May 12, 1931. R. M. BOWMAN ET AL 1,804,587

EXCAVATOR

Filed Dec. 28, 1926 3 Sheets-Sheet 1

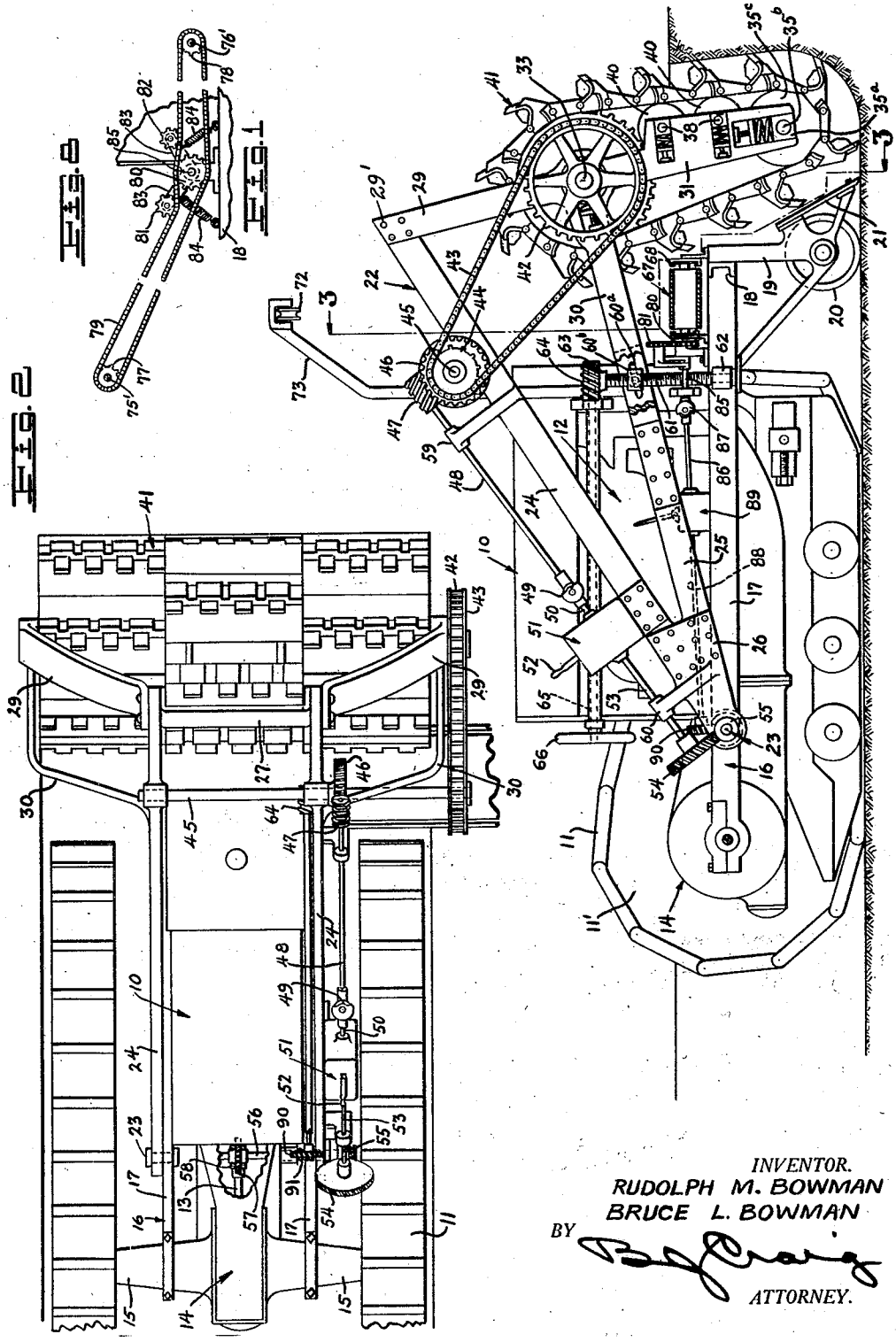

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Fig. 3

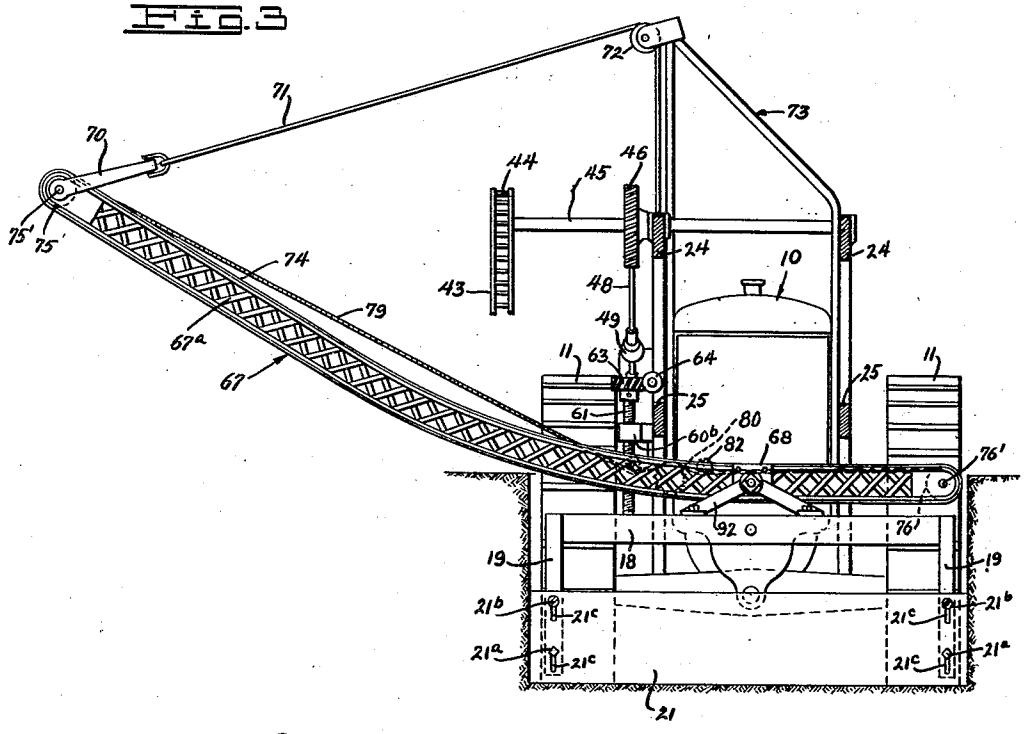


Fig. 4

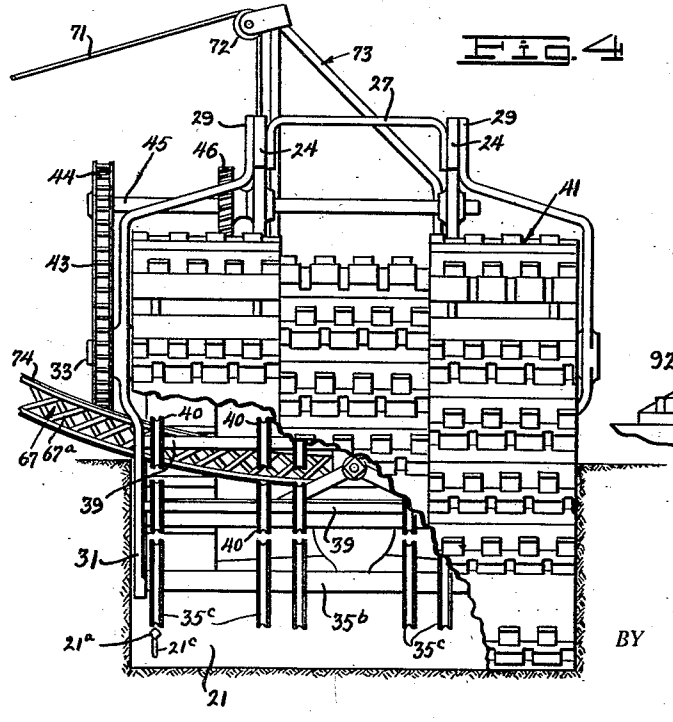
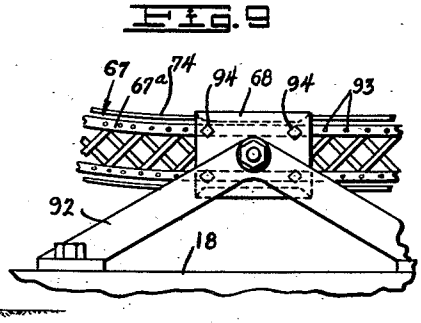


Fig. 9



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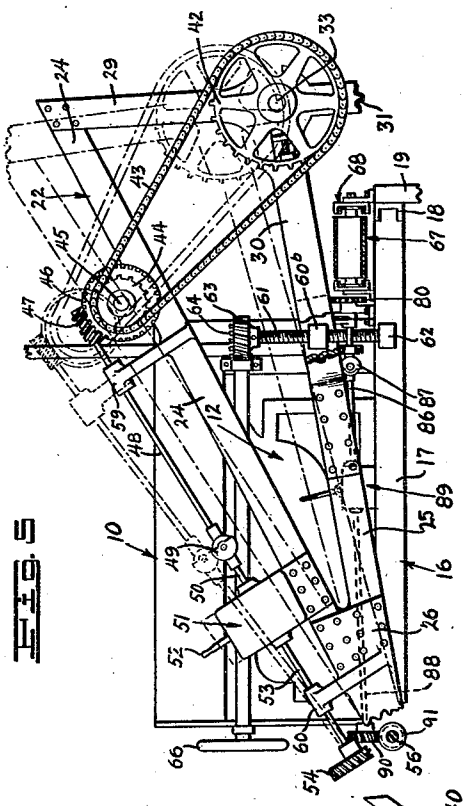

FIG. 5

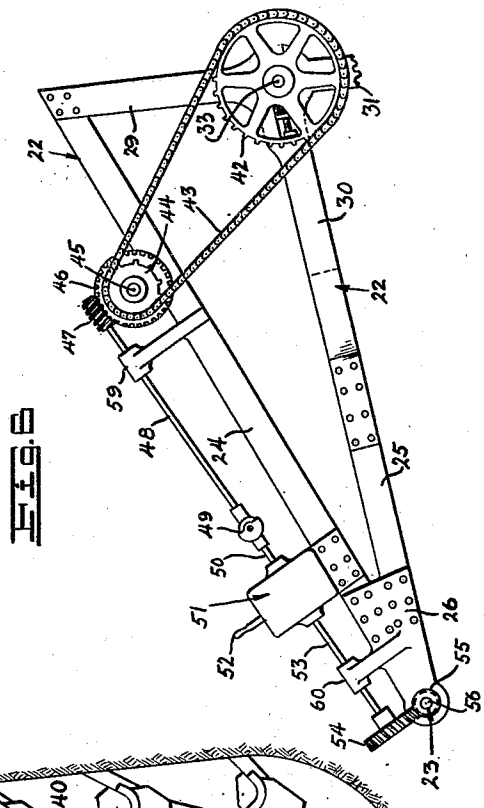

FIG. 6

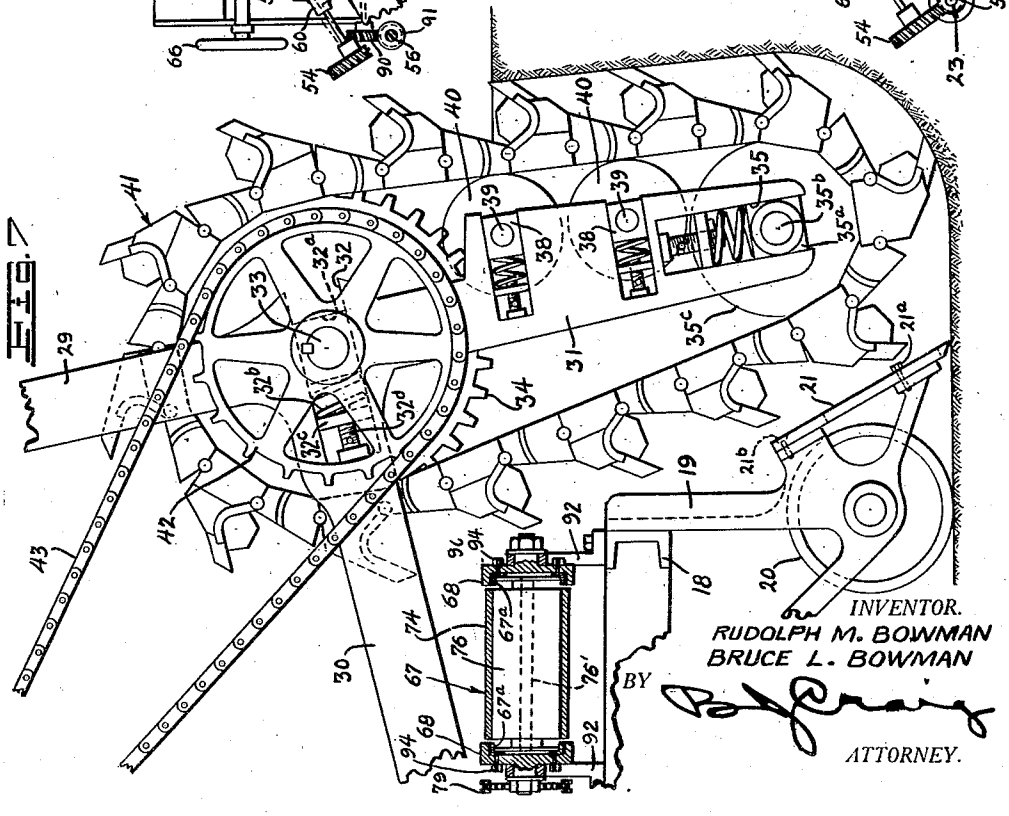

FIG. 7

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Patented May 12, 1931 1,804,587

UNITED STATES PATENT OFFICE

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EXCAVATOR

Application filed December 28, 1926. Serial No. 157,476.

This invention relates to excavators.

The general object of the invention is to provide a novel excavating machine which is particularly adapted for moving said machine to reduce grades.

A specific object of the invention is to provide an improved excavator which can be readily applied to a well known type of tractor.

Another object of our invention is to provide an improved, simple and efficient digging attachment for tractors wherein the digging arrangement and the tractor are driven from a common source of power.

Another object is to provide an improved driving means for an excavator wherein the speed of the working parts may be varied independently of the speed of the vehicle carrying the excavator.

A further object of the invention is to provide an excavator having a conveyor mechanism driven by the same power unit which drives the working member and the vehicle propelling means.

Other objects and advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of a tractor having one of the endless tracks removed to more clearly show the digging attachment.

Fig. 2 is a top plan view of a tractor equipped with my digging attachment.

Fig. 3 is a section taken on line 3—3 of Fig. 1 showing the dirt loading device.

Fig. 4 is a front view of a tractor provided with my digging attachment showing part of the digging devices broken away to more clearly illustrate the invention.

Fig. 5 is a side elevation of the digging attachment frame and a portion of the tractor showing the frame in two positions.

Fig. 6 is a side elevation of the digging attachment frame showing the driving mechanism for the digging apparatus.

Fig. 7 is an enlarged side elevation showing the digging buckets and associated parts.

Fig. 8 is a side elevation of the conveyor drive, and

Fig. 9 is a front face view of the conveyor support.

Referring now to the drawings we have indicated a tractor generally at 10 as having an endless track mechanism 11 of usual form which works over gear wheels 11′ driven by an engine 12, from a shaft 13 (see Fig. 2) through the usual gearing contained in a housing 14. The housing 14 of the tractor includes hubs 15 which extend outwardly from each side thereof.

These hubs support the gear wheels 11′ and a frame 16. The frame 16 comprises side bars 17 joined across the front of the tractor by a front member shown as a channel 18 to which spaced downwardly extending brackets 19 are secured.

These brackets 19 include bearings for a bull wheel or roller 20 which may be of a single length extending transversely of the tractor the full width of the endless tracks 11, or may comprise a plurality of short rollers.

The side brackets also form a support for a scraper plate 21, the function of which will be more fully described hereinafter. The plate 21 is secured to the side brackets 19 by means of bolts 21^a and countersunk screws 21^b and is provided with slots 21^c for allowing of a vertical adjustment of the same (see Fig. 3).

A supporting frame for our improved digging mechanism is shown at 22. Each side of the frame 22 consists of diverging arms 24 and 25 which are joined together adjacent their juncture by a plate 26. The plates 26 are supported on the side bars 17 on shafts 23. The members 24 extend forwardly to a point approximately over the bull wheel 20 and are there connected by a transverse bar 27 (see Fig. 2). The construction is such that the frame may be swung about the axis of the shafts 23.

The lower arms 25 are shorter than the arms 24 and are each connected to the stem 30 of a T-shaped member. The head of this member has an upwardly directed part 29 which is secured to the member 24 by rivets or other means 29′. The other part of the head extends downwardly as at 31 and at

the juncture of each stem 30 with the parts 29 and 31 we provide a slot 32 in which a bearing 32^a is mounted (see Fig. 7). The bearings 32^a are each resiliently engaged by a spring 32^b which in turn engages a plate 32^c which may be advanced along the slot 32 by means of a screw 32^d to support a shaft 33 on which sprockets 34 are mounted.

The lower ends of the parts 31 are slotted as at 35 to slidably receive a bearing 35^a in which a shaft 35^b is mounted. The bearing 35^a may be shifted in the slot 35 by means of an adjusting device similar to that described in connection with the bearing 32^a. The shaft 35^b has three pairs of spaced pulleys 35^c thereon.

Mounted in slots in the downwardly extending parts 31 are other bearings 38 which support shafts 39. These shafts 39 have rollers 40 thereon. The bearings 32^a and 35^a and 38 may all be adjustable and resiliently mounted as previously described.

The endless digging mechanism illustrated includes three sets of spaced chains having digging elements 41 thereon. The chains are arranged so that they pass over the sprockets 34 and over the pulleys 35^c. The particular manner in which the digging elements 41 are mounted on the chains forms no part of the present invention. The chains are engaged by the resiliently mounted rollers 40. Although we show three sets of digging elements it will be understood that the number employed may vary without departing from the features of our invention.

It will be noticed by referring to Fig. 4 that the parts 29 of the supporting member extend outwardly and downwardly on the outside of the digging elements 41, while the downwardly extending parts 31 are bent toward each other just below the shaft 33 so that their lower ends are disposed within the digging mechanism. This arrangement eliminates interference when digging a trench.

For driving the shaft 33 and the bucket drive sprockets 34, we provide a sprocket 42 on the shaft 33. This sprocket 42 is adapted to be driven by a chain 43 from a sprocket 44 secured on a shaft 45 which is arranged to be rotated by a worm wheel 46 thereon. The worm wheel 46 is shown as driven by a worm 47 secured to a shaft 48, which is adapted to be driven through the medium of a universal joint 49 by a shaft 50 of a change speed transmission 51.

The transmission 51 may be of any standard type of heavy duty type which includes a neutral or idle position and is shown as operated by a hand lever 52. The transmission 51 is shown as driven by a shaft 53 which has a worm wheel 54 secured thereon. The worm wheel 54 is driven by a worm 55 secured to a shaft 56. The shaft 56 is coaxial with the shafts 23 and is driven by a worm wheel 57 which is in turn driven by a worm 58 secured to the engine drive shaft 13 (see Fig. 2).

The shaft 48 is shown as supported in a bearing 59 on one of the frame side bars 24 while the shaft 53 is supported in a bearing 60 of the pivot place 26 and the transmission is shown as supported by one of the side bars 24.

As shown in Fig. 5 the frame 22 is movable vertically about the axis of the shafts 23 and to bring about this movement one side bar 25 is provided with a slot 60^a intermediate its length in which a bearing 60^b is slidably mounted.

The bearing 60^b is supported by screw threaded engagement with a threaded shaft 61 which is rotatably supported in a thrust bearing 62 on one of the stationary side bars 17. The shaft 61 has a worm wheel 63 secured thereon which engages a worm 64 secured on a shaft 65. The shaft 65 has a hand wheel 66 secured to its rear end for rotating the same. From the foregoing description it will be apparent that upon rotating the hand wheel 66 the digging mechanism will be raised and lowered and due to the worm gears the mechanism will be maintained in set position.

At the forward end of the tractor and just in the rear of the endless bucket mechanism a conveying mechanism 67 is provided. This mechanism is mounted on a frame 67^a, which is adapted to be moved transversely of the tractor in shoes 68.

The dumping end of the conveyor mechanism is shown as supported by a yoke 70 which is in turn supported by a cable 71 passing over a pulley 72 which is supported by an upwardly extending frame 73 shown as secured to each side of the tractor in any desired manner. This frame is removable and may be shifted to either side when the conveyor 67 is shifted to either side.

The conveyor 67 includes an endless belt 74 and the entire conveyor may be moved so that it delivers the material excavated to either side of the tractor.

The conveyor belt 74 is mounted on rollers 75 and 76 and is adapted to be driven by either roller, depending on which side the excavated material is to be discharged. As shown in the drawings the belt 74 is driven by the roller 75.

The rollers 75 and 76 are mounted on shafts 75′ and 76′ (see Fig. 8) which are supported by the frame 67^a and have sprockets 77 and 78 mounted thereon for driving the same. The sprockets 77 and 78 are adapted to be driven by a sprocket chain 79 which is in turn driven by a sprocket 80. To maintain the sprocket chain 79 in close contact with the sprocket 80 a pair of idling sprockets 81 and 82 are provided. These

sprockets are rotatably mounted on pivoted arms 83. The pivoted arms 83 are each held under tension by attaching one end of a coil spring 84 thereto. The other end of each coil spring 84 is attached to the front member 18 of the frame 16.

The sprocket 80 is adapted to be driven from a shaft 85 which may be driven by a shaft 86 through the medium of a universal joint 87. The shaft 86 is driven by another shaft 88 through the medium of a reversing transmission 89 which may be of any approved type. The shaft 88 has a worm wheel 90 secured thereon and is adapted to be driven by a worm 91 secured to the shaft 56 (see Fig. 2).

To allow the conveying mechanism 67 to be shifted transversely of the tractor we have shown the shoes 68 as pivotally mounted in brackets 92 which are secured to the transverse member 18 of the frame 16. The conveyor frame 67[a] is secured to the shoes 68 by providing a plurality of threaded apertures 93 in the frame 67[a] which are adapted to be engaged by threaded bolts 94 passing through the shoes 68.

When it is desired to shift the conveyor mechanism 67 it is only necessary to remove the bolts 94, shift the conveyor mechanism to the desired position and again secure the frame 67[a] to the shoes 68 with the bolts 94.

From the foregoing description it will be apparent that the tractor engine 12 in addition to driving the tractor is adapted to provide motive power for operating the endless tracks 11, the digging mechanism, and the conveyor mechanism 67, and that the speed of the digging mechanism may be varied independent of the speed of the tractor.

When it is desired to operate our device for digging a shallow trench or for removing dirt and loading the same on a vehicle for transportation, the engine 12 of the tractor is started and the transmission of the tractor is put in gear to cause it to move forwardly, and at the same time the transmission 51 of the digging mechanism is put in gear to cause the digging mechanism to operate. The reversing transmission 89 is also arranged to drive the conveyor belt 74 in the desired direction.

The character of the material being excavated or moved will determine the relative speed of the digging mechanism 41 and the track 11. If a hard substance is being excavated the digging mechanism will be put in high gear and the endless track driving mechanism in low gear. For softer substances the endless track driving mechanism may be put in high gear while the digging device may be slowed down.

As the buckets 40′ of the digging mechanism remove the material they carry it upwardly and over the drive sprocket 36 and discharge the material onto the conveyor mechanism 67 which conveys the same outward and upward to its extreme end, where it is discharged so that it may fall onto the body of a truck which may move beside the digging tractor, or the material may be otherwise disposed of.

If for any reason loose material gathers just in the rear of the lower end of the digging mechanism it will be carried along by the scraper plate 21 and the digging buckets will gather it up and carry it until discharged on the conveyor 67.

If when excavating, the digging buckets run against a relatively immovable object such as large rock, the yieldable bearings 32[a] and 38 allow for a rearward movement of the endless digging mechanism 41, while the bearing 35[a] allows an upward movement of the same. These movements allow the digging buckets to pass by or avoid the interfering object, which may be removed after the tractor has been backed up out of the way.

To lower or raise the digging mechanism 41 controlling the depth of cut or for digging the tractor into a trench or for digging it out when a trench is completed, it is only necessary to rotate the hand wheel one way or the other to cause the frame 23 to either raise or lower the digging mechanism 41.

What we claim is:

1. In combination with a tractor including a body, an engine having an engine drive shaft, and a rear axle housing, a frame fixedly mounted on said rear axle housing, a second frame pivotally mounted on said first frame, means engaging said first frame to move the second frame, said second mentioned frame including an end member, adjustable and resiliently mounted spaced bearings in said end member, a pair of shafts on said bearings, an endless bucket digging mechanism supported on said shafts, means to drive one of said shafts, said means including a change speed transmission, and means to drive said change speed mechanism from said engine drive shaft, a vertically adjusted scraper plate mounted on said first mentioned frame in close proximity to said digging mechanism whereby loose dirt in the rear of said digging mechanism will be moved into the path of the descending portion of said digging mechanism.

2. In combination with a tractor a body including an engine having an engine drive shaft, a rear axle housing, a frame fixedly mounted on said rear axle housing, a roller for supporting the front of the frame, a vertically adjustable scraper plate mounted on said frame in front of said roller, a pair of shafts on said frame, a second frame pivotally mounted on said shafts, a screw jack mounted on said first frame, a nut on

said screw, said nut being mounted on said second frame, said screw having a worm wheel thereon, a worm adapted to rotate said worm wheel, a rearwardly extending shaft on which said worm is arranged, said shaft having a hand wheel secured thereon, said second mentioned frame including an end member, adjustable and resiliently mounted spaced bearings on said end member, a pair of spaced shafts on said bearings, an endless bucket digging mechanism supported on said shafts, a sprocket on one of said shafts, a chain engaging said sprocket, a second sprocket, a shaft for said second sprocket, a worm wheel on said last mentioned shaft, a worm engaging said worm wheel, a rearwardly extending shaft on which said last mentioned worm is supported, a universal joint on said rearwardly extending shaft, another shaft engaging said universal joint, a change speed transmission connected to said shaft, and means to drive said change speed mechanism from said engine drive shaft, and a belt conveyor mechanism for receiving dirt from said digging mechanism.

3. In a digging mechanism including a frame, a pair of spaced upper and a pair of spaced lower bearings on said frame, said bearings being resiliently mounted in said frame, said upper bearings being movable substantially horizontal and said lower bearings being movable substantially vertical, a shaft supported by said lower bearings and another shaft supported by said upper bearings, and an endless digging mechanism supported by said shafts.

4. In a digging mechanism, means for elevating dirt, said means including a frame, a pair of spaced upper and a pair of spaced lower bearings on said frame, said bearings being resiliently mounted in said frame, said upper bearings being movable substantially horizontal and said lower bearings being movable substantially vertical, a shaft supported by said lower bearings and another shaft supported by said upper bearings, a plurality of guide wheels on said lower shaft and a plurality of sprocket wheels on said upper shaft, the diameter of said sprocket wheels being greater than the diameter of the guide wheels, an endless digging mechanism arranged over said sprockets and said guide wheels, said endless digging mechanism being adapted to be driven by said sprockets and means to drive said upper shaft.

5. In a digging mechanism including a frame, a pair of spaced upper and a pair of spaced lower bearings on said frame, said bearings being resiliently mounted in said frame, a shaft supported by said lower bearings and another shaft supported by said upper bearings, a plurality of guide wheels on said lower shaft and a plurality of sprocket wheels on said upper shaft, an endless digging mechanism arranged over said sprockets and said guide wheels, said endless digging mechanism being adapted to be driven by said sprockets and means to drive said upper shaft, a plurality of other guide wheels, said other guide wheels being adapted to engage the back of said digging mechanism and being positioned intermediate said upper sprockets and said lower guide wheels, a shaft for supporting said other guide wheels, and bearings for supporting said shaft, said bearings being resiliently mounted on said frame.

6. In a device of the class described, an endless tread tractor, a frame rigidly secured to said tractor and extending beyond the front of said tractor, a bull wheel adapted to support the front end of said frame, another frame pivotally connected adjacent the rear thereof to said first frame, means at the front of said pivoted frame for supporting an endless digging mechanism, and means on said first frame coacting with means on said pivoted frame for raising or lowering said pivoted frame.

7. In a device of the class described, an endless tread tractor, a frame rigidly secured to said tractor and extending beyond the front of said tractor, a bull wheel adapted to support the front end of said frame, another frame pivotally connected adjacent the rear thereof to said first frame, means at the front of said pivoted frame for supporting an endless digging mechanism, means on said pivoted frame coacting with means on said tractor for driving said digging mechanism, said means on said pivoted frame including a change-speed transmission, and means on said first frame coacting with means on said pivoted frame for raising or lowering said pivoted frame.

In testimony whereof, we hereunto affix our signatures.

RUDOLPH M. BOWMAN.
BRUCE L. BOWMAN.