

May 22, 1934.

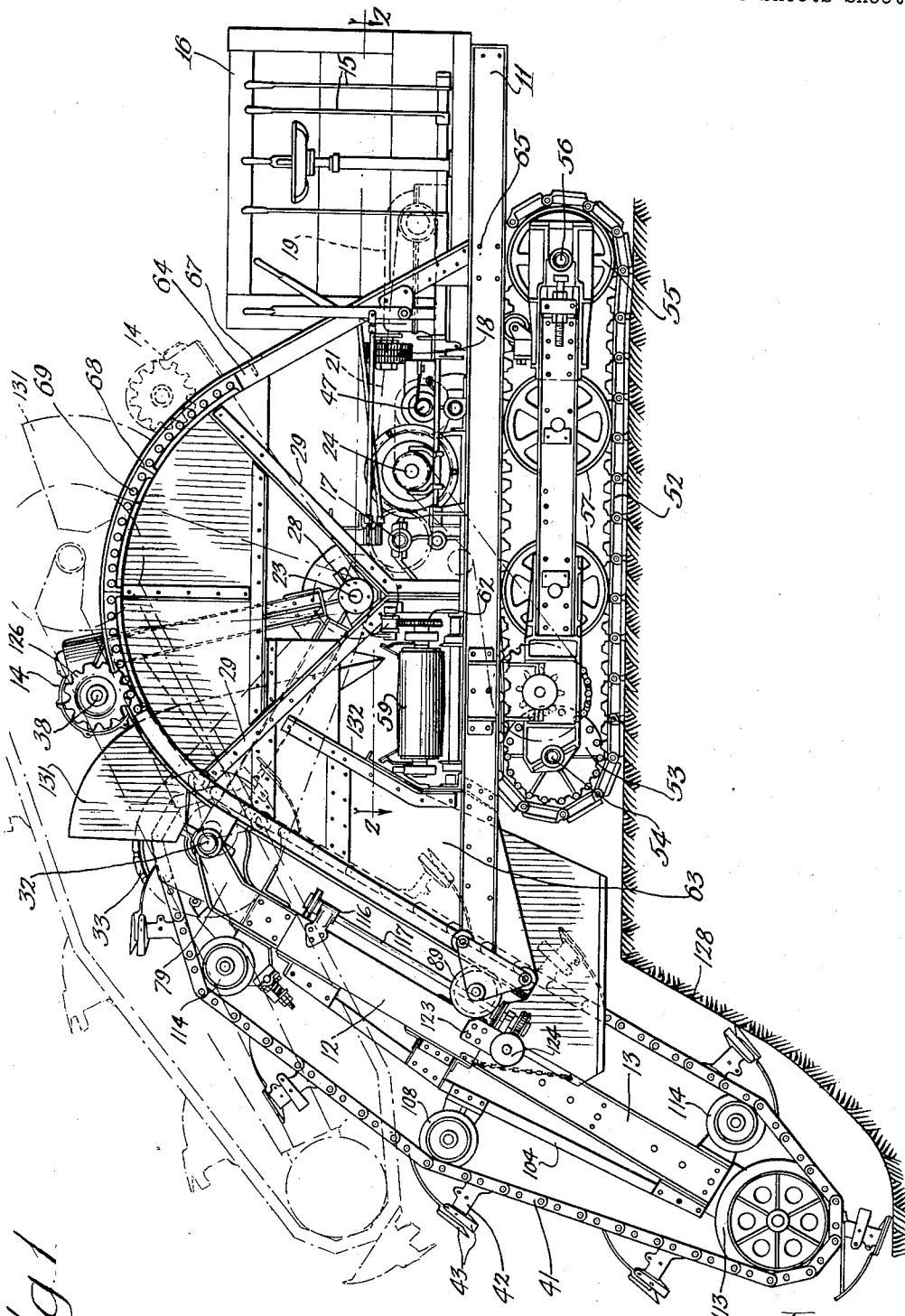
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TRENCHER

Original Filed Sept. 3, 1929

8 Sheets-Sheet 1



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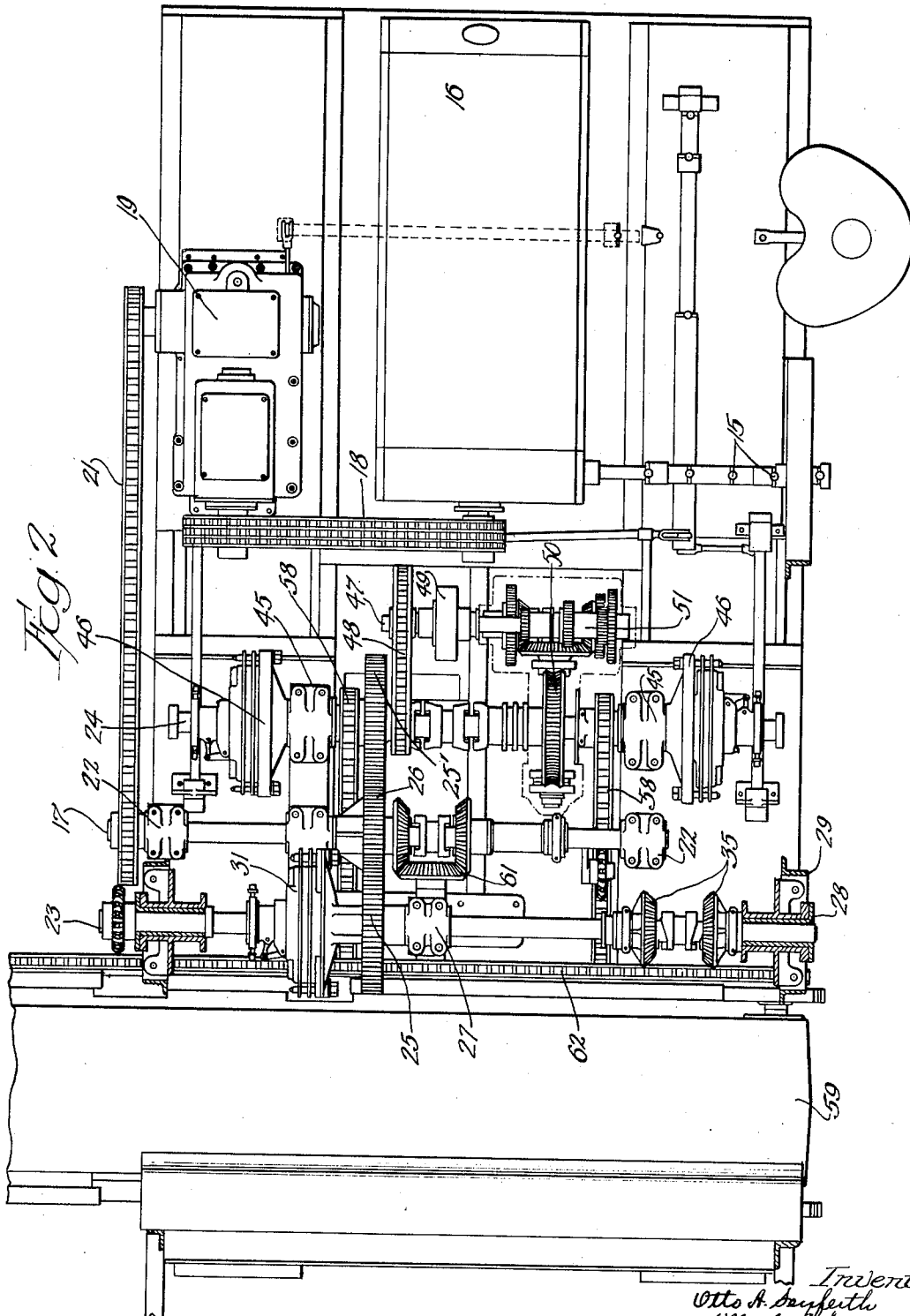
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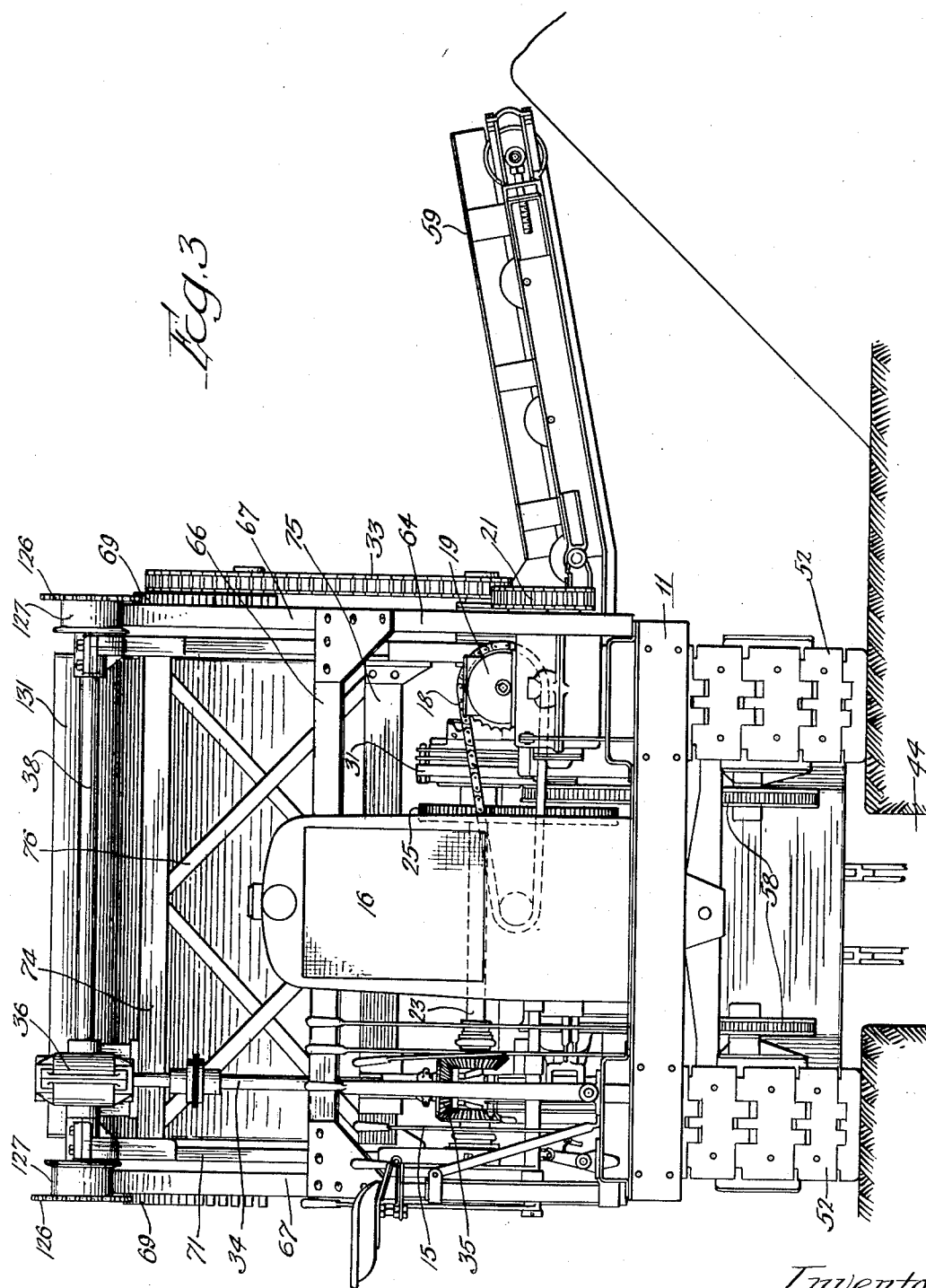
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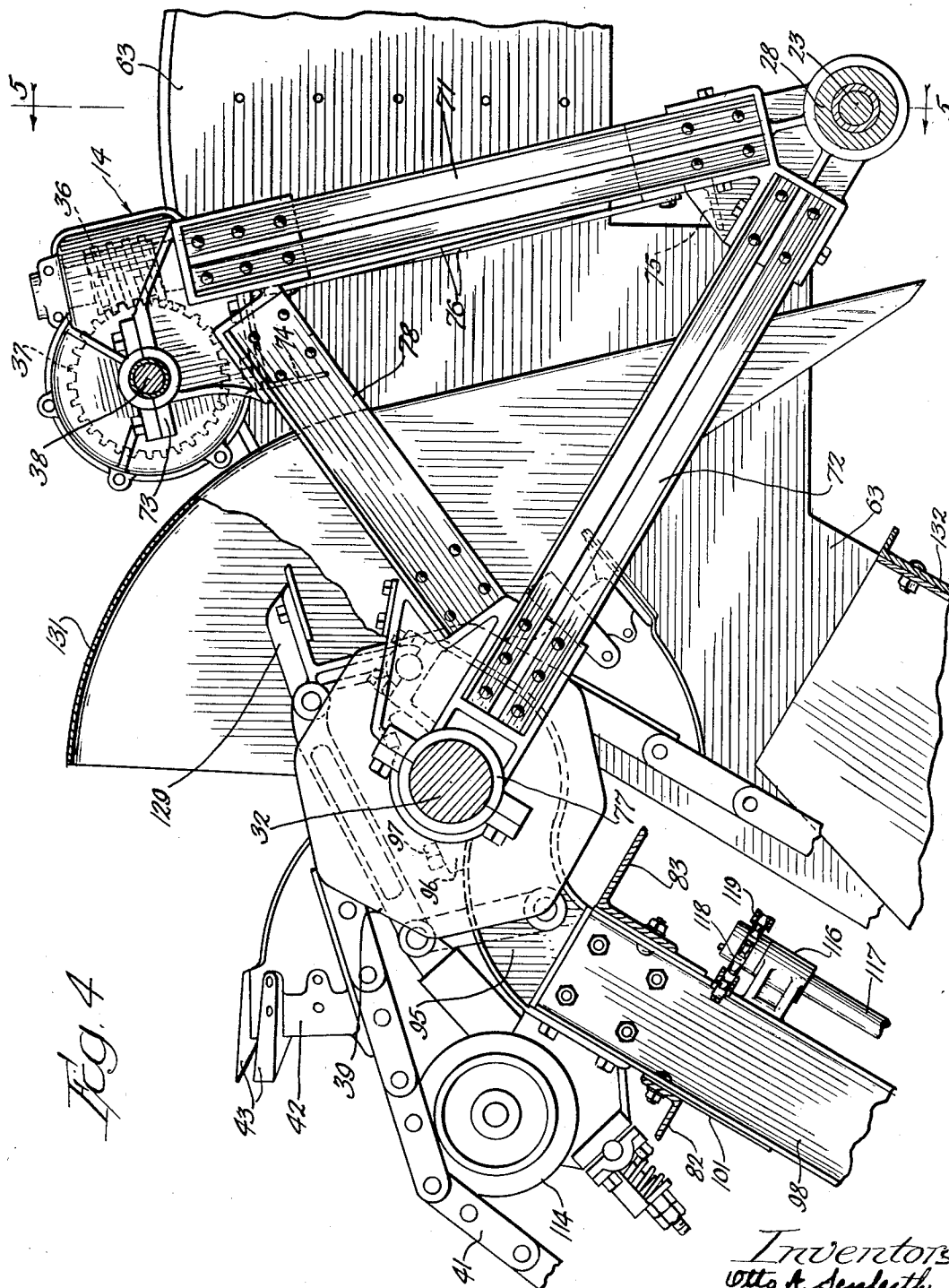


Fig. 4

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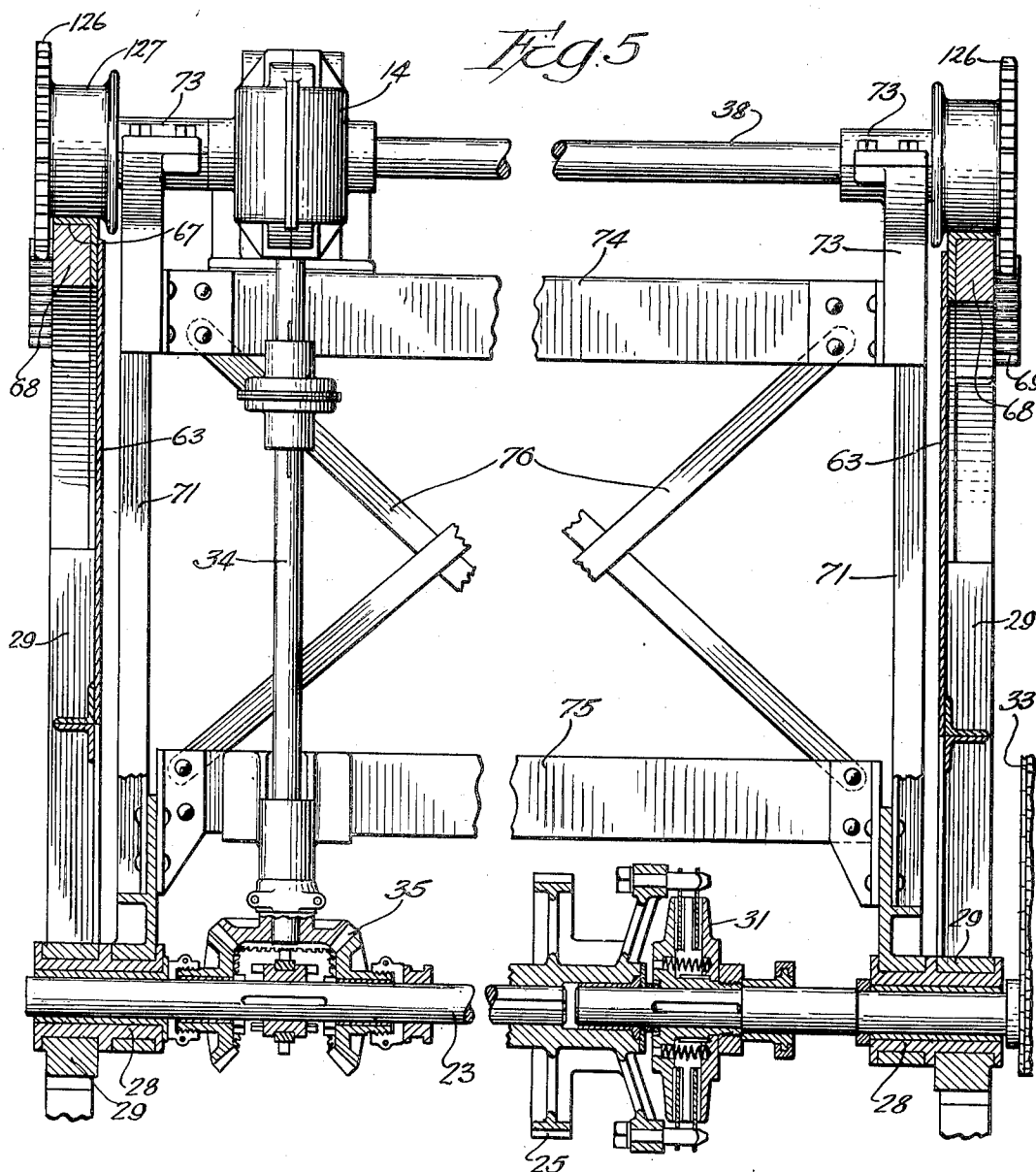
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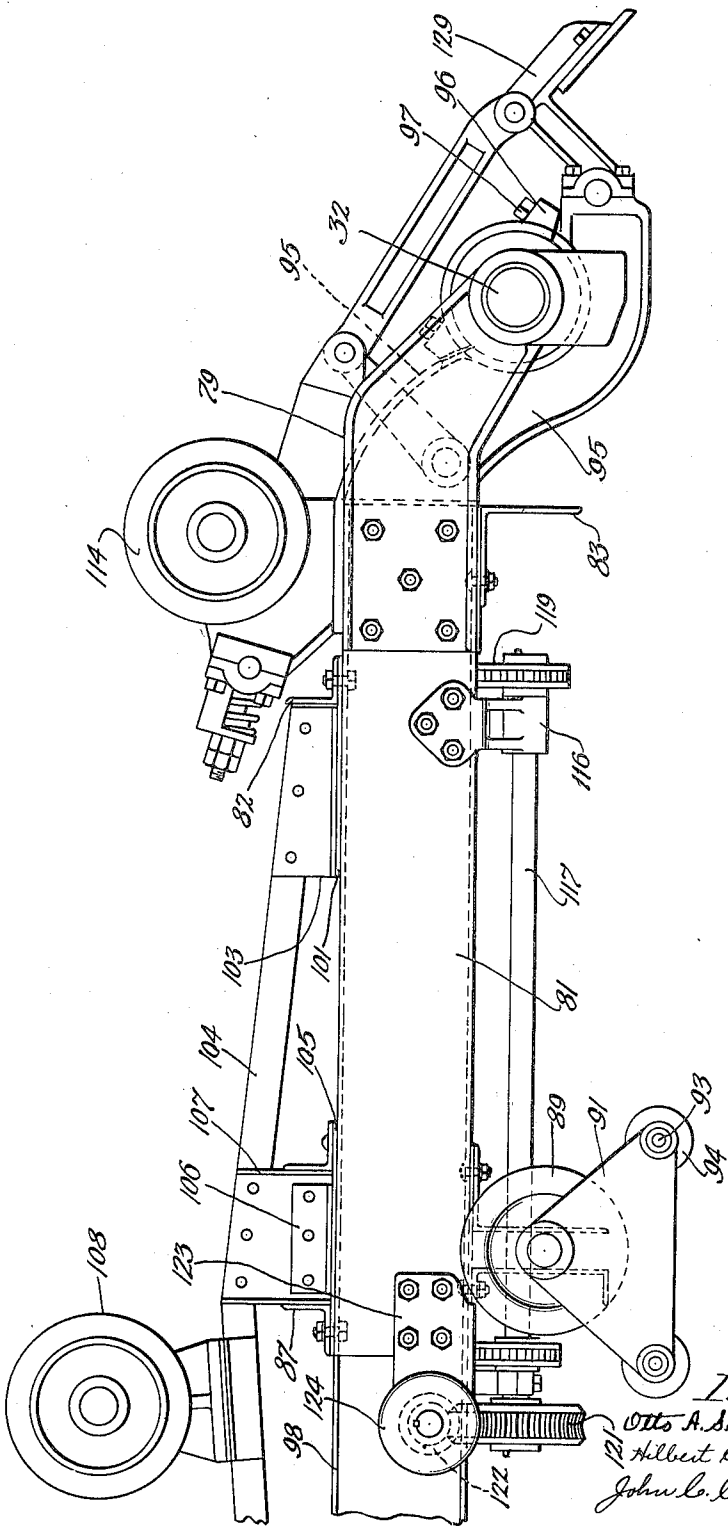
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Fig. 6



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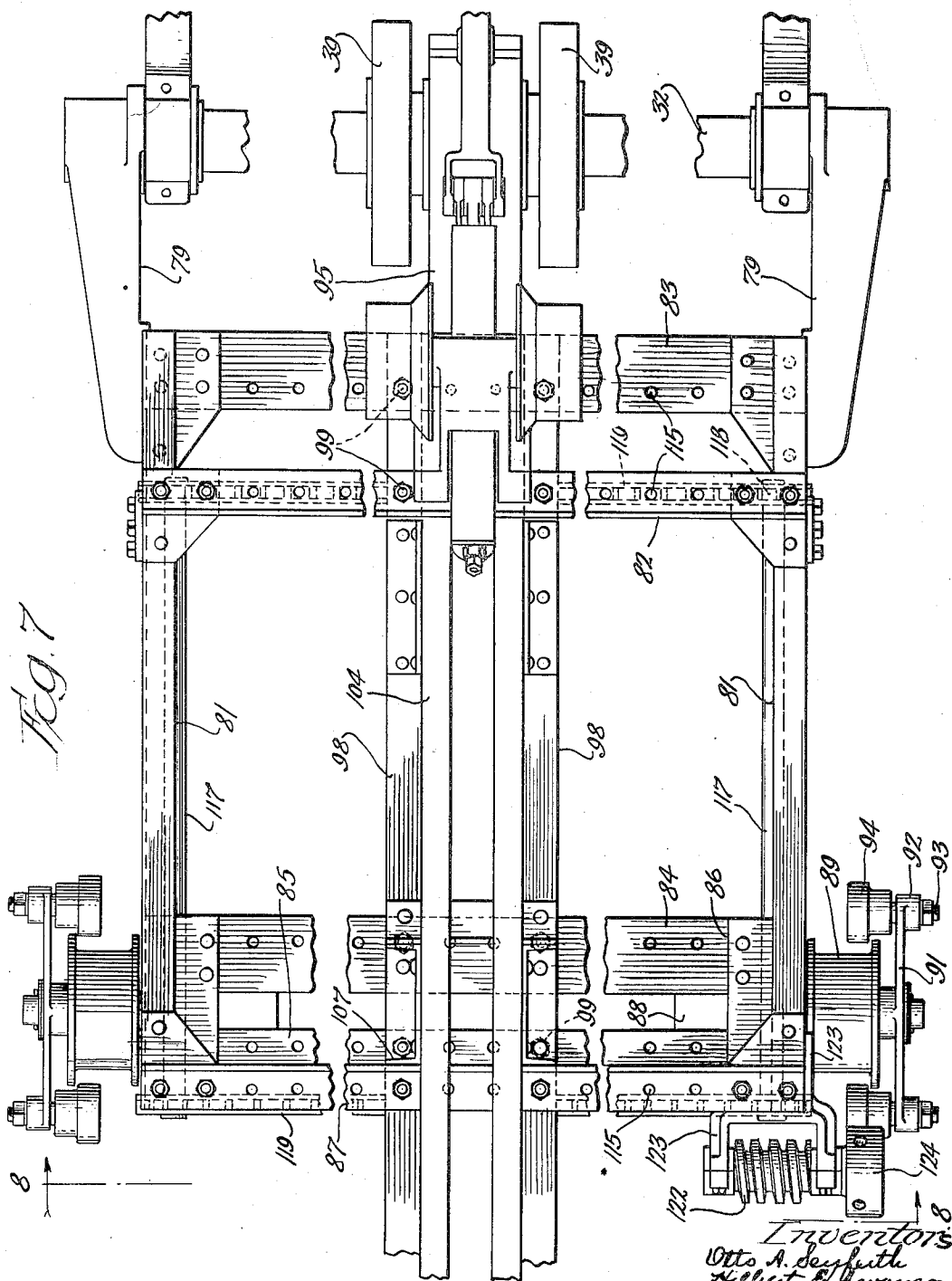
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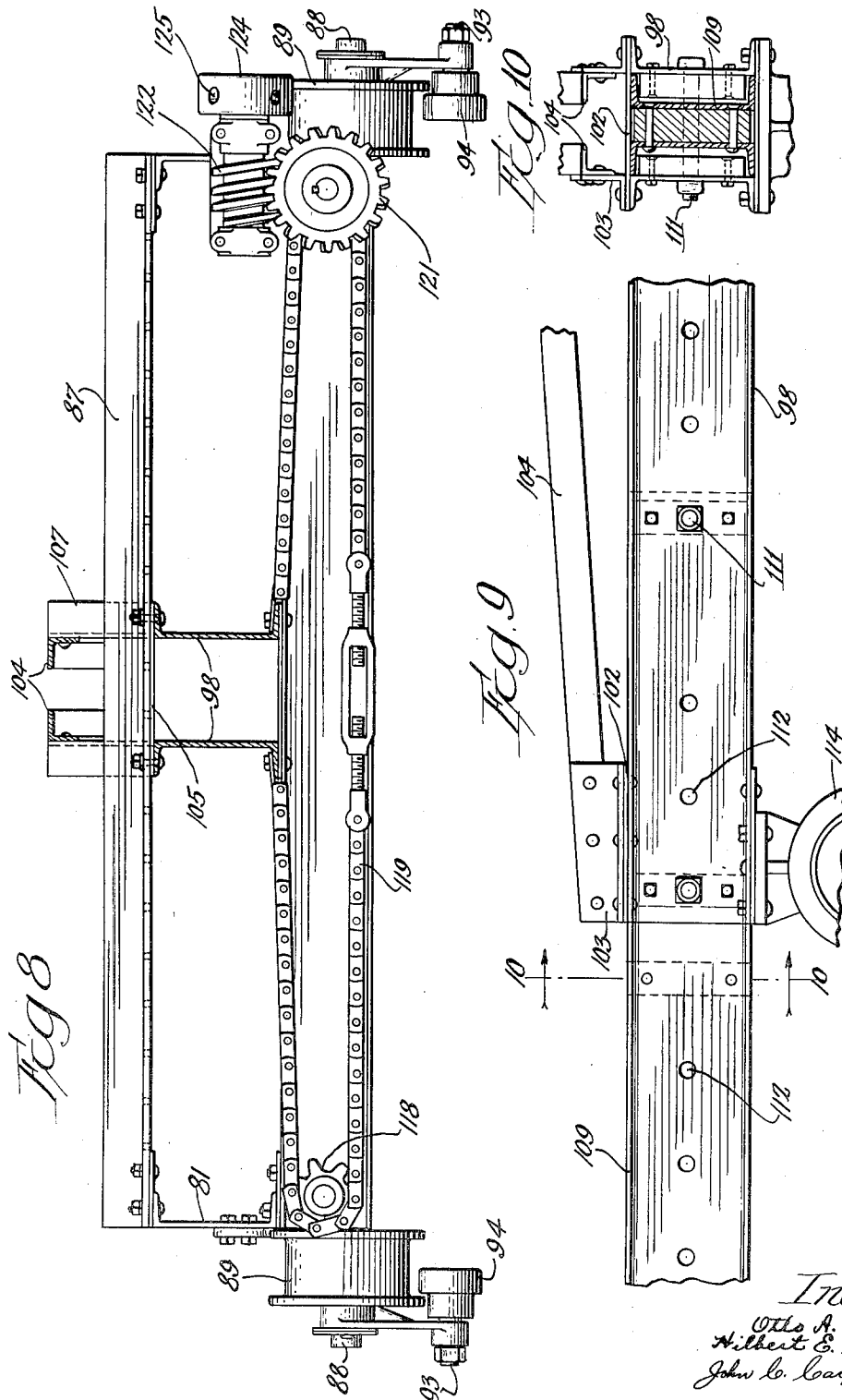
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TRENCHER

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8 Claims. (Cl. 37—90)

This invention relates to excavators, and more particularly to the type of excavator wherein a boom is arranged at the back of the excavator body and a series of buckets are movable lengthwise of the boom when the boom is in a lowered or digging position, to dig a trench.

The invention has for its object the provision of an excavator of the above described trencher type of compact form and of relatively light weight, and which will have large range and capacity.

The invention has for an important object also provision in an excavator of this type for positively locking the boom in any desired position. The invention contemplates in this regard the construction and arrangement of the driving parts of the excavator in such manner and arrangement that they may be readily manipulated to alter the position of the boom and will, after each such manipulation of themselves, lock the boom in the assumed position.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a side elevation of an excavator embodying the principles of our invention;

Fig. 2 is a plan section on the line 2—2 of Fig. 1;

Fig. 3 is an end view of the excavator shown in Fig. 1;

Fig. 4 is an enlarged side elevation of a portion of the digging boom and hoist with parts cut away and parts in section;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is a side elevation of a portion of the secondary frame and the digging boom;

Fig. 7 is a plan view of the parts shown in Fig. 6;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a partial side elevation of the lower portion of the boom; and

Fig. 10 is a section on the line 10—10 of Fig. 9.

To illustrate the invention, the drawings show an excavator which has a main frame 11, a secondary frame 12, a digging boom 13 mounted on the secondary frame and a boom hoisting device 14 arranged to be driven over a portion of the main frame to raise or to lower the digging boom 13. The excavator is provided with suitable driving means as hereinafter described and is controlled by means of control levers 15.

The above-mentioned driving means for the excavator includes an engine 16 supported on the front end of the main frame 11 and a main drive shaft 17 arranged to be driven from the engine 16 by means of a sprocket chain 18 through a speed transmission 19 and a sprocket chain 21 to the main drive shaft. Suitable bearings 22 on the main frame 11 support the main drive shaft 17 which drives a digging drive shaft 23 and a traction drive shaft 24 through a suitable change-speed transmission, by means of spur gears 25, 26, and 25' (Fig. 2 of drawings).

The digging drive shaft 23 is supported in a bearing 27 on the main frame 11 and intermediate the ends of the shaft and end bearings 28, said bearings 28 being mounted in forked, upstanding members 29 on each side of the main frame 11. A suitable clutch 31 is provided on the digging drive shaft 23 and this shaft is arranged to drive an excavator shaft 32 by means of a sprocket chain 33. The boom hoisting device 14 is also driven by the shaft 23, which is geared to the lower end of an upstanding shaft 34 by reversible beveled gears 35. The shaft 34 has a worm 36 on its upper end, meshing with a driven gear 37 on a transverse shaft 38. The excavator shaft 32, the upstanding shaft 34, and the transverse shaft 38 are suitably supported on the main frame 11 in a manner to be subsequently described herein.

The excavator shaft 32 has mounted thereon (and intermediate its ends) chain sprockets 39 which are arranged to rotate with the shaft 32 and to be shifted axially of the shaft. The sprockets 39 drive bucket chains 41 which carry an endless series of buckets 42. The buckets 42 are provided with suitable cutters 43 which are arranged to cut a trench 44 of desired width and depth as the buckets are thus driven around the digging boom 13.

The transverse shaft 38 is arranged to drive the boom hoisting device 14 along a portion of the main frame 11 to raise the digging boom 13 from a digging position to the carrying position shown by the broken lines in Fig. 1, or the reverse.

The traction drive for the excavator comprises two sprocket chains 58 leading respectively to the two traction devices and taking over sprockets formed for control by the clutches 46 mounted upon the traction shaft 24. The traction shaft 24 is rotated through a change-speed device to be now described. Gear 25' is loose on shaft 24 and is fixed to actuate a sprocket chain 48 taking over a sprocket on a change-speed shaft 47 mounted in suitable bearings on the main frame. This

shaft carries a friction clutch 49 and also a change-speed gearing 51. The change-speed gearing 51 acting through the worm drive 50 imparts rotation to the shaft 24 at the selected speed ratio and manipulation of the clutches 46 accomplishes propulsion and control of the locomotion of the excavator.

The excavator traction means preferably comprises a usual multi-pedal organization arranged at each side of the apparatus. This multi-pedal organization includes, generally speaking, traction belts 52, driving sprockets 53, idler rollers 57, and tensioning rollers 55. These various sprockets and rollers are carried, in accordance with the usual practice, in a traction frame 54 suitably connected to the main frame of the apparatus so that the two traction devices together support said main frame. The traction means are individually driven from the traction drive shaft 24 so that steering by driving may be accomplished.

The main drive shaft 17, besides driving the digging drive shaft 23 and the traction drive shaft 24, drives a shiftable dirt conveyor 59 by means of reversible beveled gears 61 and a sprocket chain 62. The conveyor 59 is suitably supported on the main frame 11 and arranged so that it is shiftable from one side to the other of the excavator for the disposal of dirt on either side of the trench 44.

The main frame 11 is provided with upstanding sides 63, the tops of which are secured to angles 64 which curve down and are secured on their ends to the main frame 11 by rivets 65. The upstanding sides 63 are further supported on the main frame 11 by the forked upstanding members 29 which are riveted to the sides, and are braced across their front ends by a member 66 riveted to each of the angles 64. One leg of each angle 64 flanges outwardly to form a curved guide track 67 on each side of the excavator and standing above the main frame 11. The guide tracks 67 are hereinafter referred to as guides and are provided for interlocking with an end of the secondary frame 12 to hold the digging boom and the secondary frame on the main frame and to guide them in their movement from a digging position to the carriage position or the reverse as will be described presently.

A guide rack 68 conforming with the contour of the guides 67 is mounted on each curved angle 64 just below the outwardly extending flange of the angle. The racks 68 comprise a plurality of lugs 69 which extend outwardly beyond the flanged sides of the angles 64 and around the upper portion of the cam portions 67.

An inverted A-link has two upstanding legs 71 and 72 on each side of the excavator and between the upstanding sides 63. The lower ends of the A-legs are secured to the end bearings 28 of the digging drive shaft 23. The upper ends of the A-legs 71 are secured to end bearings 73 for supporting the boom hoist shaft 38 which carries the boom hoisting device 14. The A-legs 71 are cross-supported by an upper transverse member 74 and a lower transverse member 75, riveted to the upper and to the lower ends of the A-legs 71, respectively, and reinforcing members 76 riveted on their ends to the supporting members 74 and 75. The transverse members 74 and 75 also support the upstanding shaft 34.

The upper ends of the A-legs 72 are secured to end bearings 77 for supporting the excavator shaft 32 which carries the digging boom 13. Each inverted A-link has a cross arm 78 which is se-

cured to the bearings 73 of the boom hoist shaft 38 and the bearings 77 of the excavator shaft 32. Manifestly, the A-links, besides supporting the shafts 32 and 38 on the digging drive shaft 23, provide a common pivot around the shaft 23 for the boom 13 and the boom hoisting device 14 and coordinate the movement of the secondary frame 12 and the boom 13, which are supported on the shaft 32 with that of the boom hoisting device 14 supported on the shaft 38. The shaft 23 being supported on the main frame 11, it will be understood that the common pivot for the boom hoisting device 14, the boom 13, and the secondary frame 12 is on the main frame 11.

The secondary frame 12 is substantially rectangular (when viewed in plan) and is mounted on the excavator shaft 32 by means of bearing arms 79 on each end of the shaft 32. The ends of the arms 79 remote from the excavator shaft are suitably secured to the upper ends of longitudinal channels 81. The upper ends of the longitudinal channels 81 are cross-supported by a transverse angle 82 suitably secured on each end to the upper flanges of the channels 81 and a transverse angle 83 secured to the lower flanges of the channels 81.

The lower ends of the channels 81 are secured on the ends of a transverse angle 84 spaced apart from a transverse channel 85. The transverse members 84 and 85 are arranged under the longitudinal channels 81 and are tied together on each end by a tie plate 86 secured to the upper flanges of the members 84 and 85. At the same end of the channels 81 a transverse angle 87 is suitably secured on the upper flange of each longitudinal secondary frame channel.

The transverse angle 84 and the channel 85 of the secondary frame 12 have mounted between them and at each end a stub shaft 88, the outer end of which extends laterally beyond the ends of the transverse members 84 and 85. Each shaft 88 has a bearing roller 89 between its outer end and the side of the secondary frame 12 for supporting the lower end of the secondary frame on the guide portions 67. Each roller 89 engages the corresponding guide portion 67 and is adapted to ride thereon when the secondary frame is moved relative to the main frame 11. A guide follower 91, which is substantially triangular in shape and which has a shaft opening in its upper vertex, is pivotally mounted on the outer end of each shaft 88. The two lower vertices of each guide follower 91 are provided with bosses 92 which are drilled to carry studs 93 which extend inwardly under the guide portion 67. The studs 93 are provided on their inner ends with guide follower rollers 94 which are engaged under the guide portions 67.

Manifestly, by engaging each guide portion 67 between one of the bearing rollers 89 and the guide follower rollers 94 on the secondary frame, relative movement between the secondary frame 12 and the guide portions 67 or the main frame 11 will be guided by the interlocking construction just described. It will be manifest also that the secondary frame 12 which has its upper end pivoted on the main frame 11 by means of the A-legs 72 of the inverted A-links is held on the guide portions 67 between the rollers 89 and 94.

The digging boom 13 is slidably mounted on the excavator shaft 32 by means of a bearing arm 95 which is substantially a channel in section. The bearing arm 95 is arranged on its upper end to fit around the excavator shaft 32 and provides a boom supporting bearing with a cover

96 secured on the bearing arm around the shaft 32 by bolts and nuts 97. This bearing arm 95 is shaped as a reversing curve and has its lower end bolted between spaced, longitudinal channels 98 of the boom 13. The chain sprockets 39 are arranged on the shaft 32 on each side of the bearing arm 95 and are adapted to slide therewith axially of the shaft. The boom channels 98 are mounted above transverse secondary frame members 83, 84 and 85 and beneath the angle bars 82 and 87 and the boom may be locked in various positions by bolts 99.

The longitudinal members 98 are tied together on their upper ends by a tie plate 101 adjacent the transverse angle 82 and on their lower end by a tie plate 102. Short angles 103 extending parallel to and down the boom 13 are riveted on opposite sides of the outer face of each tie plate. An angle 104 extends out from each angle 103 at the upper end of the channels 98 to an outstanding support substantially midway between the ends of the channels 98 and back to the angles 103 at the lower end of the channels 98, forming a gable portion on the boom 13. The ends of the angles 104 are riveted to the angles 103. The outstanding support at the peak of the gable portion comprises a tie plate 105 on the channels 98 and adjacent the transverse angle 87, three short angles 106 on the upper face of the tie plate 105 arranged at the sides and at the top of the plate, and outstanding channels 107 for each side angle 106, all riveted together and the outstanding channels riveted at their outer ends to the angles 104. A pair of idler rollers 108 are suitably mounted adjacent the peak of the gable portion toward the lower end of the boom 13 for a purpose to be described presently.

The boom channels 98 have telescoped between their lower ends lower boom channels 109 which are secured in place by means of bolts and nuts 111. The channels 98 and 109 are provided with bolt holes 112 for adjusting the length of the boom 13 to vary the maximum depth of cut. A pair of idler rollers 113 are mounted on the lower ends of the lower channels 109 and idler rollers 114 are carried by the channels 98 for guiding bucket chains 41 which are driven longitudinally around the boom 13 by the driven sprockets 39 on the excavator shaft 32.

The boom 13, as stated before, is slidably mounted on the excavator shaft 32 and movably secured between the transverse secondary frame members 83, 84, and 85 and the transverse angles 82 and 87. Each of the transverse secondary frame members and each transverse angle are provided with a plurality of bolt holes 115 for bolts and nuts 99. The holes 115 extend substantially across the secondary frame 12 for securing the boom 13 in adjusted position transversely of the secondary frame. For shifting the boom 13 transversely of the secondary frame 12, bearings 116 for shafts 117 are secured to each longitudinal secondary frame channel 81.

The shafts 117 extend down parallel to the channels 81 and through the transverse secondary frame angle 84 and channel 85 and have chain sprockets 118 on each end. A chain 119 extends across the secondary frame 12, meshes with corresponding sprockets 118 on each of the ends of shafts 117, and has its ends secured to the boom 13 as shown in Fig. 8. The lower end of one of the shafts 117 has keyed thereon a driving gear 121 enmeshed with a worm 122 mounted by means of an extension bracket 123 on the lower end of one of the secondary frame longitudinal

channels. The worm gear 122 is controlled by a wheel 124 on the same shaft. The wheel 124 is provided with a plurality of holes 125 into which a lever may be inserted for rotating the wheel to shift the boom 13.

Manifestly, when the bolts and nuts 99, which lock the boom to the transverse secondary frame members 83, 84, and 85 and the transverse angles 82 and 87, are removed, the boom 13 may be shifted transversely of the secondary frame by a rotary movement of the wheel 124.

The boom hoisting device 14 is pivoted on the digging drive shaft 23 by means of the A-legs 71 and is fastened to the excavator shaft 32 by means of the cross-arms 78 of the inverted A-links. A shouldered pinion 126 meshing with the rack 68 is mounted on each end of the boom hoist shaft 38 and is arranged to be driven over the rack. The pinions 126 rotate with the shaft 38 which is driven from the digging drive shaft 23 by means of the beveled gears 35, the worm 36 and the driven gear 37 on the shaft 38. The sprockets 126 are provided with inwardly extending shoulders 127 which roll on the guide portions 67 when the hoisting device is driven over the racks 68 to raise or to lower the digging boom 13. The engagement between the sprockets 126 and the racks 68 cooperates with the engagement between the worm 36 and the driven gear 37 and that of the beveled gear 35 to provide a self-locking feature for the boom hoisting device 14 and therefore for the digging boom 13 in any position from that of the maximum depth of cut to the carrying position on the guide portions 67 of the main frame 11.

In operation, the excavator is driven on its traction treads 52 along the ground and the digging boom 13 is lowered by means of the boom hoisting device to a digging position shown in Fig. 1. The bucket chains 41 carrying the buckets 42 are driven longitudinally around the boom 13 on the idler rollers 108, 113 and 114 by means of the driven sprockets 39 on the excavator shaft 32. The buckets 42 when so driven scrape and cut against a breast 128 of the trench 44 at the lower end of the boom 13. As the buckets are driven further around the boom, they are cleaned by a suitable bucket cleaner 129 on the upper end of the boom and the dirt is thrown into a dirt chute 131 suitably secured to the upper end of the secondary frame 12. The dirt is guided from the chute 131 by means of an upstanding dirt guide 132 to the shiftable conveyor 59 which deposits it on a side of the excavator.

Upon completion or cessation of digging, the digging boom 13 is raised over the guide portions 67 of the main frame 11 to the position shown by the broken lines in Fig. 1, by means of the boom hoisting device 14.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In combination in an excavator, a main frame, a secondary frame, a digging boom mounted thereon, a boom hoist, a hoist rack on the main frame, and an inverted A-link concentrically pivoting the digging boom and the boom hoist on the main frame.

2. In an excavator, a main frame having arched side portions, a secondary frame mounted in said main frame, having parts engaging said side portions, and means also engaging said side portions for moving said secondary frame from an operative digging position to an inoperative carrying position.
3. In an excavator, a main frame having arched side portions, a secondary frame mounted in said main frame having parts engaging said side portions, and means also engaging said side portions for moving said secondary frame from an operative digging position to an inoperative carrying position, said means comprising racks and pinions, the racks being mounted upon said side portions and the pinions being movable with said secondary frame.
4. In an excavator, a chassis comprising a main frame having guide portions, a secondary boom carrying frame slidably engaging said guide portions, and power means cooperating with said guide portions for moving said secondary frame.
5. In an excavator, a chassis comprising a main frame having guide portions, a secondary boom carrying frame slidably engaging said guide portions, and power means cooperating with said guide portions for moving said secondary frame, said power means including disconnectable gearing, parts of which lock the secondary frame in assumed positions upon disconnection.
6. An excavator, comprising a main frame having side guiding portions each providing an inclined secondary frame guiding part, and an arcuately arranged rack portion, swinging power members having pinion engagement with the rack portions of said side frame members and connected to said secondary frame for adjusting said secondary frame to desired digging position.
7. An excavator, comprising a main frame having side guiding portions each providing an inclined secondary frame guiding part, and an arcuately arranged rack portion, and swinging power members having pinion engagement with the rack portions of said side frame members and connected to said secondary frame for adjusting said secondary frame to desired digging position, said swinging power members including a frame and gear drive adapted to lock said secondary frame in assumed position.
8. An excavator, comprising a chassis having guide portions, a secondary frame carried in said main frame and in engagement with said guide portions, a power shaft whose axis passes through the geometrical centers of said guide portions, and means connecting said shaft, said guide portions and said secondary frame for adjusting said secondary frame to desired digging position.
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35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150