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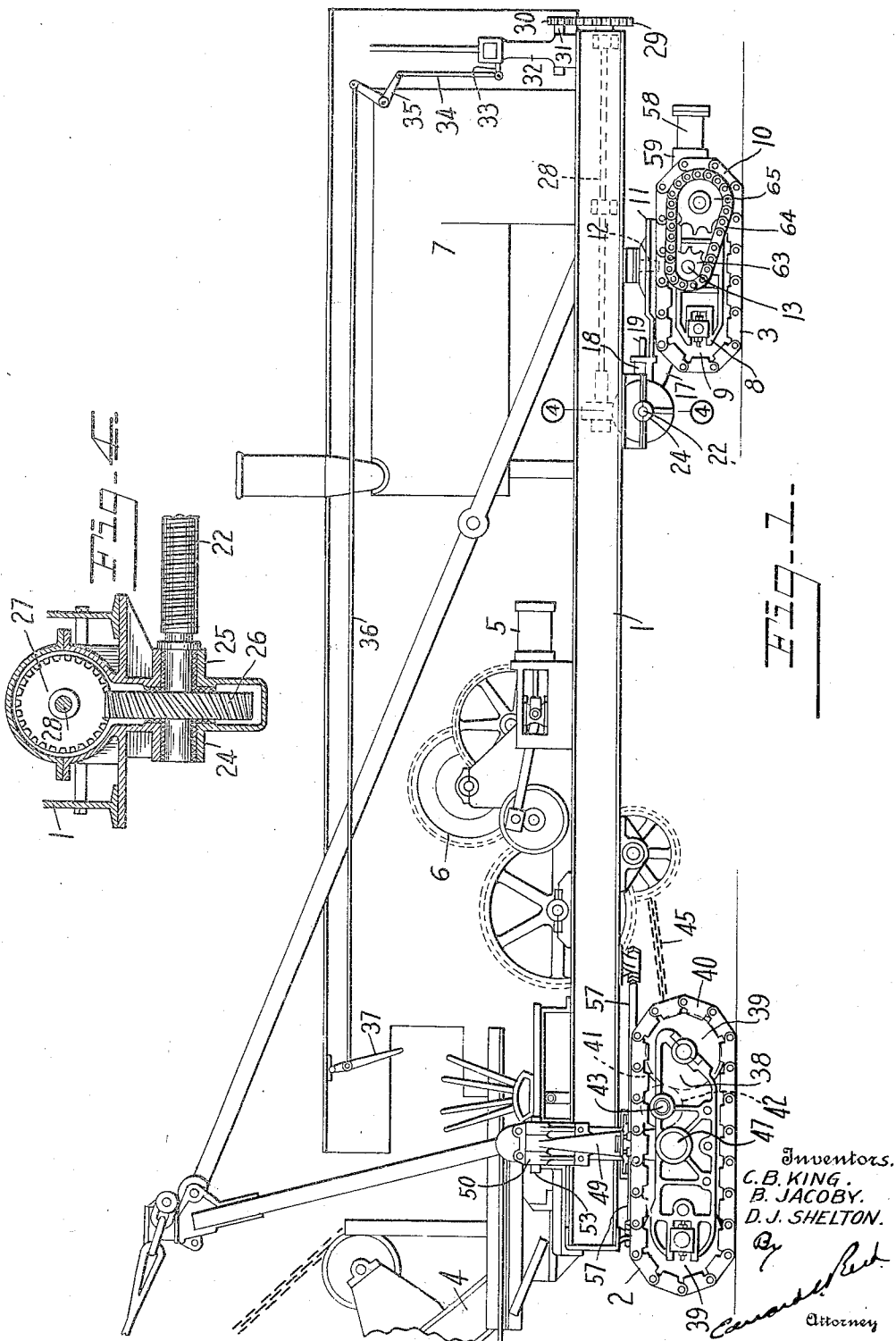
C. B. KING ET AL

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EXCAVATING MACHINE

Filed Feb. 12, 1923

3 Sheets-Sheet 1



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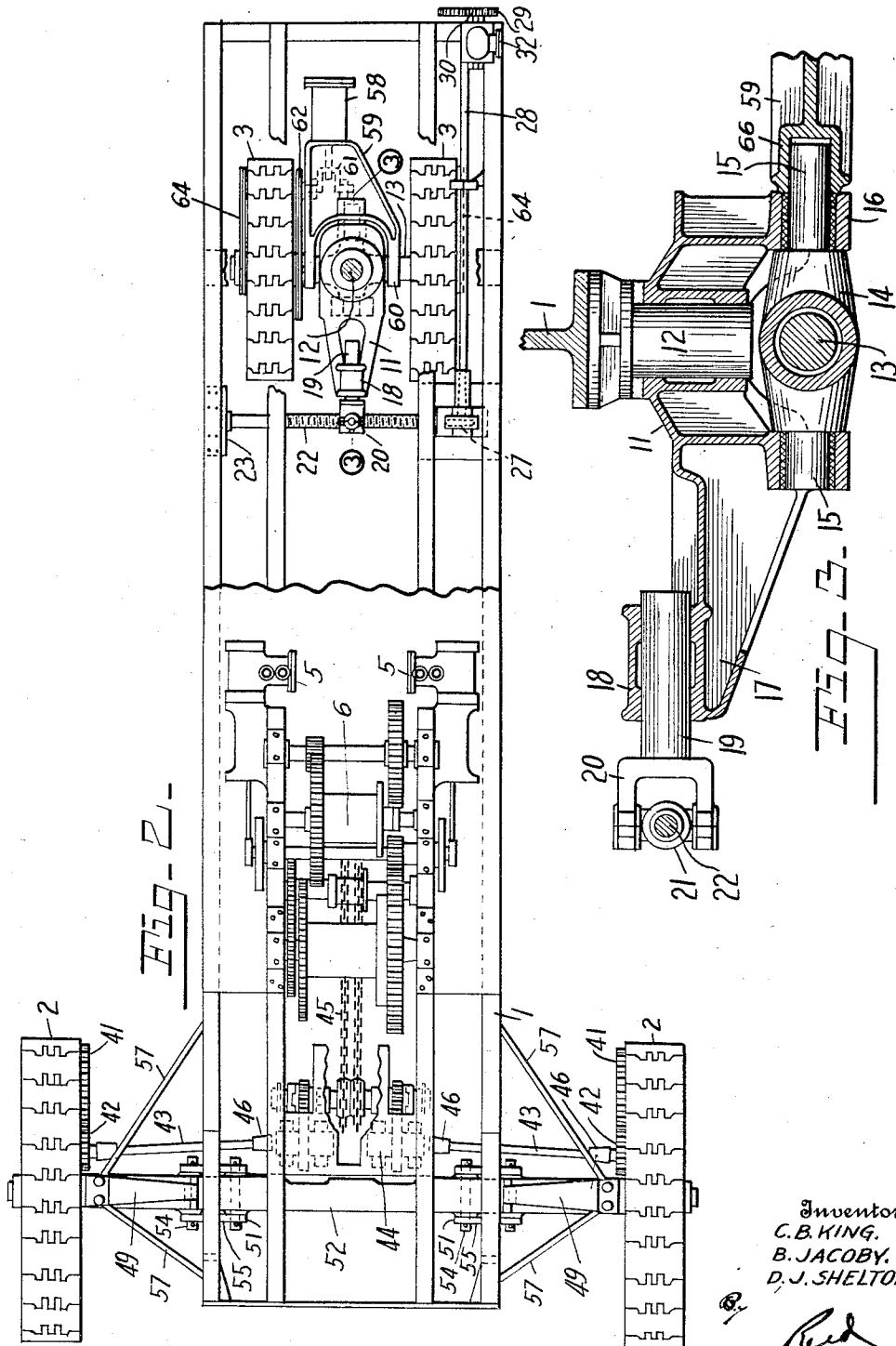
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3 Sheets-Sheet 2



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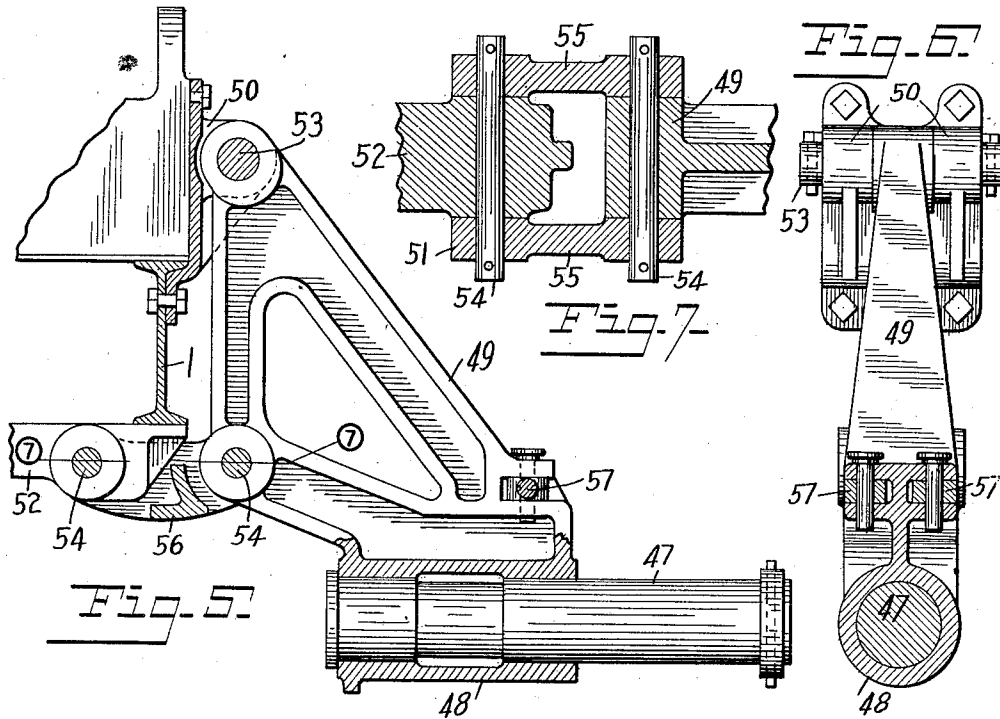
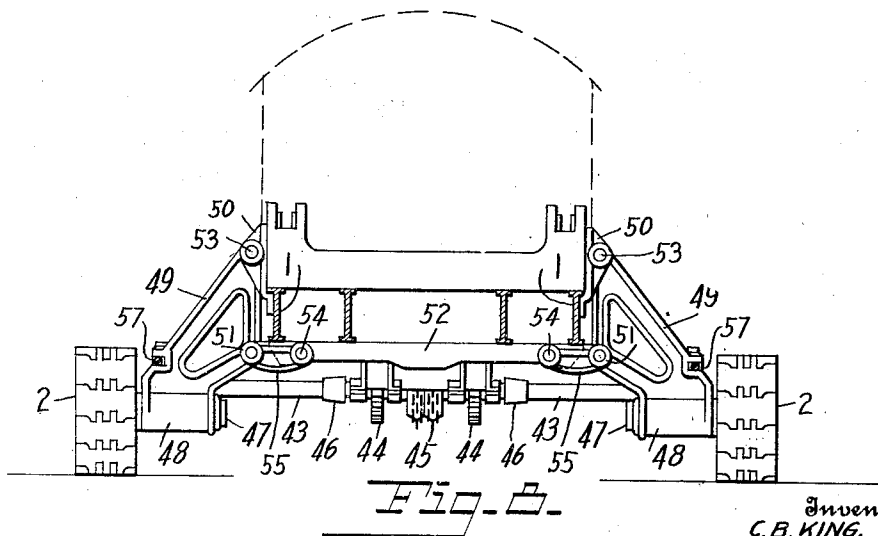
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EXCAVATING MACHINE

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3 Sheets-Sheet 3



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EXCAVATING MACHINE

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This invention relates to excavating machines and more particularly to crawling traction mechanism for propelling and steering such machines. It has been customary to mount excavating machines of the smaller types on crawling traction devices and to steer the same by controlling the relative movements of the two traction devices. This type of mechanism cannot be satisfactorily applied to the larger sizes of excavating machines because of the excessive length of the traction device.

One object of the invention is to provide crawling traction devices for propelling and steering a machine of this kind which will be of such a character and so arranged and operated that they can be applied to excavating machines of any size with entire satisfaction.

A further object of the invention is to provide separate traction devices for propelling and steering the machine; and to provide power operated means for imparting steering movement to the steering traction devices.

A further object of the invention is to so arrange the traction devices that they will adequately brace the machine against lateral strain, without interfering with the free steering of the machine.

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

In the accompanying drawings Fig. 1 is a side elevation of an excavating machine embodying our invention; Fig. 2 is a plan view of the same, partly broken away, and with the cab removed; Fig. 3 is a section taken on the line 3—3 of Fig. 2; Fig. 4 is a section taken on the line 4—4 of Fig. 1; Fig. 5 is a detail view, partly in section, of one of the supporting members for the propelling traction devices; Fig. 6 is an end elevation of said supporting member; Fig. 7 is a section taken on the line 7—7 of Fig. 5; and Fig. 8 is a front elevation of the forward

traction devices showing the main frame partly in section.

In these drawings we have illustrated one embodiment of our invention and have shown the same as applied to a steam shovel of what is known as the railroad type. These shovels are of large capacity and have a relatively long frame. While they are frequently mounted on railway trucks for use on tracks they may be and often are mounted on tractor wheels for use without tracks. It will be understood, however, that this particular embodiment of the invention has been chosen for the purposes of illustration only and that the invention may be applied to excavating machines of various kinds or sizes and that the traction devices themselves and the manner of mounting and controlling the same may take various forms without departing from the spirit of the invention.

In that particular form of the invention here illustrated the excavating machine comprises a main frame 1 which is supported at its front end by crawling traction devices 2 and at its rear end by crawling traction devices 3, the two sets of devices being entirely separate one from the other. Mounted on the main frame 1 at the forward end thereof is the excavating mechanism, which consists of a boom 4 which carries the usual excavating dipper and cooperating parts, a portion of boom only being shown. Mounted on the frame in the rear of the excavating mechanism are steam engines 5 which operate suitable mechanism 6 for actuating the excavating mechanism and for propelling the machine from one position to another. On the rear portion of the frame 1 is a steam plant 7. The several parts described as mounted on the frame 1 are of well known construction and need not be here described in detail.

In the present arrangement of the crawling traction device both pairs of traction devices are power driven, the rear pair serving both

as propelling devices and as steering devices but, if desired, the front pair of traction devices only may be power driven to propel the machine and those at the rear of the machine may serve solely to steer the machine as it is propelled by the front traction devices.

The traction devices themselves may be of any suitable character but preferably each traction device 3 of the rear pair comprises a rigid frame 8 having journaled in the front and rear ends thereof drums 9 about which extends a belt or endless track 10. The rear traction devices are mounted for movement about a vertical axis so that they can be moved about said axis for steering purposes. To this end we have mounted beneath the rear portion of the main frame 1 a steering frame or head 11 which is rotatably mounted upon a pin or trunnion 12 carried by and depending from the main frame at a point substantially midway between the lateral edges thereof. Carried by this frame is an axle 13 upon the end portions of which the rigid frame members 8 of the respective traction devices are mounted, so that each traction device has independent movement about an axis transverse to its length. It is also desirable that each traction device should be capable of vertical movement as a whole, to enable the mechanism to better accommodate itself to irregularities in the surface over which it is traveling. To permit of this movement of the traction devices we have mounted in the steering frame 11 a cross head 14 having at its ends trunnions 15 which are journaled in bearings 16 in the frame 11, and the axle 13 is mounted in this cross head. Consequently the axle may rock about an axis transverse to its length and extending lengthwise of the main frame to permit each traction device as a whole to rise and fall. The individual traction devices may move about the axis of the axle 13 with a rocking movement, and the axle is capable of movement about a vertical axis, that is, the axis of the frame 11, to enable the traction devices to be adjusted for steering purposes. The steering movement may be imparted to the traction devices in any suitable manner but preferably power operated mechanism is employed for this purpose. In the particular form of the device here shown we have provided the steering frame 11 with an arm 17 which preferably extends forwardly and is provided in its forward end with a guideway 18 in which is slidably mounted a shank 19 of a yoke 20. Pivotaly mounted on a vertical axis between the arms of the yoke is a nut 21 through which extends a screw threaded shaft 22. This shaft or screw extends transversely to the main frame and is journaled at one end in a bearing 23 and at its other end in bearing 24 and 25. Rigidly secured to the screw shaft and arranged between the bearings, 24 and 25, is a spiral gear 26 which meshes with

a second spiral gear 27 mounted on a shaft 28 which extends lengthwise of the main frame 1, along one of the side members thereof, and has secured thereto near the rear end of the frame, a gear 29 which meshes with a pinion 30 on the shaft 31 of a steam engine 32. It will be apparent therefore that the operation of the steam engine will rotate the shaft 28 and the screw 22 in one direction or the other and that the rotation of the screw will cause the nut 21 to travel along the same, thereby rocking the steering frame 11 and consequently the traction devices 3 about a vertical axis. This movement of the traction devices is preferably under the control of the operator at the forward end of the machine and to this end the engine is provided with a suitable controlling valve having an operating arm 33 which is connected by a rod 34 with one arm of a bell crank lever 35 which is here shown as mounted on the cab near the roof thereof and the other arm of which is connected by a rod 36 with an operating lever 37 at the forward end of the cab and adjacent to the operator's position.

It will be noted that the steering traction devices 3 are arranged relatively close together, being in the present instance, arranged well within the lateral limits of the main frame 1. Consequently they offer a minimum of resistance to the steering movement and the steering of the machine is facilitated. Excavating machines of this type are subjected to severe lateral strains. The boom and excavating dipper have a swinging movement through an arc of at least 180° so that the excavating may be done on either side or in front of the machine and the loaded dipper may be swung from one side to the other. The boom being of considerable length and the dipper of large capacity a very great strain is imposed upon the machine which tends to tilt it about an axis extending lengthwise thereof. To overcome this tilting strain in a railway type shovel it has been customary to provide jacks or braces extending from the frame to the ground on both sides of the machine. These braces, of course, had to be removed or elevated each time the machine was shifted from one position to another and then readjusted. In the present machine we have so mounted and arranged the forward traction devices, 2, that they serve to brace the machine against lateral tilting movement. The traction devices 2 are similar in construction to the traction devices 3 and each comprises a rigid main frame 38 having journaled in the front and rear ends thereof drums 39 about which extends the endless track or belt 40. As has been stated these forward traction devices serve to propel the machine and to this end the driving mechanism on the main frame is suitably connected with the respective traction devices. As here shown each of the

rear drums 39 of the traction device 2 has connected therewith a gear 41 with which meshes a pinion 42 which is secured to a shaft 43, one end of which is journaled in the frame 38 of the traction device and the other end of which is connected with suitable transmission mechanism 44 which is operated through suitable driving connections 45 by the engines 5 on the main frame. The shaft 43 is provided with universal joints 46 which enable it to accommodate itself to the movements of the traction device. The rigid frames 38 of the traction devices are pivotally mounted on axles or trunnions 47 which are mounted in sockets or bearings 48 rigidly secured to the main frame.

These sockets are preferably so arranged with relation to the main frame that the traction devices will be supported beyond and at considerable distance from the respective sides of the main frame and the sockets are so connected with the main frame as to constitute brace connections between the traction devices and the frame. By thus giving the forward traction device a very wide tread and bracing them against the frame of the machine they take the place of the bracing jacks which are commonly used to hold the frame against lateral tilting movement. The sockets 48 may be connected with the frame in any suitable manner but, in the present instance, each socket is connected with, and is preferably formed integral with, a triangular bracket 49 the upper corner of which is arranged between lugs 50 rigidly secured to the main frame, and the lower inner corner of which is connected by means of a link 51 with the adjacent end of the bolster 52. The connections between the upper corner of the triangular bracket and the lugs 50 is by means of a pin 53 and the link 51 is connected with the bracket and the bolster by pins 54. The links may be of any suitable construction but, as here shown, they consist of side members 55 connecting one to the other at their lower edges by a transverse web 56 and having their ends spaced apart to receive between them, respectively, portions of the bracket 49 and of the bolster 52. The triangular bracket or supporting structure for each traction device is braced against fore and aft movement by brace rods 57 which are connected at their outer ends with the bracket and at their inner ends with the main frame.

With the mechanism so far described the machine will be propelled by the front traction devices, the rear traction devices serving only as steering devices. When the steering traction devices are also to be power driven, to assist in propelling the machine, they may be driven from any suitable source of power and through any suitable mechanism which will not interfere with their steering movement. In the present instance, we have shown

a separate driving engine mounted on the supporting structure for the traction devices and moving with the traction devices. As here shown this engine is mounted on the axle which carries the two traction devices of the rear pair and is so arranged that it will move with that axle in the movement of the latter about both its vertical axis and its transverse horizontal axis. The engine in this particular mechanism is shown at 58 and is mounted on an engine frame 59 arranged in the rear of the steering frame or head 11 and, in the present construction, has forwardly extending portions 60 arranged on the respective sides of the steering frame and has bearings in which the axle is mounted so that the engine frame is supported by the axle. The engine shaft 61 is connected by a sprocket drive 62 with the axle 13, which thus constitutes a driving shaft, and the axle is provided on each outer end with a sprocket wheel 63 which is connected by a sprocket chain 64 with a second sprocket wheel 65 secured to the drum of the adjacent traction device so that the latter will be driven from the axle. In order to hold the engine frame 59 against movement about the longitudinal axis of the axle 13 it is connected with the steering frame 11 and, as here shown, this connection comprises a socket or bearing 66 formed in the engine frame in line with the rear bearing 16 of the steering frame and adapted to receive the end of the rear trunnion 15 which is of sufficient length to extend beyond the bearing 16 and into the socket 66. This arrangement causes the engine frame to be supported normally in a horizontal position but permits the same to have movement with the steering head about the horizontal transverse axis thereby avoiding any interference with the driving connection between the engine and the traction devices by the movement of the axle about this transverse axis.

While we have shown and described one embodiment of our invention we wish it to be understood that we do not desire to be limited to the details thereof as various modifications may occur to one skilled in the art. Having now fully described our invention what we claim as new and desire to secure by Letters Patent, is:

1. In a mechanism of the character described, a main frame, a pivot pin depending from said main frame, a steering frame having a vertical bearing to receive said pivot pin, an axle mounted on said steering frame beneath said bearing for rocking movement with relation to said steering frame about an axis extending lengthwise of said main frame, traction devices connected with the respective ends of said axle, an arm projecting from said steering frame, means carried by said main frame for actuating said arm to move said steering frame and said axle about the axis of said pivot pin, an engine supporting

structure carried by said axle and movable therewith about the axis of said pivot pin, an engine mounted on said structure, and driving connections between said engine and said traction devices.

2. In a mechanism of the character described, a main frame, means to support one end of said frame, an axle mounted beneath the other end of said frame for movement about a vertical axis, a steering frame mounted on said axle, means acting on said steering frame to move said axle about said vertical axis, an engine frame mounted on said axle, an engine mounted on said engine frame and having operative connection with the respective traction devices, and means for connecting said engine frame with said steering frame to hold the engine frame against movement about said axle.

3. In a mechanism of the character described, a main frame, traction devices to support one end of said frame, a steering frame mounted beneath the other end of said main frame for movement about a vertical axis, a transverse axle mounted in said steering frame for movement about an axis extending lengthwise of said main frame, crawling traction devices carried by the respective ends of said axle, means for actuating said steering frame to move said axle, and said traction devices about said vertical axis, an engine frame mounted on said axle, an engine carried by said engine frame and having an operative connection with the respective traction devices, said engine frame having a bearing arranged in line with the axis of said axle which extends lengthwise of said main frame, and a part carried by said steering frame and mounted in said bearing of said engine frame.

4. In a mechanism of the character described, a main frame, traction devices to support one end of said frame, a steering frame mounted beneath the other end of said main frame for movement about a vertical axis, said steering frame having bearings in the front and rear ends thereof, a cross head having trunnions journaled in said bearings, an axle mounted in said cross head, crawling traction devices mounted on the respective ends of said axle, means for actuating said steering frame to move said axle and said traction devices about said vertical axis, an engine frame mounted on said axle, an engine carried by said frame and having an operative connection with the respective crawling traction devices, said engine frame having a bearing arranged in line with the rear bearing in said steering frame and one of the trunnions of said cross head being extended beyond the rear bearing of said steering frame into the bearing in said engine frame.

5. In a mechanism of the character described, a main frame, means for supporting one end of said main frame, a steering frame

mounted beneath the other end of said frame for movement about a vertical axis, an axle journaled on said steering frame, traction devices carried by said axle, means for moving said steering frame and said axle about said vertical axis, an engine frame mounted directly on said axle and held against rotation therewith, an engine carried by said frame, a driving connection between said engine and said axle, and a driving connection between said axle and each of said traction devices.

6. In a mechanism of the character described, a main frame, means for supporting one end of said main frame, a steering frame mounted beneath the other end of said main frame for movement about a vertical axis, a cross head pivotally mounted on said steering frame on a substantially horizontal axis, an axle mounted in said cross head, traction devices mounted on the respective ends of said axle, an arm connected with said steering frame, and power operated means connected with said arm to move said steering frame and said axle about said vertical axis.

7. In a mechanism of the character described, a main frame, means for supporting one end of said main frame, an axle mounted beneath the other end of said frame for movement about a vertical axis, traction devices carried by said axle, means for moving said axle and said traction devices about said vertical axis, an engine frame journaled on said axle and extending lengthwise of said main frame, an engine carried by said engine frame and having operative connection with the respective traction devices, and means for holding said engine frame against movement about the longitudinal axis of said axle.

8. In a mechanism of the character described, a main frame, means to support one end of said frame, a steering frame mounted beneath the other end of said main frame for movement about a vertical axis, an axle supporting member mounted in said steering frame for movement about a horizontal axis extending lengthwise of said main frame, an axle journaled in said supporting member for rotation about its longitudinal axis, traction devices connected with the respective ends of said axle, an engine supported by said axle for movement therewith about said vertical axis and said horizontal axis, and means for operatively connecting said engine with said axle.

9. In a mechanism of the character described, a main frame, means to support one end of said frame, a steering frame mounted beneath the other end of said main frame for movement about a vertical axis, an axle supporting member mounted in said steering frame for movement about a horizontal axis extending lengthwise of said main frame, an axle journaled in said supporting member for rotation about its longitudinal axis, traction devices connected with the respective ends of

said axle, an engine supporting frame pivotally mounted on said axle, means for connecting said engine supporting frame with said axle supporting member to hold it against movement about the longitudinal axis of said axle, and an engine mounted on said engine supporting frame, and means for operatively connecting said engine with said axle.

In testimony whereof, we affix our signatures hereto.

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