Dec. 26, 1967 G. A. PETERSEN 3,359,662

RESILIENT RETAINER FOR EXCAVATING TEETH FUSED TO TOOTH HOLDER

Filed May 17, 1965 3 Sheets-Sheet 1

FIG_1

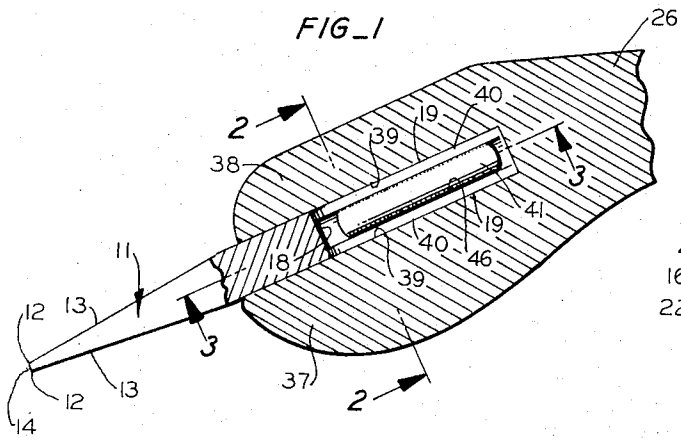


FIG_2

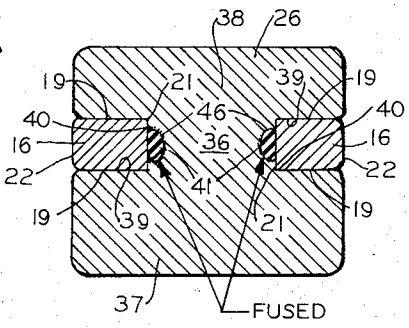


FIG_3

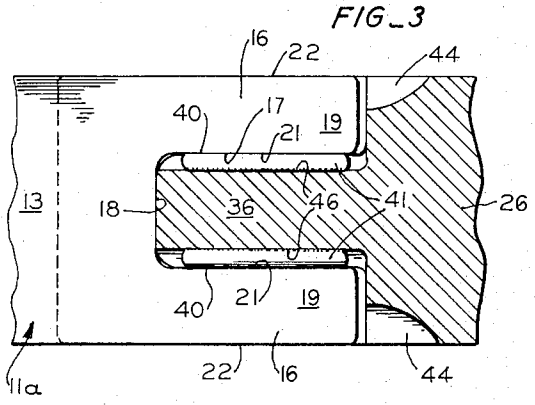


FIG_4

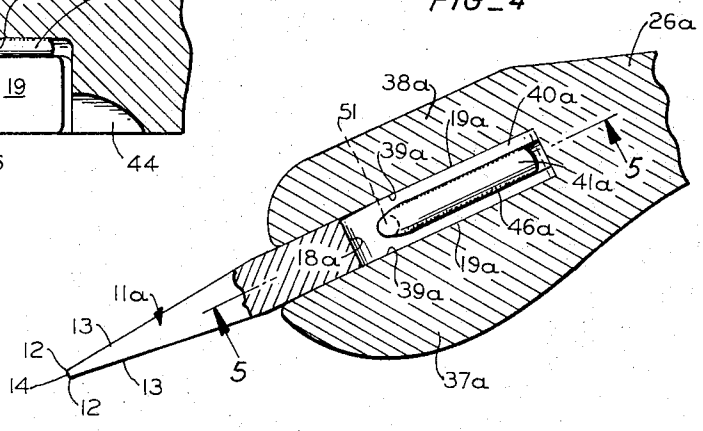
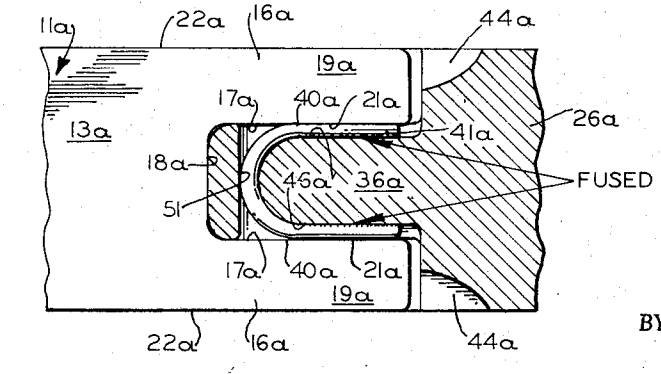


FIG_5



INVENTOR.
GERALD A. PETERSEN
BY
Julian Caplan
ATTORNEY

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FIG_6

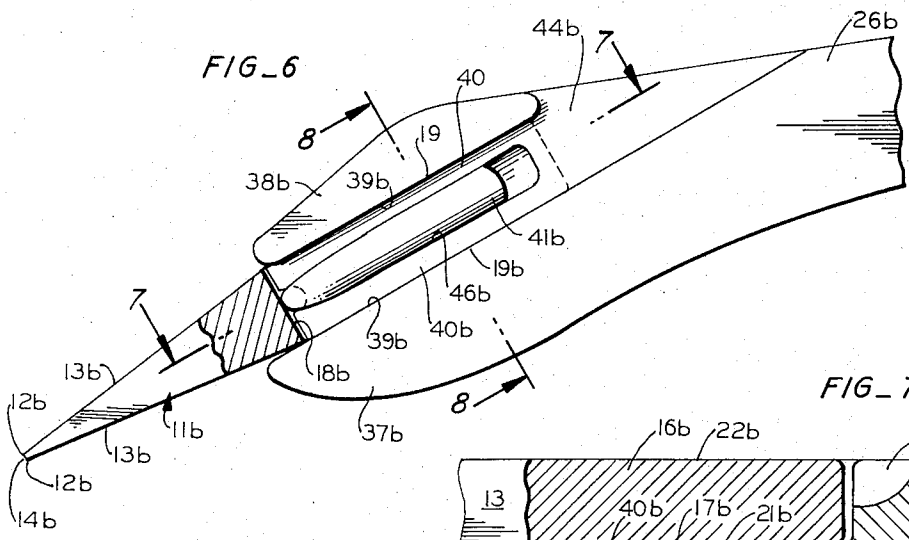


FIG_7

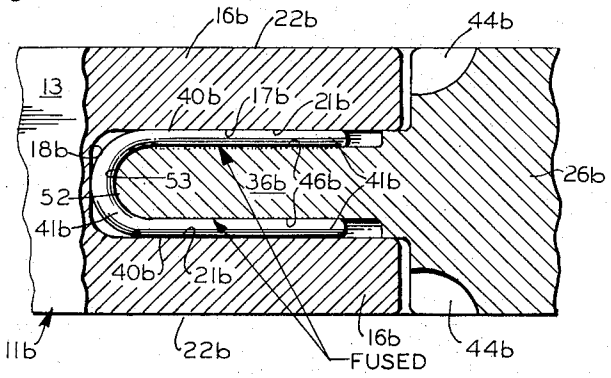


FIG_8

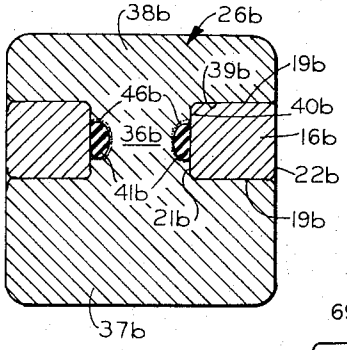


FIG_9

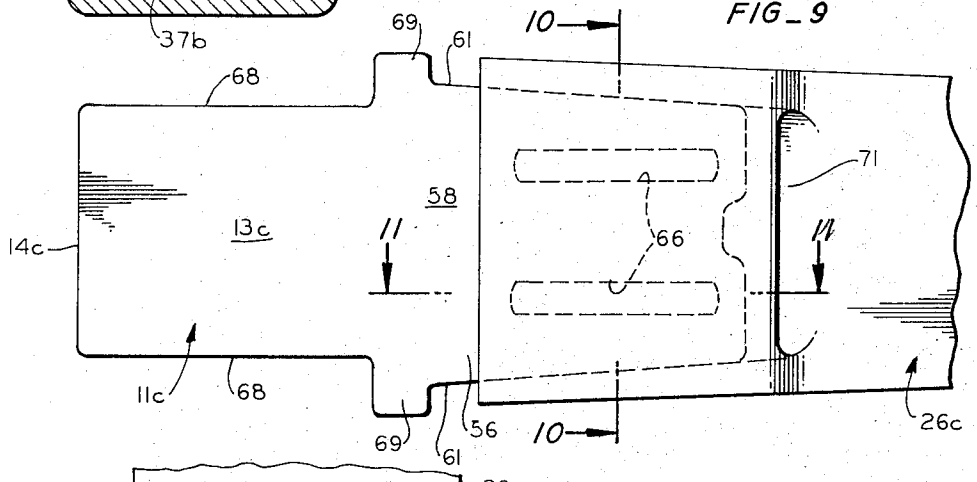
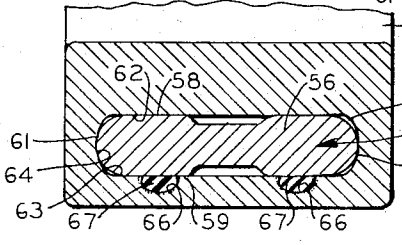


FIG_10



INVENTOR.
GERALD A. PETERSEN
BY
Julian Caplan
ATTORNEY

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FIG_12

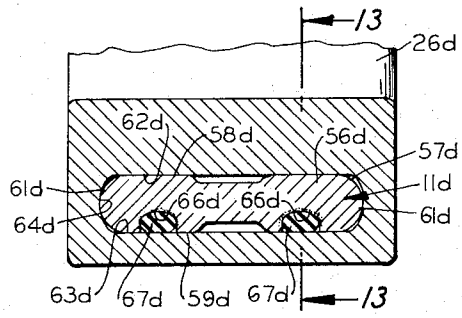
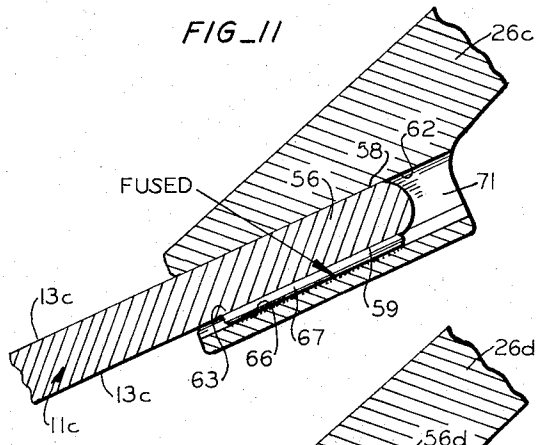


FIG_11



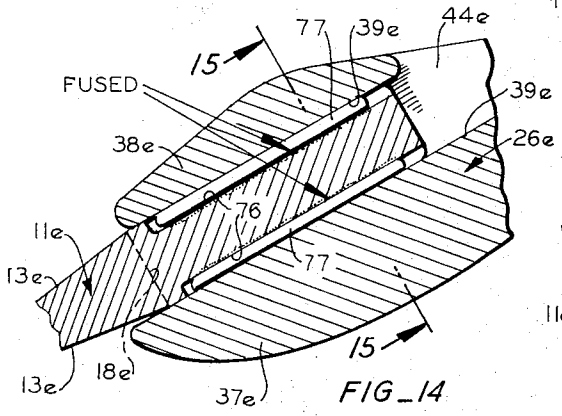


FIG_14

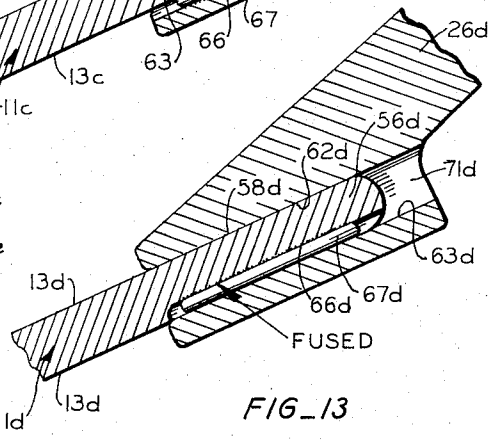


FIG_13

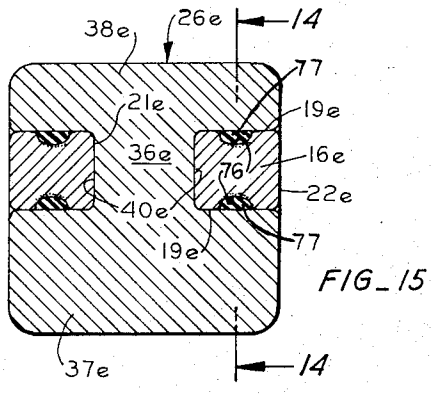
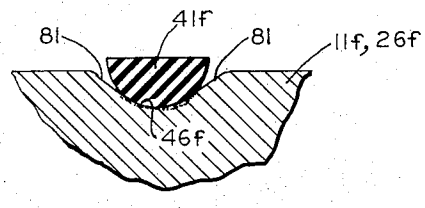


FIG_15

FIG_16



INVENTOR
GERALD A. PETERSEN
BY
Julian Caplan
ATTORNEY

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3,359,662

RESILIENT RETAINER FOR EXCAVATING TEETH FUSED TO TOOTH HOLDER

Gerald A. Petersen, Sunnyvale, Calif., assignor of one-half to Anita E. Petersen, Saratoga, Calif.

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10 Claims. (Cl. 37—142)

ABSTRACT OF THE DISCLOSURE

To facilitate retention of a resilient retainer of the type shown in Petersen Patent No. 2,968,880 in its holder prior to the tooth being installed the retainer is fused (as by vulcanizing) to the adjacent wall of its holder.

This invention relates to a new and improved resilient retainer for excavator tooth wherein the retainer is fused to the tooth holder. U.S. Patents Nos. 2,968,880 and 3,057,091 disclose reversible excavating teeth held in tooth holders by means of resilient retainers which are compressed between the tooth and a recess in the holder and physically restrain withdrawal of the tooth from its holder. In said patents a hole is formed in the holder and the retainer is inserted through the hole, initialiy extending beyond the hole and into a recess in the holder which receives a portion of the tooth. The present invention is an improvement upon such structures wherein the retainer is initially held in place while the tooth is being installed by reason of its being fused to the holder.

Accordingly, the present invention relates to a tooth for an earth-excavating machine such as an earth auger, trencher, scarifier, or the like, wherein a holder is provided to hold one or a plurality of teeth attached to the excavating equipment. A plurality of teeth may be affixed to a plate suitably positioned for effective digging action so that if the tooth is moved through the ground the teeth dig into the earth and the dirt is conveyed away from its initial location. It will be understood that other means of attachment of the tooth holder to the equipment may be employed and that a plurality or a single tooth may be held in position.

As hereinafter illustrated and described, one tooth with which this invention is most suitably used has a tapered distal portion which performs the digging function and a bifurcated proximal portion composed of two prongs each substantially rectangular in cross-section, separated from each other by a rectangular slot which extends forwardly from the proximal end of the tooth from top to bottom thereof. The holder used with such tooth is formed with a pair of recesses extending rearwardly from the forward end thereof so that, in a preferred embodiment of the invention, the resulting cross-section of the holder is substantially H-shaped in cross-section and has a vertical web filling the slot in the proximal end of the tooth. In such preferred embodiment a resilient insert is installed between the web and one of the prongs or between opposite sides of the web and both prongs, thereby securing the tooth in the holder in such manner that it may be conveniently removed when required for reversal or replacement.

An important feature of the invention is that by using a resilient retainer, bolts, metal keys, and similar fastenings to secure the tooth to its holder are eliminated, thereby eliminating much of the difficulty heretofore occasioned in securing teeth to holders by conventional means. It is also 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. The resilient insert is located in a protected position

and the configuration of the tooth and surrounding holder is such as to inhibit lodging of abrasive material in a position where wear will occur.

An important 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.

The fusing of the resilient insert in its ultimate position in the tooth holder has certain advantages. One important advantage is that it is not necessary for the workman to carry a supply of resilient inserts and to install such inserts each time a tooth is to be installed. Thus the possibility of the workmen losing or forgetting the inserts is eliminated with consequent possibility of lost time being obviated. Secondly, the location of tooth holders is sometimes inconvenient for access in that the space for the workmen's hands is limited or the tooth may be situated in a hole or other location which is similarly inconvenient. Inasmuch as the insert is permanently bonded to the holder, the workman is not required to install the insert in a hole in the field.

Finally, the permanent bonding of the insert to the holder eliminates the possibility of the insert falling out of position once it is installed and this in turn reduces the danger that a tooth may be installed in its holder with an insert accidentally not installed which may mean that the tooth will fall out of place during excavating operation, a situation which may cause serious damage to the equipment.

A still further advantage of the invention is the fact that the resilient insert accommodates variations in dimensions of the tooth and holder thereby making close tolerances in manufacture of the parts unnecessary. Further, the resilient insert accommodates wear of the parts which occurs with the passage of time.

In one form of the invention the resilient inserts are fused in longitudinal grooves in the tooth rather than in the holder, facilitating installation of the inserts but increasing the cost of the teeth.

In a further embodiment of the invention the insert is semi-circular in cross-section rather than circular and the groove receiving the insert is of the same curvature but lesser depth than the insert. This facilitates fusing the insert in place and also increases the area of surface contact against the wall of the mating part against which the insert is pressed.

Although the preferred embodiments of the invention show a bifurcated or pronged proximal portion of the tooth, the invention may be used with other proximal shapes, such as a rearward, tapered, rectangular cross-section of which the commercially available "Jiffy" shape is illustrative. In such embodiment grooves may be formed either in the wall of the holder recess or in the tooth surface.

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 side elevational view broken away in section showing the tooth holder and resilient insert.

FIG. 2 is a transverse sectional view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a longitudinal sectional view taken substantially along the line 3—3 of FIG. 1.

FIG. 4 is a view similar to FIG. 1 of a modification.

FIG. 5 is a view similar to FIG. 3 of the modification of FIG. 4.

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

FIG. 7 is a sectional view taken along line 7—7 of FIG. 6.

FIG. 8 is a transverse sectional view taken along line 8—8 of FIG. 6.

FIG. 9 is a top plan of a modification of the previously-illustrated structure.

FIG. 10 is a sectional view taken along line 10—10 of FIG. 9.

FIG. 11 is a sectional view along line 11—11 of FIG. 9.

FIGS. 12 and 13 are views similar to FIGS. 10 and 11, respectively, of another modification.

FIG. 14 is a fragmentary view similar to FIG. 1 of a still further modification, the line of the section being shown as 14—14 of FIG. 15.

FIG. 15 is a sectional view taken substantially along line 15—15 of FIG. 14.

FIG. 16 is an enlarged fragmentary sectional view of a modified shape of insert and groove.

One tooth which is the subject of this invention is illustrated in the foregoing described patent. Essentially it consists of a tapered distal portion 11 having 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 at the top and bottom of 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 from top to bottom of the tooth. Slot 17 terminates at its forward end in a wall 18. Each prong 16 has top and bottom surfaces 19 which are preferably flat and preferably parallel to each other but which may be slanted if desired. Side walls 21 are substantially vertical and define the sides of the slots 17. The outside edges 22 of the tooth may be flat or bevelled along the rear portion thereof. As illustrated in Patent No. 2,952,085 notches (not shown) may be formed in the top and bottom surfaces of the prongs and may be used as an auxiliary means for securing the tooth in position. The tooth is received in a holder 26 which may be fastened by any convenient means (not shown) to a portion of an earth-digging tool such as an auger shown in Patent No. 2,578,014. The shape of the holder is subject to wide modification depending upon the use of the equipment in which it is installed. In the preferred form of the invention herein illustrated the holder has recesses opening rearwardly from the forward end thereof so that viewed in cross-section as illustrated in FIG. 2 the holder is in the shape of the letter H, turned on its side. A connecting web 36 fits into the slot 17 between the prongs 16 of the tooth. The bottom and top flanges 37, 38 engage the bottom and top surfaces of prongs 16. The shape of the tooth recesses 39 between flanges 37, 38 are dimensioned to receive the prongs 16 of the tooth with a tight fit.

In the form of the invention shown in FIGS. 1–3, longitudinal grooves 46 are formed in the walls 40 of web 36. Installed in each of said grooves 46 is a resilient insert 41. The initial or unstressed cross-section of insert 41 is of a thickness greater than the depth of groove 46 and a width less than the width of said groove. An important feature of the invention is the fact that the resilient insert 41 is fused as by vulcanizing in the groove so that it is not normally dislodged therefrom. It will further be noted that the groove length is longer than the initial length of insert 41.

When the tooth is installed in its holder, the insert is compressed between the wall of the tooth slot and the bottom of the groove and distorts to the position best shown in FIG. 2, being compressed so that it is thinner and wider than its initial shape and it is also somewhat elongated. The surface area of contact of the insert with the tooth wall is thus augmented and the frictional resistance to withdrawal of the tooth from its holder is also augmented. Variations in dimensions and tolerances are accommodated by the resilient and deformable nature of the insert. Normally, the insert will hold the tooth in

place despite severe stresses occasioned during the digging action particularly when the tooth encounters rock, roots, and the like. When it is desired to remove the tooth for sharpening, reversal, or replacement, a tool (not shown) may be inserted in the openings 44 in the sides of the holder to engage the rear ends of the prongs and the prongs are driven forward as by hammer blow thereby overcoming the frictional resistance of the resilient inserts to relative movement between the tooth and the holder. It will be understood that other means will be employed to remove the tooth from its holder.

FIGS. 4 and 5 illustrate a modification of the structure of FIGS. 1 to 3. Many of the elements of the structure are identical with or similar to those described and corresponding parts are designated with the same reference numerals followed by the subscript *a*. In such modification, a hole 51 is formed transversely through web 36*a*, in the manner illustrated in Patent No. 2,968,880. The resilient insert 41*a* passes through such hole 51 and its ends are bent back into grooves 46*a* which are dimensioned relative to insert 41*a* similar to grooves 46 relative to inserts 41 in the modification of FIGS. 1 to 3. However, to prevent dislodgment of the insert from the holder prior to installation of the tooth, the ends of insert 41*a* are fused to the bottom of grooves 46*a* as in the preceding modification.

FIGS. 6–8 illustrate a further modification of the structure of FIGS. 1–3. Many of the elements of such structure are identical with or similar to those heretofore described and corresponding parts are designated with the same reference numerals followed by the subscript *b*. Differing from the modification of FIGS. 4 and 5, no hole 51 is formed in web 36*b*. The forward end 52 of web 36*b* is rounded and side grooves 46*b* continue around end 52 in a rounded groove 53. Resilient insert 41*b* is fitted into grooves 53, 46*b* in a U-shape which extends around front end 52 of web 36*b*. Insert 41*b* is fused as by vulcanizing to the bottom of the groove as in the preceding modification.

In the modification of FIGS. 9–11, tooth 11*c* and holder 26*c* differ from the shapes of the preceding modifications in that no slot and prongs are provided at the proximal end. In this form of the invention the proximal end 56 of tooth 11*c* is substantially rectangular in cross-section having rounded corners 57, broad top and bottom surfaces 58, 59 and vertical edges 61. A complementary recess is formed in the holder having top and bottom walls 62, 63 and end walls 64. Grooves 66 are formed in wall 63 and pieces of resilient material 67 similar to that of preceding modifications are fused into grooves 66. The cross-sectional shape of grooves 66 is preferably wider and shallower than the corresponding dimensions of the inserts 67 and when the inserts are compressed the greater area of surface contact affords a greater area surface contact with the adjoining parts.

Tooth 11*c* has forwardly tapering broad top and bottom surfaces 13*c* terminating in a transverse cutting edge 14*c*, the side edges 68 being substantially vertical and parallel and spaced apart about the same distance as the minimum width of side edges 61 of the rearward tapering proximal end of the tooth. Laterally extending lugs 69 may be formed at either side at the juncture of the proximal and distal ends of the tooth. Lugs 69 protect the holder 26*c* from wear and also facilitate withdrawal of the tooth from the holder when necessary. For the same purposes openings 71 may be formed in holder 26*c* for entry of a tool to drive the parts apart.

In the modification of FIGS. 12 and 13 grooves 66*d* are formed in tooth 11*d* rather tnan in holder 26*d*, thus differing from the preceding modification. In other respects the structures are similar and corresponding elements of FIGS. 12 and 13 are designated by the same reference numeral followed by subscript *d*.

It will be understood that, whereas in FIGS. 9–13 the resilient insert is positioned at the bottom of the tooth the position could be varied. For example, the groove and insert could be positioned at the top of the tooth.

FIGS. 14 and 15 illustrate a further modification wherein tooth **11***e* is generally similar in shape to tooth **11** and holder **26***c* to holder **26** and corresponding parts are designated by the same reference numeral followed by subscript *e*. However, in this embodiment of the invention the insert is fused to grooves in the tooth rather than in the holder, as in FIG. 1. Thus longitudinal grooves **76** are shown formed in top and bottom surfaces **19** of each prong **16** and a resilient insert **77** fused into each such groove. The compression of the insert is the same as in previous modifications. It will be understood that whereas four inserts **77** are shown in FIGS. 14–15, one or more thereof may be eliminated.

This modification provides for easier attachment of insert to its metal bed because it is more exposed and hence more easily vulcanized. However, normally the life of a holder **26***e* is many times that of a tooth **11***e* and hence the foregoing described advantage is overcome.

In FIG. 16, alternate shapes of grooves **46***f* and inserts **41***f* are shown, applicable to any of the foregoing embodiments. The shape of groove **46***f* is a segment of a circle with an arcuate length of less than 180° and slightly rounded out at each corner **81**. Resilient insert **41***f* is fused into the bottom of groove **46***f*. In the form of the invention shown in FIG. 16 the cross-sectional shape of insert **41***f* is semi-circular and this augments the area of surface contact with the opposed wall against which insert **41***f* is pressed and deformed, it being desirable that the area of contact between the insert and the mating surface be as great as possible to resist withdrawal of the tooth from the holder.

The resilient inserts previously described are generally sufficiently durable so that they will outlast several teeth. When necessary, however, the inserts may be removed from the holders and new inserts fused in place of the originals as by vulcanizing.

It will be understood that specific examples of application of the invention have been illustrated and described. However, considerable variation may be made in practice. Thus, where clearance permits, grooves **46** may be eliminated. Further, the inserts may be applied to locations other than the walls of web **36**; for example, to grooved or ungrooved walls of flanges **37**, **38** facing inward toward surfaces **19**.

What is claimed is:

1. In combination in an earth digging tool, a tooth formed of a hard piece of material and having a distal portion and a proximal portion, a toothholder formed with a recess shaped to receive at least a part of said proximal portion, said proximal portion and said holder having walls in close proximity to each other, and a resilient insert fused as by vulcanizing to one of said walls and compressed between said walls to physically restrain withdrawal of said tooth from said holder, the wall to which said insert is fused being formed with a groove, said insert fused within said groove, the initial uncompressed shape of said insert being thicker than the depth of said groove and narrower than the width of said groove, the area of said insert fused to the wall of said groove being not greater than the area of contact of said insert in its uncompressed condition with said wall.

2. The combination of claim **1**, in which said groove is semi-circular and said insert circular.

3. The combination of claim **1**, in which said insert is semi-circular and said groove has a cross-sectional shape of a segment of a circle.

4. The combination of claim **1**, in which said groove is formed in said holder.

5. The combination of claim **1**, in which said groove is formed in said tooth.

6. The combination of claim **1**, in which said proximal portion is rectangular in cross-section with broad flat top and bottom surfaces, said cross-section diminishing rearwardly.

7. The combination of claim **1**, in which the wall to which said insert is fused is formed with an aperture, said insert extending into said aperture.

8. In combination in an earth digging tool, a tooth formed of a hard piece of material having a distal portion and a proximal portion formed with a longitudinal slot extending forward from the proximal end of said tooth to divide said proximal portion into two prongs; a toothholder formed with a pair of recesses each shaped to receive one of said prongs and having a web between said recesses shaped substantially complementary to said slot; said web and at least one of said prongs having opposed walls in close proximity to each other; a resilient insert fused as by vulcanizing to one of said walls and compressed between said walls to frictionally restrain withdrawal of said tooth from said holder, said insert being fused to at least one wall of said web, said web wall being formed with a longitudinal groove and said insert being fused within said groove, the initial shape of said insert being thicker than the depth of said groove and narrower than the width of said groove, the area of said insert fused to the wall of said groove being not greater than the area of contact of said insert in its uncompressed condition with said wall.

9. In combination in an earth digging tool, a tooth formed of a hard piece of material having a distal portion and a proximal portion formed with a longitudinal slot extending forward from the proximal end of said tooth to divide said proximal portion into two prongs; a toothholder formed with a pair of recesses each shaped to receive one of said prongs and having a web between said recesses shaped substantially complementary to said slot; said web and at least one of said prongs having opposed walls in close proximity to each other; a resilient insert fused as by vulcanizing to one of said walls and compressed between said walls to frictionally restrain withdrawal of said tooth from said holder, said insert being fused to at least one wall of said web, a second said insert being fused to the wall of said web opposite said first-mentioned insert, the area of said insert fused to said wall being not greater than the area of contact of said insert in its uncompressed condition with said wall.

10. The combination of claim **8**, in which the web wall opposite said first-mentioned wall is formed with a second longitudinal groove and the forward end of said web with a front groove comprising a continuation of said first-mentioned and second longitudinal grooves, said insert bent in generally U-shape and fitting in said front and longitudinal grooves and fused therein.

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ABRAHAM G. STONE, *Primary Examiner.*

A. E. KOPECKI, *Assistant Examiner.*