Feb. 26, 1929. 1,703,320

A. J. PENOTE

TRENCH EXCAVATING MACHINE

Filed Sept. 14, 1925 4 Sheets-Sheet 1

Fig. 1

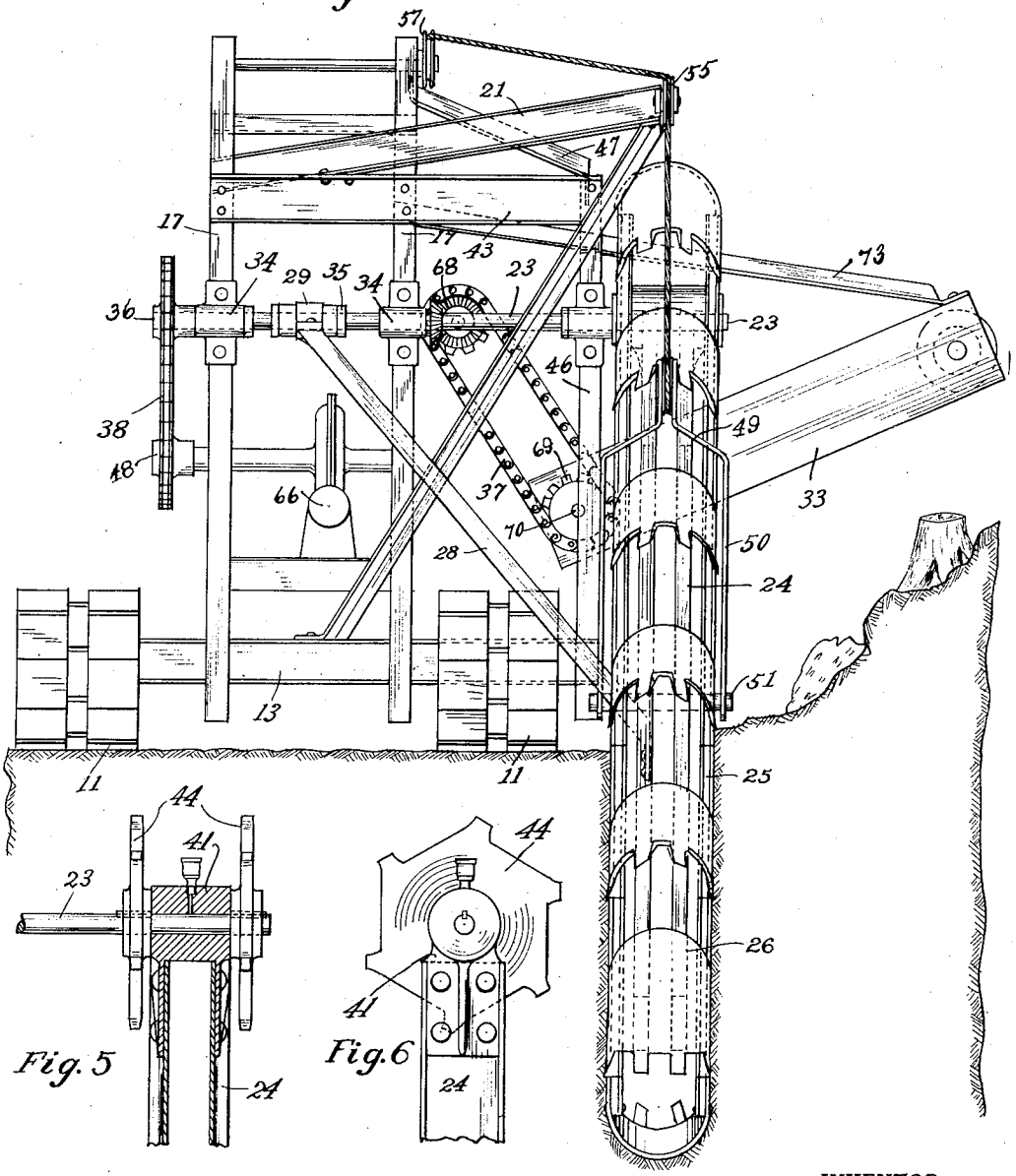

Fig. 5

Fig. 6

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Fig. 2

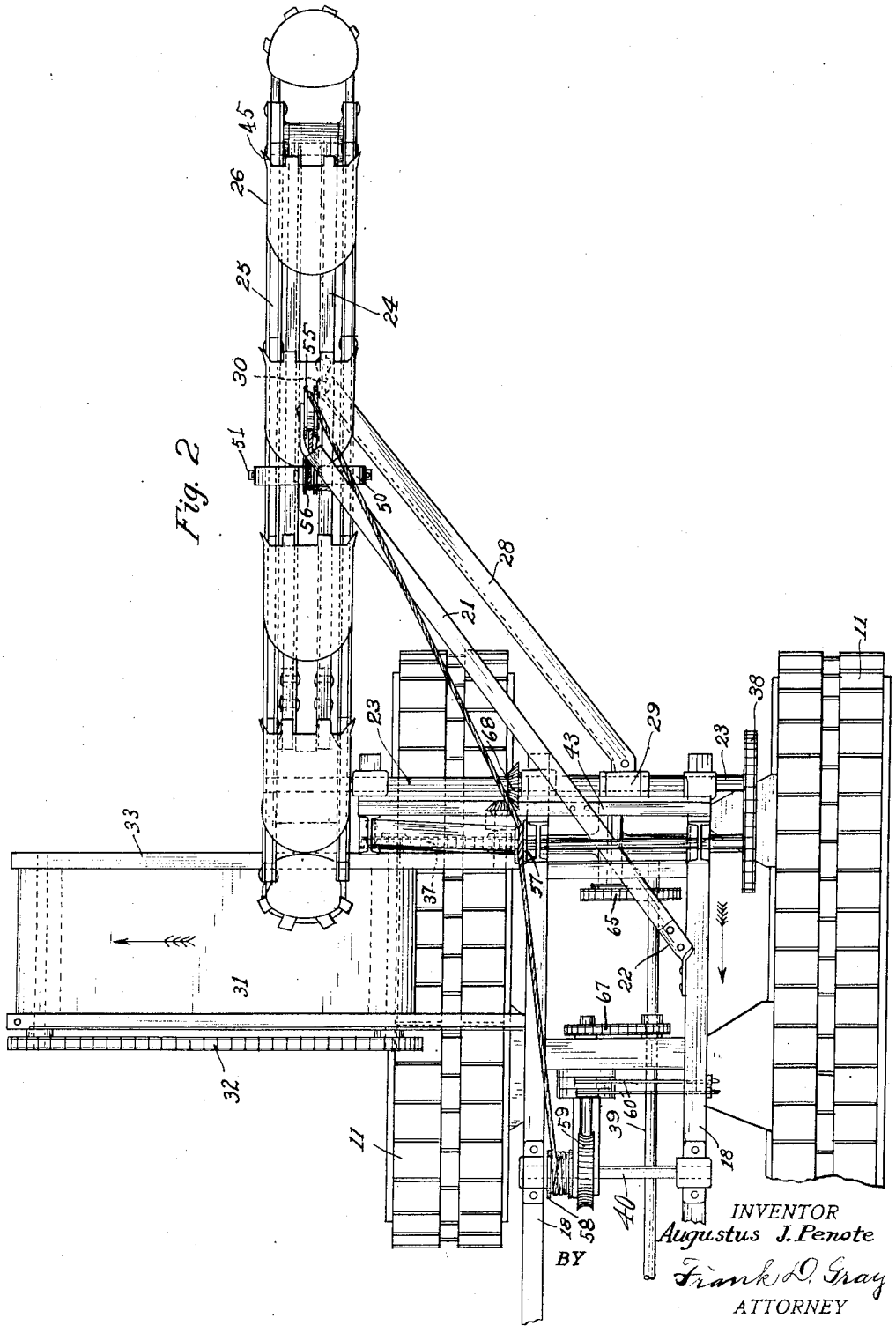

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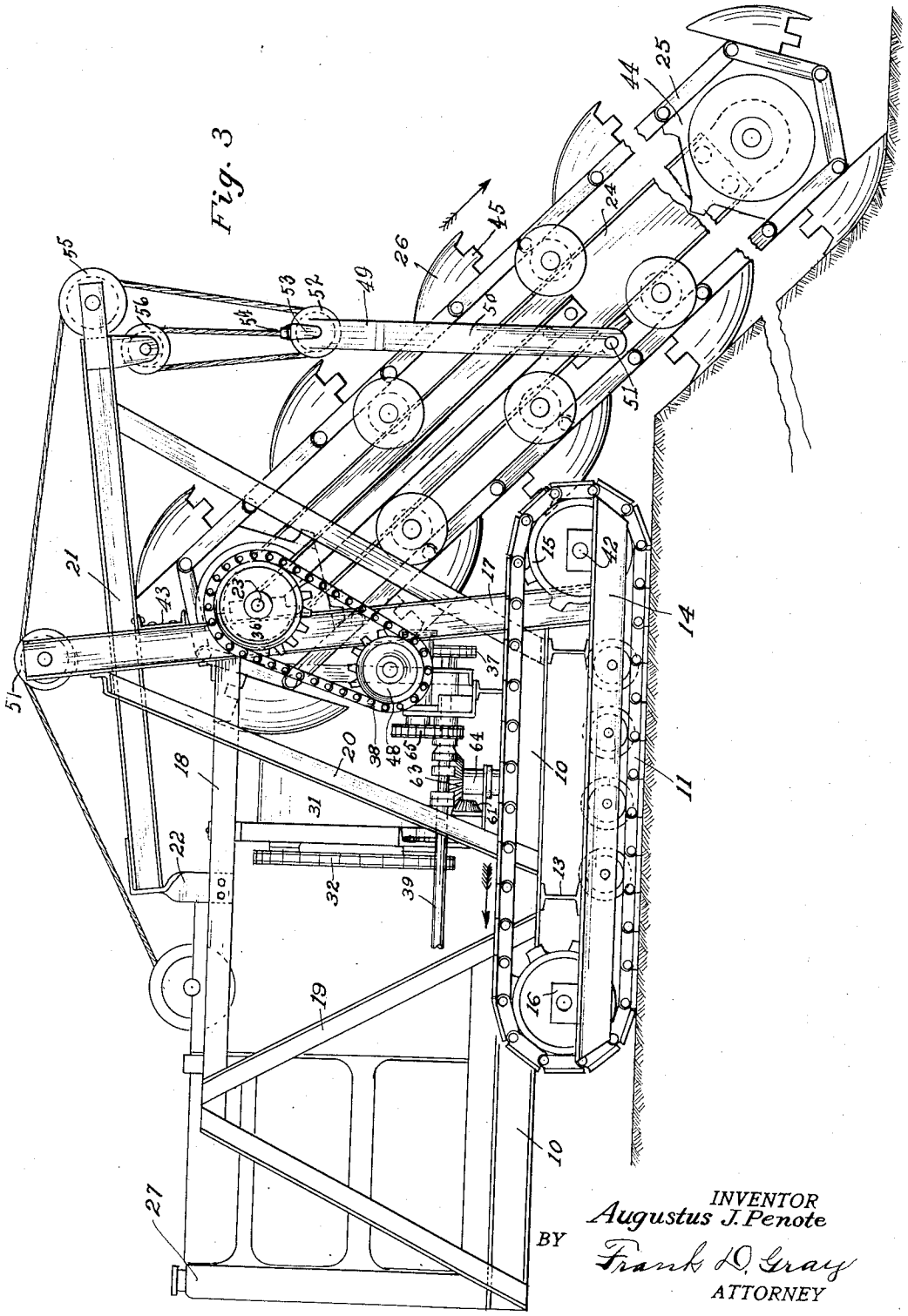
Fig. 3



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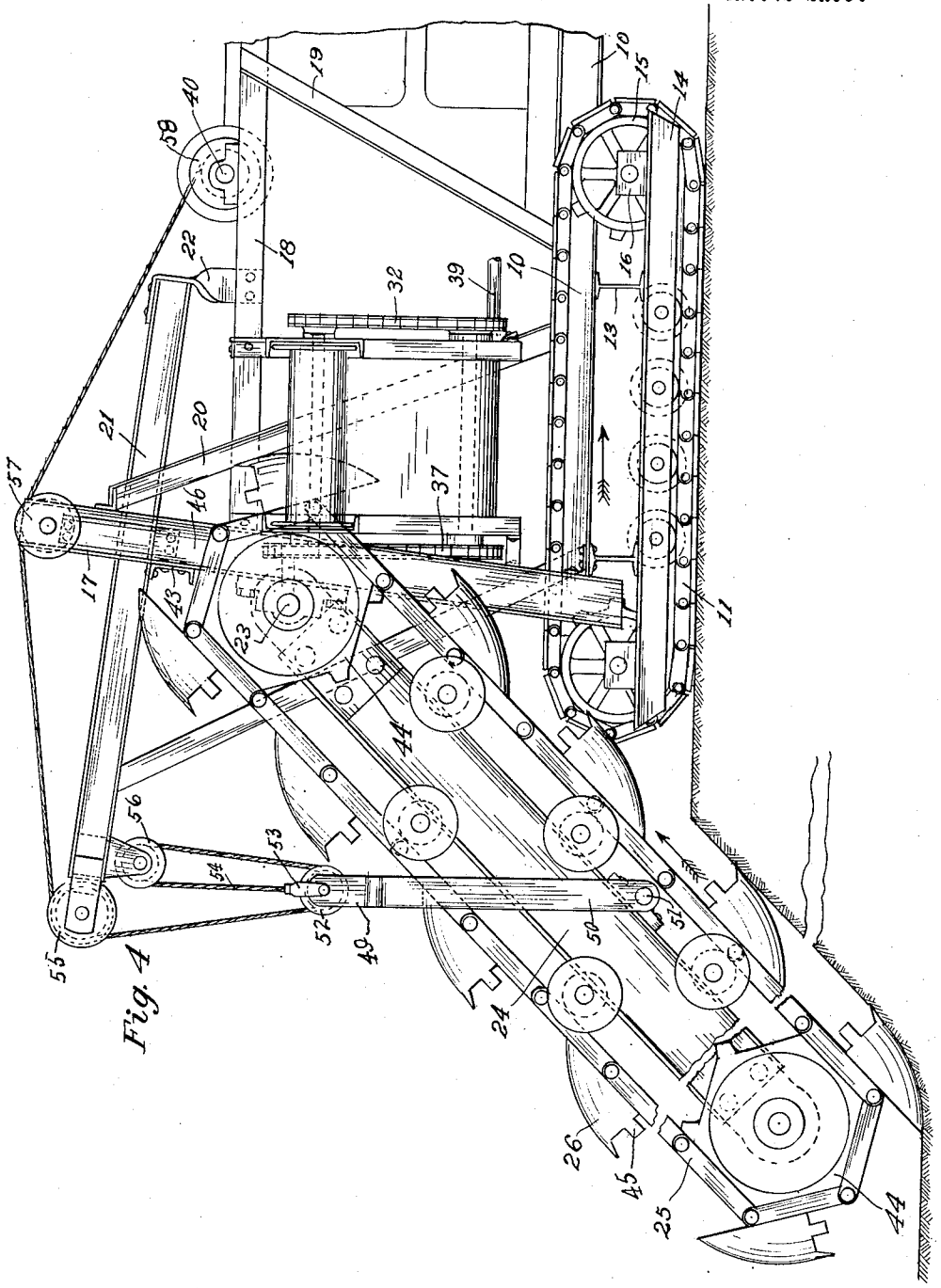

Fig. 4

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UNITED STATES PATENT OFFICE.

AUGUSTUS J. PENOTE, OF CLEVELAND, OHIO.

TRENCH-EXCAVATING MACHINE.

Application filed September 14, 1925. Serial No. 56,226.

This invention refers to improvements in excavating machines and more especially to that type of excavating machines having an endless belt or chain digger adapted to deposit the excavated material on a conveyor working transverse of the machine, and carrying the material to one side of the trench being dug.

An especial object of the invention is to provide a simple economical and efficient excavating machine that shall be relatively light in weight and can be readily and positively guided where desired, either while in operation, or when merely being transferred to another field of operations.

A further object of the invention is to provide an efficient machine for digging trenches, such as drainage trenches, or trenches for receiving sewer or gas mains for laying conduits therein, and it is a further special object of the present invention to provide an excavating machine of the type above described in which the chain excavating mechanism may be supported and actuated in a longitudinal plane wholly at one side of the outline of the machine itself, so that this machine may travel along in the center of a highway at the same time excavating a trench at one side of the main track.

With these and other objects in view, as will appear as the description proceeds, my invention embodies structural features, as described in the specifications, recited in the appended claims, and illustrated in the accompanying drawings in which—

Figure 1 is a rear elevation of my excavating machine shown in operation;

Figure 2 is a plan view of the rear end of this machine;

Figure 3 is a side elevation of the entire machine in operation, certain parts of the chain digger being removed to enable the illustration to be made on a larger scale;

Figure 4 is an elevational view of the machine taken from the side opposite to that of Fig. 3, a portion of the front end of the machine being broken away;

Figure 5 is a diagrammatic showing, in section of the structure for mounting the boom upon the driving shaft, and

Figure 6 is a side view in elevation of the structure shown in Fig. 5.

The body of my machine rests on main longitudinal sill members 10 which are supported upon belt tractors 11 which constitute, preferably, their sole support, there being no separate support for the forward end of the machine, as often thought essential in machines of this kind. Upon a base frame comprising cross bars or beams 13 and longitudinal members 14, the belt tractors 11 are mounted upon the sprockets 15 which latter are in turn mounted on the stub shafts 42 mounted in the bearing blocks 16 on the members 14. Upon said base frame are mounted inclined masts 17 for supporting certain mechanism to be used in the device including pivotal support for the upper and forward end of the belt and chain digger, as will be later more clearly explained.

Near the forward end of the frame, spaced brace members 19 are erected on the sills for supporting and securing in position parallel upper frame pieces 18 which serve to support certain control mechanism for the digger means as well as further brace the masts 17. The forward braces 20 are provided to hold the masts in position, their feet being mounted on sills 10, and an overhanging beam 21 is secured at its front end by an angle connection member 22 to one of the pieces 18, and supported midway its length upon a cross beam 43 secured to both masts and extended over on the conveyor side of the machine and overhanging the digger mechanism for the purpose of providing suitable attaching means for adjustably supporting said mechanism.

As in applicant's Patent No. 1,553,833, issued Sept. 15, 1925, the main frame of the machine is preferably supported solely on the belt tractors to make the machine more easily controlled, both as to steering the same and making possible a great reduction in the total weight of the mechanism, a result of inestimable value, as will be readily appreciated by those expert in the art. As a means of accomplishing this desired result, the frame is made to extend forwardly beyond the front ends of the tractors and the engine 27 is mounted on this overhanging part so that its weight will largely counterbalance the weight of the digger mechanism at the rear end of the machine. The said digger mechanism is mounted on the said masts 17 to swing in a vertical plane, and comprises a boom 24 which extends the length of the mechanism, the said boom comprising two spaced, parallel beams 24 upon the upper ends of which are attached a bearing member 41 having a longitudinal aperture therethrough for the purpose of mounting the same on a drive shaft 23, later to be described. The farther end of the boom

is attached to a similar member through which a pivot pin of suitable length and shape is passed and providing for the rotatable mounting of suitable sprockets 44 on its ends on either side of the bearing member 41. Similar sprockets are mounted on shaft 23 for rotation on either side of the upper member 41, and are keyed to said shaft.

The cutting means of said digger mechanism is more or less conventional, comprising preferably a pair of chains each comprising an endless series of links 25 which are mounted on the sprockets 44, as shown in the drawings, Figs. 3 and 4. On these chains are carried cutting buckets 26 provided with cutting teeth 45 serving to cut the soil away at the bottom of the trench, and carry the material up on the lower side of the boom and empty it into the cross conveyor 33 which latter empties it at one side of the machine and beyond the trench being dug. The sprockets 44 are preferably hexagonal in outline and solid so that they shall have requisite strength to bear the great strains placed upon them. The upper sprockets are driven by the shaft 23, and the lower sprockets are actuated by the digger chains themselves. The rear end of each bucket 26 hugs the carrying links 25 until the bucket reaches the upper end of the mechanism when, the links 25 being carried over the sprockets by the rotation of the latter, the bucket swings on its pivot on the link, the rear end of the bucket swinging away from the chain, and empties its contents of earthy material therefrom to fall into the conveyor 33 below it. In Fig. 3 of the drawings, a bucket is seen in the emptying position, as it is about to pass over the sprockets.

It is a special function of my machine herein disclosed that it is adapted to dig a trench at the side of the machine, thus enabling the operative to guide the machine substantially in the line of a main roadway, at the same time digging a trench at one side where the grade may be rough and possibly elevated. In this latter situation it would be almost impossible to dig such a trench by mechanism operated on a line between the side supporting tractors. To operate my digging mechanism in the manner stated, I have extended the beams 13 through the tractors on the side of the digger mechanism and erected an outer inclined mast 46 upon one of said beams 13, secured the upper end of this mast to the extended end of the cross beam 43, and braced it by a bar 47 attached to one of the main masts, as shown in the drawings.

This side auxiliary frame outside the tractor belts enables me to mount the drive shaft 23 in bearings 34 on the rear edges of the three masts 17 and 46, mount the sprockets 44 on the outer end of shaft 23 as shown and pivot the upper end of the boom 24 on the said shaft 23 between the upper sprockets. On the end of the shaft opposite the boom I mount the drive sprocket 36 and actuate the same from the sprocket 48 by a drive chain 38. The boom and the mechanism carried thereby is braced against undue lateral strains by the brace bar 28 which has an end loop 29 encircling the shaft 23 and held in proper position on said shaft by collars either side of said loop, the collars being prevented from lateral shifting on the shaft by keyed rings 35, as shown in Fig. 1. The opposite end of the brace is riveted or bolted securely to the inner beam 24 of the boom at 30 between the ends of the latter.

Suitable suspension mechanism is provided for adjusting the height to which the outer end of the boom is to be carried. For this purpose a bail 49 or yoke straddles the boom and digger mechanism, and its arms 50 are pivoted to pins 51, and a smaller yoke 53 is pivoted to the bail to which the end of a cable 54 may be attached, as shown in Fig. 3 of the drawings. The bail is suspended from the outer end of the beam 21 by the provision of pulleys pivoted on the latter, one pulley 55 receiving the cable from the pulley 52 and the other pulley 56 pivoted beneath the beam just back of pulley 55. A pulley 57 is also pivoted on the upper end of the intermediate mast 17, and the cable is guided from 55 to 57 and therefrom rearward to a suitable reel 58, mounted on the shaft 40, and which may be actuated by a worm wheel 59 from suitable driving power. Certain control mechanism 60 may be provided for manually determining the desired raising and lowering of the boom and the consequent depth of the trench which results from this adjustment.

The main drive shaft 39 receives its power from the engine 27 by suitable gearing, which latter may well include certain clutch and brake devices which are not shown in detail and, being more or less conventional, are not claimed in this application. A suggestive gearing for the purpose is shown in applicant's Patent No. 1,553,833 before referred to, and it is thought need not be repeated here. It need only be said that the bevel gear 61 driven from shaft 39 by a suitable chain, engages bevel gear 63 and thereby the shaft 64 from which the tractors are actuated. This propels the machine forward and backward, though the details are not shown in this case. It should be said that means are provided for propelling the machine at different speeds.

Chain 65 is provided for driving the worm and gear mechanism 66 by which the gear 36 receives its power, and thereby the chain digger its motion. The reel 58 receives its power from shaft 39 through the chain 67. The transverse conveyor 33 receives its power from shaft 23 through the gears 68, chain 37 and sprocket 69. This conveyor is pivoted for rising and falling motion on the shaft 70 on which said sprocket 69 is mounted, and

comprises the usual conveyor belt 31 running on the usual end rolls having sprockets connected by the sprocket chain 32. The outer end of the conveyor 33 is supported by the brace 73 from the beam 18 so that the excavated material will fall therefrom upon the ground at one side of the trench farthest from the machine, where it accumulates as a raised bank parallel with the trench. The length of this conveyor will determine how far from the machine the bank will be formed.

Operation: My improved excavating machine therefore comprises a vehicular trench digger which by means of its chain digging mechanism may be used for excavating a trench of very great depth, and because of its mounting on the side of the tractors may be utilized to dig a trench in earth of quite different character of formation, surface level and growth on such surface, from the surface of the roadway on which the usual trench digging machine is intended to travel while the machine is in operation. To make the weight of this machine the minimum possible, I have mounted the base frame solely on the tractor belts, extending the digging mechanism to the rear thereof beyond the tractors, and supporting the engine 27 on the front end of the machine frame to counterbalance the weight of the digging mechanism. Having stationed the machine where the trench is to be dug, the rear or outer end of the chain digger is lowered until the lower end of buckets thereon will touch the ground, when the engine having been started forward, the parts 39, 65, 36, 23 and 44 drive the chain digger to cut the material away from the lower side of the boom 24 and carry it up over the conveyor 33 which in turn carries it over and beyond the trench, dumping it on the ground surface, at the same time the parts 39, 61, 62, 63 and 64 are actuated to drive the tractors 11 to propel the machine slowly forward. Whenever the boom and its mechanism needs raising upward for any purpose, such as moving the machine to another position for other work, the parts 39, 67 and 58 are actuated to tighten the cable 54 and thus raise the digging mechanism on the boom, as will be understood. Since the loop 29 can be readily rotated on the shaft 23, the brace 28 will remain effective in any position of the boom on the shaft to which it is pivoted.

Very little has been said in this case about the gearing that may be used in transferring power from the engine 27, itself shown merely diagrammatically, to the various parts. Since reference is made to my patent before referred to, specifically, where much the same type of gearing for braking, clutching, reverse, multiple speed and steering directly by the actuation of the tractors independently, is used, such gearing is not again described in this case. Here the advantages claimed in the other case as to mounting the entire machine solely on the belt tractors, is used, but an entirely different type of digging device is provided, and the manner of mounting and actuating it at the side of the machine is shown and claimed. It is obvious that some changes might be made in minor details of the machine without sacrificing the great advantages sought from this novel and useful mechanism adaptable for side digging the trench, even when the weight of the entire machine is lessened rather than increased.

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

1. A vehicular excavating machine comprising an endless chain digger mechanism, a pair of endless tractor belts being its sole support, a base frame between said tractor belts, cross bars binding the base frame together laterally and one of said cross bars extending laterally through one of said endless belts outward between the spans of the belt said cross bar extension serving as support for said mechanism, a source of power mounted on said base frame, and actuating means connecting said mechanism with said power source.

2. A vehicular excavating machine comprising an endless chain digger mechanism, a pair of spaced endless tractor belts being its sole support, a motor mounted on said machine, a supporting frame mounted between said tractor belts and including cross bars one of which extends laterally through one of said endless belts outward between the spans thereof, the outward extension of said cross bar supporting the said digger mechanism for pivotal movement in a vertical plane parallel with the belt, driving connections between said motor and said belts for actuating the latter, driving connections from said motor for actuating the said digger mechanism, and actuating means connected with said motor for swinging the said digger mechanism on its pivot at will.

3. An excavating machine comprising a vehicular frame including laterally-spaced endless tractor belts, a plurality of supporting masts erected in said frame, certain of said masts being within and one of them laterally outside the outline of the frame, a drive shaft mounted to rotate in bearings on said masts and extending laterally beyond the outline of the frame bounded by the said tractor belts, a source of power mounted on one end of said frame, cross bars fixedly binding the parts of said frame between said belts and one of said cross bars extending laterally through one of said endless belts outward between the spans of the belt to a point adjacent the lower end of the said outside mast, the latter and the intermediate

masts being in the same plane, driving connections between the said source of power and said drive shaft, an endless chain digger mechanism, a boom for mounting said digger mechanism pivotally upon the extended end of said drive shaft, and actuating means connected with said power source for adjusting the said boom at will pivotally upon said shaft end.

4. An excavatng machine comprising a vehicular frame including laterally-spaced endless tractor belts which are the sole support of the machine, and a base frame including longitudinal members parallel with the belts and cross bars connecting the spaced longitudinal members, the said vehicular frame extending forward of the tractor belts to serve as a support for a driving motor, an endless chain digger mechanism, a driving shaft for actuating the digger mechanism, the rear cross bar extending laterally through one of such endless belts outward between the spans of the belt, to serve as a support, spaced masts mounted intermediate said tractor belts upon said base frame, and a mast mounted on said extended end of the rear cross bar and in a common plane with the intermediate masts, the said driving shaft supported on said masts and one end extending laterally beyond the outer mast, means for pivoting the chain digger mechanism on said laterally-extended end of the driving shaft, and actuating means connected with said driving motor for rotating said shaft.

In testimony whereof I hereunto affix my signature.

AUGUSTUS J. PENOTE.