

Aug. 11, 1953

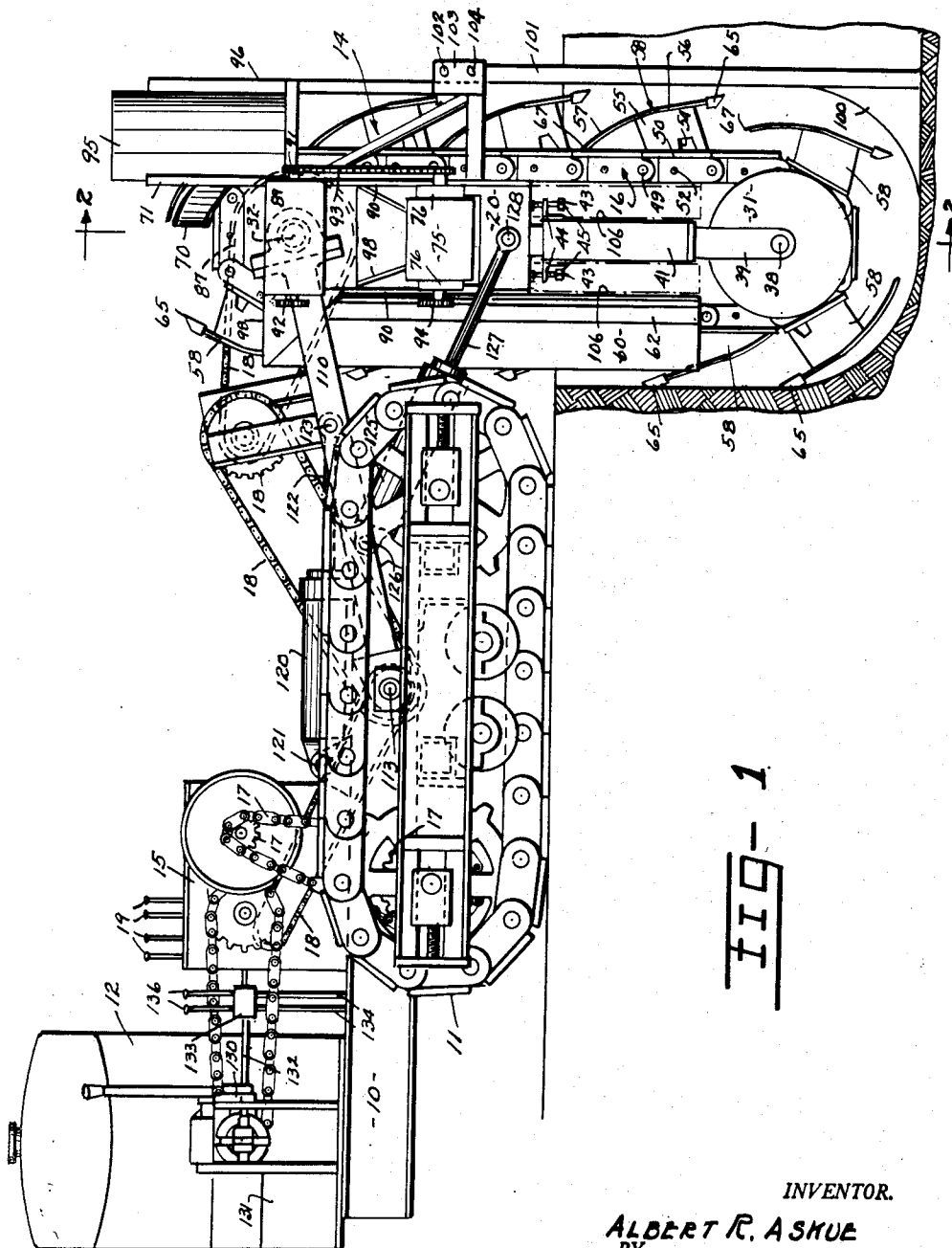
A. R. ASKUE

2,648,145

ENDLESS BUCKET CHAIN STRUCTURE FOR TRENCHING MACHINES

Filed May 25, 1950

4 Sheets-Sheet 1



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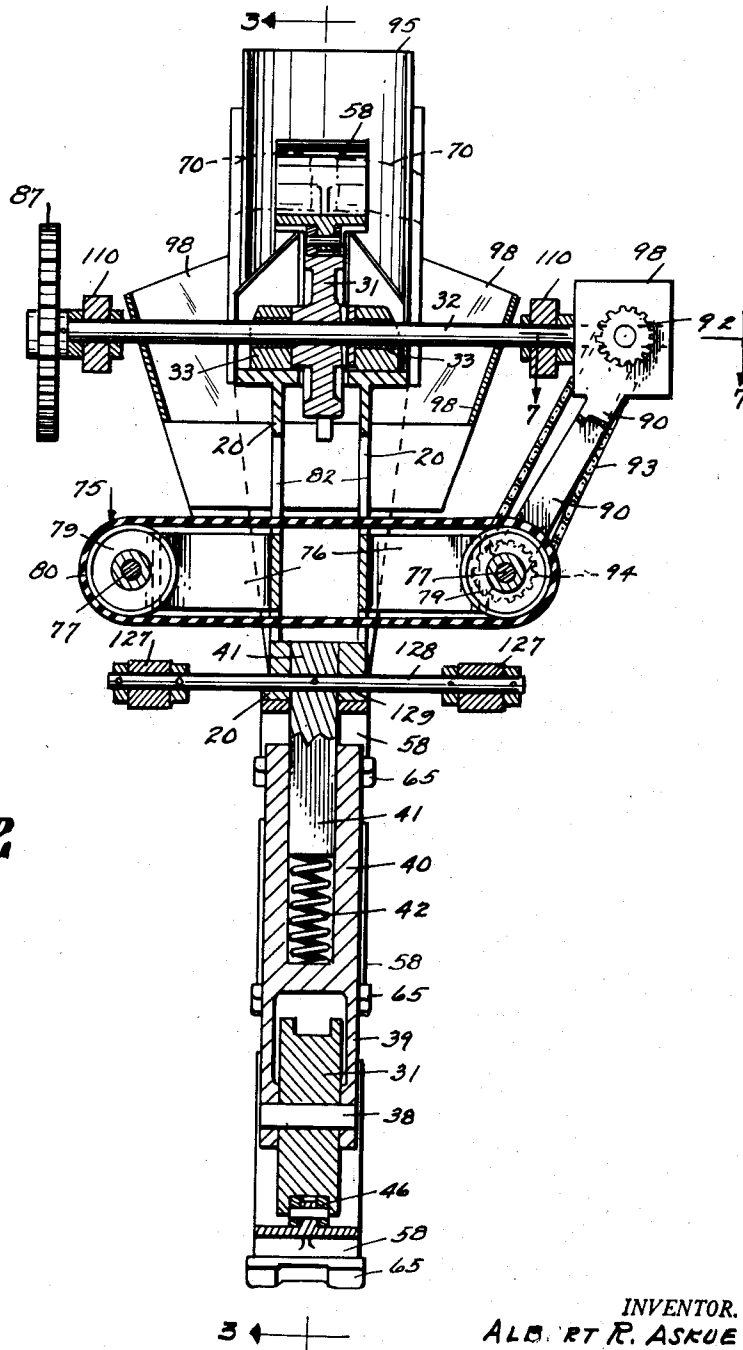
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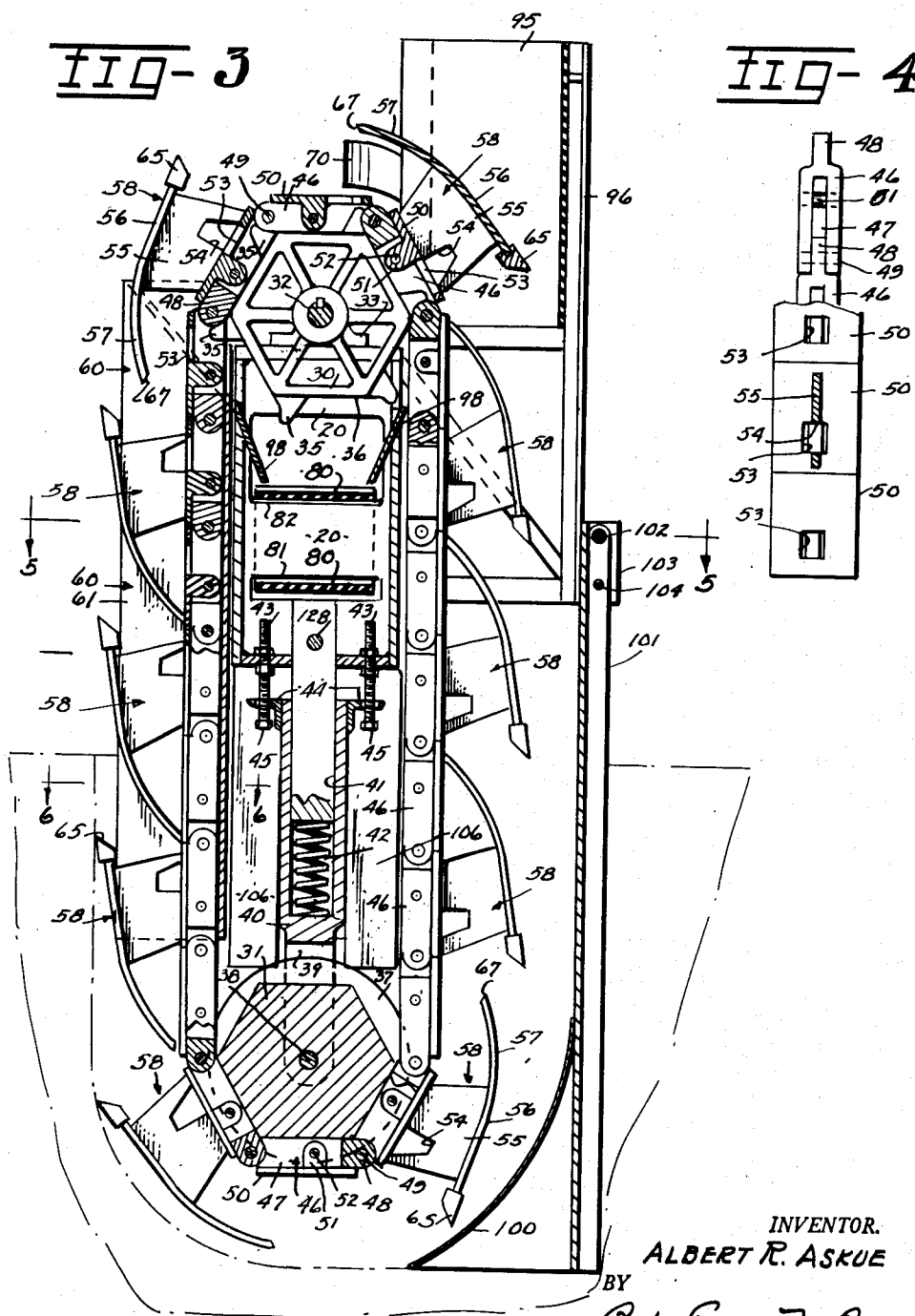
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ENDLESS BUCKET CHAIN STRUCTURE FOR TRENCHING MACHINES

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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

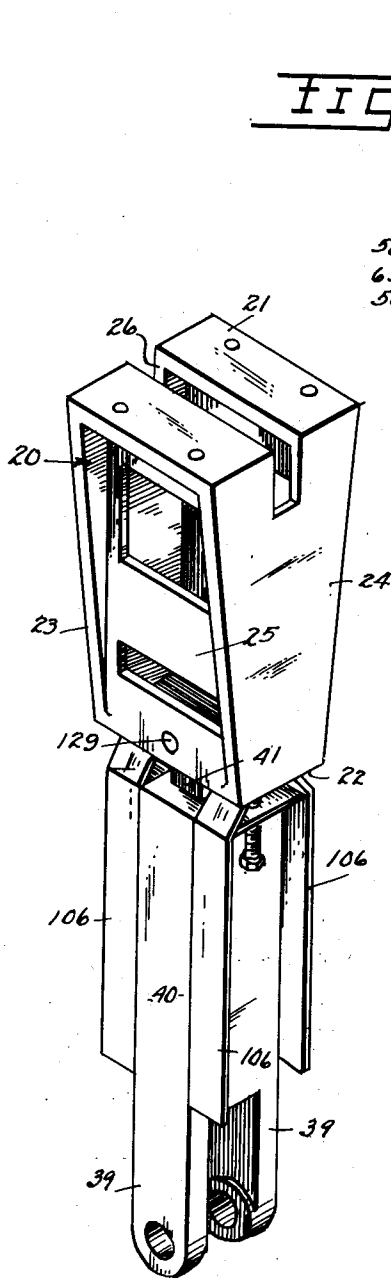


FIG-8

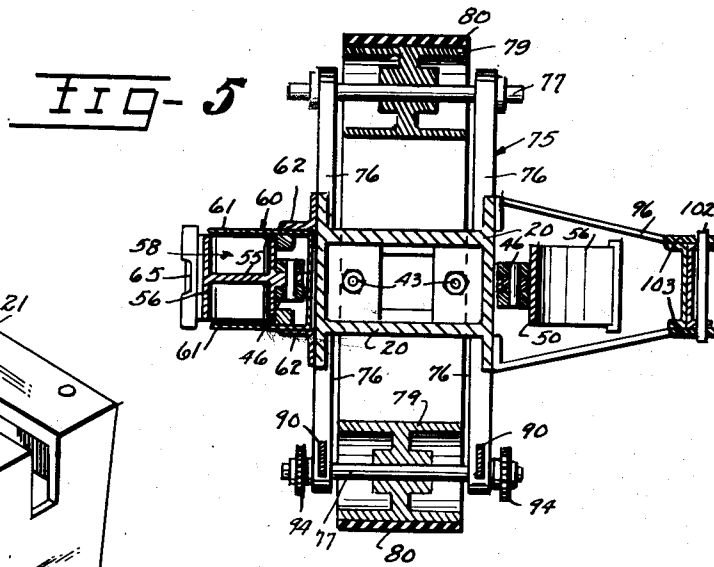
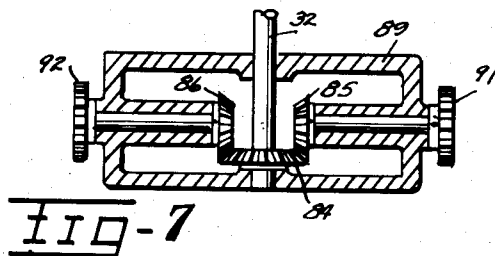


FIG-7

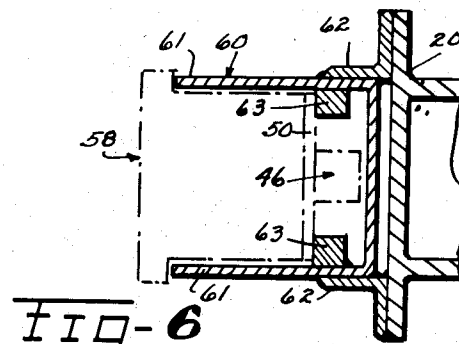


FIG-6

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ENDLESS BUCKET CHAIN STRUCTURE FOR
TRENCHING MACHINES

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Application May 25, 1950, Serial No. 164,241

2 Claims. (Cl. 37—192)

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This application is a continuation in part of my copending application filed April 13, 1949 and assigned Serial No. 87,217.

The present invention relates to improvements in trench excavating machines. The invention is especially concerned with the provision of an improved excavating unit to facilitate the construction of a light weight excavating machine which may be used to advantage in connection with the excavation of trenches for public utility service lines, i. e., for excavating trenches between the curb and dwellings to enable the laying of underground gas, water, or sewer service lines, and the like. These, accordingly, are the general objects of the present invention.

A more specific object of the invention is the provision of an improved, compact excavating unit for a trenching machine which will facilitate the construction of a small light weight machine, which unit will be exceedingly rugged, and capable of efficient operation at relatively high speeds and under substantially all types of soil conditions.

Other objects and advantages of the invention will become more apparent from the following description, reference being had to the accompanying drawings in which a preferred embodiment of the invention is illustrated. The essential novel features of the invention will be summarized in the claims.

In the drawings, Fig. 1 is a side elevation of an excavating machine illustrating the improved excavating unit in position for digging a trench; Fig. 2 is an enlarged vertical transverse section through the excavating unit, the plane of which is indicated by the lines 2—2 on Fig. 1; Fig. 3 is an enlarged, vertical longitudinal section taken through the excavating unit, the plane of the section being indicated by the lines 3—3 on Fig. 2; Figs. 4, 5 and 6 are sectional details of the excavating unit, the planes of the sections being indicated by the correspondingly numbered lines on Fig. 3; Fig. 7 is a sectional detail of a portion of a conveyor drive mechanism, the plane of the section being indicated by the lines 7—7 on Fig. 2; and Fig. 8 is a perspective view of the excavating unit frame.

The improved excavating unit has been illustrated in connection with the excavating machine of my copending application heretofore referred to. Briefly, this machine comprises a main frame 10 supported by a pair of tractor belts or crawlers, one of which is shown at 11.

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A power unit or motor 12 is mounted on the frame 10 and is connected to drive the crawlers 11 and the improved excavating unit which is generally indicated at 14.

The motor 12 drives a speed control and clutch unit 15. This unit is connected with the crawlers 11 by drive chains and sprocket wheels generally indicated at 17, and is connected with the excavating unit 14 by drive chains and sprocket wheels generally indicated at 18. Suitable levers 19 are provided to permit manual control of the unit 15.

The improved excavating unit 14, with which the present invention is particularly concerned, is mounted on the frame 10 rearwardly of the tractor belts, and is arranged to be selectively positioned for the excavation of trenches of various depths, or to be raised out of the ground to an idle position. The excavating unit 14 is mounted at the rear end of the machine and is of the ladder type. This unit includes a pair of vertically spaced rotatable members about which an endless excavating belt or chain 16 is looped. The chain 14 is provided with a series of excavating buckets 58 as will be hereinafter more fully described. The improved excavating unit 16 includes a main frame 20, which, as shown in Figs. 2, 3, 5 and 8, comprises a substantially vertically extending rectangular box-like structure having top and bottom walls 21 and 22, front and rear walls 23 and 24, and spaced vertically extending side walls 25.

The excavator chain 16, at its upper end, is looped about a sprocket wheel 30, and at its lower end, about a supporting member 31. The sprocket wheel 30 is drivingly secured to a shaft 32 journaled in bearings 33 which are secured to the top wall 21 of the frame 20. The bearings 33 are positioned to either side of a longitudinally extending slot 26 formed in the top wall 21 of this frame, and into which the sprocket wheel 30 projects. The periphery of the sprocket wheel 30 is substantially hexagonal and each of its peripheral faces 36 is provided with an outwardly extending lug 35. These lugs are positioned at the forward end of their respective sprocket faces 36 and are narrower than such faces so as to enter between forks 47 of interconnected links 46 which form the excavating chain 16, as will be hereinafter more fully described.

The lower chain supporting member 31 comprises a hexagonal surfaced member similar in size and contour to that of the sprocket wheel 30, and which engages the links 46 of the chain

16 as shown in Fig. 3. This member has no chain engaging teeth, but is provided with a pair of integrally formed side flanges 37 which embrace and retain the chain in position thereon. The member 31 is journaled on a spindle 38 carried by the forked lower end 39 of a rectangular post 40. The upper end of this post telescopically embraces the lower end of a correspondingly shaped downwardly extending post 41, the upper end of which is secured to the frame 20.

The excavator chain 16 is maintained in taut condition by a coil spring 42 which is interposed between the telescoping posts 40 and 41 as shown in Fig. 3. Suitable stay bolts 43 are secured to and extend downward from the frame 20, and pass freely through openings in lip-like formations 44 carried by the upper end of the telescoping post 40. These bolts have heads 45 which, should the chain 16 break, would prevent excessive downward movement of the lower chain supporting member 31.

The excavator chain 16 is best shown in Figs. 3 and 4 and forms the subject matter of my copending application for Letters Patent filed May 25, 1950, and assigned Serial No. 164,242. As illustrated, it will be seen that this chain comprises a series of pivotally interconnected links 46. Each link is forked at one end as at 47 and its other end comprises a tongue 48 arranged to enter the forked end 47 of the next succeeding link and be pivotally connected thereto by a pin 49. A flat rectangular plate 50 is secured to each chain link 46 by a pin 52 which extends through the respective link and a lug 51 projecting inwardly from the plate. The plates 50 on the stretches of the chain between the two supporting members 30 and 31 form a substantially continuous surface, the width of which is slightly less than the width of trench to be excavated. Each plate 50 is provided with a rectangular opening 53 which, as the links 46 pass over the sprocket wheel 30, is substantially in alignment with the tooth or lug 37 thereof. Thus any accumulation of excavated material may be forced outward through such openings by the sprocket wheel lugs, thereby preventing damage to the chain.

In the embodiment shown, every other plate 50 carries an excavator bucket 58. Each alternate plate is provided with a centrally located outwardly projecting web 55. These webs are parallel with the chain and extend outward at right angles to the surface of the plates 50. Each web 55 carries on its outer edge a plate 56 of substantially the same width as the plates 50. These plates 56 extend rearwardly from their respective links and curve inwardly as at 57, terminating relatively close to the far end of the plate 50 of the next succeeding chain link 46. Accordingly, the plates 56 form front or spade portions of the excavating buckets 58. The back of the buckets are formed by the plate 50 of the respective chain link and the plate 50 of the next succeeding chain link, the latter being overhung by such spade portion 57. Each web 55 has an opening 54 to permit substantially unrestricted passage of material through the plate opening 53 as heretofore described.

The side walls of the buckets are formed by a relatively stationary, elongated channel shaped trough 60 which is carried by the excavator frame 50 as shown in Figs. 3 and 6. The trough 60 extends vertically from a horizontal plane relatively close to the lower chain supporting member 31 to a horizontal plane slightly above the

axis of the sprocket wheel 30. The trough 60 is secured to vertically extending spaced angle members 62 carried by the frame 20. The forward stretch of the excavating chain 16 rides in this trough, the side walls 61 of which extend forward substantially to the outermost edge of the buckets 58, thereby closing the sides of the buckets 58 at the forward stretch of the excavator chain.

The trench is excavated wide enough to clear a path for the trough 60. To this end the forward edge of the spade-like member 56 of each bucket 58 is provided with a rooter or cutter 65. To this end these cutters extend forwardly of and project to either side of the side walls 61 of the trough 60. Consequently upon the rotation of the chain in the direction of the arrow in Fig. 3 accompanied by forward movement of the machine, dirt is removed from the trench and carried upward in the trough 60 to the upper end of the excavator unit where it is discharged onto a conveyor 75.

Inward flexing or bending of the forward stretch of the excavating chain is prevented by a pair of bearing bars or rails 63. As shown in Fig. 6, a bar 63 is secured to the inner surface of each side wall 61 of the trough 60. These bars extend substantially the entire length of the trough and are engaged by the inner face of the chain-plates 50.

As the buckets 58 pass around the sprocket wheel 30, the rearmost edge 67 of the plates 56 thereof are separated from the plate 50 of the next succeeding chain link, thus opening the bucket. While the buckets are so opened, a pair of relatively stationary scraper or cleaner members 70 remove any material tending to adhere to the surfaces of the bucket.

The cleaner members 70 are shown as being secured to respective brackets 71 which project upwardly from the frame 20 at either side of the chain 16. As indicated in Figs. 1 and 2, the cleaners 70 extend inward from opposite sides toward the bucket webs 55 and between the plates 56 and 50 which form the front and rear walls of the buckets. Any excavated material which tends to adhere to the walls of the bucket is forced outward along the surfaces of these cleaners and is discharged to either side of the frame structure 50. This discharged material, together with that discharged by gravity, falls onto a conveyor 75 which ejects the material from the machine.

The conveyor 75 is best illustrated in Figs. 2 and 5. Each side of excavator frame 20 is provided with a pair of spaced outwardly extending arms or brackets 76. A spindle 77 is journaled in the outer end of each pair of arms 76. Each spindle carries a drum 79 which coacts to support a conveyor belt 80. This belt comprises an elongated strip of flexible material, the ends of which are secured together as by lacing or the like, and which is looped about the spaced drums 79. The lower stretch of the belt 80 extends through aligned openings 81 formed in the side walls 25 and 26 of the frame 20, while its upper stretch passes through the lower portion of enlarged openings 82 in such walls. Consequently, excavated material falling onto the conveyor belt 80 will be discharged from the machine by the movement of such belt and thrown to either side of the trench, dependent upon the direction of such movement.

The conveyor 75 is driven by a drive chain 18 heretofore mentioned and which drives the

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sprocket wheel shaft 32 of the excavator unit. As shown in Figs. 3 and 7, the shaft 32 extends some distance to either side of the excavator structure and on one end thereof carries a sprocket 87 which is driven by a drive chain 18. A beveled gear 84 is mounted on the other end of the shaft 32 and drives beveled pinions 85 and 86, carried by respective shafts 87 and 88. These shafts are journaled in a housing 89 supported by a pair of arms 90 which are carried by the brackets 76. The shafts 87 and 88 each project to the exterior of the housing 89 and are provided with respective sprocket wheels 91 and 92. These sprocket wheels are driven in opposite directions and may be selectively connected with the adjacent conveyor spindle 77 by a removable drive chain 93 which couples the selected sprocket wheel with one of a pair of sprocket wheels 94 mounted on such conveyor shaft.

The excavated material discharged by the buckets is directed toward the conveyor 75 by a hopper-like formation 98 carried by the frame and provided with downwardly projecting, transversely extending lip formations 99 which converge inwardly toward the longitudinal edges of the conveyor belt 80 and retain the discharged material on the belt.

Suitable shield plates 106 (Fig. 8) project downward from the bottom of the excavator frame 50 toward the lower chain supporting member 31 and serve to prevent inadvertent lodging of excavated material on the surface of such chain supporting member, or on the inner surfaces of the excavator chain links.

Overthrow of the excavated material is prevented by a U-shaped shield 95 mounted on structural members 96 carried by the excavator frame 30. This shield may be made of rubber belting which has been found to be exceedingly durable when so used. The shield 90 deflects overthrown material downward to a curved cleaner member or crumbling shoe 100. This shoe is substantially the same width as the trench and is carried by a downwardly depending channel 101 which extends substantially to the bottom of the trench. This shoe diverts the overthrown material forward where it is picked up by the excavator buckets as they pass around the lower member 31, thereby providing a trench substantially free from loose material.

The cleaner 100 is pivotally connected to the frame structure 96 at a point above the trench so that, should it strike an obstruction, it will pivot rearwardly and upwardly without damage to the structure. As illustrated, a pivot pin 102 passes through the webs of the channel 101 and rearwardly extending lips 103 formed on the frame members 96. The cleaner is normally retained in an active position by a frangible pin 104 which may extend through the webs of the channel 101 and the lips 103 some distance below the pivot pin 102.

The excavating unit 14 is raised and lowered in accord with the desired depth of trench to be excavated and the long stretches of the excavating chain 16 are maintained substantially vertical throughout the entire digging range of the unit. The mechanism for accomplishing this forms the subject of my copending application Serial No. 87,217, heretofore referred to. Briefly, the excavating unit 14 is pivotally mounted on one end of a boom 110 comprising a pair of rigid elongated spaced arms interconnected intermediate their ends by suitable cross members. The shaft 75

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32 has been formed to provide a suitable pivotal connection and, as illustrated, is rotatably mounted in the outermost ends of the boom arms. The inner end of the boom 110 is pivotally mounted on a transversely extending shaft 113 mounted on the frame 10.

The boom 110 is rocked about the axis of its pivot shaft and retained in an adjusted position by a hydraulic unit comprising a hydraulic cylinder 120, pivoted to the frame as at 121 and provided with a piston 122, the outer end of which is pivotally connected with the boom 110 as at 123.

The excavating unit 14 is rocked about the axis of the shaft 32 and is retained in its adjusted position by a hydraulic unit comprising a cylinder 125 pivoted to the boom as at 126 and provided with a piston 127, the outer end of which is pivotally connected to a shaft or rod 128 mounted in a transverse opening 129 in the excavator frame 20.

The motor 12 operates a pump 130 which provides the source of the power for the hydraulic cylinders 120 and 125. This pump withdraws fluid from a reservoir 131, mounted on the main frame 10, and forces such fluid under pressure through a conduit 132 to a manually operable control valve mechanism 133 and thence through suitable independent conduits 134 to the cylinders 120 and 125. The flow of fluid to and from the respective unit cylinders is controlled by the manipulation of manually operable valve levers 136 which selectively actuate the valve 133.

From the foregoing it will be seen that this invention provides an improved excavating unit for trenching machines, which unit is comparatively small, compact, of light weight, exceedingly rugged, and which will permit the excavation of comparatively narrow trenches at relatively high rates of speed.

I claim:

1. An excavator chain support and guide for a trenching machine, said support and guide comprising an elongated substantially rectangular vertically extending hollow frame, a rectangular post extending downward therefrom, a hollow rectangular frame extension, a spring in said extension and interposed between the extension and the post, means to limit the movement of the frame, a wheel rotatably mounted at the top of said hollow frame, a second wheel mounted at the bottom of said frame extension, an endless excavator chain looped about said wheels and said frame, an elongated vertically extending channel secured to one side of said frame and having a web portion disposed between one stretch of said chain and said frame and extending substantially from one wheel to the other, said channel having a pair of spaced outwardly extending side flanges embracing the buckets of said chain, and a pair of spaced guide rails mounted on said channel and extending throughout its entire length to form a rigid guideway along which the chain slides to prevent buckling of the chain.

2. An excavator chain support and guide for a trenching machine, said support and guide comprising an elongated substantially rectangular vertically extending hollow frame, a rectangular post extending downward therefrom, a hollow rectangular frame extension, a spring in said extension and interposed between the extension and the post, means to limit the movement of the extension relative to said post, a wheel mounted at the top of the frame, a second wheel

mounted at the bottom of said frame extension, an endless excavator chain including a chain comprising a series of pivotally interconnected links each having a plate secured to its outer face and extending to either side thereof together with excavating buckets mounted on certain of said plates, said chain including spaced buckets looped about said wheels and said frame, an elongated vertically extending channel secured to one side of said frame and having a web portion disposed between one stretch of said chain and said frame and extending substantially from one wheel to the other, said channel having a pair of spaced outwardly extending side flanges embracing the plates of said chain, and a pair of spaced guide rails mounted on each of said channel flanges and extending inwardly therefrom throughout its entire length and having continuous forwardly facing guide surfaces engaging and along which the plates of the chain

slide to prevent buckling of the chain, said rails being spaced from each other to permit passage of the links therebetween.

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