Jan. 24, 1961 G. A. M. PETERSEN 2,968,880

REVERSIBLE TOOTH HAVING RESILIENT RETAINING MEANS

Filed Feb. 20, 1959

3 Sheets-Sheet 1

Fig. 1.

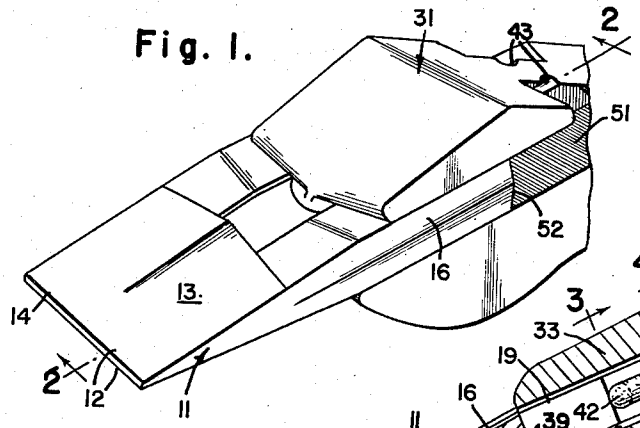


Fig. 2.

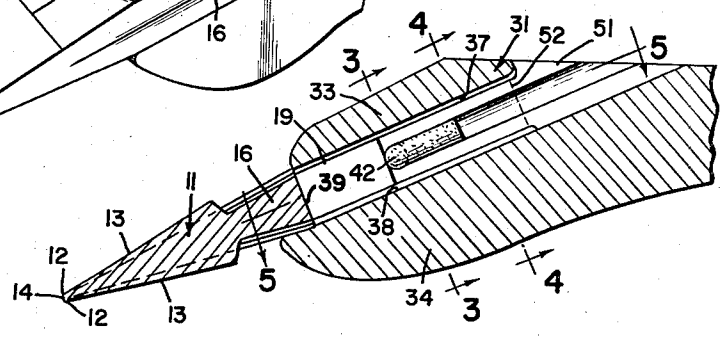


Fig. 3.

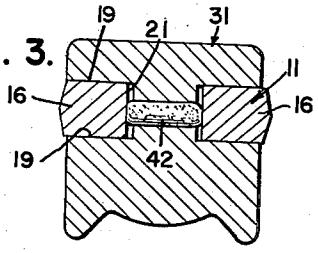


Fig. 4.

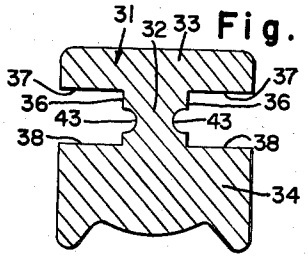


Fig. 5.

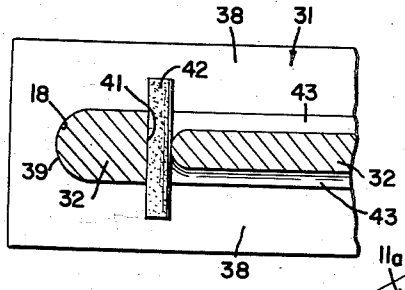


Fig. 6.

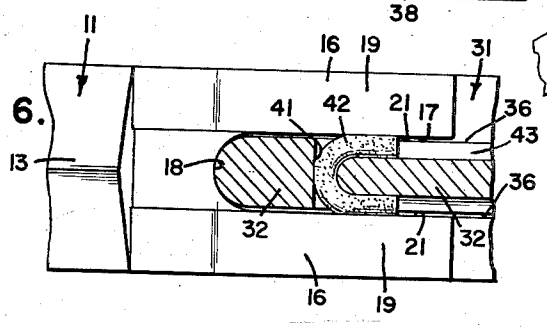
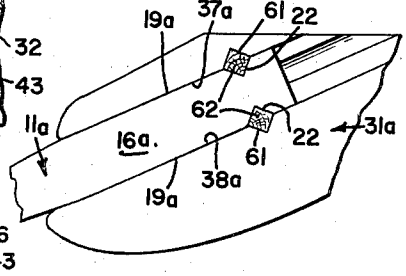


Fig. 7.



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Jan. 24, 1961 G. A. M. PETERSEN 2,968,880

REVERSIBLE TOOTH HAVING RESILIENT RETAINING MEANS

Filed Feb. 20, 1959

3 Sheets-Sheet 2

FIG. 8.

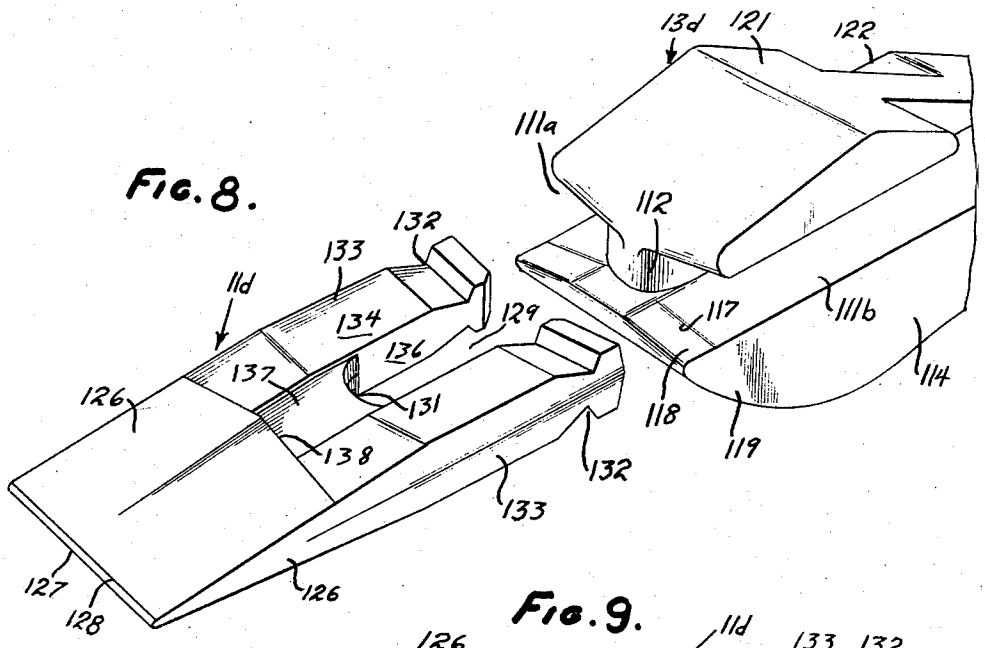


FIG. 9.

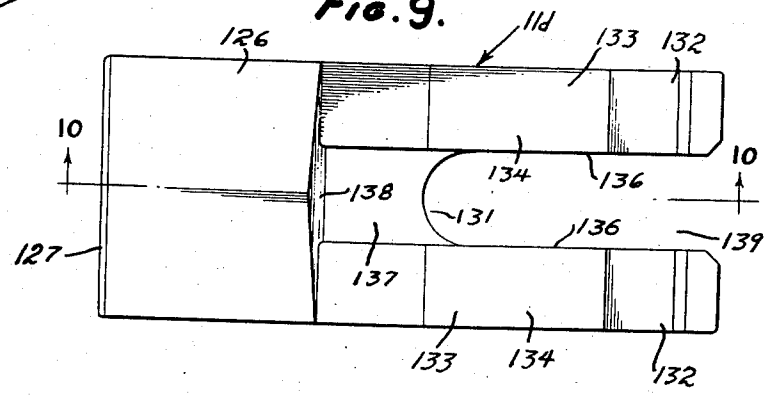
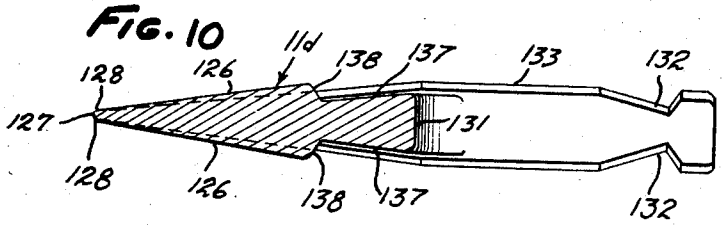


FIG. 10



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Jan. 24, 1961 G. A. M. PETERSEN 2,968,880

REVERSIBLE TOOTH HAVING RESILIENT RETAINING MEANS

Filed Feb. 20, 1959

3 Sheets-Sheet 3

FIG. 11.

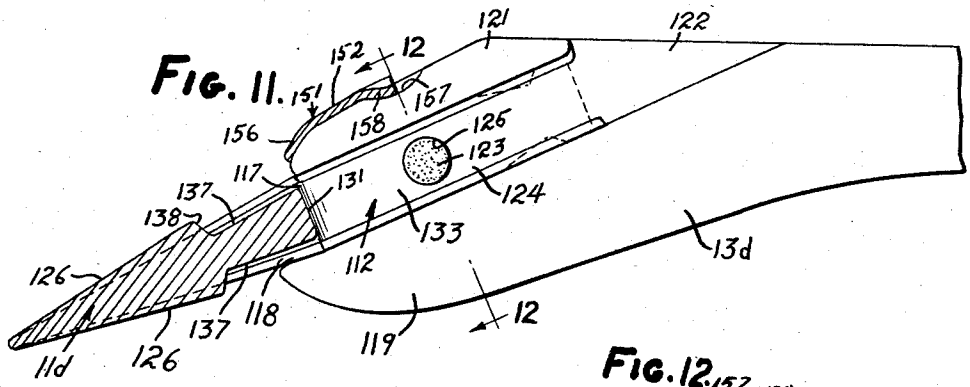


FIG. 12.

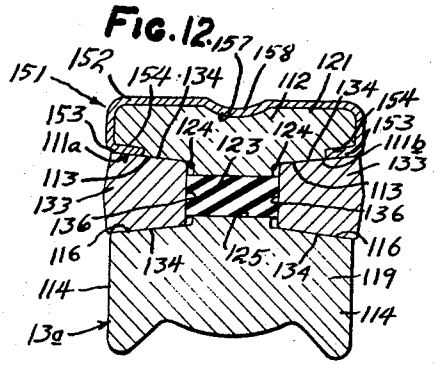


FIG. 13.

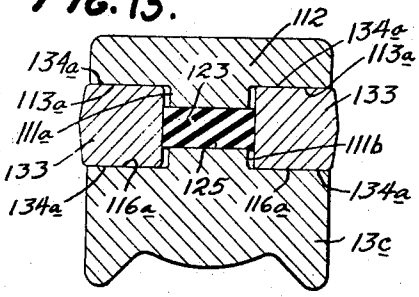


FIG. 14.

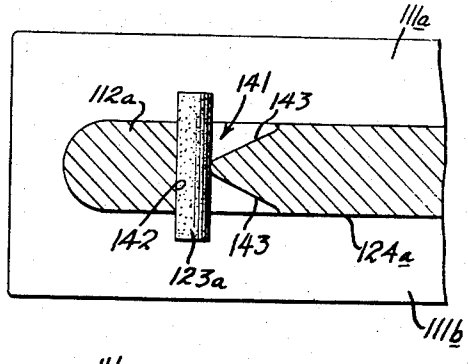
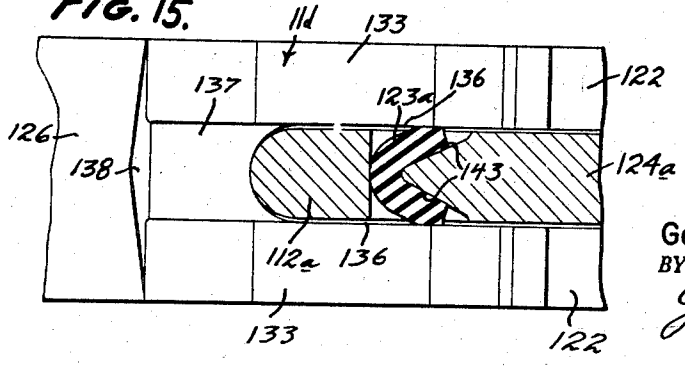


FIG. 15.



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2,968,880

REVERSIBLE TOOTH HAVING RESILIENT RETAINING MEANS

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Filed Feb. 20, 1959, Ser. No. 794,544

20 Claims. (Cl. 37—142)

This invention relates to a new and improved reversible tooth for earth digging equipment and more particularly to a means for retaining such a tooth in a shank. Reference is made to my copending patent applications, Serial No. 620,291, filed November 5, 1956, now Patent No. 2,877,574 and Serial No. 682,720, filed September 9, 1957, of which the present application is a continuation-in-part.

As illustrated and described in the aforementioned applications, a tooth for an earth digging machine has a tapered distal portion which performs the digging function and a bifurcated proximal portion composed of two prongs separated from each other by a rectangular slot which extends forwardly from the proximal end of the tooth. I have invented and described in the foregoing applications various means whereby such a tooth may be retained in a shank plate attached to digging equipment such as an earth auger, a trenching machine, or a wide variety of other digging tools.

The present invention is characterized by the fact that the shank is formed with a pair of recesses extending rearwardly from the forward end so that the resulting shape of the shank is substantially H-shaped in cross section and has a vertical web fitting into the slot in the proximal end of the tooth and is further and more importantly characterized by the fact that a resilient insert extends through the shank web and engages the inner vertical surfaces of the tooth prongs, thereby securing the tooth to the shank.

One of the features of the present invention is the fact that the use of bolts, metal keys, and similar fastening means to secure the tooth to the shank is eliminated, thereby eliminating much of the difficulty heretofore occasioned in securing teeth in shanks. It will be apparent that the resilient insert hereinafter described in detail is protected from wear and abrasion which are the conditions most likely to cause failure in conventional teeth. A conventional tooth commonly used for the same purpose as the present invention is formed with a socket into which a stud on the shank plate fits. Various difficulties have arisen in the use of this construction which are eliminated in the construction which is the subject of this invention. The present invention is characterized by the fact that the resilient insert is situated deep inside the shank where it is protected by the tooth and shank, and further that the configuration of both the tooth and the surrounding shank is such as to inhibit lodging of abrasive material in a position where wear will occur.

An advantage of the present invention is the facility with which the tooth may be installed and removed, and the fact that no special tools are required for such purpose.

A still further feature of the invention is the provision of auxiliary or emergency means for securing the tooth to the shank in the event that the resilient insert is misplaced or worn out.

A still further advantage of the invention is the fact

that the resilient insert accommodates minor variations in the construction of the tooth and shank plate, thereby making close tolerances unnecessary and further accommodates wear of the parts with the passage of time.

Accordingly, one of the principal objects and advantages of the present invention is the provision of a tooth which may be attached to and removed from a shank plate or other portion of an earth-digging tool or other piece of similar equipment with a minimum of time and effort.

Another object and advantage of the invention is the provision of a reversible tooth which may be used first on one side and, when worn, may be turned over and used on the other side. One of the particular features of the invention is the facility with which the tooth may be reversed and, after having been reversed, securely locked in position with a minimum of labor and without the use of special tools or equipment.

Still another feature of the invention is the provision of cooperating means on the tooth and shank plate or other portion of the equipment to which the tooth is attached, which assist in securing the tooth in place.

A still further feature of the invention is the provision of cooperating means on the tooth and shank plate to which it is attached, which prevent the tooth from being displaced from its proper position when the tooth is subjected to severe stress, such as striking a hard object at one corner of the tooth.

Other objects of the present invention will become apparent 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 showing a tooth and a portion of a shank therefor.

Fig. 2 is a vertical sectional view taken substantially along the line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 2.

Fig. 4 is a sectional view through the shank taken substantially along the line 4—4 of Fig. 2 with the tooth and resilient retaining means removed.

Fig. 5 is a sectional view taken substantially along the line 5—5 of Fig. 2 with the tooth removed and showing the resilient insert in the position which it assumes prior to installation of the tooth.

Fig. 6 is a view similar to Fig. 5 showing a portion of the tooth installed in position and illustrating the position which the resilient insert assumes when the tooth is installed.

Fig. 7 is a fragmentary side elevation of a portion of a tooth and shank showing a modified construction.

Fig. 8 is an exploded perspective view of another modification.

Fig. 9 is a top plan of the tooth of Fig. 8.

Fig. 10 is a vertical sectional view taken substantially along line 10—10 of Fig. 9.

Fig. 11 is a vertical sectional view of the assembled tooth and shank.

Fig. 12 is a transverse sectional view taken substantially along line 12—12 of Fig. 11.

Fig. 13 is a view similar to Fig. 12 of a further modified construction.

Fig. 14 is a sectional view of a further modified construction shown prior to insertion of the tooth in the shank.

Fig. 15 is a view similar to Fig. 14 showing the tooth in position in the shank.

The tooth which is the subject of this invention is illustrated in my foregoing described applications. Essentially, it consists of a tapered distal portion 11 hav-

ing cutting edges 12 which are reversible in the sense that the tapered top and bottom distal surfaces 13 are truncated at the front edge 14. Rearwardly of the top and bottom surfaces 13 are proximal prongs or roots 16 on either side of the tooth separated from each other by a rectangular slot 17 which extends forwardly from the proximal end of the tooth. Slot 17 terminates at its forward end in a semicircular wall 18. Each prong 16 has a top and a bottom surface 19 which are preferably flat and preferably parallel to each other but which may be slanted if desired. Vertical side walls 21 are formed defining the sides of the slot 17 and it is against these walls which the resilient insert hereinafter described in detail presses to hold the tooth in its shank.

In the form of the tooth illustrated in my foregoing defined patent applications, transverse notches 22 are formed on the top and bottom surface of each prong 16 (see Fig. 7 of this application). In the form of tooth illustrated in Figs. 1 to 6, inclusive hereof, the notches are eliminated. As hereinafter described, however, the notches 22 shown in Fig. 7 may function as an auxiliary means for securing the tooth in position.

Tooth 11 is received in a shank 31 which may be fastened by any convenient means to a portion of the earth digging tool. The shape of shank 31 is subject to wide modification, depending upon the use of the tool in which it is installed. As illustrated in my foregoing patent applications, several teeth may be attached to a single shank plate and the shank plate may be secured in various ways to the digging equipment. The shank herein illustrated may be defined as essentially H-shaped in the sense that it is formed with a vertical web 32 extending between an upper transverse member 33 and a lower transverse member 34. The cross-sectional shape of web 32 is such as to fit inside the slot 17 with a slight clearance between the edges 36 of the web 32 and the side walls 21 of the slot. Top portion 33 is formed with a top wall 37 on either side of web 32 and also with bottom wall 38 on either side of web 32. The spacing between walls 37 and 38 is sufficient to accommodate the thickness of the prongs 16 of tooth 11. In those instances where the surfaces 19 on the top and bottom of the tooth are parallel, walls 37 are parallel to walls 38, but on the other hand, if the surfaces 19 of the tooth are slanted, then the walls 37 and 38 assume a slanted position to accommodate the tooth. Web 32 extends forwardly to a rounded point 39 which fits against the end 18 of slot 17 so that the rearward thrust of the tooth 11 during the digging operation is transmitted to point 39 and web 32 and thus to the shank 31.

Extending transversely horizontally through the web 32 is a hole 41 which receives a resilient insert 42 formed of rubber, neoprene, or the like, which is preferably circular in cross section. The length of insert 42 is substantially greater than the width of web 32. In order to allow the insert 42 to bend backwardly, grooves 43 are formed in the walls 36 of web 32. Grooves 43 are preferably semi-circular in cross section and have a radius approximately equal to the radius of insert 42. Grooves 43 enable the insert to bend backwardly as shown in Fig. 6 when the tooth 11 is driven in position.

Thus, in installing the tooth, the prongs 16 are inserted in the opening to either side of web 32 of the shank 31 and the proximal ends of the tooth bend the insert 42 back to assume the position shown in Fig. 6. Insert 42 bears against the walls 21 of the tooth and causes the shank 31 to grip the tooth 11 so that it cannot be readily dislodged. Normal usage of the earth digging equipment will not cause dislodgment of the tooth. By reason of the resilient nature of insert 42, wear, vibration, the abrasive action of sand, gravel or rocks in which the tool is digging, and the like, will not ordinarily cause separation of the tooth from the shank.

When it is necessary to remove the tooth as, for example, when it is desired to reverse the tooth so that the cutting edges 12 may be substituted one for the other, a driving implement may be inserted through the back end of the opening 51, which is defined by the surfaces 37, 38 and 36 of the shank, and brought to bear against the rearward end 52 of the tooth. Thus the tooth may be driven forwardly until it is dislodged.

The modification of Fig. 7 illustrates an auxiliary means for locking the tooth in position. In this form notches 22 are formed transversely across the top and bottom surfaces 19*a* of the prongs 16*a* of the tooth 11*a*. Similarly, notches 61 are formed in surfaces 37*a* and 38*a* of shank 31*a*. Notches 61 and 22 are preferably triangular in shape and alligned so that a square opening is provided into which square pegs 62 may be driven. Pegs 62 may be formed of wood or may be formed of a relatively soft metal and function as keys to hold the tooth 11*a* in the shank 31*a*. Preferably, pegs 62 are used as auxiliary means for securing the tooth to the shank in the sense that they may be used as emergency substitutes if for some reason the inserts 42 are lost. Additionally, they may be used in addition to inserts 42 to supplement the same.

Figs. 8–15, inclusive, illustrate a modification of the invention. The shank 13*d* is formed with a first recess 111*a* on one side of the shank and a similar recess 111*b* on the opposite side, there being a web 112 between the two recesses. The top wall 113 of each recess 111*a* and 111*b* extends from the outer edge 114 of the shank 13*d* inwardly to the web 112, slating downwardly-inwardly. The bottom wall 116 of the recess 111*a* and 111*b* extends inwardly from the side edge 114 to web 112 and slants upwardly-inwardly. The shape of shank 13*d* is subject to considerable modification but, as illustrated in Figs. 8–15, inclusive, is formed with a step having a front face 117 and a bottom face 118 at the forward end thereof, the bottom portion 119 of the shank projecting out beyond the top portion 121 thereof. In addition, the top portion 121 is formed relatively short, so that there is provided a step 122 at the rear of top portion 121. Recesses 111*a* and 111*b* extend from the surface 117 back to rear step 122.

Extending transversely through a complementary aperture 125 in web 112 is a resilient insert 123 disposed in a direction normal to the side edges 124 of web 112 and projecting slightly outwardly relative to said side edges 124. The resilient insert 123 is illustrated in the accompanying drawings as being round in cross-section, but it will be understood that this shape is subject to considerable modification. The function of the insert 123 is to provide the principal means for securing the tooth 11*d* in shank 13*d* against unintentional dislodgment and yet to permit dislodgment of the tooth when it is necessary to remove the same for reversing or replacement.

Tooth 11*d* is formed of a hard piece of metal and its distal faces 126 taper forwardly to a truncated forward end 127 providing first and second cutting edges 128. The proximal end of the tooth is bifurcated by a slot 129 extending forwardly from the proximal end thereof for approximately one-half the length of the tooth, and the slot 129 may terminate in a rounded end 131 or the end may be square as in Patent 2,877,574. Depressions 132 may be formed in the top and also in the bottom surfaces 134 of each of the roots 133 of the tooth, which are separated by slot 129. The top and bottom surfaces 134 of each root 133 are beveled complementary to the surfaces 113 and 116 of recesses 111*a* and 111*b*. The tapered surfaces are optional but assist in preventing sideward motion of the tooth in use. The side edges 136 of slot 129 are spaced apart a distance slightly greater than the distance between side edges 124 of web 112, but are sufficiently close together so as to be contacted and resiliently gripped by the outer ends of insert 123. The space between edges 136 and 124 provides room for deformation of resilient insert 123. Forwardly of slot 129, tooth 111*d* is formed with a depression 137 extend-

ing between roots **133** and forwardly of depression **137** is a shoulder **138** extending transversely across both the top and the bottom surfaces of the tooth. Shoulders **138** provide a convenient surface for application of a tool to dislodge the tooth from the shank. The end **131** of slot **129** engages the forward surface of the web **112** and transmits the backward thrust on the tooth to the shank.

It will thus be seen that, when the tooth **11***d* is installed in the shank **13***d*, it is held therein by a combination of the frictional engagement of surfaces **134** with surfaces **113** and **116** and, further, by the frictional engagement of the ends of insert **123** with the side edges **136** of slot **129**. Further, the tapered surfaces **113**, **116** and **134** prevent sideward movement of the tooth toward either side, in that they wedge the tooth in place.

In order to protect the top portion **121** of the shank **13***d* from wearing out because of the abrasive action of the material being dug, a replaceable cap **151** is employed. Cap **151** may be made of sheet metal or the like and has a central portion **152** which closely conforms to the contour of the top surface of top portion **121** and depending, inwardly turned edges **153** which fit into cooperating grooves **154** in surfaces **113**. The forward end of cap **151** is formed with a downwardly turned nose **156** which fits over the front end of top portion **121** and prevents rearward displacement of the cap. To prevent forward displacement of cap **151**, a dimple **157** may be formed in the top surface of top portion **121** and the rear portion of central portion **152** formed with a depression **158** fitting into the dimple. It will be understood that various alternative modifications may be employed to hold the replaceable cap **151** in place on shank **13***d* and it will further be understood that cap **151** may be employed with various other tooth and shank constructions, such as those illustrated in this specification.

An additional modification is illustrated in Fig. 13, wherein the top walls **113***a* of the recesses **111***a* and **111***b* are parallel, as are the bottom walls **116***a*, instead of the tapered or angularly disposed corresponding surfaces of the modification of Fig. 12. The tooth used with the shank **13***e* may be of the shape illustrated in Fig. 13 having beveled surfaces **134**, or the surfaces **134***a* corresponding to surfaces **134** may be parallel.

A further modification is shown in Figs. 14 and 15, wherein the web **112***a* is formed with an aperture **141**, the front wall **142** of which is arcuate. The rearward walls **143** adjacent the outer edges **124***a* of web **112***a* extend rearwardly. A cylindrical insert **123***a*, similar in dimension to the insert of the preceding modification, is installed in the aperture **141**. When the tooth is driven into position (Fig. 15), the resilient insert **123***a* bends rearwardly into the backswept cavity defined by rearward walls **143**, and thus the insert **123***a*, in its distorted shape, bears against the edges **136** of the tooth over a greater area.

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:

1. In combination in an earth-digging tool, a tooth formed of a unitary piece of hard material with a tapered distal portion and a proximal portion having top and bottom faces and formed with a substantially rectangular longitudinal slot extending forwardly from the proximal end of said tooth to divide said proximal portion into two prongs, said slot forming substantially parallel longitudinal walls transverse to said top and bottom faces; and a shank formed with a recess to receive said prongs, said shank having a web extending through said recess, said web being formed with a hole transverse to said walls; and a resilient insert extending through said hole and projecting beyond said hole, said insert being jammed between at least one said wall and said web to frictionally restrain withdrawal of said tooth from said shank.

2. The combination of claim 1 in which said web is formed with at least one longitudinal groove rearwardly of said hole, said groove being of a depth less than the thickness of said insert.

3. The combination of claim 1 in which said recess extends rearwardly of the proximal ends of said prong whereby access to said proximal ends is provided to drive said tooth out of said shank.

4. In combination in an earth-digging tool, a tooth formed of a unitary piece of hard material with a tapered distal portion and a proximal portion having substantially parallel top and bottom faces and formed with a substantially rectangular longitudinal slot extending forwardly from the proximal end of said tooth to divide said proximal portion into two prongs, said slot forming substantially parallel, longitudinal walls transverse to said top and bottom faces; and a shank projecting forwardly and formed with a pair of longitudinally rearwardly extending recesses each having a cross-sectional shape of said prongs and divided by a web projecting into said slot, said web formed with a transverse hole spaced rearwardly from the front edge of said web and transverse to said walls, and a resilient insert passing through said hole and having a length greater than said hole, said insert extending rearwardly and being compressed between said web and said walls to frictionally restrain withdrawal of said tooth from said shank.

5. The combination of claim 4 in which the forward end of said web abuts the forward wall of said slot whereby force exerted on said shank is transmitted to said distal portion of said tooth.

6. The combination of claim 4 in which at least one said recess extends rearwardly beyond the proximal end of said prong through which access to the proximal end of said prong is provided to drive said tooth out of said shank.

7. The combination of claim 4 in which said web is formed with at least one longitudinal groove rearwardly of said hole, said groove being of a depth less than the thickness of said insert.

8. The combination of claim 4 in which at least one face of one of said prongs is formed with a notch extending across said prong and which further comprises a deformable member driven into said notch and wedged between said prong and shank to restrain withdrawal of said tooth from said shank.

9. The combination of claim 4 in which at least one face of one of said prongs is formed with a first notch extending across said prong and in which said shank is formed with a second notch opposite and in proximity to said first notch and which further comprises a deformable member driven into said notches and wedged between said prong and shank to restrain withdrawal of said tooth from said shank.

10. In combination, in an earth-digging tool, a unitary shank shaped to receive the proximal end of a tooth, a tooth formed of a unitary piece of material and having its proximal end shaped to fit said shank, said tooth having top and bottom forwardly converging distal faces and a substantially rectangular proximal portion rearward of said distal faces having a longitudinally forwardly extending, substantially rectangular slot extending forwardly from the proximal end of said tooth extending through from said top to said bottom surface and dividing said proximal end into two discrete prongs, each substantially rectangular in shape, said shank being formed with a pair of recesses each of a shape to receive one of said prongs, said shank having a web between said recesses, and a resilient insert carried by said web and projecting into at least one of said recesses and bearing against the sides of said slot frictionally to restrain dislodgement of said tooth from said shank.

11. The combination of claim 10 in which said insert extends through said web and is positioned to engage both sides of said slot.

12. The combination of claim 10 in which said web is formed with an aperture extending transversely through said web and said resilient insert has a cross-sectional configuration substantially the same as said aperture, the opposite ends of said insert extending beyond said web.

13. The combination of claim 10 in which said web is formed with an irregularly shaped aperture extending through said web, the side edges of said web rearwardly of said aperture being formed with second recesses communicating with said aperture, said insert prior to assembly of said tooth being longer than the thickness of said web at said aperture, the ends of said insert being deformed upon assembly of said tooth into said second recesses.

14. The combination of claim 10 in which the top and bottom surfaces of said prongs converge inwardly from the side edges of said tooth toward said slot.

15. The combination of claim 14 in which the top and bottom walls of said recesses converges inwardly from the side edges of said shank toward said web complementary to the converging surfaces of said prongs.

16. The combination of claim 14 in which the top and bottom walls of said recesses are substantially parallel.

17. In combination, in an earth-digging tool, a unitary shank shaped to receive the proximal end of a tooth, a tooth formed of a unitary piece of material and having its proximal end shaped to fit said shank, said tooth having top and bottom forwardly converging distal faces and a substantially rectangular proximal portion rearward of said distal faces having a longitudinally forwardly extending, substantially rectangular slot extending forwardly from the proximal end of said tooth extending through from said top to said bottom surface and

dividing said proximal end into two discrete prongs, each substantially rectangular in shape, said shank being formed with a pair of recesses each of a shape to receive one of said prongs, said shank having a web between said recesses, said web frictionally engaging both sides of said slot to restrain dislodgement of said tooth from said shank.

18. The combination of claim 17 which further comprises a replaceable cap fitting around the top of the distal portion of said shank, and cooperating means on said shank and cap detachably holding said cap in place.

19. The combination of claim 17 which further comprises a replaceable cap fitting around the top of the distal portion of said shank and being formed with side edges engaging the top walls of said shank and cap detachably holding said cap in place.

20. In combination, in an earth-digging tool, a shank shaped to receive the proximal end of a tooth, a tooth having its proximal end shaped to fit said shank, said tooth having a longitudinally forwardly extending slot extending forwardly from the proximal end of said tooth from top to bottom of said tooth and dividing said proximal end into two discrete prongs, said shank being formed with recesses each shaped to receive one of said prongs, said shank having a web between said recesses, and a resilient insert carried by said shank and bearing against said tooth frictionally to restrain dislodgement of said tooth from said shank.

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