Feb. 18, 1964 P. EYOLFSON 3,121,289

RETAINER FOR EXCAVATING TOOTH

Filed Feb. 23, 1962 2 Sheets-Sheet 1

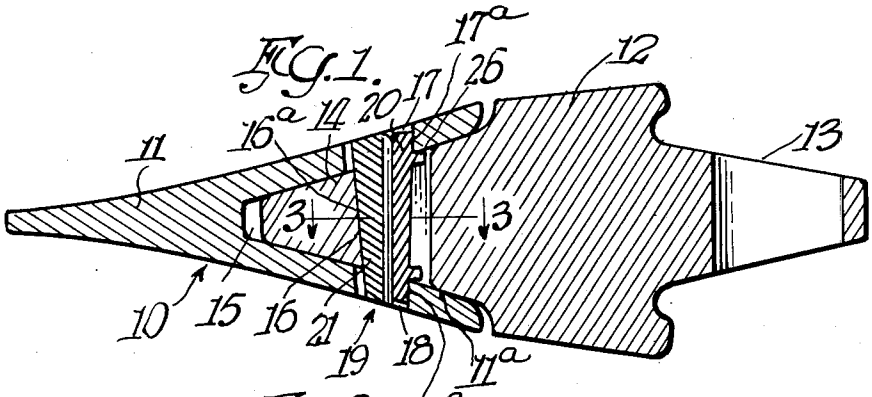


FIG. 1.

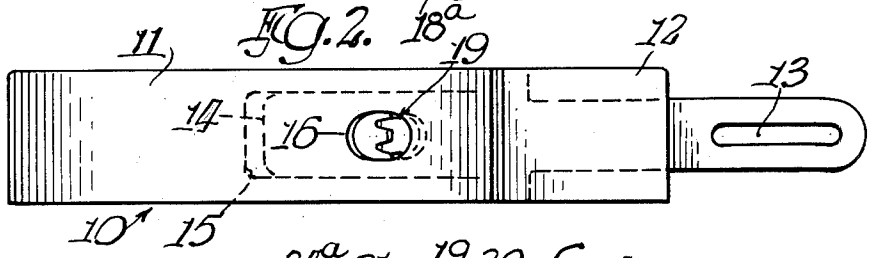


FIG. 2.

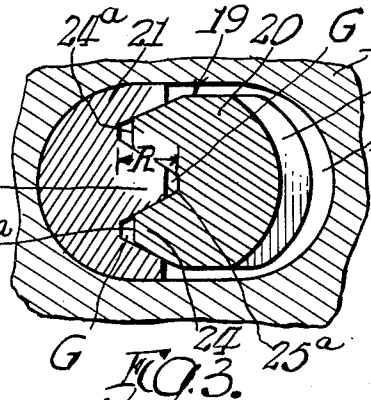


FIG. 3.

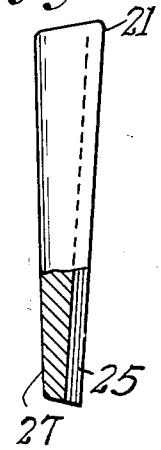


FIG. 4.

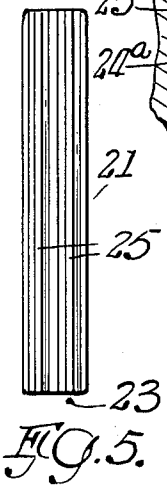


FIG. 5.

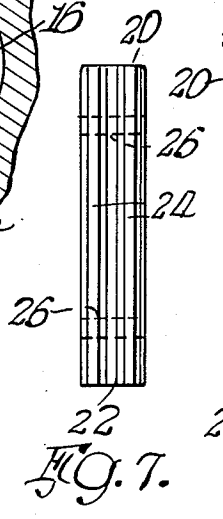


FIG. 7.

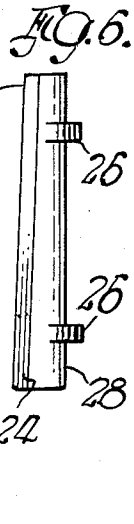


FIG. 6.

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RETAINER FOR EXCAVATING TOOTH

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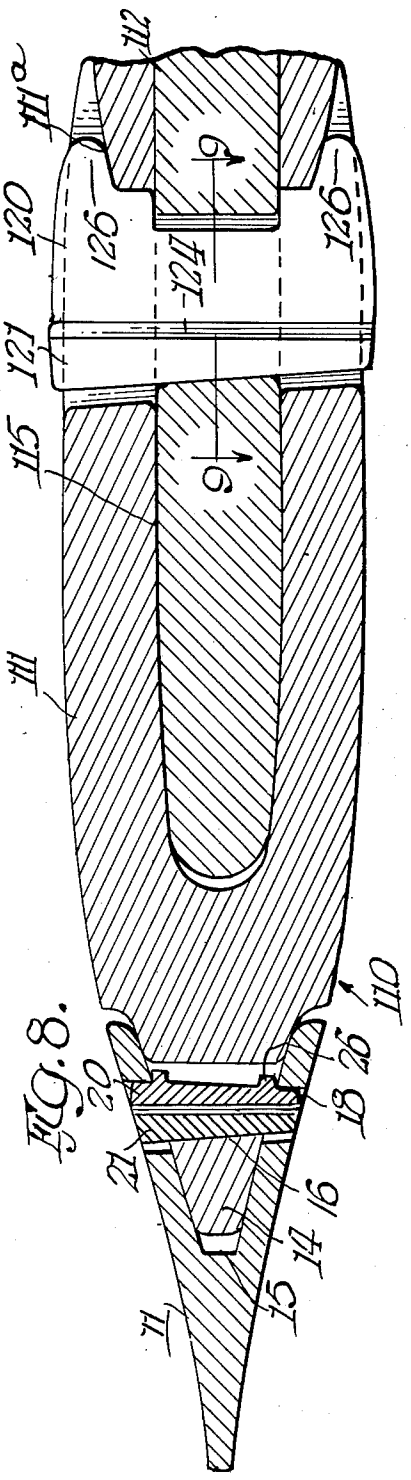


FIG. 8.

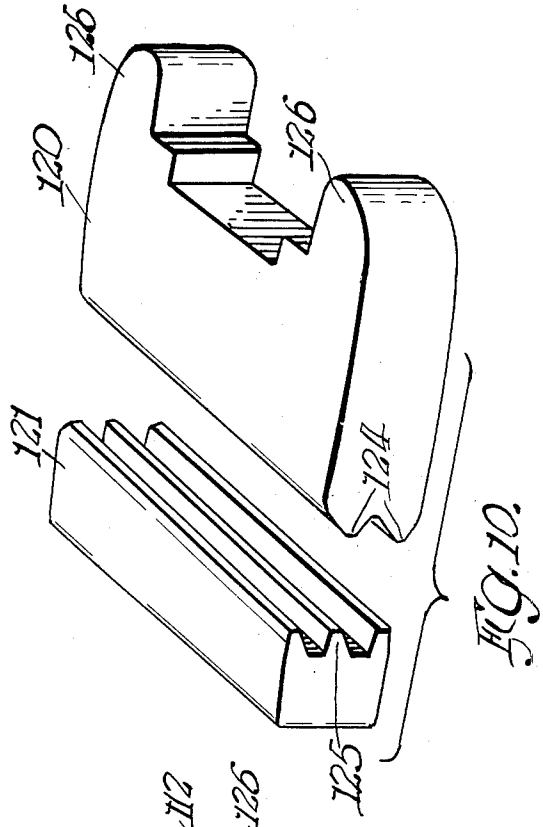


FIG. 10.

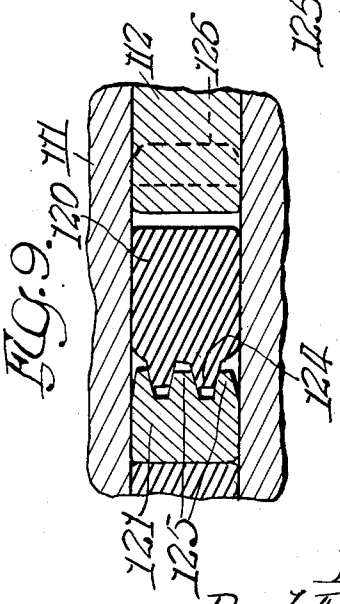


FIG. 9.

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3,121,289

# RETAINER FOR EXCAVATING TOOTH

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9 Claims. (Cl. 37—142)

This invention relates to a retainer for an excavating tooth, and, more particularly, to a removable device for releasably locking a wedge-shaped member on a support.

In excavating work, it is the practice to equip the digging edge of the bucket, for example, with a series of forwardly-projecting teeth so as to facilitate entry into the ground or rock. The wear on these teeth is necessarily more rapid than on the bucket leading edge, so it has been the further practice to make these teeth replaceable. The problem facing engineers has been to make the temporary mounting of these teeth as secure as possible, yet also make them readily detachable. This dilemma has been imperfectly solved in the past, since the more secure the mounting, the harder the removal when repair or replacement is necessary. Here, it should be appreciated that the initial mounting is all important, since inadvertent loss or detachment during operation can seriously damage the much more expensive excavating bucket. Repair of the bucket would also mean disadvantageous down-time of expensive machinery.

It is an object of this invention to provide a retainer which fulfills the dual purpose indicated above.

Another object is to provide a retainer device for an excavating tooth which is characterized by novel internal ribbing in the two-piece retainer which serves to make a secure attachment of the wedge-shaped member to its support, yet which is readily disassemblable to facilitate replacement of a worn tooth part.

Still another object is to provide a novel two-piece retainer which is characterized by exceptional wear life, being constructed completely of metal, and which thereby avoids the problems of tolerance and wear characteristic of prior art retainers which employ various resilient elements or plugs.

Other objects and advantages of the invention may be seen in the details of construction and operation set down in this specification.

The invention will be explained in conjunction with the accompanying drawing, in which—

FIG. 1 is a sectional elevational view, taken along a vertical midplane of an excavating tooth equipped with the inventive retainer;

FIG. 2 is a top plan view of the tooth of FIG. 1;

FIG. 3 is an enlarged, generally full-sized, cross-sectional view of a fragment of the device of FIG. 1 and as would be seen along the sight line 3—3 of FIG. 1;

FIG. 4 is a side elevational view, partially broken away, of one element of the retainer seen in the preceding views;

FIG. 5 is a rear elevational view of the retainer element of FIG. 4;

FIG. 6 is a side elevational view of the other retainer element;

FIG. 7 is a front elevational view of the FIG. 6 element;

FIG. 8 is a fragmentary elevational view, partially in section, of another form of excavating tooth with which the inventive retainer is usefully employed;

FIG. 9 is a fragmentary sectional view, taken along the line 9—9 of FIG. 8; and

FIG. 10 is an enlarged, perspective view of the two elements making up the retainer seen in FIGS. 8 and 9.

Referring now to FIG. 1 of the drawing, the numeral 10 designates generally an excavating tooth, which is seen



to include a point 11 and an adapter 12. The adapter 12 is equipped with a mounting slot 13 and a forwardly-extending nose portion 14.

Teeth of this type are well known, and the general shape thereof is that of a wedge, as can be appreciated from a comparison of FIGS. 1 and 2. The point 11, at its rear end, is equipped with a wedge-shaped socket 15, in which the wedge-shaped nose 14 of the adapter 12 is received. The adapter 12 may be secured to a bucket or other excavator by means of a pin (not shown) extending through the slot 13.

For example, the adapter may take the alternate form of that shown and designated as 111 in FIG. 8, wherein the overall tooth is designated by the numeral 110. The forward edge of the bucket 112 fits within a horizontally-extending slot or recess 115, so that in certain instances there is required not only a releasable coupling of the point to the adapter, but the adapter to the bucket. In other instances where the equipment is so arranged as to minimize wear on the adapter, the adapter may be weldably secured, bolted, etc. in a more permanent fashion to the excavator.

Turning now to the first drawing sheet, it will be seen that the nose 14 of the adapter 12 is equipped with a vertically-extending opening or slot 16. The slot 16 is alignable with top and bottom openings 17 and 18 in the point 11. Removably inserted in the aligned openings 16–18 is the inventive retainer generally designated 19 and which is seen to include a spool element 20 and a wedge-shaped element 21. The element 20 is seen apart from the combination in FIGS. 6 and 7, while the element 21 is seen in FIGS. 4 and 5.

Each element 20 and 21 is relatively elongated and in the confronting elongated faces 22 and 23 is equipped with a plurality of longitudinally-extending ribs 24 and 25, respectively. The ribs 24 and 25 intermesh, as seen in FIG. 3, and cooperate with the transverse ribs provided on the spool element 20 as at 26 in frictionally maintaining the two elements together and within the aligned openings 16–18.

Reference to FIG. 1 reveals that the ribs 26 are in engagement with the inner upper and lower walls of the socket 15 and thus serve to maintain the spool element 20 against vertical displacement, particularly during the time the retainer device 19 is being assembled within the tooth 10.

The element 21 is seen to be apertured or wedge-shaped in side elevational view (see FIG. 4) and is characterized by having both the front and rear faces 27 and 25 tapered. The spool element 20 may also be tapered in the front face 24 thereof, for example, as can be appreciated from a consideration of FIG. 6.

The longitudinally-extending ribs 24 and 25, as can be most readily appreciated from a consideration of FIG. 3, are flattened at their peaks as at 24*a* and 25*a*, respectively. This provides a clearance at the apex of the grooves G so that the bearing between the ribs is on the sides thereof, yielding an advantageous holding power.

As a specific example of the retainer 19, the spool element 20 has a length of 7⅜", with a ⅝" taper per foot on the front longitudinal face 24 thereof. The transversely-extending ribs 26 are each 5/16" wide, and spaced 1 3/16" away from the adjacent end. The root dimension R of the untrimmed rib is ½" in the illustration given, but this is reduced by ⅛" to provide the flattened peaks 24*a* and 25*a* previously referred to. In this specific illustration, the wedge-shaped element on its rear face is equipped with a ⅝" taper per foot and on its front face equipped with a ⅜" taper per foot.

The invention is advantageously employable in coupling an adapter of the so-called "Whisler" type to a bucket, and this is seen in the second sheet of the draw-

ing, FIGS. 8–10. Here, the wedge element is designated by the numeral 121, while the spool element is designated 120. Again, there are provided the corrugations on the confronting intermeshing faces as at 124 and 125. The rear portion of the spool element 120 is equipped with rearwardly-extending lugs 126 at the upper and lower ends thereof for mating engagement with the rear portion of the wedge-shaped member 111 as at 111*a*, corresponding to the engagement illustrated in FIG. 1 as at 11*a*.

In the operation of the invention, the wedge-shaped member 11 or 111 is mounted on the holder or support 12 or 112, with the vertical openings aligned. Thereafter, the spool element 20 or 120, respectively, is mounted or inserted in place in the aligned openings, with the rearwardly-extending ribs 26 or 126 in engagement with the wedge-shaped member as at 11*a* or 111*a*. Thereafter, the wedge element 21 or 121 is positioned with its longitudinally-extending corrugations 25 or 125 in intermeshing register with the mating corrugations 24 or 124 of the spool member and then driven home. It will be seen that the top and bottom ends of the wedge element 21 are beveled to correspond approximately to the taper of the wedge-shaped element 11. The retainer will usually protrude above the surface from ⅛" to 1", depending upon the worn condition of the bearing surface of the nose and minor dimensional variations between one tooth point and the next.

The intermeshed ribs 24 and 25, by virtue of engagement along their sides, as contrasted to the peaks and valleys, result in exceptional holding power, resisting the tendency of the wedge element 21 or 121 to be displaced upwardly when any force is applied to the excavating tooth. The forward wall or face 27 of the wedge element engages the forward wall 16*a* of the slot or opening 16, while the rear wall 28 of the spool element 20 engages the rear walls or faces 17*a* and 18*a* of the openings 17 and 18, respectively. The walls 17*a* and 18*a* preferably extend perpendicularly to the horizontal midplane of the tooth—corresponding to the sight line 3—3. The forward wall 16*a* in the nose 14 may either be rearwardly inclined or perpendicular to the above-mentioned midplane, depending on whether the adapter is to be reversible. In either event, the inventive retainer provides an advantageous frictional engagement therewith.

The intermeshed ribs 24 and 25 utilize the wedge principle in obtaining the advantageous frictional engagement. Frictional resistance is independent of area contact and is obtained by multiplying the total force perpendicular to the surface concerned by the coefficient of friction. The resulting force perpendicular to a wedge face is calculated by multiplying the applied force by the cosecant of the angle between the wedge face and the direction of the applied force. In the inventive design, the included angle of the fluted teeth is approximately 50°, and since the applied force splits this angle, the multiplying factor is cosecant 25°, to 2.37. Thus, in the present design, the frictional resistance to sliding of the surfaces has been increased 2.37 times.

The inventive construction makes it possible to hold the retainer assembly in place without welding, which has been a common expedient in the past. Further, it is possible to furnish more than 2.5 more take-up with the same length of wedge. This stems form the fact that for a spool and wedge to stay in place, the tangent of the wedge angle must be less than the coefficient of friction. At best, the coefficient for dry steel is approximately 0.040, which sets the limiting angle at about 2.3°. Since the coefficient of friction is not too reliable under shock loading conditions, it has been common practice to limit the wedge taper to about ⅜" per foot, or an angle of approximately 1.8° whose tangent is 0.031. This in turn is the lower limit to which the coefficient of friction can drop if the wedge is not to squirt out under service loading conditions. Through the use of the fluted mating surfaces of the invention, it has been found that the retainer elements stay



in place over a period of six to eight weeks without further attention, where a conventional flat surface assembly could not hold for an hour without welding. Further, the conventional ⅜" taper per foot requires that the wedge must be driven 4" to take up a ⅛" variation in horizontal feet. By using the fluted spool and wedge, I have been able to increase the taper to 1" per foot so that the same ⅛" take-up can be accomplished in 1½" of wedge travel instead of 4".

A further advantage accrues from utilizing the greater taper in that the conventional ⅜" taper wedge has been customarily made about twice as long as necessary and, when driven into place, the bottom of the wedge (and sometimes the top) had to be trimmed off to prevent knocking the wedge out with a rock. A common alternate is to furnish up to five different sizes of shorter wedges to accommodate the fit variations. The provision of the fluted surfaces allows the use of the greater wedge taper, and therefore two sizes of wedges can supply the same range of take-up as five sizes of conventional wedges. Although the increased taper necessarily increases the tendency of the wedge to eject itself, this is more than compensated for by the increase in frictional holding power. In the inventive construction, the tendency of the wedge to eject itself is increased 1.68 times, but this is more than compensated for by the 2.37 time increase in frictional holding power.

While in the foregoing specification a detailed description of the invention has been set down for the purpose of explanation thereof, many variations in the details herein given may be made by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A retainer for an excavating tooth wherein a wedge-shaped member is releasably locked by said retainer on a holder, said retainer comprising:

(A) an elongated wedge part, and

(B) an elongated spool part,

(C) each part being equipped with a longitudinally-extending face adapted to enter into confronting, engaging relation with the other part face, the length of said faces being substantially the same, whereby said parts are substantially coextensive to develop a pin-like configuration when said parts are assembled,

(D) each of said faces being equipped with longitudinally elongated, transversely spaced ribs for intermeshing engagement with the ribs of the other face, and

(E) said spool part, on the longitudinally-extending side thereof opposite said longitudinally-extending face, being equipped with a pair of longitudinally spaced-apart, transversely-extending, integral projections each equipped with a tooth-engaging surface for engaging said tooth to anchor said spool part during longitudinal movement of said wedge part relative to said spool part to develop said pin-like configuration.

2. The structure of claim 1 in which said ribs have flattened peaks, the rib width and transverse spacing being arranged to cause the flattened rib peaks of one part to be spaced from the other part face when the two parts are in said intermeshing engagement whereby the sides of the ribs necessarily are in engagement when said parts are in said pin-like configuration.

3. The structure of claim 1 in which both of said parts are longitudinally tapered.

4. In an excavating tooth,

(A) a forwardly-extending, wedge-shaped member, and

(B) a supporting member therefor,

(C) aligned openings in said member adapted to receive a retainer,

(D) a retainer in said openings releasably locking said wedge-shaped member on said supporting member and comprising

(1) an elongated wedge part, and

(2) an elongated spool part, said spool part being equipped with transversely-extending ribs on the rear surface thereof engaging said wedge-shaped member,

(3) said spool part, on its elongated front face, and said wedge part in its elongated rear face, each being equipped with a plurality of transversely spaced-apart, longitudinally-extending ribs arranged in intermeshed relation.

5. The structure of claim 4 in which said wedge-shaped member is a tooth point.



6. The structure of claim 4 in which said wedge-shaped member is an adapter.

7. The structure of claim 4 in which the front face of said spool member is downwardly convergent relative to the rear face thereof.

8. The structure of claim 1 in which each of said projections is positioned a spaced distance from the spool part ends.

9. The structure of claim 1 in which said pair of projections is positioned at the spool part ends.

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