

June 10, 1930.

H. H. BARBER

1,762,569

DITCHING MACHINE

Filed April 13, 1925

3 Sheets-Sheet 1

Fig 1.

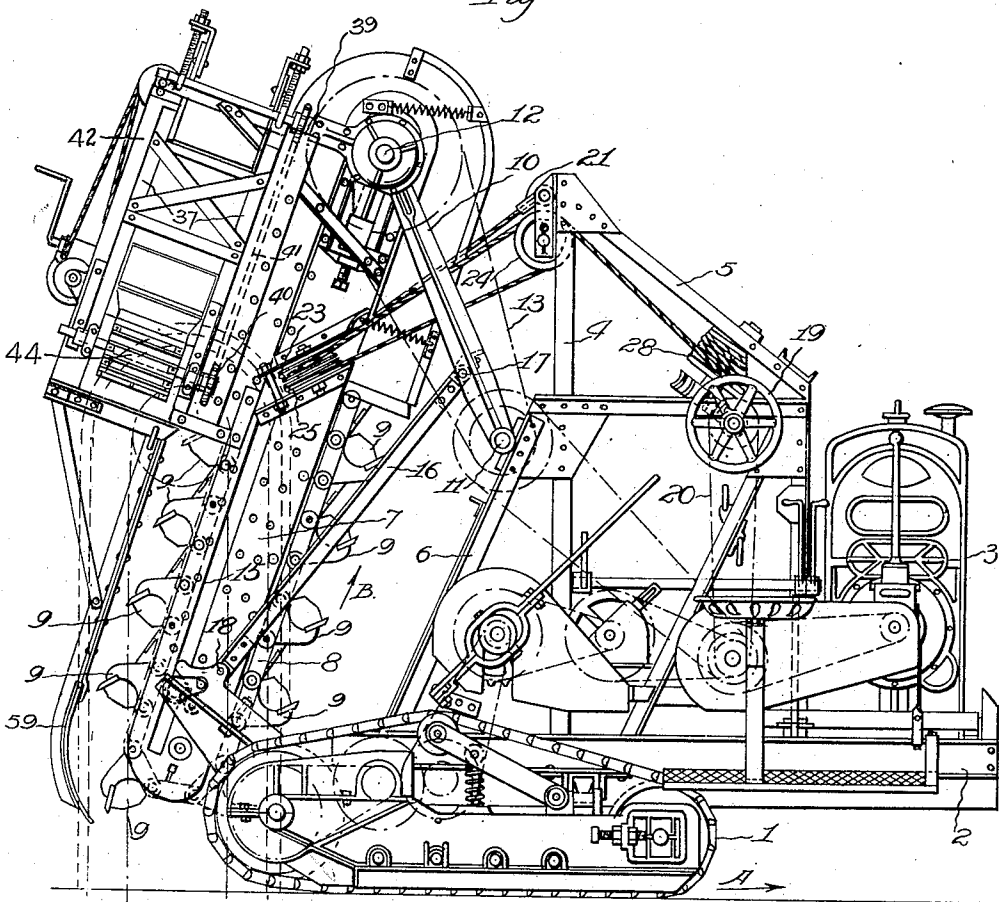


Fig. 7.

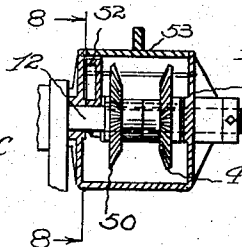
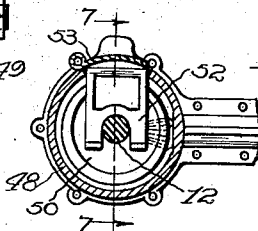


Fig. 8.



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Witness
A. M. Campbell

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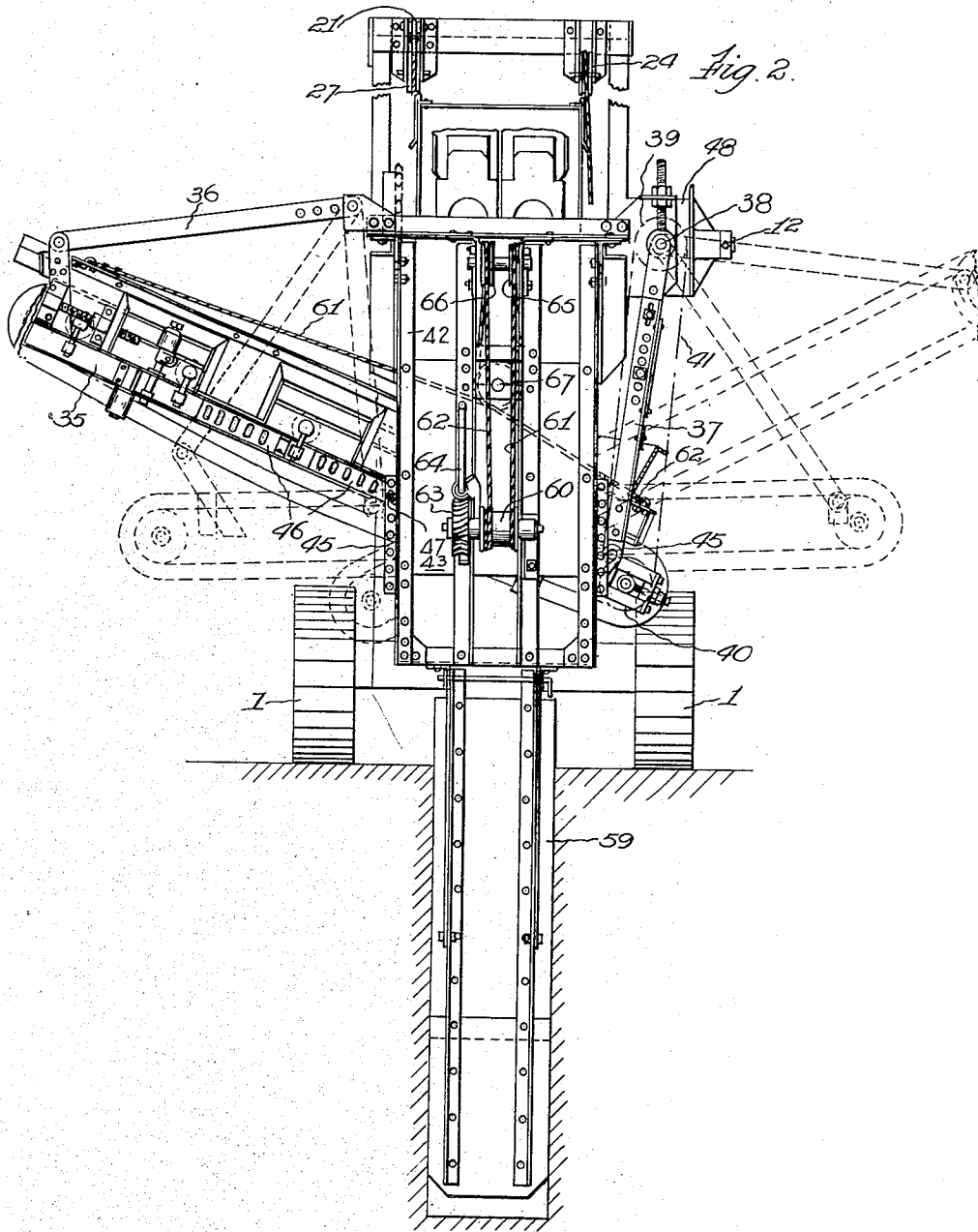
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DITCHING MACHINE

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3 Sheets-Sheet 2



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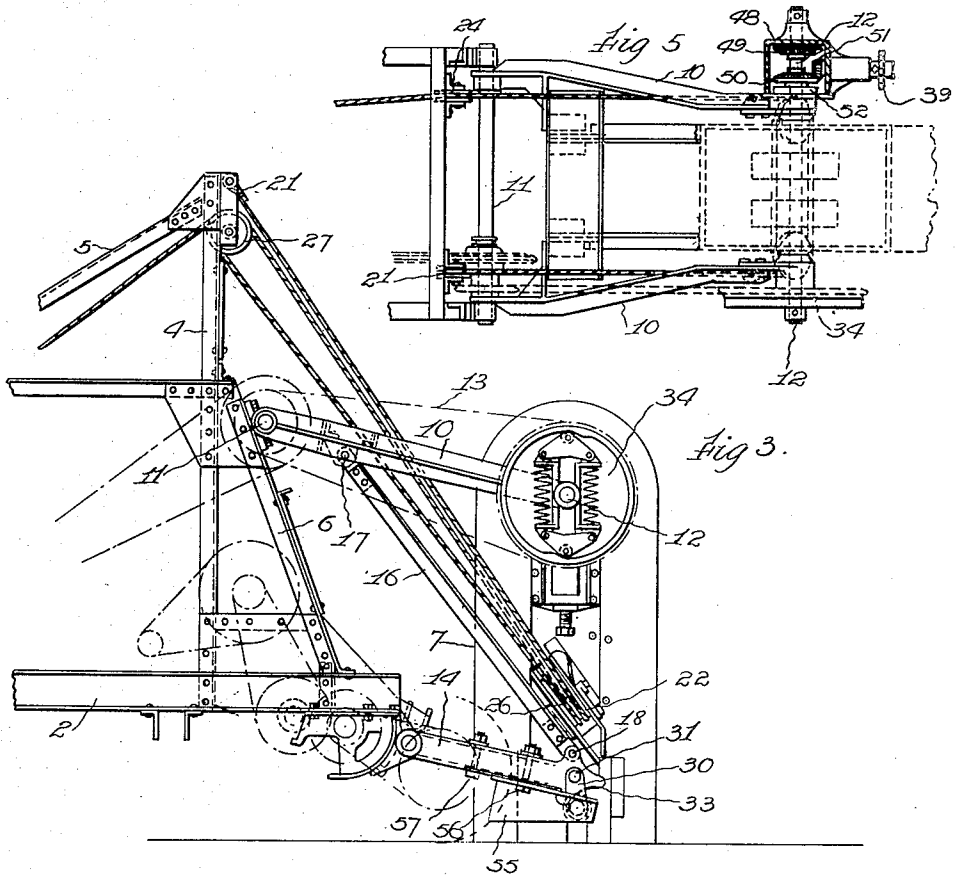
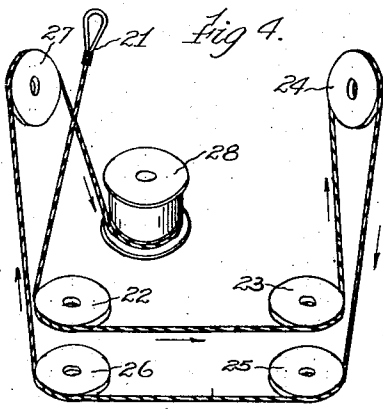
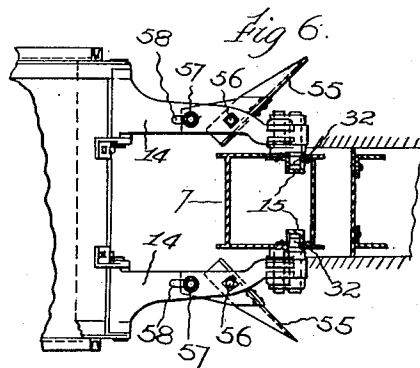
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DITCHING MACHINE

Filed April 13, 1925

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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DITCHING MACHINE

Application filed April 13, 1925. Serial No. 22,535.

The purpose of this invention is to provide a ditch or trench digging machine of the same general character as that shown in my pending application Serial No. 730,813, filed August 8, 1924. The present invention relates to various improvements in details of construction and operation, among which are an improved distribution of the power plant and digging boom with respect to the supporting tractor, an improved hoisting arrangement for the digging boom, and a new arrangement of the discharge or "spoil" conveyor by which it is adjustable to deliver material at either side of the trench. These and other features comprising the invention are herein described, illustrated and particularly indicated by the claims.

In the drawings:—

Figure 1 is a side elevation of the ditching machine embodying this invention showing the digging boom elevated above the ground level in a position in which the machine is adapted to travel when not at work.

Figure 2 is a rear elevation somewhat condensed by breaking out of certain parts and designed primarily to show the mounting and range of adjustment of the spoil conveyor in relation to the digging boom.

Figure 3 is a detail side elevation showing the connection between the vehicle frame and the digging boom as viewed from the side of the machine opposite that seen in Figure 1.

Figure 4 is a diagram indicating the arrangement of the hoisting cable for the digging boom.

Figure 5 is a detail plan view of the upper radius arms for the boom.

Figure 6 is a detail plan view of the lower radius arms showing the boom in section.

Figure 7 is a detail section taken as indicated at line, 7—7 on Figure 8, and showing the reversible driving gears for the spoil conveyor.

Figure 8 is a transverse section of the same taken as indicated at line, 8—8, on Figure 7.

As seen in Figure 1 the machine is mounted on a tractor of the crawler type having the usual road-engaging chains, 1, and supporting horizontal frame members, 2, which in

the present design extend for a considerable distance forwardly of the crawler chains, 1. At the forward end of the frame the power plant is mounted and may be understood to be an internal combustion engine enclosed in a suitable hood, 3, and connected both for driving the crawler chains, 1, and for operating the digging mechanism. Back of the power plant there is shown a framed superstructure including uprights, 4, diagonals, 5, and inclined braces, 6. The digging boom, 7, supports and guides an endless chain, 8, provided with digging buckets, 9, which may be of the type shown in my pending application Serial No. 713,242, filed May 14, 1924. This boom is attached to the superstructure of the vehicle frame by a pair of radius arms, 10, pivotally connected to the inclined brace members, 6, at 11, and pivotally engaging the boom at the axis of its head shaft, 12, so as to avoid variation in the tension of the drive chain, 13, as the radius arms, 10, are swung about their pivots, 11, in adjusting the boom up or down. Extending rearwardly from the tractor a yoke comprising shorter radius arms, 14, engages with the longitudinal slots, 15, in the boom, 7, and serves as a portion of the means to draw the boom forward as the crawler chains, 1, advance over the ground in the direction of arrow, A, with the boom lowered into working position and its buckets traveling upwardly in the direction of arrow, B. A working position of the boom is indicated in the dotted outline at C in Figure 1 while the extreme lower limit of working position is shown at D by a fragmentary dotted outline.

It is desirable to have the chain, 8, operate substantially in a vertical direction during the digging so that the buckets may carry and retain a full load of material without serious spillage above ground; but for travel of the machine when not in use it is preferable to have the boom swung as closely over the tractor chains, 1, as possible. This result is attained by making the radius arms, 10, considerably longer than the arms, 14, and also allowing the arms, 10, to move through a wider angle. The two sets of radius arms are coupled by links, 16, connected to the upper

arms, 10, at pivotal points, 17, fairly close to the fulcrum pivots, 11, of said arms but connected to the arms, 14, by pivots at 18 near the outer ends of the lower arms.

5 The raising and lowering of the boom is accomplished by means of a cable and winch which may be operated by a hand wheel shown at 19 but may also be arranged for connection through a sprocket chain, 20, with the power plant at 3. Instead of providing
10 duplicate cables and winches which are likely to be troublesome because of unequal stretching of the two cables, requiring compensating adjustment, I find it simpler to employ a single continuous cable anchored as shown at
15 21 near the upper end of one of the uprights, 4, and passing thence downwardly around a pulley, 22, at one side of the boom, 7. A similar pulley, 23, at the other side of the boom directly across from the pulley, 22,
20 then receives the cable and delivers it upwardly to a pulley, 24, near the top of the upright, 4, at the opposite side of the frame from the anchorage, 21. From the pulley,
25 24, the cable might pass directly to the winding drum but to secure increased lifting power I prefer to pass it back from the pulley, 24, to a second pulley, 25, coaxial with the pulley 23, and thence across the boom around a pulley,
30 26, associated with the pulley, 22, from which it passes upwardly around the final guide pulley, 27, and thence to the winding drum or winch, 28. This arrangement is clearly shown diagrammatically in Figure 4.
35 Any stretch in the cable is distributed throughout its length and the boom tends to adjust itself so that there is no tendency for the cable to twist or distort either the digging boom or the frame of the machine. It
40 will be noted that the hoisting cable extends in an inclined direction from the frame so that the horizontal component of force is effective for maintaining the boom at its work.

Instead of being directly attached to the
45 arms, 14, of the lower yoke the boom, 7, is connected to these arms in a manner which permits it to yield slightly if the machine encounters an unusually stubborn obstruction such as a large boulder buried below the surface
50 of the ground. This yielding connection consists of the swinging links, 30, shown in Figure 3 as pivoted at 31 to the arms, 14, near their outer ends. The links, 30, carry swiveled lugs, 32, which slidably engage in
55 the slots, 15, of the boom, 7, and normally hang below the pivots, 31. Upon encounter of an obstruction the tractor continues to move forward but the boom lags behind causing the links, 30, to swing toward horizontal
60 position to the limit set by the projecting stop, 33, at the end of each arm, 14. The inertia of the mass of the boom and its associated parts together with the fact that this weight must be raised slightly during the
65 rearward swing of the links, 30, provides for

the absorption of the shock due to the boulder or other obstacle in a way which avoids any serious danger of breakage and frequently this upward yield of the boom will actually result in loosening the obstruction by giving
70 the buckets a little additional time for grappling with it. If the obstruction does not yield the machinery is safeguarded by the provision of a safety sprocket indicated at 34 on the head shaft, 12.

75 With reference to Figure 3 it will be noted that the arms 14 are spacing members and that they support none of the weight of the boom. It will further be noted that the links 30 swing about the pivots 31 thus permitting a slight forward and rearward swing of the lower end of the boom and that the horizontal component of force of the downwardly
80 inclined hoisting cable tends to pull the lower end of the boom forward at all times during the digging operation thus urging the boom forwardly against the forward lug on the arm 14 and against the material upon which
85 the buckets on the boom are intended to operate.

90 As the material is excavated by the buckets, 9, it is carried upwardly along the front side of the boom, 7, and is then discharged from the buckets as they pass over the head sprockets on the shaft, 12, being thrown off rearwardly in such discharge clear of the descending side of the digging chain. Upon discharge from the buckets, 9, the material is caught on a "spoil" conveyor which may be
95 of the endless belt or apron variety associated with the ditcher boom at the rear thereof and mounted to travel transversely of the direction in which the tractor chains, 1, advance so as to deliver the material at one side
100 of the ditch. The frame, 35, of the spoil conveyor is slung from the ditcher boom by hanger links, 36 and 37, extending upwardly and convergently in pairs from opposite ends of the frame, 35. This permits the frame, 35,
105 to be swung to extend outwardly from either side of the machine and by reason of the oblique relation of the links, 36 and 37, to each other its outer end will be uppermost at either position of adjustment as indicated in Figure 2. An intermediate horizontal position
110 is possible and may be utilized where the dirt is merely to be piled at one side of the trench but for loading it directly into wagons or trucks the inclined positions are more serviceable. Preferably the links, 37, are
115 pivoted at their upper ends at the axis of a drive shaft, 38, carrying a sprocket, 39, which drives the sprocket, 40, of the spoil conveyor through a suitable chain, 41. The lower pivotal connection of the links, 37, to the frame,
120 35, is sufficiently close to the axis of the sprocket, 40, so that the drive is not disturbed by shifting the position of the spoil conveyor throughout its range of adjustment. The conveyor swings between the downwardly
125 130

traveling buckets, 9, and an outer framing, 42, carrying a guard plate, 43, for confining the material as it falls onto the belt, 44, of the spoil conveyor and thus prevents spillage back into the trench. The framing, 42, carries perforated plates, 45, and one or more members, 46, having a series of elongated apertures or slots is attached to the frame, 35, so that a connecting bolt, 47, may be passed through the registering apertures of the two frames for holding the conveyor at any desired angle of adjustment. The links, 36, are provided with a series of holes near the upper end, and the links, 37, are shown as made in two parts spliced together with a series of holes in the overlapping portions; this permits varying the lengths of both links either for changing the inclination of the spoil carrier, or, in the case of the link, 37, for adjusting it to any variation in the length of the drive chain, such as might occur by stretching of the chain after long use, or upon replacing it with a new one.

In the housing, 48, which encloses the extended end of the head shaft, 12, I provide a pair of bevel gears 49 and 50, which are definitely spaced apart by their hubs for alternative meshing with a bevel pinion, 51, upon the shaft, 38, which carries sprockets, 39, from which the spoil conveyor is driven. As indicated in Figure 7, the gears, 49 and 50, are operatively engaged with the shaft, 12, by means of a key or feather and they are longitudinally slidable thereon within the casing, 48. A spacer, 52, is removably seated on the shaft, 12, having a downwardly open notch to engage the shaft and is maintained in position by the opening in the casing, 48, over which a hinged cover, 53, is mounted. Upon opening the cover, 53, the spacer, 52, may be removed and replaced at the other end of the gears, 49 and 50, after they have been shifted along the shaft, 12, for driving the spoil conveyor in the opposite direction.

For picking up promptly any spillage at the sides of the trench I find it convenient to mount on the radius arms, 14, a pair of scraper blades, 55, which may be pivotally attached at 56 to said arms and positively positioned by clamping bolts, 57, engaging slots, 58, in the arms at a distance from the pivot points, 56. These scraper blades diverging outwardly and rearwardly from the arms, 14, and just back of the upwardly traveling buckets, 9, operate to clean up the edges of the trench by spreading outwardly any material which may spill from the upwardly moving buckets or which may be broken loose at the surface of the ground adjacent the trench.

Means for shifting the carrier frame, 35, from one side to the other or to intermediate positions comprises a winding drum, 60, mounted on the rear of the boom frame and a pair of cables, 61 and 62, leading from said drum, 60, to opposite ends of the frame, 35.

The drum, 60, has an associated worm wheel, 63, and worm gear operated by a hand crank, 64, the pitch of the worm being such as to retain the parts at any desired position of adjustment. The cables, 61 and 62, lead upwardly from the drum, 60, over guide pulleys, 65 and 66, respectively, and thence downward around pulleys horizontally journaled at 67 about which the cables pass to opposite ends of the frame, 35.

I claim:—

1. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, a spoil carrier including a frame mounted adjacent the boom and extending transversely of the path of the digging belt, an endless belt carrier on said frame, and links for the spoil carrier supporting it on the boom with pivotal connections permitting the spoil carrier frame to be swung laterally of the vehicle, the link connections being arranged to carry the side of the spoil carrier frame toward the boom frame in a plane parallel with and proximate to the latter, the proximate parts of the two frames having distributed longitudinally of them respectively, co-operating means for securing the two frames together at the various points at which they lap upon each other in the range of the transverse swinging movement of the spoil carrier frame.

2. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, a spoil carrier including a frame mounted adjacent the boom and extending transversely of the path of the digging belt, an endless belt carrier on said frame, and links for the spoil carrier supporting it on the boom with pivotal connections permitting the spoil carrier frame to be swung laterally of the vehicle, the link supports for the spoil carrier being arranged to cause the side of the spoil carrier frame toward the boom frame to be in a plane parallel with and proximate to the latter, the proximate parts of the two frames having distributed longitudinally of them respectively, co-operating holes for receiving means for securing the two frames together at the various points at which they lap upon each other in the range of the transverse swinging movement of the spoil carrier frame, the said holes upon one of said parts being elongated to insure registration with a hole upon the other part at any selected position of adjustment of the spoil carrier frame.

3. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, a spoil carrier including a frame mounted adjacent the boom and extending transversely of the path of the digging belt, an endless belt carrier on said frame, and links for the spoil carrier supporting it on the boom with pivotal connections permitting the spoil carrier frame to be

swung laterally of the vehicle, the link which supports one end of the spoil carrier frame being adjustable to vary its effective length.

4. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, a spoil carrier including a frame mounted adjacent the boom and extending transversely of the path of the digging belt, an endless belt carrier on said frame, and links for the spoil carrier supporting it on the boom with pivotal connections permitting the spoil carrier frame to be swung laterally of the vehicle, driving means for the digging belt on the boom, comprising a shaft journaled at the upper end of the boom, driving means for the endless belt of the spoil carrier journaled at one end of the spoil carrier frame and gears on the two shafts respectively adapted to be connected for driving the spoil carrier shaft by the digging belt shaft, said gears being adjustable to reverse the direction of driving of the spoil carrier belt at will.

5. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, a spoil carrier including a frame mounted adjacent the boom and transversely of the path of the digging belt with an endless belt carrier on said frame, hanger links for the spoil carrier depending at opposite sides of the path of the digging belt and pivotally attached to the carrier frame adjacent its opposite ends, driving means for the digging belt comprising a shaft journaled at the upper end of the boom, a drive shaft for the spoil carrier at one end of its frame with gearing connecting said shafts, the hanger link at that end of the spoil carrier having its opposite ends pivoted adjacent said shaft for the digging belt and the shaft for the spoil carrier belt respectively.

6. In combination with a vehicle having a frame, a vertically adjustable boom with a digging belt thereon, a radius arm connecting a fulcrum on the vehicle with the upper end of the boom, a cable having one end attached to an elevated point at one side of the frame, a windlass mounted on the frame and to which the other end of the cable is attached, guide pulleys at opposite sides of the boom receiving the cable from the point of anchorage passing it across the boom and delivering it upwardly therefrom to an elevated point at the other side of the frame.

7. In combination with a vehicle having a frame, a vertically adjustable boom with a digging belt thereon, a radius arm connecting a fulcrum on the vehicle with the upper end of the boom, a cable having one end attached to an elevated point at one side of the frame, a windlass mounted on the frame and to which the other end of the cable is attached, guide pulleys at opposite sides of the boom receiving the cable from the point of anchorage passing it across the boom and delivering

it upwardly therefrom to an elevated point at the other side of the frame, a guide pulley at said point over which the cable returns downwardly to the boom, a second pair of pulleys on the boom over which it crosses the latter extending thence upwardly to a pulley on the frame adjacent the point of anchorage and from said pulley to the windlass.

8. In combination with a vehicle, a boom and an endless digging belt carried thereby, a spoil carrier associated with said boom, a shaft journaled in the boom for the digging belt, a shaft journaled in the spoil carrier frame for its belt, a pair of associated oppositely facing bevel gears operatively carried by the shaft on the boom and slidable thereon, a countershaft with a bevel pinion positioned between said gears for meshing alternately therewith, a housing enclosing said bevel gears and pinion and a spacer adapted to be removably lodged on the boom shaft at either end of said associated bevel gears for holding them at either limit of their shifting range, said housing being formed to retain the spacer in position.

9. In combination with a vehicle, a vertically adjustable boom and an endless digging belt carried thereby, radius arms extending from the vehicle and engaging the upper end of the boom, additional radius arms extending from the lower portion of the vehicle with means engaging a lower portion of the boom, said means comprising links pivotally attached to the lower radius arms and normally depending therefrom, the boom having vertical guideways and said links having means engaging said guideways at a distance from their pivotal connection to the radius arms, the boom being carried rearwardly of the vehicle and being thus adapted to yield rearwardly by swinging of the said links upon encountering obstructions.

10. In combination with a vehicle having a frame, a vertically adjustable boom mounted thereon, a radius arm pivotally mounted on the vehicle frame and from the free end of which the boom pivotally depends; a member pivotally connected with the vehicle frame having pivotal and sliding connection with the boom below the pivotal connection of the same with said radius arm for guiding and controlling the position of the lower end of the boom; and a link pivotally connecting the radius arm with said member, the pivot of said link to the radius arm being nearer the fulcrum of the latter than the distance of the pivot of the link to the member from the fulcrum of said member on the vehicle frame.

11. In combination with a vehicle including a frame, a vertically adjustable boom and an endless digging belt carried thereby, means for carrying the boom comprising a radius arm fulcrumed on the frame and pivotally connected to the upper end of the

boom, a member fulcrumed on the frame attached to said boom intermediate its upper and pivotally and slidably connected with the boom below the radius arm, the lower member comprising two arms which extend respectively at opposite sides of the path of the digging belt, and having each mounted upon its lower side, and projecting outward obliquely and rearwardly with respect to the path of advance of the machine, a surface scraper for spreading loose material and smoothing the surface at the margins of the cut made by the digging means.

12. In a ditching machine including a vehicle, a boom, a radius rod pivotally connecting said vehicle with the upper part of said boom, a draft member connected to the lower part of the vehicle and a link pivoted to said draft member and slidably engaging said boom.

13. In a ditching machine including a vehicle, a boom, a radius arm pivoted to said vehicle and to the upper end of said boom, a pair of draft arms attached to the lower part of said vehicle and extending upon opposite sides of said boom, a link pivoted to each draft member and each link having a slidable connection with a side of the boom.

14. In a ditching machine comprising a vehicle, a boom, a radius rod pivotally connecting said vehicle with the upper part of said boom, a draft member connected to a lower part of said vehicle, and a connecting member supported upon said draft member for relative movement thereto and having sliding engagement with said boom.

15. In a ditching machine, including a vehicle, a boom, a radius arm pivotally connecting the upper part of said boom to said vehicle, a lower member connected to said vehicle and slidably engaging said boom and a connection between said radius arm and member for conjoint movement.

16. In a ditching machine including a frame, a boom, a radius rod connecting said frame and boom, a cable anchored at one end to said frame and traversing said boom in two directions for equalizing the pulling effort with respect thereto, a winding drum upon which the free end of said cable is wound, and means for operating said drum.

17. In a ditching machine, a frame, a radius rod pivoted to said frame and extending rearwardly, a boom pivoted to said radius rod, and a hoisting cable extending from said frame in a downward inclined direction and attached intermediate the ends of the boom and effective for maintaining said boom at its work and means including a swingable link having a slidable connection with the boom for connecting said frame and boom.

18. In a ditching machine, a frame, a boom, a radius rod pivotally connecting said frame with the upper part of said boom, means for raising and lowering said boom in a substantially endwise direction comprising a cable

and lower ends and having a horizontal component of force for maintaining the boom at its work and a jointed connection between said frame and boom.

19. In a ditching machine, a truck, a boom, a radius rod pivotally connecting said truck with the upper part of said boom, arms extending from said truck, links pivoted to said arms and slidably pivoted to said boom, and a hoisting cable carried by said truck and extending in an inclined downward direction to said boom and means for attaching said cable to said boom.

20. In a ditching machine embodying a truck, a substantially vertical boom, a radius rod pivotally connecting said boom and truck, a hoisting cable attached to said boom intermediate the ends thereof, and means for supporting and operating said cable at an inclination with a horizontal component of force effective for holding said boom at its work and a flexible link connection between said frame and boom.

21. In a ditching machine, a frame, a radius rod pivoted to said frame and extending rearwardly, a boom pivoted at its upper end to said radius rod, hoisting mechanism for said boom including a cable extending from said frame in a downwardly inclined direction and attached intermediate the ends of the boom and means for spacing the lower portion of said boom from said frame.

22. In a ditching machine, a frame, a boom, a radius rod pivotally connecting said frame with the upper end of said boom, means for raising and lowering the boom in a substantially endwise direction including a cable attached to said boom intermediate its upper and lower ends and having a horizontal component of force acting in a forward direction, and means for spacing the boom from the lower part of said frame.

23. In a ditching machine embodying a truck, a boom having a substantially vertical digging position, a radius rod pivotally connecting said boom and truck, a hoisting cable attached to said boom intermediate the ends thereof, means for supporting and operating said cable at an inclination with a horizontal component of force effective for holding said boom against the wall of the trench to be removed, and means for spacing said boom from the lower part of said truck.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 31st day of March, 1925.

HARRY H. BARBER.