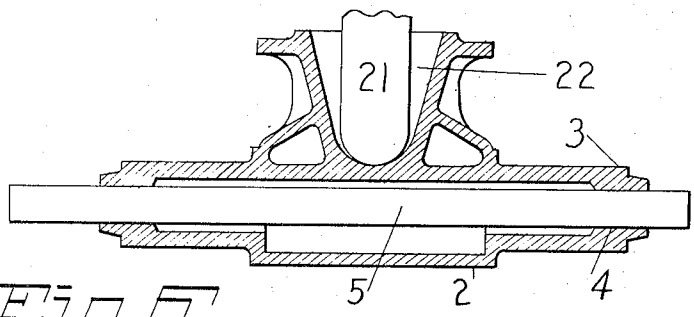
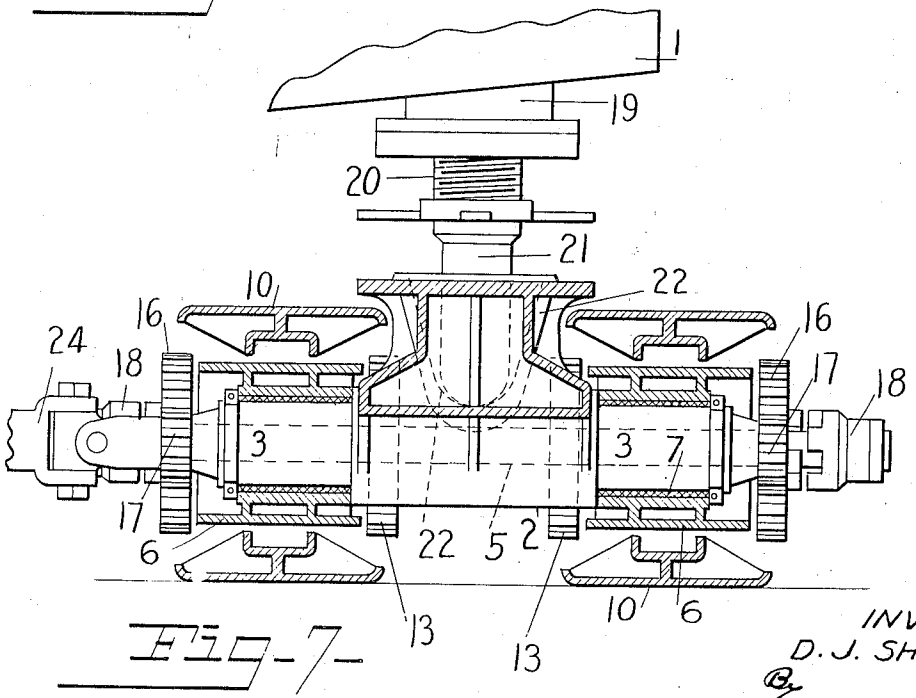


Fig. 6.

Fig. 7.



INVENTOR.
D. J. SHELTON.
By Edward Reed
ATTORNEY.

May 12, 1931. D. J. SHELTON 1,804,816

CRAWLING TRACTION MECHANISM

Filed Feb. 13, 1925 4 Sheets-Sheet 4

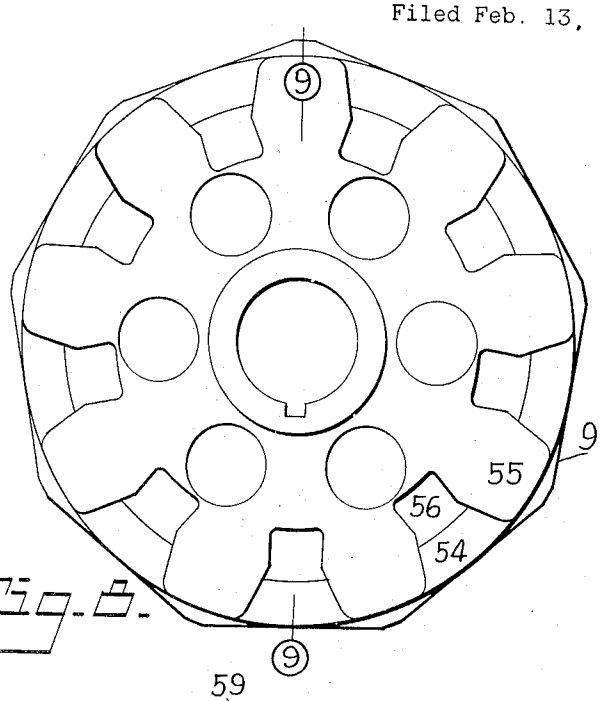


Fig. 8.

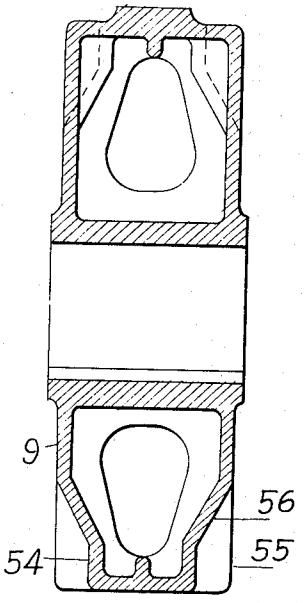


Fig. 9.

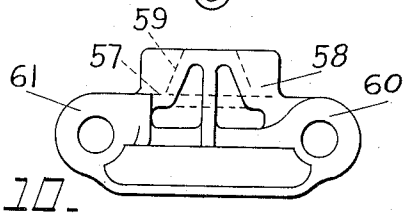


Fig. 10.

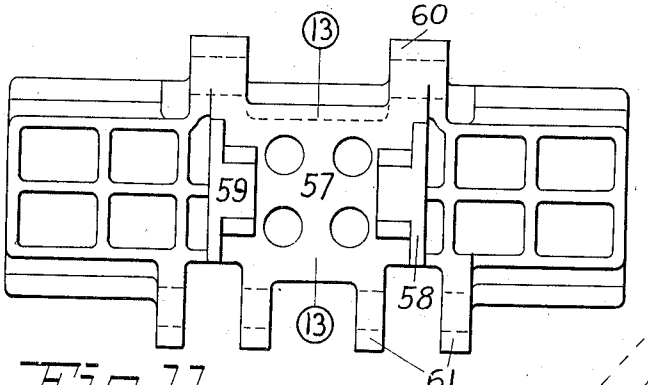


Fig. 11.

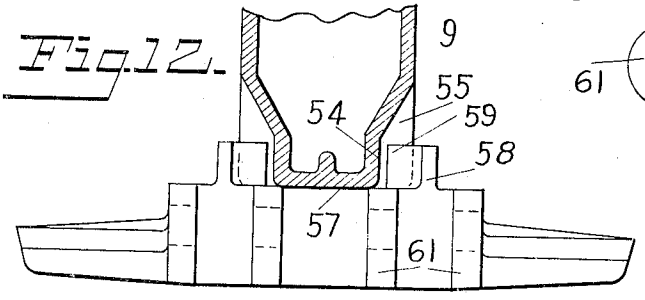


Fig. 12.

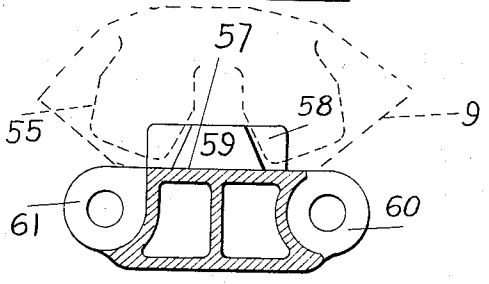


Fig. 13.

INVENTOR.
D. J. SHELTON.
By Edmund Reed
ATTORNEY.

Patented May 12, 1931

1,804,816

UNITED STATES PATENT OFFICE

DWIGHT J. SHELTON, OF MARION, OHIO, ASSIGNOR TO THE MARION STEAM SHOVEL COMPANY, OF MARION, OHIO, A CORPORATION OF OHIO

CRAWLING TRACTION MECHANISM

Application filed February 13, 1925. Serial No. 8,899.

This invention relates to crawling traction mechanism and is designed more praticularly for use with large power operated shovels of the revolving type, and similar machines.

Power operated shovels of the revolving type comprise a base or lower frame on which is mounted a revolving superstructure which carries the excavating mechanism and power plant. These shovels are of very large capacity and have very great weight. In some models the base frame is more than thirty feet square. Ordinarily a shovel is provided at each corner of the base frame with a truck, the trucks being usually provided with flanged car wheels so that the machine may travel over parallel railway tracks. The surface of the ground over which such a shovel works is usually very irregular and even when supported upon tracks it has been found desirable to provide an equalizing mechanism whereby the base frame and revolving superstructure may be maintained substantially level regardless of the different vertical positions of the trucks.

The primary object of the invention is to provide a crawling traction mecahnism suitable for application to a revolving shovel of this type, or similar mechanism.

A further object of the invention is to provide such a crawling traction mechanism which will accommodate itself to the irregularities in the surface of the ground upon which the shovel rests or over which it is moving.

A further object of the invention is to provide such a crawling traction mechanism with power operated means for manipulating the same to steer the machine as it is moved from one position to another.

Other objects of the invention will appear as the device is described in detail.

In the accompanying drawings Fig. 1 is a bottom plan view of the base frame of a revolving shovel showing my invention applied thertto; Fig. 2 is a plan view of a crawling traction truck, with the endless tracks in section; Fig. 3 is a side elevation of such a truck; Fig. 4 is a section taken on the line 4—4 of Fig. 1; Fig. 5 is a side elevation, partly in section, of a truck frame; Fig. 6 is a transverse sectional view taken centrally of the truck frame; Fig. 7 is a transverse sectional view of one of the trucks taken on the line 7—7 of Fig. 2; Fig. 8 is a side elevation of the driving tumbler of one of the crawling traction devices; Fig. 9 is a transverse sectional view of the same; Fig. 10 is an end elevation of one of the tread plates of the endless track; Fig. 11 is an inner plan view of such a tread plate; Fig. 12 is a side elevation of such a tread plate showing a portion of the tumbler in section; and Fig. 13 is a transverse sectional view of the tread plate taken on the line 13—13 of Fig. 11.

In these drawings I have illustrated one embodiment of my invention and have shown the same as applied to a power operated shovel of the revolving type such as is shown and described in Patent No. 1,280,238, granted October 1, 1918 to George W. King, et al. It will be understood, however, that the invention itself may take various forms and that it may be applied to machines of various kinds without departing from the spirit thereof.

In illustrating the invention I have omitted the superstructure and the parts carried thereby and have shown only the base or lower frame 1 but it will be understood that this base frame supports the revolving superstructure, which is rotatably mounted on an axis arranged centrally of the base frame, and that this superstructure carries the boom, excavating mechanism and power plant. I have also omitted from these drawings the equalizing mechanism, with the exception of a portion of one of the equalizing jacks by means of which the trucks are connected with the base frame.

As shown in Fig. 1 the base frame is supported at each of its four corners by separate crawling traction trucks. These trucks are similar in construction and the description of the construction of one of them will suffice to describe all of them. Each truck comprises a truck frame 2 which, in the present device, consists of a single casting and is provided with laterally extending trunnions 3 projecting from the opposite sides thereof and arranged in alinement one with

the other. The truck frame is hollow and the trunnions are provided at their outer ends with bearings 4 in which is journaled a shaft 5. The truck preferably comprises two crawling traction devices and these devices are arranged on opposite sides of the truck frame and are journaled on the trunnions 3 for rocking movement about the axis theerof. In the construction here shown, each crawling traction device comprises a rigid longitudinally extending frame 6 provided substantially midway between its ends with a bearing 7 to receive the adjacent trunnion 3 of the truck frame. Mounted at the respective ends of the rigid frame 6 of the crawling traction device are tumblers 8 and 9 about which extends an endless belt or traveling track 10. Preferably the frame 6 of the crawling traction device is bifurcated at its ends and provided with bearings for shafts 11 and 12 on which the tumblers 8 and 9 are mounted, the tumblers being arranged in the spaces between the arms of the bifurcated end portions of the frame 6. One of the tumblers of each crawling traction device, preferably that one at the outer end of the traction device, serves as a driving member for actuating the endless track 10. To this end the shaft 12 on which the outer tumbler, 9, is mounted has secured to its end a gear 13 which meshes with a pinion 14 carried by a shaft 15 journaled in the frame member 6. Mounted on the shaft 15, on that side of the frame 6 opposite the pinion 14, is a gear 16 which meshes with a pinion 17 secured to the shaft 5 which is journaled in the trunnions of the truck frame. Preferably means are provided for disconnecting the crawling traction device from the shaft 5 and to that end the pinion 16 is here shown as loosely mounted on the shaft 15 and a clutch 18 is provided for connecting the gear with the shaft. The shaft 5 is connected with a suitable source of power and through the mechanism above described serves to actuate both crawling traction devices simultaneously and at the same rate of speed. The crawling traction truck may be connected with the base frame of the machine in any suitable manner but preferably the connections are of such a character that the truck frame, and consequently the truck as a whole, may have tilting movement about an axis extending lengthwise thereof, which tilting movement, combined with the tilting movement of the individual crawling traction devices about their transverse axes, enables the truck to accommodate itself to the irregularities in the surface of the ground. In the present device, I have connected the trucks with the base frame 1 by means of an equalizing mechanism, such as is shown and described in the above mentioned patent, and which permits the truck as a whole to move toward and from the base frame. It is not necessary to describe the construction or operation of the equalizing mechanism as a whole but, as shown in Fig. 7, it comprises an equalizing jack arranged at each corner of the base frame. Each of these jacks includes a cylinder 19 carried by the base frame and having mounted therein a vertical reciprocatory piston 20, the lower end of which projects downwardly and constitutes a post, as shown at 21, by means of which the truck frame is connected with the jack. The connection between the post and the truck frame may take various forms but, in the present mechanism, the truck frame is provided with a central portion which extends slightly above the level of the upper stretches of the endless tracks 10 and is provided with a socket 22 in which the post 21 is mounted. In order that the truck frame may have tilting movement with relation to the post 21 and consequently with relation to the base frame, the lateral walls of the socket 22 are spaced apart at their upper ends a distance substantially greater than the width of the post 21 and converge toward the bottom of the socket and the post itself has its lower end rounded, the bottom of the socket also being rounded in the present instance, whereby pivotal connection is established between the post and the truck frame. It is not desirable in the present machine that the truck frame should tilt about a transverse axis with relation to the post 21 and the base frame and I have therefore shown the front and rear walls of the socket as substantially parallel and as fitting snugly against the sides of the post, there being just sufficient clearance to permit of the free movement of the truck frame about its longitudinal axis. It will also be noted that the post 21 has its front and rear sides flat and inasmuch as these sides of the post contact with the front and rear walls of the socket it will be apparent that the truck frame is held rigidly against rotation with respect to the post. However, the piston 20, of which the post 21 is a part, is rotatable in a cylinder 21 so that the truck as a whole may have movement about a vertical axis arranged centrally thereof.

The shaft 5 which drives the traction devices has secured thereto a shaft 23 which is provided with universal joints 24 to render the same flexible and which is connected with a shaft 25 mounted in bearings 26 on the base frame. Secured to the shaft 25 is a beveled gear 27 which meshes with a beveled pinion 28 on a shaft 29 extending lengthwise of the base frame and journaled in bearings 30. Mounted on the shaft 29 is a gear 31 which meshes with a pinion 32 secured to a shaft 33 also extending lengthwise of the base frame but arranged out of line with the shaft 29 and here shown as mounted in bearings 34 on the base frame. A gear 35 secured

to the shaft 33 meshes with a pinion 36 on a shaft 37 mounted in bearings 38 on the base frame and arranged substantially in line with the shaft 29. Rigidly secured to the shaft 37 is a beveled gear 39 which meshes with a corresponding gear 40 on a vertical shaft 41 which is mounted in the base frame at the axis of rotation of the superstructure and is connected with the power plant carried by that superstructure and thus constitutes the main driving shaft for the crawling traction devices. The driving mechanism may be disconnected from the crawling traction devices when desired and to this end the gear 31 is rotatably mounted on the shaft 29 and is connected thereto by means of a clutch 42. It will be noted that this mechanism is duplicated at the front and rear ends of the base frame, each set of mechanism being connected with the two trucks at the corresponding end of the base frame. Thus by manipulating the clutches 42 to connect one mechanism with the driving shaft and to disconnect the other therefrom, the machine as a whole may be propelled in either direction.

Power operated means are provided for moving the crawling traction trucks about their vertical axes to effect the steering of the machine when the latter is being moved from one position to another. Separate steering means are provided for the trucks at the front and rear ends of the machine and the mechanism is of such a character that the trucks of either pair will be operated simultaneously, and the steering connections are of a flexible character so that they will not interfere with the vertical or the tilting movements of the truck frame and the crawing traction devices and will be operable in all positions of said truck frames and said crawling traction devices. The truck frame of each of the trucks is provided with longitudinally extending portions or arms 43 which project respectively from the body portion of the truck frame to points beyond the inner and outer ends of the crawling traction devices. The outer arms of each pair of crawling traction trucks are connected one to the other by a suitabe connecting device such as a cable 44, and the inner arms of each pair of crawling traction trucks are connected by means of cables 45 and 46 with a drum 47 which is mounted on a shaft 48 journaled in suitable bearings on the base frame and arranged, in the present instance, parallel with the shaft 33. The cables are wound about the drum 47 in opposite directions so that as one cable is wound onto the shaft the other will be paid out. Hence when the drum is rotated in one direction the cable 45 will be wound onto the drum and the truck, shown at the right hand lower corner of Fig. 1, will be moved about its axis, this movement being transmitted through cable 44 to the truck at the lower left hand corner of that figure which is turned simultaneously and to a like extent, this movement of the last mentioned truck being permitted by the paying out of the cable 46 on the drum 47. Likewise when the rotation of drum 47 is reversed the trucks will be simultaneously actuated in the opposite direction. The drum 47 is rigidly secured to the shaft 48 and a gear 49 loosely mounted on that shaft meshes with the gear 36 on the shaft 37 and a clutch 50 is provided for connecting the gear with the shaft to rotate the drum in one direction. The shaft 48 is also provided near its other end with a gear 51 which is connected through an idle gear 52 (see Fig. 4), with a gear 31 on the shaft 29. The gear 51 is connected with the shaft 48 by means of a clutch 53. When the machine is being propelled the clutches 50 and 53 are shifted to disconnect the gears 49 and 51 from the drum and the clutch 42 is seated to connect the gear 31 with the shaft 29, thus the movement of the driving shaft 41 will be transmitted through the train of gears to the crawling traction devices. When it is desired to turn the trucks to change the direction of the machine the clutch 42 is disengaged to disconnect the gear 31 from its shaft and the clutch 50 is engaged to connect the gear 49 with the drum, thus causing the drum to be rotated in one direction. When it is desired to turn the trucks in the other direction the clutch 50 is disengaged to disconnect the gear 49 from the drum and the clutch 53 is engaged to connect the gear 51 with the drum, thus causing the shaft to be driven from the gear 31 and, because of the interposition of the idle gear 52, the drum will be rotated in a reverse direction. No special means has here been shown for shifting the clutches and this may be accomplished in any suitable manner. It will be understood that these machines seldom travel any great distance and when they do travel they are propelled very slowly and consequently it is not objectionable to entirely disconnect the driving connection while the trucks are being turned to the desired extent.

The outer tumblers 9 of each crawling traction device, which serve as drivers for the endless tracks, are preferably constructed to function after the manner of sprocket wheels but, in the present instance, are so formed they will have a firm bearing contact on the tread plate and it will not be necessary to form openings or pockets in the tread plate, which would in service become clogged with earth, stones and the like. In the present construction the tumbler is provided on each side thereof with a series of peripheral recesses 54 which are spaced equal distances apart, those portions of the tumbler lying between the recesses, as shown at 55, constituting teeth. The inner walls of the recesses are flared outwardly, as shown at 56, so as to cause any dirt, earth or other obstruction which may enter the same to be forced out

by the tooth on the track plate, as will hereinafter appear. Each tread plate or link of the endless belt comprises a plate which, in the present instance, is of a length considerably greater than the width of the rigid frame of the crawling traction device and is provided at its center with a flat contact surface 57 which engages at the periphery of the tumbler, the latter being preferably provided with a series of flat surfaces to provide a relatively large firm contact between the same and the track sections. On each side of this contact portion of the tread plate are provided inwardly extending projections or webs 58 of sufficient height to overlap the lateral edges of the tumbler and hold the track against lateral displacement with relation thereto. Each of these webs has rigidly secured thereto a lug 59 the lugs projecting laterally one toward the other and constituting teeth which enter the recesses 54 in the tumbler and cooperate with the teeth 55 thereof. The tread plates or sections are pivotally connected one to the other to form the endless track and to this end are provided with pivot lugs 60 and 61, the pivot lugs on the abutting edges of adjacent tread plates being arranged to interlock one with the other and connected together by pivot pins.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a machine of the character described, a base frame, a vertical post depending from said base frame, a truck frame arranged beneath said base frame and having a socket to receive the lower end of said post, said socket having its lateral walls converging toward the bottom thereof and having its front and rear walls substantially parallel, the lower end of said post being rounded to permit said truck frame to have tilting movement about a longitudinal axis, said truck frame also having laterally extending trunnions, crawling traction devices pivotally mounted between their ends on the respective trunnions, and means for actuating said crawling traction devices.

2. In a machine of the character described, a base frame, a vertical post depending from said base frame and mounted for longitudinal movement with relation to said base frame, a truck frame arranged beneath said base frame and having a socket to receive the lower end of said post, said socket having its lateral walls converging toward the bottom thereof and having its front and rear walls substantially parallel, the lower end of said post being rounded to permit said truck frame to have tilting movement about a longitudinal axis, said truck frame also having laterally extending trunnions, a rigid frame member mounted on each of said trunnions and movable about the axis thereof, tumblers carried by the respective ends of each of said rigid frames, endless tracks extending about the respective tumblers and rigid frames, and means for actuating one of said tumblers in each of said frames to impart movement to said tracks.

3. In a machine of the character described, a base frame, crawling traction trucks arranged beneath the respective corners of said frame at one end thereof, each of said trucks comprising a truck frame and a crawling traction device connected therewith, means for connecting said truck frames with said base frame for movement about vertical axes with relation thereto, arms carried by each of said truck frames and extending forwardly and rearwardly therefrom, means for connecting the forwardly extending arms of the two truck frames one to the other, cables connected with the rearwardly extending arms of the respective frames, a drum about which said cables are wound in opposite directions, means for rotating said drum to impart movement to both truck frames about their vertical axes, and means for actuating said crawling traction devices.

4. In a machine of the character described, a base frame, crawling traction trucks arranged beneath the respective corners of said base frame at one end thereof, each of said trucks comprising a truck frame having laterally extending alined trunnions and having forwardly and rearwardly extending arms, crawling traction devices mounted on the respective trunnions of each of said truck frames, means for actuating said crawling traction devices to propel said machine, a connection between the forwardly extending arms of said truck frames, separate cables connected with the rearwardly extending arms to said truck frames, a drum about which said cables are wound in opposite directions, and means for actuating said drum to move said trucks about said vertical axes.

5. In a machine of the character described, a base frame, crawling traction trucks arranged beneath the respective corners of said base frame at one end thereof, each of said trucks comprising a truck frame having laterally extending alined trunnions and having forwardly and rearwardly extending arms, and also having a socket, posts carried by the respective corners of said base frame and extending into the sockets of the respective truck frames, crawling traction devices pivotally mounted on the respective trunnions of each of said truck frames, means for actuating said crawling traction devices, means for connecting the forwardly extending arms of said truck frames one to the other,

cables connected with the rearwardly extending arms of said truck frames, a drum about which said cables are wound in opposite directions, and means for rotating said drum to move said truck frames about the axes of the respective posts.

6. In a machine of the character described, a base frame, crawling traction trucks arranged beneath the respective corners of said base frame at one end thereof, each of said trucks comprising a truck frame having laterally extending alined trunnions and having forwardly and rearwardly extending arms, crawling traction devices mounted on the respective trunnions of each of said truck frames, means for actuating said crawling traction devices to propel said machine, a connection between the forwardly extending arms of said truck frames, separate cables connected with the rearwardly extending arms to said truck frames, a drum about which said cables are wound in opposite directions, and reversible means for actuating said drum to cause said truck frames to be moved about vertical axes.

7. In a machine of the character described, a base frame, equalizing jacks mounted at the respective corners of said base frame and each comprising a plunger mounted therein for both rotary and longitudinal movement, said plunger having a downwardly extending portion non-circular in cross section, a truck frame arranged beneath each of said equalizing jacks and having a socket to receive said downwardly extending portion of said plunger, said socket being shaped to hold said truck frame against rotation with relation to said plunger but to permit said frame to have tilting movement about a longitudinal axis with relation to said plunger, said truck frame also having laterally extending alined trunnions, crawling traction devices pivotally mounted on the respective trunnions, means for actuating said crawling traction devices, each truck frame also having forwardly and rearwardly extending arms, means for connecting the forwardly extending arms of two of said truck frames, cables connected with the rearwardly extending arms of said two truck frames, a drum about which said cables are wound in opposite directions, and reversible means for actuating said drum to cause said truck frames to be moved about the axes of the respective plungers.

8. In a machine of the character described, a base frame, crawling traction trucks arranged beneath said base frame to support the same, each of said trucks comprising a truck frame, having laterally extending alined trunnions, a shaft journaled in said trunnions, rigid frame members journaled on the respective trunnions, tumblers mounted at the respective ends of each of said rigid frames, an endless track extending about said tumblers, a driving connection between said shaft and one of the tumblers on each of said frames, and means for rotating said shaft.

9. In a machine of the character described, a base frame, crawling traction trucks arranged beneath said base frame to support the same, each of said trucks comprising a truck frame, said truck frame having laterally extending trunnions, a crawling traction device arranged on each side of said truck frame, each of said crawling traction devices comprising a rigid frame journaled between its ends on one of said trunnions, tumblers rotatably mounted in the respective ends of said rigid frame, an endless track extending about said tumblers, a shaft extending transversely to said truck frame and journaled in said trunnions, a geared connection between said shaft and one tumbler of each traction device, means for rotating said shaft, connecting members depending from said base frame adjacent to each of said trucks and mounted for vertical movement with relation to said base frame, and means for connecting said truck frames with the respective connecting members for movement about longitudinal axes with relation thereto.

10. In a machine of the character described comprising a structure to be supported, a plurality of separate crawling traction trucks arranged in supporting relation to said structure near the respective lateral edges thereof, each of said trucks comprising a frame mounted for tilting movement about an individual axis extending lengthwise of said truck between the lateral edges thereof, and a crawling traction device having supporting connection with said frame and movable with relation thereto about an intermediate axis extending transversely to said truck.

11. In a machine of the character described comprising a structure to be supported, a plurality of separate crawling traction trucks arranged beneath the respective lateral edges of said structure to support the same, each of said trucks comprising a frame mounted for tilting movement with relation to said structure about an individual axis extending lengthwise of said frame between the lateral edges thereof, crawling traction devices mounted on the respective sides of said frame for tilting movement about a transverse axis with relation to said frame, and means for actuating said crawling traction devices.

12. In a mechanism of the character described comprising a structure to be supported having equalizing cylinders at the respective lateral edges thereof, a truck unit arranged directly below each equalizing cylinder and including a frame, a plunger supported by said frame and mounted in said equalizing cylinder, said frame being movable with relation to said plunger about an

axis extending lengthwise of the frame, and a crawling traction device having supporting connection with said frame and tiltable about a transverse axis with relation thereto.

13. In a mechanism of the character described comprising a structure to be supported having equalizing cylinders at the respective lateral edges thereof, a truck unit arranged directly below each equalizing cylinder and including a frame capable of movement about a longitudinal axis extending between lateral edges thereof, crawling traction devices mounted on the respective sides of said frame for separate tilting movement about transverse axes, and a plunger supported by said frame and mounted in said equalizing cylinder.

14. In a mechanism of the character described comprising a structure to be supported having equalizing cylinders at the respective lateral edges thereof, a truck unit arranged directly below each equalizing cylinder and including a frame capable of movement about a longitudinal axis extending between lateral edges thereof, crawling traction devices mounted on the respective sides of said frame for separate tilting movement about transverse axes, and a plunger supported by said frame, held against rotation with relation thereto and rotatably mounted in said equalizing cylinder.

In testimony whereof, I affix my signature hereto.

DWIGHT J. SHELTON.