

June 7, 1955

W. H. HELTON

2,709,860

ENDLESS CHAIN DIGGER TOOL

Filed Jan. 17, 1950

2 Sheets-Sheet 1

Fig. 1

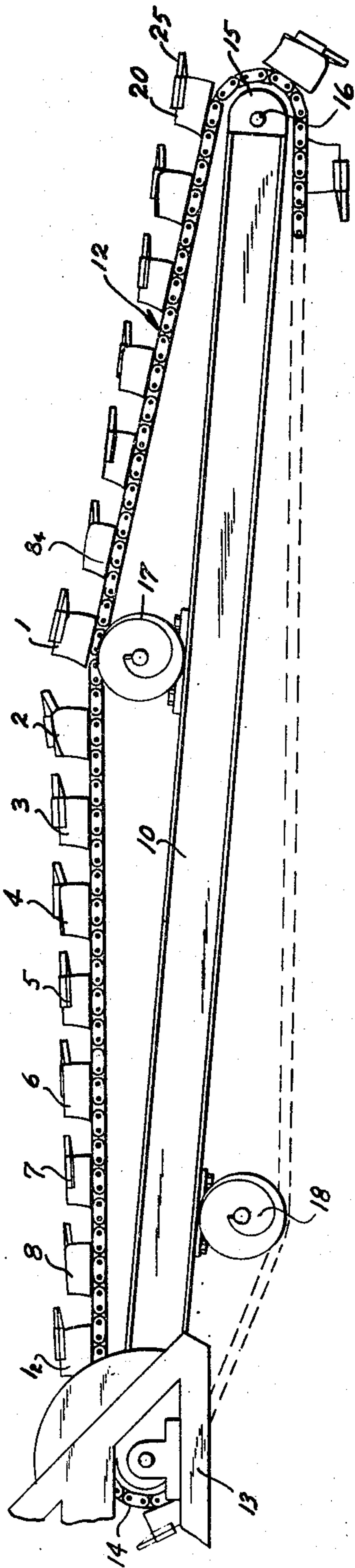
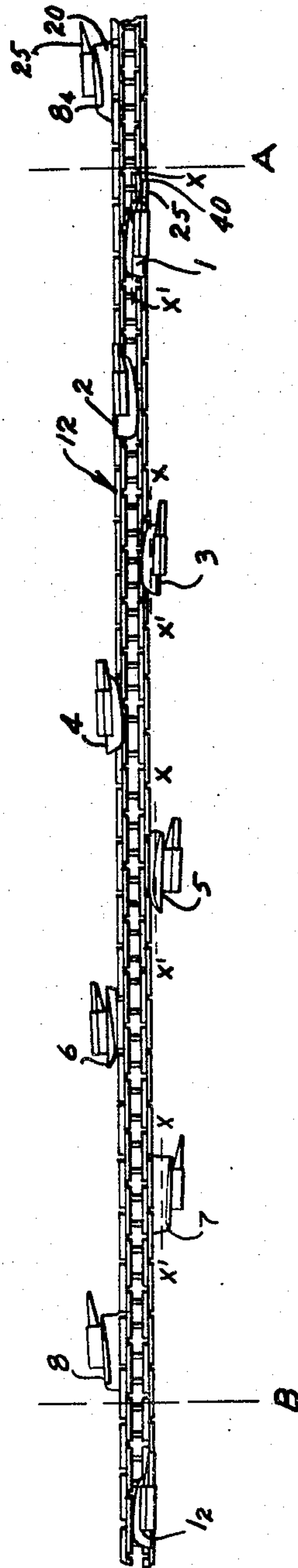


Fig. 2



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Fig. 3

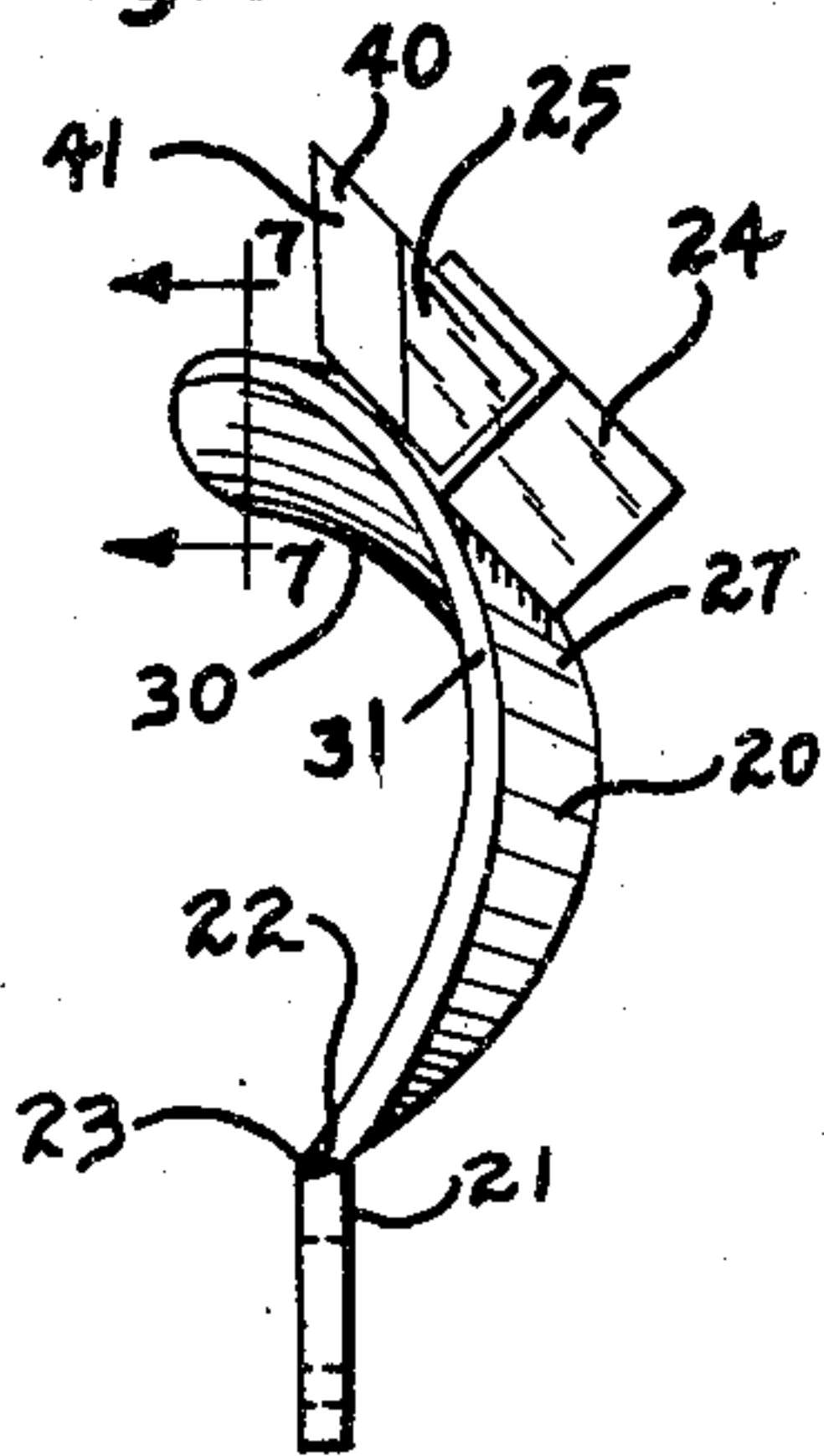


Fig. 4

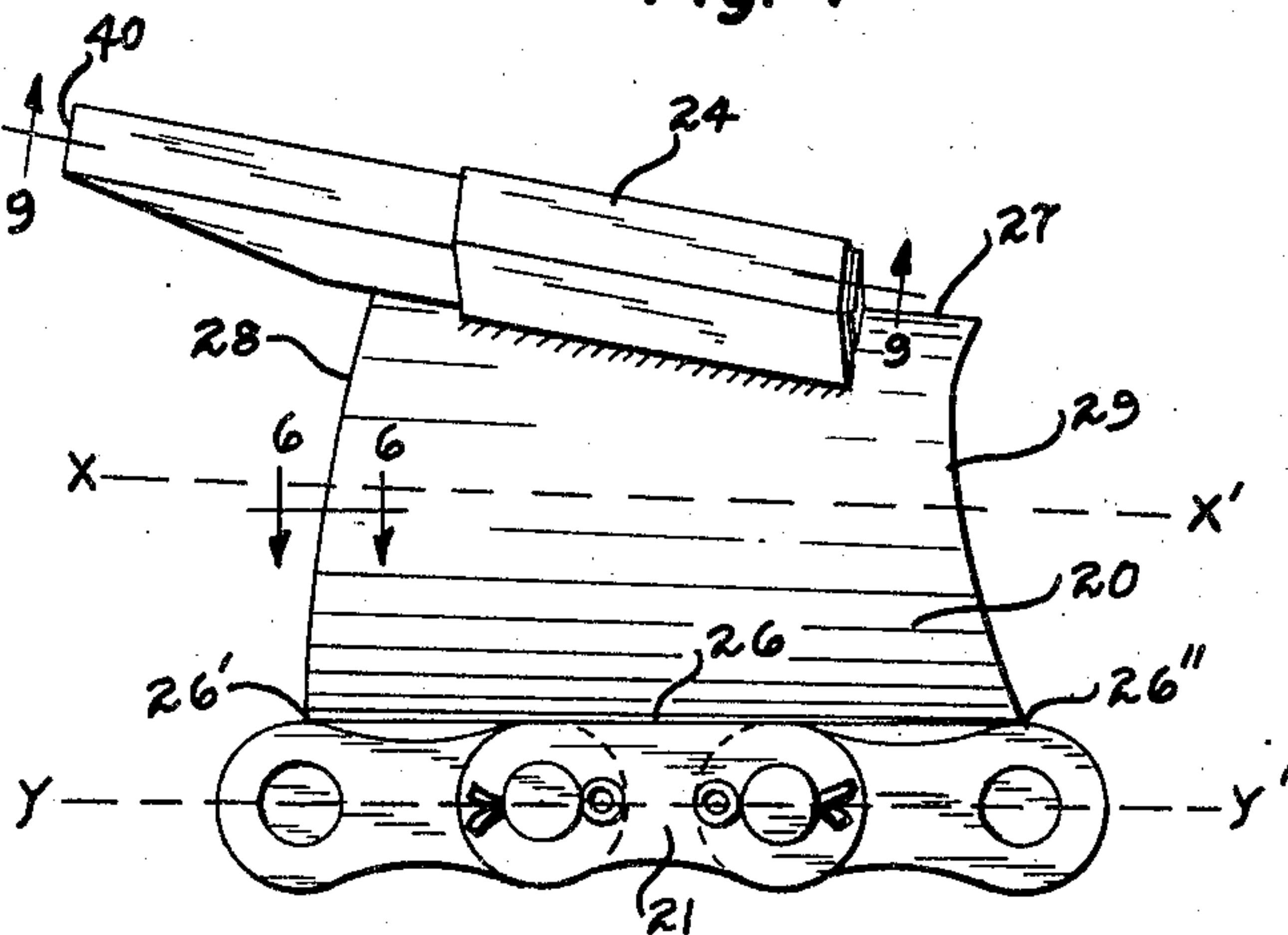


Fig. 6



Fig. 8

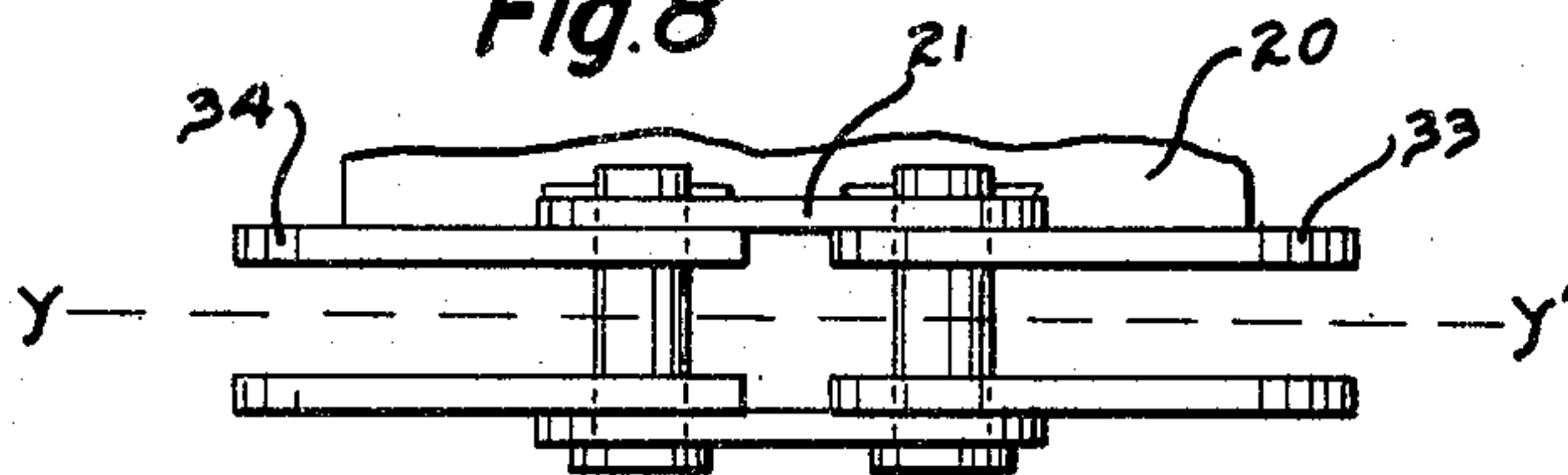


Fig. 9

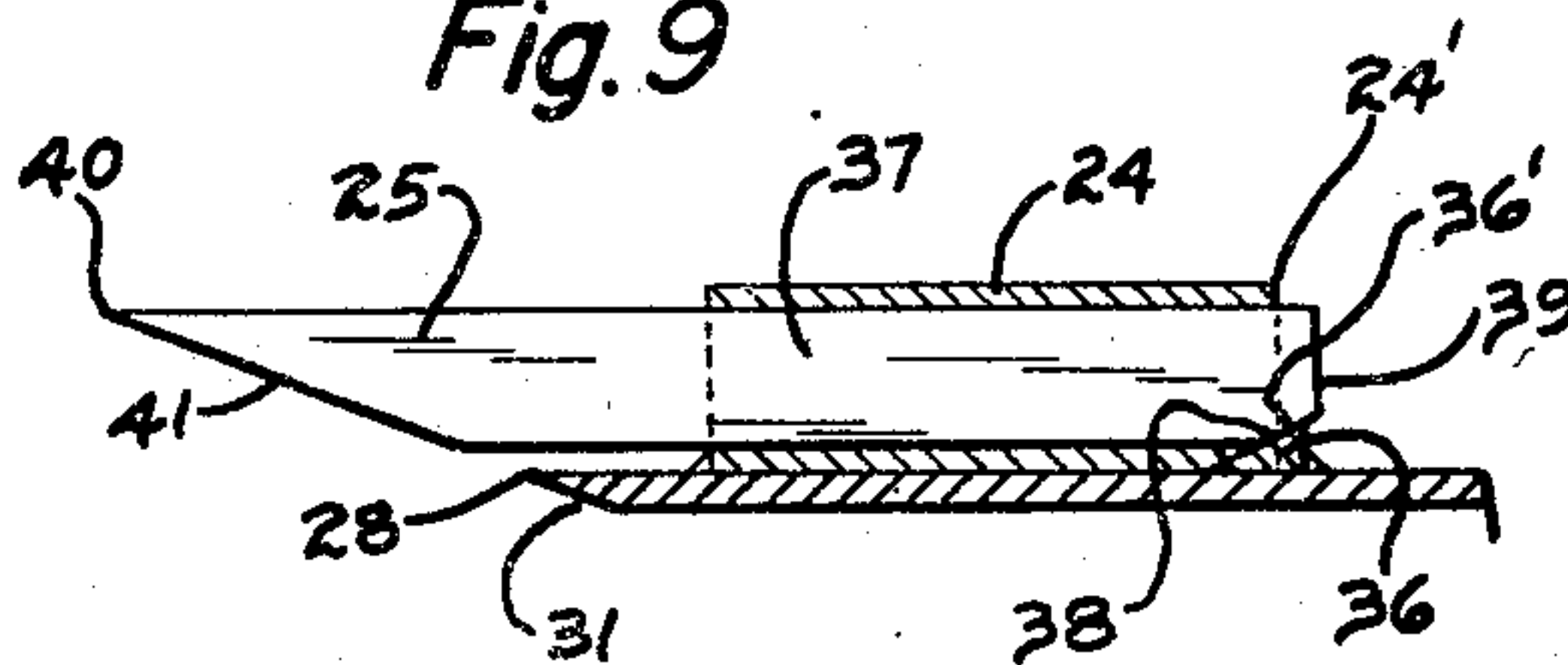


Fig. 5

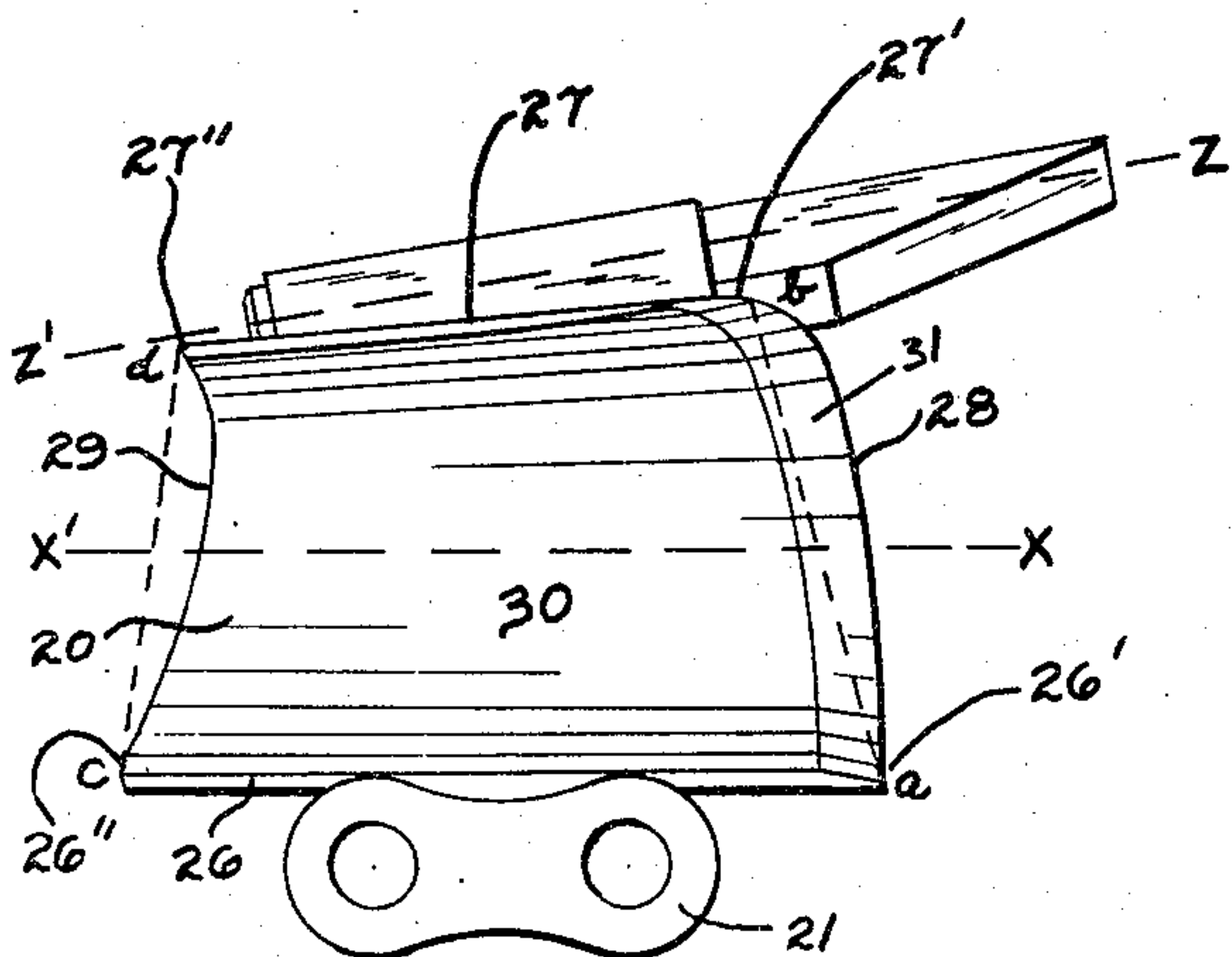


Fig. 7



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## ENDLESS CHAIN DIGGER TOOL

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2 Claims. (Cl. 37—191)

My invention relates to improvements in endless digger chains such as are employed on ditch or trench digging machines, being mounted about sprocket wheels, one of which is carried on the outer end of a boom which depends into the ditch or trench as it is dug.

The digger chain according to my invention is particularly adapted for use with "Jeep-type" vehicle diggers wherein a boom carrying the endless chain is mounted at the rear of the "Jeep" and receives its power through a power take-off from the motor of the "Jeep." The digger elements attached to the present "Jeep-type" diggers become worn especially when digging in hard ground and require frequent replacement. A number of different shaped digger elements are presently required to make up the digger chain unit and therefore a larger number of different shaped digger elements must be carried to replace the elements as they become worn. My scoop is of arcuate cross section and all of the scoops are uniform but are attached to the chain so as to extend laterally at a different angle. The primary digging portion of my digging element is a tooth which is removably mounted on the scoop and projects beyond the leading end of the scoop. When their teeth become worn it is only necessary to replace the worn tooth with a new tooth or a resharpened tooth in place of removing the whole digger element as is the present practice. In my type of digger chain all of the scoops are of uniform construction and all have teeth that are uniform and interchangeable. With my type of scoop and digger tooth it has been found that a trench may be dug faster and more efficiently and the digging of a trench or ditch in hard ground has been found to be much easier and more efficient than heretofore.

It is an object of the invention to provide an improved scoop of general arcuate cross section for attachment to an endless chain type of digger.

Another object of the invention is to provide a scoop of general arcuate cross section and a removable digging tooth so arranged on the scoop that it digs or loosens the dirt ahead of the scoop.

A further object of the invention is to attach a plurality of arcuate scoops to an endless chain so as to form a unit of scoops which are laterally disposed and longitudinally spaced along the chain with their inner arcuate surface facing towards the chain and with their longitudinal axes extending substantially parallel to the longitudinal center of the chain so that each successive scoop on the same side of the chain in the opposite direction to the motion of the chain when digging has its longitudinal axis lying at a greater distance from the chain than the axis of the next preceding scoop in the unit.

A still further object of the invention is to attach a plurality of units of scoops as just above described to the outer periphery of an endless chain to form a complete endless digging chain.

It is another object of the invention to mount on an endless chain a plurality of arcuate scoops having attached to each a digging tooth which may easily be replaced when worn and to so mount the scoops that they are longitu-

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nally spaced along each side of the chain with their inner arcuate surfaces facing toward the chain and with each successive scoop in the opposite direction to the motion of the chain and on the same side of the chain being attached so that its longitudinal axis lies a greater distance from the chain than the axis of the next preceding scoop and so that the leading edge of each successive tooth also lies at a greater distance from the chain than the leading edge of the next preceding tooth.

A still further object of my invention is to provide a scoop of arcuate cross section which has a greater arcuate opening at its leading end than at its trailing end and to mount a tooth on the scoop so that it extends beyond the leading end and has its longitudinal axis converging at an acute angle from leading end to trailing end of the tooth toward the longitudinal axis of the scoop.

Another object of my invention is to provide a scoop of arcuate cross section for an endless chain which has a bottom edge adapted for attachment to a link of the chain, a top edge which is of lesser length than the bottom edge and which extends in a direction so that it converges from its leading end to its trailing end toward the longitudinal axis of the chain, a leading open arcuate end having an edge contour which is arcuate and gradually recedes from the leading end of the bottom edge toward the leading end of the top edge and has a trailing arcuate open end of lesser arcuate opening than the arcuate opening of the leading end whereby the dirt picked up by the scoop may be collected in the scoop and carried along with the scoop.

Another object of my invention is to provide a scoop of arcuate cross section for attachment to an endless chain with a pocket to receive a digging tooth which when seated in the pocket projects beyond the leading end of the scoop and will have its major axis extending at a converging acute angle from leading end to trailing end of the tooth toward the longitudinal axis of the scoop.

Another object of my invention is to provide an arcuate shaped scoop having open leading and trailing ends wherein the chord of the arcuate leading end is of greater length than the chord of the trailing arcuate end and the leading end and the top edge of the scoop are provided with cutting edges.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples are given by way of illustration only and, while indicating preferred embodiments of the invention, are not given by way of limitation, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

In the drawings similar characters of reference indicate corresponding parts in the several views.

Figure 1 is a side elevation of an endless digger chain mounted on a projecting boom having mounted thereon scoops and their digging teeth according to my invention.

Figure 2 is a plan view on a larger scale than Figure 1 showing the positioning of the scoops and their attached teeth according to my invention.

Figure 3 is a front elevational view of a scoop with tooth attached showing one position of attachment of the scoop to a side link of the endless digger chain.

Figure 4 is a right hand side view of the scoop shown in Figure 3 with additional links attached.

Figure 5 is a left hand side view of the scoop shown in Figure 3 with additional links attached.

Figure 6 is a sectional view along line 6—6 of Figure 4 showing the leading cutting edge of the arcuate scoop.

Figure 7 is a sectional view along lines 7—7 of Figure



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3 showing the cutting edge of the top portion of the arcuate scoop.

Figure 8 is a bottom plan view of Figure 4 showing a complete link and the broken away scoop attached to a side link.

Figure 9 is a sectional view along lines 9—9 of Figure 4 showing the mounting of the tooth in the tooth receiving pocket.

Referring to Figure 1, a boom support 10 for an endless chain digger generally indicated at 12 is shown mounted on the rear supports 13 of a mobile vehicle such as a "Jeep," not shown. Power to rotate the chain is supplied by a suitable power take off at the support end 13 of the endless chain 12. The forward end of the endless chain is supported on a drive sprocket 14 while the rear end passes over a guide sprocket 15 mounted on the rear end of the boom 10 by a shaft 16. The endless chain 12 is guided over an upper guide at 17 and a lower guide at 18 mounted on the boom 10. The upper guide 17 is mounted about midway the length of the boom 10 and includes a transverse screw conveyor which serves to move the dug dirt transversely to either side of the trench when the boom is depending into the trench being dug.

The lower guide 18 includes a transverse screw conveyor which is mounted toward the forward end of the boom and on its underneath side and serves to move the dug dirt to either side of the trench as the scoops drop their load of dirt at the leading end of the trench.

Referring now to Figure 3 the scoop of arcuate cross section according to my invention is shown generally at 20 attached in one position along its bottom edge 22 to a side link 21 of the endless chain as by welding indicated at 23. Attached to the outer surface of the scoop 20 is a pocket 24 in which is received a digger tooth 25 both of which are hereinafter more fully described.

The scoop 20 of arcuate cross section as seen in Figure 3 is further shown in Figures 4 and 5. Scoop 20 has a horizontally extending bottom edge or portion 26 having a leading end 26' and a trailing end 26''. The longitudinal axis of the scoop is shown in Figures 4 and 5 at X—X' which is substantially parallel to the bottom edge 26 and the longitudinal center Y—Y' of the chain, see Figure 8.

The top edge or portion of the scoop 20 is indicated at 27 and it extends from its leading end 27' to its trailing end 27'' in a converging direction toward the longitudinal axis X—X' of the scoop. The top edge 27 is of lesser length than the bottom edge 26. The leading open arcuate end 28 of the scoop extends in a gradually receding arc from the leading end 26' on the bottom edge 26 to the leading end 27' of the top edge 27. The leading edge of the leading end 28 melds into the leading end of the top edge 27 and provides a continuous contour therewith. The trailing arcuate end of the scoop is indicated at 29. Referring to Figure 5, it will be noted that the chord a—b of the arcuate open end 28 is of greater length than the chord c—d of the open trailing end of the scoop and likewise the leading open arcuate end 28 has a greater arcuate opening than the trailing arcuate end 29 which provides a wedging effect in the scoop to collect the dug dirt into the scoop so that it will be carried along with the scoop as it moves along with the endless chain. The chord a—b is about 4 inches in length while the chord c—d is about 3 inches in length in one size of scoop according to my invention while the top edge is about 4 inches long and the bottom edge is about 5½ inches long.

In mounting the scoop 20 on the chain the interior or concave surface 30 of the arcuate scoop is so positioned that it faces toward the endless chain on which it is attached as best shown in Figures 3 and 4.

In Figure 6 there is shown a cross section of the leading end 28 of the scoop. The inner surface 30 at the leading end 28 is tapered or sharpened as at 31 to provide a cutting edge.

Referring to Figure 7, there is shown a cross section

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of the top edge or portion 27 wherein the inner surface 30 is tapered as at 32 to form a cutting edge throughout the entire length of the top edge 27.

In Figure 8 there is shown the side link 21 with its attached scoop 20 and immediately adjacent links generally indicated at 33 and 34. The longitudinal center of the chain is shown by the broken line Y—Y'.

Attached to each of my scoops is a digging tooth 25 which may be easily removed and replaced by a sharpened or new tooth when it becomes worn. One manner of attaching the tooth so that it may be readily removed is illustrated. This means of attachment provides for a minimum amount of drag resistance and yet permits the tooth to be easily replaced. The pocket 24 in which the tooth is seated is of square cross section open at each end and attached to the outer surface of the scoop as by welding. The pocket has a longitudinal major axis as indicated at Z—Z' in Figure 5 and is attached to the outer surface of the scoop proximal to the top edge 27 with the major axis Z—Z' extending from its leading end Z to trailing end Z' at an acute angle converging toward the longitudinal axis X—X' of the scoop 20. At the rear end of the tooth mounting pocket 24, as shown in Figure 9, there is attached as by welding a barrier 36 having an upwardly and rearwardly inclined face at 36'. Mounted within the square shaped pocket 24 is the digging tooth 25 having a square shaped shank 37 and an upwardly and rearwardly inclined face 38 at its trailing end 39 which fits against the inclined barrier surface 36' thus a firm seat for the tooth to prevent its further rearward movement in the pocket 24. The trailing end 39 of the tooth extends a slight amount beyond the trailing end 24' of pocket 24 so that the trailing end 39 on the tooth may be more easily driven in a forward direction to unseat and remove the tooth from the pocket. The cooperating inclined surfaces or faces 36' and 38 provide a wedging action for the shank 37 held within the walls of the pocket 24 so that the tooth is held in operating or digging position.

Referring now to Figures 3, 4 and 9, it will be noted that the leading end of the tooth 25 is indicated at 40 and that the tooth is formed with a tapered surface 41 and thus provides a sharpened cutting end at 40. The tapered surface 41 extends in general alignment with the leading tapered surface 31 on the leading end 28 of the scoop as best shown in Figures 9 and 3 which permits a smooth travel of the dirt cut or dug by the leading end of the tooth backward along the tooth surface 41 to the inner confines of the concave arcuate shaped scoop 20.

Referring now to Figures 1 and 2, it will be observed that the scoops 20 with their attached teeth 25 are attached to the chain so that their concave faces or inner arcuate surfaces face toward the longitudinal center of the chain 12. The scoops extend transversely from the chain 12 and are successively longitudinally spaced. In Figure 2 there is shown a unit of scoops, for example, extending from A to B with their leading ends extending toward the right, the direction of motion of the upper pass of the endless chain 12 shown in Figure 1. The lower pass of the chain, which is the digging pass, carries the same representation of the scoops. Scoops 1, 3, 5 and 7 are shown on the same side of the chain while scoops 2, 4, 6 and 8 are on the opposite side of the chain. The successive scoops on the same side of the chain have their longitudinal axes X—X' lying laterally from the chain at a greater distance than the next preceding scoop. For example, the longitudinal axis X—X' of scoop 1 is shown lying substantially above the longitudinal center of the chain while scoop 3 has its axis X—X' still further laterally away from the longitudinal center of the chain and the axes of scoops 5 and 7 yet still further away. This arrangement permits the leading ends 40 of the teeth 25 on each successive scoop to lie further away from the chain than the next preceding scoop so that each tooth cuts into the ground at



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a successive greater distance to dig the trench. It will be noted that scoop 7, shown in Figure 2, has its tooth 25 at the greatest distance of any of the teeth from the chain on the same side of the unit of scoops extending from A to B.

The complete endless chain 12 in Figure 1 has a spacing of scoops so that four complete units of scoops as extend from A to B in Figure 2 are included. Thus in Figure 2 there is shown at the left extreme end the positioning of the first scoop 1<sub>2</sub> of the second group of scoops while at the extreme right end of Figure 2 there is shown the last scoop 8<sub>4</sub> of the fourth unit of scoops. In other words the units of scoops may be arranged so as to repeat their positioning around the outer periphery of the endless chain so as to form a complete digging endless chain.

In assembling a unit of scoops as extend from A to B, see Figure 2, the scoop indicated at 2 is welded to its carrying link in a position as shown in Figure 3. The scoop at 1 is likewise so positioned but on the opposite side of the chain. The next pair of scoops as at 4 and 3 are welded to their carrying links so that their axes  $x-x'$  lie in vertical planes which are further away from the chain than are the vertical planes containing axes  $x-x'$  of scoops indicated at 2 and 1. This as explained previously allows each digging edge 40 on the teeth 25 carried by the scoops to engage the ground in the trench at a further distance outward from each side of the chain. This arrangement permits each successive scoop in a direction opposite to the direction of chain motion to collect or scoop up dirt at a greater distance from the chain than the next preceding scoop on the same side of the chain. Thus, the width of the trench dug is governed by the positioning of the scoop which is so attached to its link that its longitudinal axis and the digging end of its tooth is at the greatest distance from the chain.

In the scoops according to my invention all of the scoops are alike. Contrasted with this in the presently used endless chain diggers of the "Jeep-type" some six different shaped digger elements are required and when these become worn they have to be replaced. In my scoop all that has to be replaced is the primary digging element the tooth that is seated in a pocket on the scoop from which it may be easily and quickly knocked loose and removed so as to be replaced by a new or re-sharpened tooth.

My scoop with its digging pin when assembled as a plurality of scoop units to make up an endless chain will dig even very hard and compacted earth. By a proper arrangement of the scoops on the endless chain, my endless chain digger will dig a trench that will have straight sides and a lever bottom. My endless chain digger is very efficient in operation and in a recent test in relatively hard ground dug 547 feet of ditch 3 feet deep in 3 hours' time.

I claim as my invention:

1. An earth digging tool for an endless chain type of trenching machine, comprising a scoop of arcuate cross section with its inner surface concave, said scoop having its longitudinal axis extending substantially parallel to said chain and having a bottom edge extending parallel to said chain and substantially parallel to the axis of said chain, said bottom edge being adapted for attachment to said chain whereby the inner concave surface of said arcuate scoop faces toward the chain, a top edge

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extending from its leading end to its trailing end in a substantial converging attitude toward said longitudinal axis of the scoop and a substantially horizontal plane through said longitudinal axis, a leading open end having an arcuate edge throughout its whole extent gradually receding from the bottom edge to the top edge of said scoop, a trailing open end of a substantially lesser arcuate opening than said leading end whereby the scoop contracts from leading open end to trailing open end, a tooth receiving pocket attached to the outer surface of said arcuate scoop with the major axis of the pocket extending divergent at an acute angle to said substantially horizontal plane through the longitudinal axis of the scoop and toward said leading end, and a removable and narrow elongated tooth seated in said pocket and extending a substantial distance beyond the leading end of said arcuate scoop whereby said tooth loosens the earth in advance of said leading end of said scoop.

2. An earth digging tool for an endless chain type of trenching machine, comprising a scoop of arcuate cross section with its inner surface concave, said scoop having its longitudinal axis extending substantially parallel to said chain and having a bottom edge extending parallel to said chain and substantially parallel to the axis of said chain, said bottom edge being adapted for attachment to a side link of said chain, a top edge having its adjacent portions tapered to provide a cutting edge, said top edge extending from its leading end to its trailing end in a substantially converging attitude toward said longitudinal axis of the scoop and a substantially horizontal plane through said longitudinal axis, a leading open end having an arcuate edge throughout its whole extent gradually receding from the bottom edge to the top edge of said scoop and having the inner surface adjacent the leading edge tapered to provide a cutting edge, a trailing open end substantially small than the leading open end whereby the scoop gradually contracts from leading end to trailing end, a tooth receiving pocket attached to the outer surface of the arcuate scoop in spaced relation proximal to said top edge and having its longitudinal axis extending divergent at an acute angle to said substantially horizontal plane through the longitudinal axis of the scoop and toward said leading end, and a removable and narrow elongated tooth seated in said pocket and having a tapered end surface extending substantially beyond the leading end of said scoop, said tapered surface on the tooth extending in substantial alignment with the tapered inner surface on the leading portion of the scoop.

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