Jan. 14, 1964 R. FERWERDA 3,117,386

TOOTH ARRANGEMENT FOR EARTH DIGGING APPARATUS

Filed March 7, 1961 3 Sheets-Sheet 1

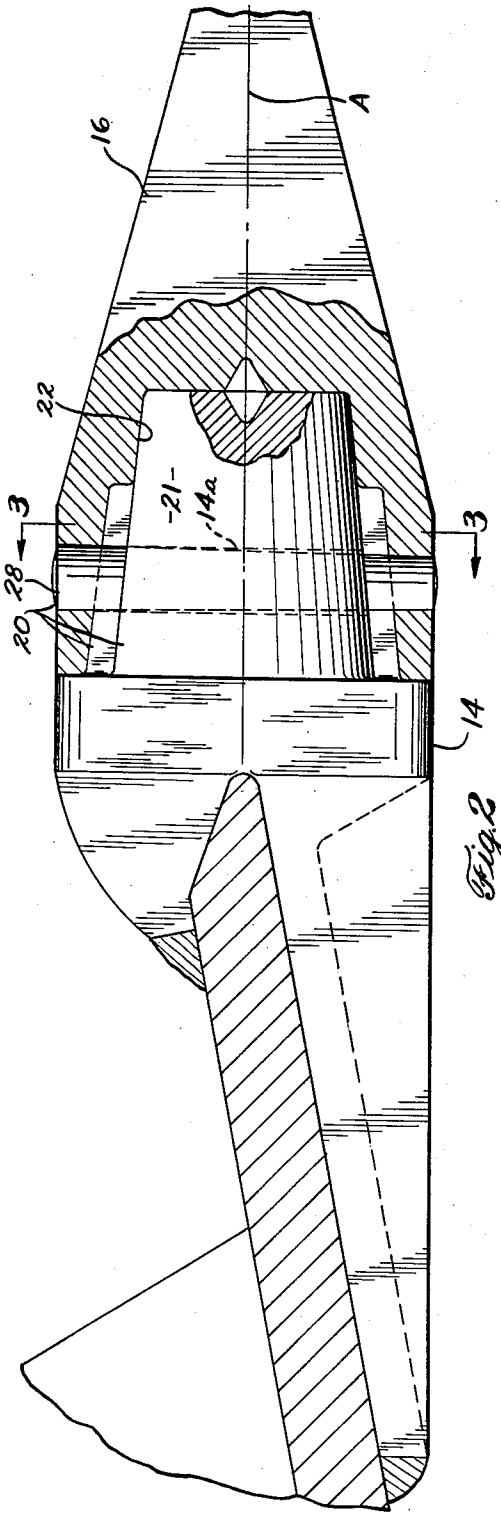


Fig. 2

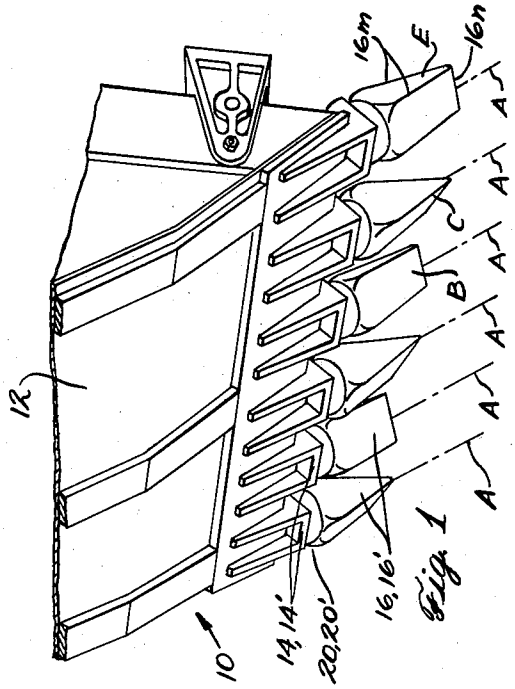


Fig. 1

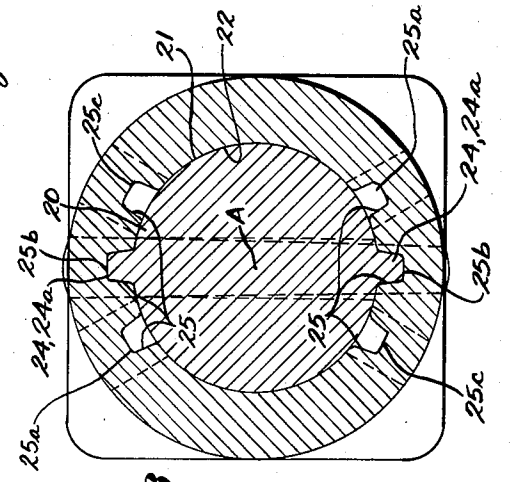


Fig. 3

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TOOTH ARRANGEMENT FOR EARTH DIGGING APPARATUS

Filed March 7, 1961 3 Sheets-Sheet 2

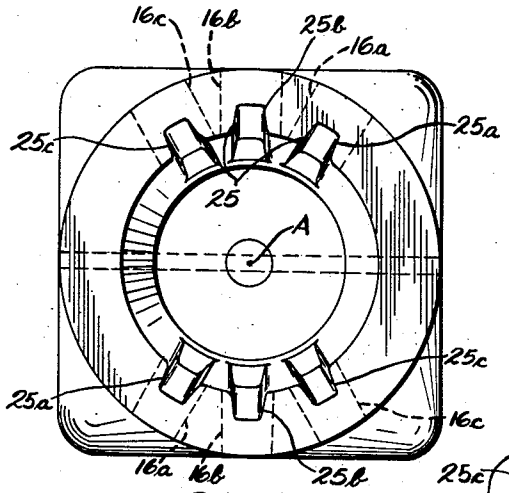


Fig. 6

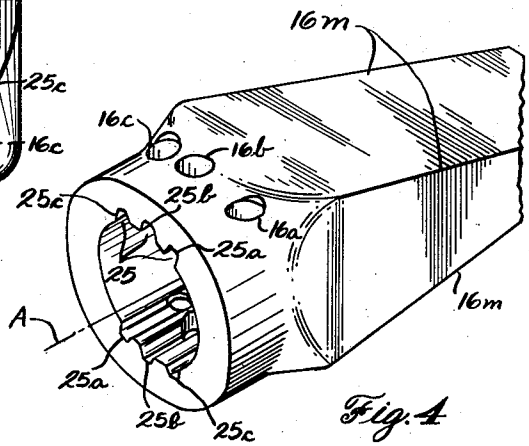


Fig. 4

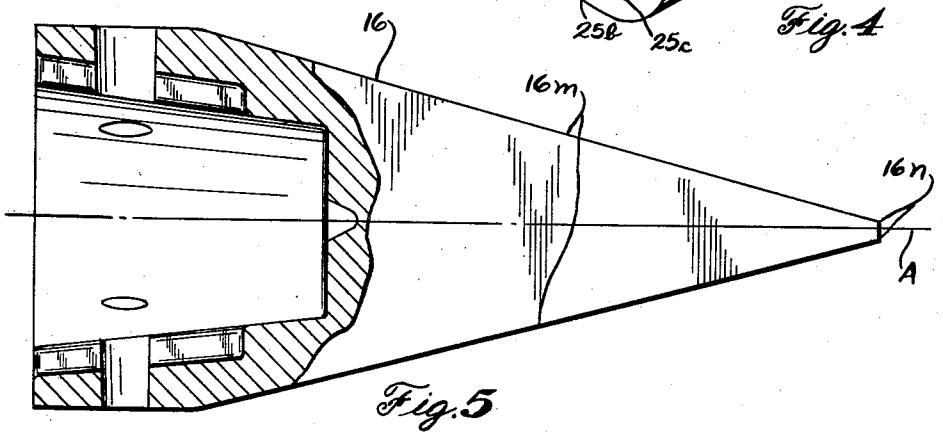


Fig. 5

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TOOTH ARRANGEMENT FOR EARTH DIGGING APPARATUS

Filed March 7, 1961 3 Sheets-Sheet 3

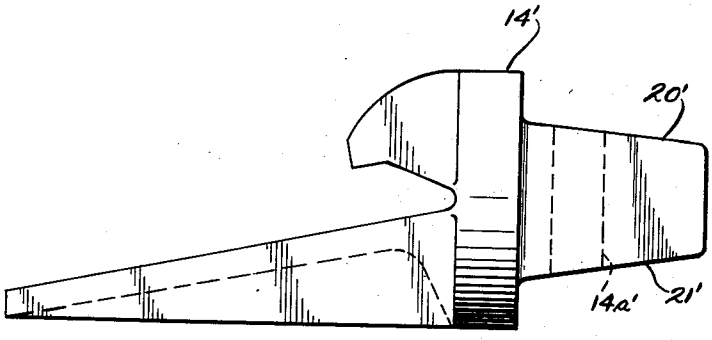


Fig. 7

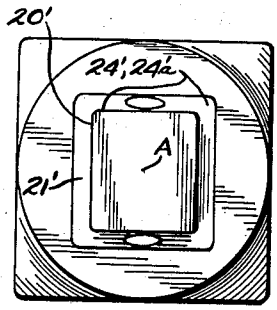
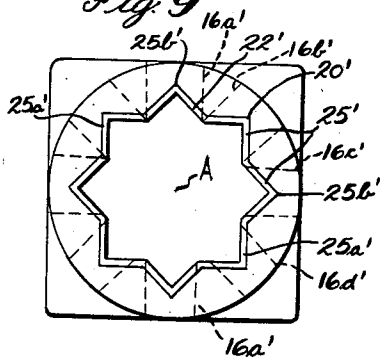


Fig. 8

Fig. 9



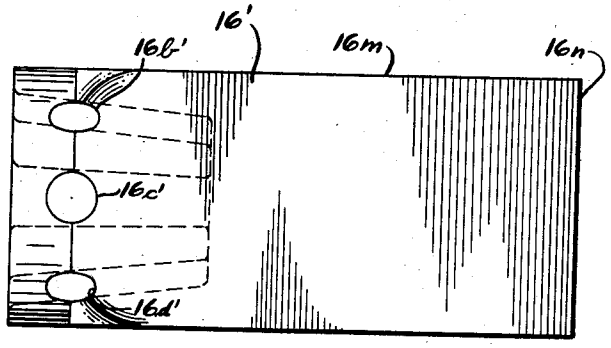


Fig. 10

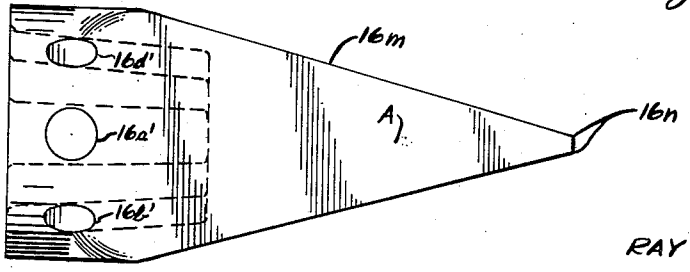


Fig. 11

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TOOTH ARRANGEMENT FOR EARTH DIGGING APPARATUS

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Filed Mar. 7, 1961, Ser. No. 94,055
4 Claims. (Cl. 37—142)

This invention relates to improvements in the tooth arrangement and tooth mounting for an earth breaking apparatus or unit.

One of the objects of the present invention is to provide such unit with a plurality of teeth, some of which may have different orientations, so as to break up the earth more readily, to minimize shock load upon the teeth during earth engagement, etc. wherein at least some of the teeth are detachably connected for independent replacement.

A further object of the present invention is to provide a unit of the aforementioned type wherein at least some of the teeth are adapted to be detachably connected and assembled in any of a plurality of angularly related assembled positions to vary the orientation of the tooth cutting edge with respect to the earth being broken.

A further object of the present invention is to provide a combined tooth and tooth mounting adapter for an earth breaking unit of the type described having a connecting means permitting a plurality of circumferentially displaced assembled positions of said tooth and adapter.

A further object of the present invention is to provide such unit or a combined tooth and tooth mounting adapter characterized by its inexpensive manufacturing cost, ease of assembly of its component parts, structural simplicity, compactness in design, strong and sturdy nature, multiplicity of functional advantages, and/or superior features when used in an earth breaking unit.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings,

FIG. 1 is a perspective view of the bottom of a digging bucket having a plurality of teeth and tooth mounting adapters of the present invention thereon;

FIG. 2 is an enlarged side view, partially in section, of a first form of one of the teeth and adapters in one assembled position;

FIG. 3 is a transverse sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a perspective view of the tooth in FIG. 2 removed from its adapter;

FIG. 5 is an enlarged side elevational view, partially in section, of the tooth in FIG. 4;

FIG. 6 is an enlarged end view looking at the left end of the tooth in FIG. 4;

FIG. 7 is a side elevational view of another form of adapter adapted to be secured to the bucket base in place of the adapter in FIG. 2;

FIG. 8 is an end view, taken from the right, of the adapter in FIG. 7;

FIG. 9 is an end view of the tooth adapted to be used on the adapter in FIG. 7;

FIG. 10 is a top plan view of the tooth in FIG. 9; while FIG. 11 is a side elevational view of the tooth in FIG. 10.

Before the unit, teeth and adapters here illustrated are specifically described, it is to be understood that the invention here involved is not limited to the structural details or arrangement of parts here shown since structure embodying the present invention may take various forms. It also is to be understood that the phraseology or terminology herein employed is for purposes of description and not of limitation since the scope of the present invention is denoted by the appended claims.

Earth breaking unit **10** may take various forms, such as a digging bucket, scraper blade, other type earth digging apparatus, etc. but is illustrated herein as an earth digging bucket **10** in FIG. 1 adapted to be moved through an earth digging stroke by any suitable power apparatus, such as by being mounted on the end of a boom, such as on the apparatus in my United States Patent 2,541,045, granted February 13, 1951, or in my copending United States patent application entitled "Telescopic-Boom-Operated Digging Bucket," filed February 13, 1957, Serial No. 639,885, now Patent No. 2,984,372.

Unit **10** in FIG. 1 shows the use of either form of the invention in FIGS. 2–6 (tooth **16** and adapter **14**) or in FIGS. 7–11 (tooth **16'** and adapter **14'**).

Unit **10** includes bucket base **12** to which are secured a plurality of laterally spaced apart tooth mounting adapters or holders **14** or **14'**, secured in any suitable manner, such as by welding; and a plurality of earth breaking teeth with one tooth **16** or **16'** carried by each adapter. Each tooth **16** or **16'** has four cutting side edges **16***m* tapering toward a cutting end edge **16***n*.

A suitable connecting means **20** is provided on each assembled adapter and tooth for rigidly connecting tooth **16** and adapter **14** thereof in any of a plurality of angularly related assembled positions so that cutting edge **16***m* or **16***n* on the tooth may be mounted in any one of a plurality of these angularly related assembled positions on its adapter **14** with these being six different circumferentially displaced positions about axis A of the tooth and adapter in the assembled position, as will be more apparent hereinafter. Each connecting means **20** includes a male telescopic portion **21** on adapter **14** and female telescopic portion **22** on tooth **16** tapered for fitting together as shown in FIG. 2; key **24** integrally formed on the periphery of male portion **21**; a plurality of keyways **25** telescopically coacting with any one keyway **25** telescopically engaged with key **24** to prevent relative rotation between tooth **16** and adapter **14** in the assembled position of FIG. 2; and lock means comprising tapered pin **28**, three diametrically aligned holes **16***a*, **16***b* and **16***c* in tooth **16**, and diametrical hole **14***a* of uniform diameter in adapter **14** with all of these holes located in a plane perpendicular to axis A in the assembled position of FIG. **2**.

The assembly of each tooth **16** on its adapter **14** and the use of its connecting means **20** should be readily apparent. To mount tooth **16** on its adapter **14** in the assembled position in FIG. 2, female portion **22** of tooth **16** is telescoped axially along axis A over male portion **21** on adapter **14** into the assembled position in FIG. 2. Any of three assembled positions, circumferentially displaced about axis A, may be chosen. In each, a keyway **25** in FIG. 3 is telescopically engaged with key **24** by movement along axis A. This construction permits tooth **16** to have six different possible circumferential positions about axis A with respect to its adapter **14**. After the assembled position has been reached, tapered pin **28** is driven through one of the holes **16***a*, **16***b* or **16***c* aligned with hole **14***a* to lock tooth **16** against axial disassembly from adapter **14** while interengaged key **24** and keyway **25** prevent relative rotation therebetween.

As will be apparent hereinafter, the description in the preceding paragraphs also applies generically to the same named parts, positions, movements and modes of operation for the structure shown in the second form in FIGS. 7–11.

However, the two forms, one in FIGS. 2–6 and the other in FIGS. 7–11, differ in some respects.

In FIGS. 2–6, male telescopic portion **21** is generally circular in cross section in FIG. 3 with two outwardly projecting diametrically aligned teeth **24***a* providing key **24**. Female telescopic portion **22** has in FIG. 3 a bore circular in cross section with three pairs of outwardly directed grooves **25***a*, **25***b* and **25***c* providing three keyways **25** with the two grooves in each pair diametrically aligned to form one keyway **25** and to receive both teeth **24***a*. These three pairs of grooves **25***a*, **25***b* and **25***c* are rotationally displaced about center axis A to provide by keyways **25** six different equi-angular related assembled positions for tooth **16**.

In FIGS. 7–11, there is provided adapter or holder **14'**, tooth **16'**, connecting means **20'**, male telescopic portion **21'**, female telescopic portion **22'**, key **24'**, keyways **25'**, and diametrical hole **14***a'* of uniform diameter in adapter **14'**. Connecting means **20'** includes male telescopic portion **21'** in FIGS. 7 and 8 generally square in cross section to provide key **24'** by its four square corners **24***a'*. Female telescopic portion **22'** has a bore formed in cross section in FIG. 9 by the periphery of two similar squares arcuately displaced 45 degrees about center axis A to provide two keyways **25'** by the four corners **25***a'* of one square and the four corners **25***b'* of the other square. This construction permits tooth **16'** to have eight different, equiangular related positions on adapter **14'**, instead of the six described for tooth **16**, with tooth **16'** adapted to be locked in any of these positions by tapered pin **28** extending through diametrical hole **14***a'* and one of the four diametrically aligned holes **16***a'*, **16***b'*, **16***c'* or **16***d'* in tooth **16'**, as contrasted with the three holes **16***a*, **16***b* and **16***c* described in tooth **16**.

Although squares are shown in FIGS. 8 and 9, it should be understood that any type regular polygon may be used in place of the square in FIGS. 8 and 9, because a square is only one form of regular polygon, and the resulting tooth and adapter will still assemble satisfactorily in a plurality of different positions. However, the arcuate displacement between these polygons may be different than the 45 degrees shown in FIG. 9 and the number of positions may be different than eight in number, depending upon the type regular polygon used.

Although key **24** or **24'** and keyways **25** or **25'** are specifically shown herein, it should be apparent that the cross sectional shape of portions **21** or **21'** and **22** or **22'** may take any of a variety of non-circular shapes for providing this plurality of equi-angular related positions upon assembly.

The advantages of each illustrated tooth and adapter form are many. First, the plurality of teeth **16** or **16'** on bucket **10** in FIG. 1 may be arranged relative to base **12** so that a corresponding cutting edge on some of the teeth have a different orientation relative to base **12** than on the other of the teeth **16** or **16'**. Here the teeth are in different circumferentially displaced positions about parallel axes A to provide a twisted tooth blade with teeth **16** or **16'** arranged at different angles with some teeth tilted toward the left and others tilted toward the right, such as being alternately tilted toward the left and right as shown in FIG. 1. This tooth arrangement causes the earth to break up more readily, minimizes shock load upon the teeth during earth engagement (in contrast with a structure wherein all the cutting end edges **16***n* are in a common horizontal plane and make simultaneous engagement with the earth), and substantially increases earth breaking production. Second, connecting means **20** or **20'** detachably connects each tooth **16** or **16'** for easy replacement to its adapter **14** or **14'** after tooth breakage occurs. There is no need to replace the whole blade with all of the teeth **16** or **16'** but only the individually broken tooth **16** or **16'**. The machine has less down

time because a dull or broken tooth **16** or **16'** can be quickly replaced for easy maintenance. Third, a tooth having one of its cutting side edges **16***m* worn can be moved to one of the other six positions about axis A on the same adapter **14** or **14'** or may be moved to another adapter to present a new sharp edge in digging position. Hence, it is possible to utilize on each tooth **16** or **16'** all four cutting side edges **16***m* and both the upper and lower edges of cutting end edges **16***n*. **14** or **14'** permit each tooth to be used on any of the adapters. Fourth, this construction eliminates the need for differently constructed left and right handed teeth fitting in adapters **14** or **14'** to obtain tooth arrangement positions B and C in FIG. 1. A single tooth **16** or **16'** may be used in either position. Fifth, all the teeth **16** or **16'** may be mounted with all cutting end edges **16***n* colinear so that all teeth are located in the straight line normal position generally used on excavating buckets.

Various changes in details and arrangement of parts can be made by one skilled in the art without departing from either the spirit of this invention or the scope of the appended claims.

What is claimed is:

1. An earth breaking unit comprising a bucket having a digging edge, a plurality of tooth-mounting adapters spaced along said digging edge and rigidly connected thereto, a plurality of teeth, one tooth mounted in each adapter and each tooth having a forward cutting edge with a lower earth engaging corner and an upper corner, said adapters and said teeth being located substantially in a straight line, said teeth arranged in pairs in which the forward cutting edges of said pair of teeth incline towards each other so that the lower corners of the cutting edges are closer together than the upper corners, and each tooth of a pair having a shank which engages positioning surfaces on its associated adapter providing at least two positions of said teeth in their associated adapters so that each tooth of a pair is interchangeable with the other tooth of the pair whereby the upper corner of the cutting edge of the first tooth becomes the lower corner of the second tooth.

2. An earth breaking unit as defined in claim 1 in which each of the adapters includes a female telescopic portion with said positioning surfaces and each of said shanks including a male telescopic portion that is square in cross section for interengagement with said female positioning surfaces.

3. An earth breaking unit as defined in claim 1 in which each shank includes splines and each adapter has positioning surfaces comprising a bore with splineways for interengagement with said splines.

4. An earth breaking unit as defined in claim 1 in which there are at least two pairs of teeth that are located substantially in said straight line.

References Cited in the file of this patent

UNITED STATES PATENTS

513,827	Richards	Jan. 30, 1894
792,761	Duncan	June 20, 1905
817,512	Palmer	Apr. 10, 1906
1,056,484	Anderholm	Mar. 18, 1913
1,262,870	Thomson	Apr. 16, 1918
1,333,852	Kittredge	Mar. 16, 1920
1,688,136	Chayes et al.	Oct. 16, 1928
1,692,501	Hanks	Nov. 20, 1928
1,909,850	Younie	May 16, 1933
1,978,733	Yocum	Oct. 30, 1934
2,397,521	Askue	Apr. 2, 1946
2,605,110	Blum	July 29, 1952
2,666,273	McIninch	Jan. 19, 1954
2,691,899	Brown	Oct. 19, 1954

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,117,386 January 14, 1964

Ray Ferwerda

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 9, for "edges", second occurrence, read -- edge --; line 10, before "14 or" insert -- The interchangeability of teeth 16 or 16' and adapters --.

Signed and sealed this 16th day of June 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents