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3,286,379

DIGGING TOOTH WITH CORRUGATED CROSS-SECTION

Filed Jan. 13, 1964

2 Sheets-Sheet 1

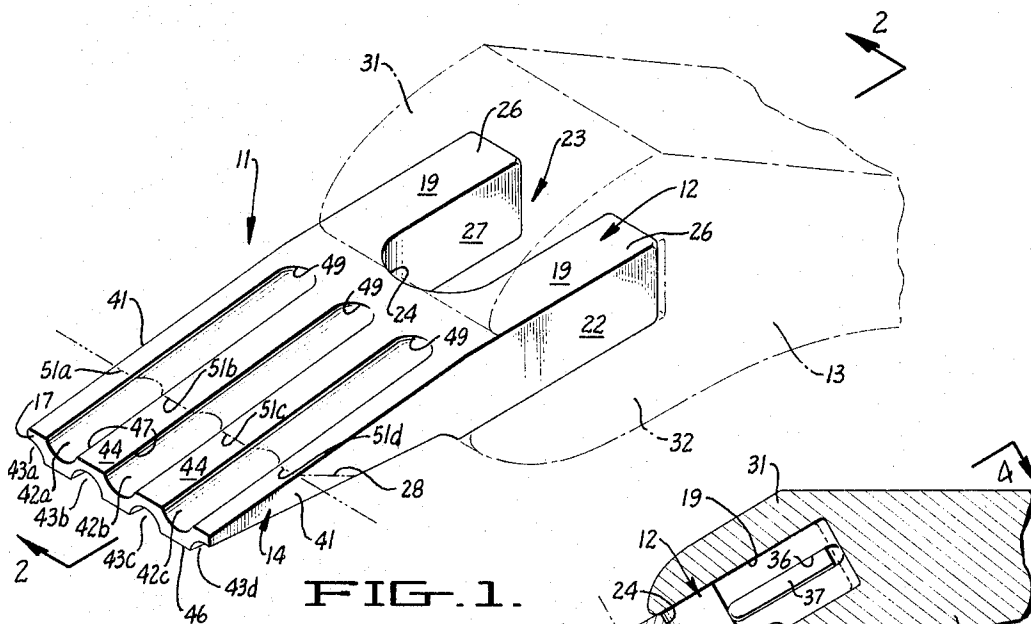


FIG. 1.

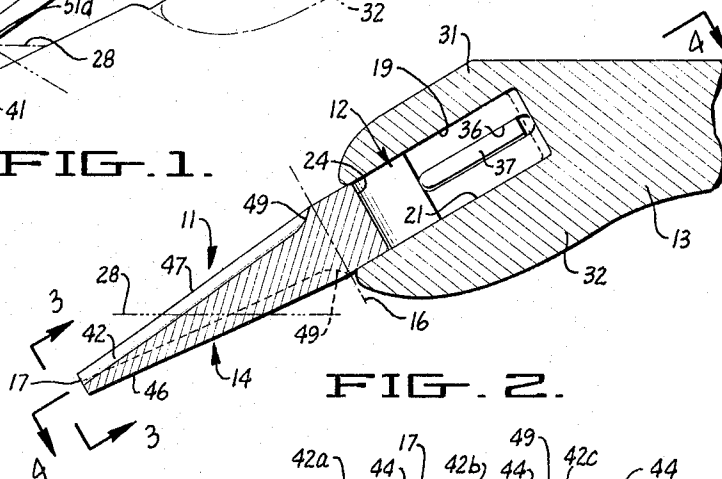


FIG. 2.

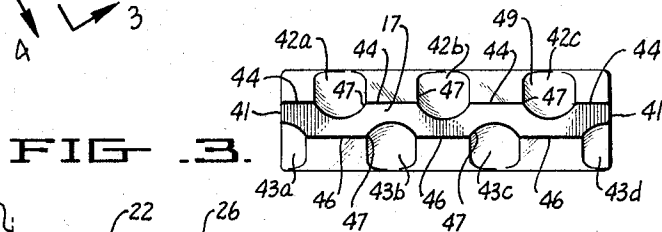


FIG. 3.

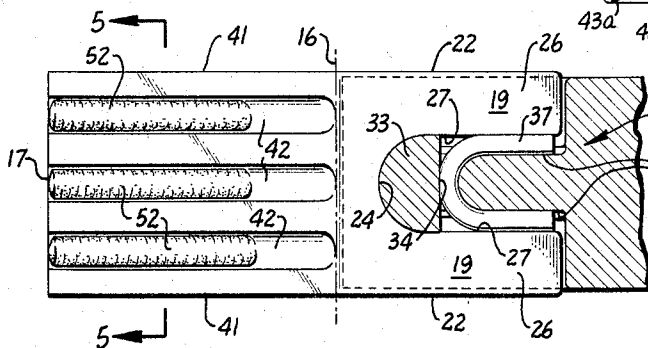


FIG. 4.

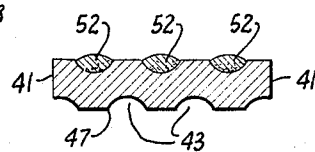


FIG. 5.

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2 Sheets-Sheet 2

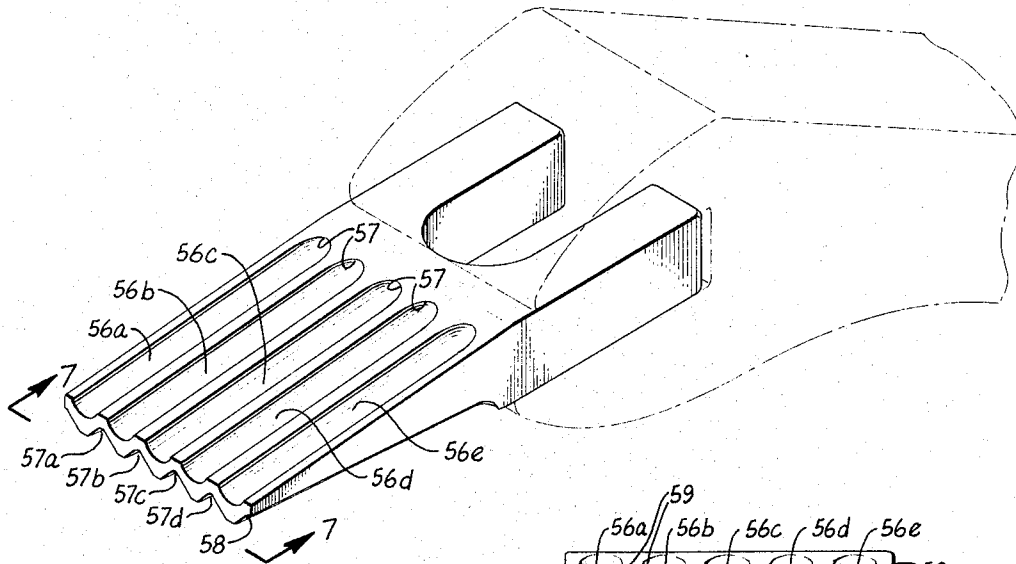


FIG. 6.

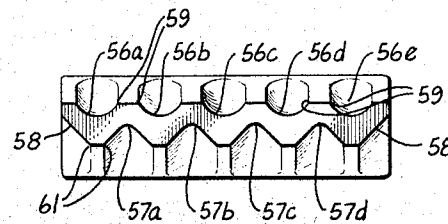


FIG. 7.

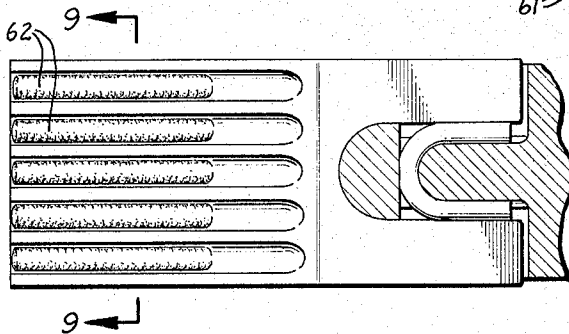


FIG. 8.

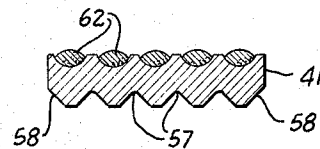


FIG. 9.

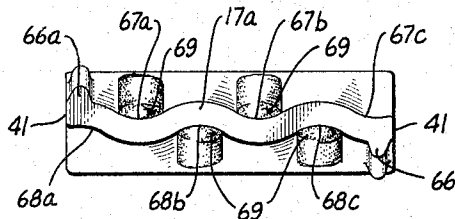


FIG. 10.

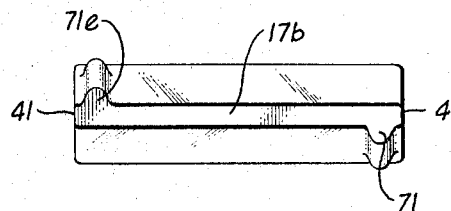


FIG. 11.

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DIGGING TOOTH WITH CORRUGATED CROSS-SECTION

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Filed Jan. 13, 1964, Ser. No. 337,318
6 Claims. (Cl. 37-142)

This invention relates to a new and improved tooth for earth digging equipment of the type of earth augers, trenching machines and similar equipment. The tooth is attached in a replaceable manner to a holder fastened to the equipment, or to the equipment itself. In such manner, after the tooth is worn it may be removed and replaced.

A particular feature of the construction of the present invention is the corrugated shape of the blade at the distal end of the tooth. In conventional teeth of this general type, such as that illustrated in Petersen Patent No. 2,698,880, the cutting edge is straight, being initially a thin rectangle. As wear occurs, the cutting edge tends to remain rectangular, but becomes more blunt by reason of the longitudinal tapering of the tooth. The present invention has a cutting edge which may be termed "corrugated." As wear occurs, the bottoms of the corrugations are worn away by abrasion, leaving a plurality of points or fingers spaced from each other across the width of the blade. The fingers or points are very effective in cutting action and their presence improves tooth cutting efficiency.

A further advantage of the construction of this invention is the fact that the corrugated shape reinforces and strengthens the cutting edge.

Still another feature of the invention is the presence of corners, or bends, in the sinuous cross-sectional shape of the blade which improves digging action, particularly in augers. Where teeth are mounted in augers, as shown in Petersen Patent No. 2,578,014, the movement of the cutting edge of the tooth relative to the soil is oblique having two components, one longitudinal relative to the tooth on one transverse. The presence of corners or bends in the cutting edge is particularly effective in effectuating the transverse component of the cutting action.

Still another advantage of the present invention is the fact that the force which is applied to the tooth by the cutting equipment and which is transmitted to the soil in a cutting action is distributed over a smaller cross-sectional area. Such distribution of force over a smaller area improves the shearing action in the soil.

A still further feature of the invention is the fact that the tooth of the present invention sharpens itself by reason of abrasion along two surfaces caused by the soil on which the tooth works.

In one or more forms of the invention hereinafter described in detail, the depressions in the corrugated blade surface on the top of the tooth are filled with a hardening substance, such as tungsten carbide. As the steel body of the tooth wears, the hard portions in the valleys of the blade tend to remain, since they are more wear resistant and form fingers somewhat similar to the fingers heretofore mentioned. The presence of these fingers is extremely effective in performing a cutting action.

In a still further modification of the invention hereinafter described, a rib is formed adjacent one cutting edge of the tooth on the lower surface thereof. Particularly when such tooth is used in an earth auger, the rib acts as a reinforcement of the edge which receives the greatest amount of wear and tends to reduce the wearing away of such corner.

Other objects of the present invention will become ap-

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parent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a perspective view of one form of tooth, in accordance with the present invention, showing in phantom a holder for the tooth and also showing in dot-and-dash lines the approximate shape of the blade after considerable wear has occurred.

FIG. 2 is a sectional view, taken substantially along the line 2-2 of FIG. 1.

FIG. 3 is an end view of the tooth, viewed in the direction of line 3-3 of FIG. 2.

FIG. 4 is a sectional view, taken substantially along the line 4-4 of FIG. 2, and also showing as a modification the filling of the valleys in the top of the blade with a hard substance.

FIG. 5 is a transverse sectional view, taken substantially along the line 5-5 of FIG. 4.

FIG. 6 is a view similar to FIG. 1, of a modification.

FIG. 7 is an end view as viewed along line 7-7 of FIG. 6.

FIG. 8 is a view similar to FIG. 4, showing a further modification generally in accordance with the construction of FIG. 6, but with a hardening substance in the valleys of the corrugations of the tooth and blade.

FIG. 9 is a transverse sectional view substantially along the line 9-9 of FIG. 8.

FIGS. 10 and 11 are end views, generally similar to FIG. 3 of additionally modified teeth.

Teeth 11 formed in accordance with the present invention are generally similar in side elevation and in plan. Their general outline resembles that shown in Petersen Patent No. 2,968,880. Each such tooth has a proximal portion 12 which functions to attach the tooth to a holder 13 and a distal portion 14 which, commencing at about transverse plane 16, tapers longitudinally to a transverse cutting edge or blade 17. The proximal portions 12 herein illustrated are similar to that of said Petersen Patent No. 2,968,880, it being understood that other constructions for attachment to holders 13 may be used with the distal portions of the teeth hereinafter described in detail. A more complete description of the proximal portion 18 of the tooth and its holder 13 is set forth in Patent No. 2,968,880, but for purpose of the present description it may be said that the top and bottom surfaces 19, 21 of the proximal end of the tooth are generally parallel to each other and the side edges 22 are likewise parallel to each other and extend forwardly the full length of the tooth. A slot 23 extends from the proximal end of the tooth between the top and bottom surfaces 19, 21 forwardly to a rounded forward terminus 24, thereby dividing the proximal end of the tooth into two prongs 26, each approximately rectangular in cross-section and each having an inward facing substantially vertical longitudinal wall 27.

The holder 13 for the tooth is either formed integrally with or attached by means forming no part of this invention to the digging equipment, such as an auger, trencher, or the like. The angle at which tooth 11 is held relative to the ground is best shown in FIG. 2, it being assumed that the tooth moves relative to the ground about horizontally. With prolonged wear, the tooth is truncated to about reference plane 28, which is oblique to section line 4-4 (the medial longitudinal plane of the tooth). Holder 13 has top and bottom portions 31, 32 having spaces therebetween to receive sprongs 26 of tooth 11 and interconnected by web 33 which substantially fills slot 23 between prongs 26. In a preferred method of attachment of the tooth to its holder, a hole 34 extends transversely through web 33 and grooves 36 extend longitudinally

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rearward of the hole on both sides of web 33. A resilient key 39, which may be a short, round, piece of rubber or rubber-like material, extends through hole 34 projecting out to either side of web 33. When tooth 11 is forced into its holder 13, the ends of key 37 are forced rearwardly and are compressed between walls 27 of prongs 26 and grooves 36, it being understood that the depth of grooves 36 is less than the cross-section of key 37. Thus key 37 frictionally retains tooth 11 in holder 13. Openings 38 are formed in holder 13 rearwardly of tooth 11 so that an instrument may be used to drive tooth 11 out of holder 13 when it is necessary to replace the same.

The distal portion 14 of the tooth is preferably rectangular in plan, the side edges 41 of the distal portion comprising continuations of the side edges 23 of prongs 26 and the forward or the cutting blade edge 17 being transverse. In prior developments of this tooth, the cross-sectional shape of the cutting edge or blade 17 has been a thin rectangle, as shown in FIG. 1 of Patent No. 2,968,880. In accordance with the present invention, the cutting edge of blade 17 is corrugated or ribbed providing the features and advantages which have heretofore been set forth.

In the form of the invention shown in FIGS. 1 to 3, the initial shape of the tooth is illustrated in solid lines. Three arcuate longitudinally extending depressions or corrugations 42a to 42c are formed in the top surface of the tooth, said depressions being arcuate and being spaced apart a distance about equal to the width thereof, with the middle depression 42b being centrally located and the outer depressions 42a, 42c being approximately midway between the central depression 42b and the outside edges 41 of the tooth. The bottom of the tooth is formed with similar depressions 43a to 43d below the spaces between the upper depressions 42a to 42c, there being two full bottom depressions 43b, 43c to either side of the center and two partial bottom depressions at the outside edges. This shape leaves flat surfaces 44 between the depressions 42 on top and flat surfaces 46 between the depressions 43 on the bottom and provides corners 47 which facilitate digging action, particularly in an earth auger where there is a component of digging action transverse to the direction of the tooth. Corrugations 42, 43 extend back almost the full length of the distal end of the tooth, blending as indicated by reference numeral 49 into the general configuration of the tooth at its rearward end.

As wear occurs, the bottom portion of the tooth between the bottom depressions 43 tend to wear away until they intersect the top depressions 42, and this results in a shape wherein there is a plurality of fingers or tines 51a to 51d (see FIG. 1) spaced apart and constituting the portions of the blades between the top depressions 42. The effectiveness of these fingers 51 in digging action has likewise heretofore been explained.

It will be seen that the wear of the tooth results in a sharpening of blade 17 so long as sufficient stock remains, and that although the shape of the blade changes materially as wear occurs, nevertheless, its digging efficiency is not substantially impaired.

In the form of the invention shown in FIGS. 4 and 5, a material 52 of great hardness is applied in the depressions 42 in the top surface of the tooth, it being understood that such hardness material could also be applied to the bottom depressions 43, although this is not usually necessary or desirable. Such a hardness material 52 may be tungsten carbide, or similar compositions which are puddle, welded, or otherwise applied. When wear occurs in this form of the invention, the steel between the hard inserts 52 wears away first and this results in fingers or points of hardened material 52 remaining on the cutting blade, such fingers or points performing an effective cutting action similar to the fingers 51 of the modification of

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FIGS. 1 to 3, but being created by a different physical property and being somewhat differently located.

With reference to the depressions 42, 43 shown in FIGS. 1 to 5, inclusive, it will be understood that the number and spacing thereof is subject to wide variations. The shape of the depressions, instead of being arcuate, may be more generally angular.

In the form of the invention shown in FIGS. 6 and 7, five equally spaced generally arcuate depressions 56a to 56e are formed in the top surface of the blade, the spacing between the depressions being considerably less than that in the preceding modification. Depressions 56 extend back to blended ends 57. The bottom surface of the blade is formed with inverted V-shaped depressions 57a to 57d, having the apices rounded and located directly below the middles of the spaces between the top depressions 56. The corners 58 of the bottom edge of the blade are formed bevelled. The form of the invention of FIGS. 6 and 7 provides a plurality of corners 59, 61, similar to corners of the preceding modification. Further, as wear occurs the fingers or points are formed by wearing away of the portions between the bottom depressions until they intersect the top depressions. Elements of the modifications of FIGS. 6 to 9, similar to FIGS. 1 to 5, are provided with the same reference numerals and not separately described.

In the form of the invention of FIGS. 8 and 9, the top depressions 56 are filled with hard material 62, such as tungsten carbide, in manner similar to the form of the invention of FIGS. 4 and 5.

In the form of the invention shown in FIG. 10, the shape of blade 17a is sinuous having an arcuate length of approximately 1080°. The origin of the sinuous curve intersects the blade shape at either outside edge 41. Depressions 67a to 67c are formed in the top and depressions 68a to 68c in the bottom. As best shown in FIG. 10, the right hand edge of the blade receives the major portion of the wear when installed in an earth auger, such as shown in Petersen Patent No. 2,578,014, by reason of the transverse component of the cutting action and, also, by reason of the fact that the outside edge of the tooth traverses a greater circumferential path in the turning action of the auger. To protect the tooth against greater wear, a rib 66 is formed on the bottom surface immediately under the outer edge 41 of the tooth, which provides additional stock to resist wear. This form of the tooth is reversible (i.e., the tooth may be removed from its holder and inverted). Accordingly, a similar rib 66a is formed on the top surface of the opposite edge for use after the tooth has been inverted.

By reason of the sinuous nature of the blade, the bottom portions between the bottom depressions tend to wear more rapidly forming with the passage of time fingers or points similar to those heretofore described.

Optionally, the depressions 67, 68 in the top and/or bottom surfaces of the tooth of FIG. 10 may be filled with a hardening material 69, such as tungsten carbide, applied in the manner of FIGS. 4 and 5, and for a similar function.

In the form of the invention shown in FIG. 11, the blade 17b is straight, being generally of a thin rectangular shape similar to that shown in Petersen Patent No. 2,968,880. A rib 71 is formed adjacent the outer edge 41 of the tooth on the bottom surface thereof for a purpose similar to the rib 66 in the modification of FIG. 10, and a similar rib 71a is formed on the top surface adjacent the inner edge 41 similar in function to rib 66a of FIG. 10, so that when the tooth is inverted the rib 71a performs a function similar to rib 71. In this form of the invention, corrugations are absent and hence the fingers which are features of the form of the invention of FIGS. 1 to 10, inclusive, are not created by wearing action. However, the ribs protect the edge of the tooth which has the greatest abrasion from excessive wear.

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Although the foregoing invention has been described in some detail, by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be practiced within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. A unitary tooth for digging equipment comprising a proximal portion formed for attachment of said tooth to a holder and a distal portion, said distal portion formed with top and bottom surfaces, each said surface formed at the distal end of said tooth with longitudinal corrugations extending rearward from the distal end of the tooth and forming with said distal end a plurality of corners, said corners and distal end comprising digging surfaces, said tooth tapering forwardly, said corrugations on said top surface being laterally offset and staggered relative to said corrugations on said bottom surface.

2. A tooth according to claim 1, in which said distal portion is formed with a longitudinal rib on the underside adjacent one side edge.

3. A tooth according to claim 2, in which said distal portion is formed with a second longitudinal rib on the top surface adjacent the side edge opposite said first mentioned rib.

4. A tooth according to claim 1, in which the valleys of the top surface are at least partially filled with a hard material.

5. A unitary tooth for digging equipment comprising a proximal portion formed for attachment of said tooth

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to a holder and a distal portion, said distal portion being substantially rectangular in plan with corrugated top and bottom surfaces, the corrugations of said surfaces extending longitudinally rearwardly from the distal end of said tooth and being laterally staggered relative to each other, said top and bottom surfaces being uniformly spaced apart and presenting in front elevation a sinusoidal shape, and a longitudinal rib on said bottom surface along one side edge, said rib extending rearward from the distal end of said tooth substantially the length of said corrugations.

6. A tooth according to claim 5, in which at least some of said corrugations are at least partially filled with hard material.

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