

PATENT SPECIFICATION (11)

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(54) CUTTING EDGE AND TOOTH MOUNTING MEMBER FOR EARTH-MOVING MACHINES

- (71) We, CATERPILLAR TRACTOR Co., a corporation organized and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61602, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- Presently, many earth moving machines such as buckets, loaders, scrapers, and bulldozers are fitted with cutting edges and with teeth which project forwardly of the cutting edges. The teeth tend to break up the earth or working medium to increase penetration of the cutting edges as well as to increase the overall efficiency of the machine. Replaceable cutting edges and teeth are essential inasmuch as the main earth engaging surface, i.e. the bucket bottom or the scraper blade, is usually far too costly to subject to localized wear.
- The main earth engaging surfaces of such machines are usually protected by such cutting edge and tooth assemblies in areas which are in almost constant contact with earth, rock, sand and other abrasive materials. Because of this, the useful life of these individual components is relatively short. To improve the useful life of such working components, especially cutting edges, various innovations have been employed.
- Heavier metal sections have been utilized for the individual cutting edge and stronger materials such as alloy steel as well as hardening heat treatments for the cutting edge surfaces have been employed with varying results.
- Tooth assemblies, which are most advantageously utilized to form a leading edge for the cutting edges in extremely hard and relatively impenetrable working mediums, have also extended the wear life of the associated cutting edges inasmuch as they act as a shield for such cutting edges.
- There have been numerous prior art attempts to provide replaceable cutting edges and replaceable tooth members for earth working surfaces. Some attempts have involved the use of bolt-on adapters for securing teeth to the cutting edge elements. Since earth working teeth are often very heavily loaded, such bolts were subject to breakage under shear forces and the tooth adapters often broke under the stresses applied. To overcome this problem, integral teeth and cutting edge modules were introduced. Examples of such innovations are found in United States Patents Nos. 3,059,357, and 3,653,133.
- Such one-piece cutting edge and tooth designs effectively eliminated premature bolt and adapter breakage but introduced a new problem.
- In such integral cutting edge and tooth assemblies, tooth wear is much more rapid than cutting edge wear. Once the tooth is worn away, the cutting edge is no longer capable of providing good penetration in hard surface working mediums. In order to provide the machine with a new tooth element, the relatively unworn integral edge portion must be discarded. This obvious waste of material is inefficient and highly disadvantageous economically.
- According to the present invention there is provided a cutting edge and tooth mounting member for releasable attachment to an earth working surface of an earth working apparatus, said cutting edge and tooth mounting member comprising a cutting edge and tooth mounting portion integrally formed as a one-piece unit and attachable as a unit to said earth working surface by releasable fastening means, the or each said tooth mounting portion including a flat distally located abutment surface.
- In a preferred embodiment the invention provides a one-piece cutting edge and tooth mounting members as described above and a replaceable tooth for operative association therewith. The cutting edge and tooth mounting member may be cast in singular and plural tooth mounting embodiments to suit various earth working requirements. The tooth mounting portions and the teeth therefor are preferably dimensioned such that there is a uniform load distribution taken

upon the tooth mounting such that no substantial shearing force is transmitted to the readily replaceable pins or other fastening means utilized for nominal connection of the tooth members to the mounting portions.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Fig. 1 is an isometric view of two one-piece cutting edge and tooth mounting members attached to an earth working surface and showing means for connecting earth working tooth members thereto; and

Fig. 2 is a cross-sectional view taken along the line II—II of Fig. 1.

With reference to the drawing, two one-piece cutting edge and tooth mounting members 9 and 10 are shown secured to an earth working surface 11 of an earth moving machine by means of a plurality of bolt assemblies 12.

The one-piece member 10 includes a cutting edge portion 13 and a plurality of tooth mounting portions 14. In the usual application, the entire working surface 11 of the machine would be protectively covered by a plurality of one-piece members 10 either alone or in combination with a plurality of single tooth mounting members 9 such that the entire earth working surface 11 would be wear protected during use.

A hardened earth working tooth 17 is provided for mating attachment to each of the mountings 14 of the one-piece cutting edge and adapter members. The teeth are conveniently secured upon the mountings by means of readily removable conventional retaining means such as a pin 18 and a snap ring 19. The particular retaining means used is not critical inasmuch as it does not bear substantial loading during use, due to the particular design of and mating relationship between the mountings and the teeth.

As may be seen in the drawing, the bolt assemblies 12 are recessed within counterbores beneath the upper surface portions of the one-piece cutting edge and tooth mounting members. In such disposition they are not exposed to appreciable wear. With particular reference to Fig. 2 of the drawing, it will be noted that a particularly advantageous stress distribution is achieved by virtue of the construction of the mounting portions and teeth. Each tooth has a hollowed out converging interior bore with a flat abutment surface 20, as shown. Each mounting portion 14 is equipped with a similar abutment surface 21 for precise mating with the abutment surface 20. The degree of convergence of the surfaces 22 of each mounting portion is slightly less than that of the interior surfaces 23 of the tooth members so as to produce a tight fit between the surfaces 20 and 21 and a slight tolerance

between the surfaces 22 and 23 in the vicinity of a protrusion or shoulder portion 25 of the mounting portions. The pin 18 is placed through mating bores and apertures in the mounting portion and tooth member respectively such that it absorbs little or no compressive or shear stress when the surface 20 of the tooth member is in mating engagement with the surface 21 of the mounting portion. The pin fastening means 18 serves primarily to prevent the tooth member 17 from falling axially away from the mounting portion 14 primarily under the influence of its own weight.

The particular disposition and configuration of the bolt means 12 rearwardly of the mounting portions 14 also aids in producing an even stress distribution in the earth working surface 11. As shown, the upper-most portion 26 of the earth working surface 11 engages a substantial portion of the lower-most surface 27 of the cutting edge and tooth mounting member and stress distribution is throughout the entire mating area. Under normal loading conditions, the bolts 12 are in tensile stress and act to prevent the tipping or rotation of the member 9 or 10 about a point in the vicinity 29 of the earth working surface 11.

As previously stated, since the teeth 17 initially engage the soil and rock through which the members 9 and 10 pass, they generally wear at a rate faster than that of the edge portions 13. The teeth 17 are relatively inexpensive, however, and may be replaced without undue difficulty when worn. In practice, the teeth are replaceable approximately ten times more frequently than are the cutting edge portions of members 9 and 10. The tooth mounting portions are formed (e.g. cast) integrally with the cutting edge portions to provide greater strength than would be possible with prior art bolt-on adapters. If one of the teeth 17 wears more rapidly than other teeth, it can readily be replaced without disturbing any other component. In a like fashion, any one-piece cutting edge and tooth mounting member 9 or 10 may be advantageously replaced without disturbing the other such members.

WHAT WE CLAIM IS:—

1. A cutting edge and tooth mounting member for releasable attachment to an earth working surface of an earth working apparatus, said cutting edge and tooth mounting member comprising a cutting edge and at least one tooth mounting portion integrally formed as a one-piece unit and attachable as a unit to said earth working surface by releasable fastening means, the or each said tooth mounting portions including a flat distally located abutment surface for mating engagement, in use, with a complementary abutment surface of replaceable tooth means.

upon the tooth mounting such that no substantial shearing force is transmitted to the readily replaceable pins or other fastening means utilized for nominal connection of the tooth members to the mounting portions.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Fig. 1 is an isometric view of two one-piece cutting edge and tooth mounting members attached to an earth working surface and showing means for connecting earth working tooth members thereto; and

Fig. 2 is a cross-sectional view taken along the line II—II of Fig. 1.

With reference to the drawing, two one-piece cutting edge and tooth mounting members 9 and 10 are shown secured to an earth working surface 11 of an earth moving machine by means of a plurality of bolt assemblies 12.

The one-piece member 10 includes a cutting edge portion 13 and a plurality of tooth mounting portions 14. In the usual application, the entire working surface 11 of the machine would be protectively covered by a plurality of one-piece members 10 either alone or in combination with a plurality of single tooth mounting members 9 such that the entire earth working surface 11 would be wear protected during use.

A hardened earth working tooth 17 is provided for mating attachment to each of the mountings 14 of the one-piece cutting edge and adapter members. The teeth are conveniently secured upon the mountings by means of readily removable conventional retaining means such as a pin 18 and a snap ring 19. The particular retaining means used is not critical inasmuch as it does not bear substantial loading during use, due to the particular design of and mating relationship between the mountings and the teeth.

As may be seen in the drawing, the bolt assemblies 12 are recessed within counterbores beneath the upper surface portions of the one-piece cutting edge and tooth mounting members. In such disposition they are not exposed to appreciable wear. With particular reference to Fig. 2 of the drawing, it will be noted that a particularly advantageous stress distribution is achieved by virtue of the construction of the mounting portions and teeth. Each tooth has a hollowed out converging interior bore with a flat abutment surface 20, as shown. Each mounting portion 14 is equipped with a similar abutment surface 21 for precise mating with the abutment surface 20. The degree of convergence of the surfaces 22 of each mounting portion is slightly less than that of the interior surfaces 23 of the tooth members so as to produce a tight fit between the surfaces 20 and 21 and a slight tolerance

between the surfaces 22 and 23 in the vicinity of a protrusion or shoulder portion 25 of the mounting portions. The pin 18 is placed through mating bores and apertures in the mounting portion and tooth member respectively such that it absorbs little or no compressive or shear stress when the surface 20 of the tooth member is in mating engagement with the surface 21 of the mounting portion. The pin fastening means 18 serves primarily to prevent the tooth member 17 from falling axially away from the mounting portion 14 primarily under the influence of its own weight.

The particular disposition and configuration of the bolt means 12 rearwardly of the mounting portions 14 also aids in producing an even stress distribution in the earth working surface 11. As shown, the upper-most portion 26 of the earth working surface 11 engages a substantial portion of the lower-most surface 27 of the cutting edge and tooth mounting member and stress distribution is throughout the entire mating area. Under normal loading conditions, the bolts 12 are in tensile stress and act to prevent the tipping or rotation of the member 9 or 10 about a point in the vicinity 29 of the earth working surface 11.

As previously stated, since the teeth 17 initially engage the soil and rock through which the members 9 and 10 pass, they generally wear at a rate faster than that of the edge portions 13. The teeth 17 are relatively inexpensive, however, and may be replaced without undue difficulty when worn. In practice, the teeth are replaceable approximately ten times more frequently than are the cutting edge portions of members 9 and 10. The tooth mounting portions are formed (e.g. cast) integrally with the cutting edge portions to provide greater strength than would be possible with prior art bolt-on adapters. If one of the teeth 17 wears more rapidly than other teeth, it can readily be replaced without disturbing any other component. In a like fashion, any one-piece cutting edge and tooth mounting member 9 or 10 may be advantageously replaced without disturbing the other such members.

WHAT WE CLAIM IS:—

1. A cutting edge and tooth mounting member for releasable attachment to an earth working surface of an earth working apparatus, said cutting edge and tooth mounting member comprising a cutting edge and at least one tooth mounting portion integrally formed as a one-piece unit and attachable as a unit to said earth working surface by releasable fastening means, the or each said tooth mounting portions including a flat distally located abutment surface for mating engagement, in use, with a complementary abutment surface of replaceable tooth means.





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2. A member as claimed in claim 1, wherein said releasable fastening means includes a plurality of evenly spaced apart bolts disposed within a recessed portions of said cutting edge and tooth mounting member.

3. A member as claimed in claim 1 or 2, which has a plurality of said tooth mounting portions integrally formed with said cutting edge.

4. A member as claimed in any of claims 1 to 3, in combination with replaceable tooth means for engagement upon the or each said tooth mounting portion, the or each said tooth means including a corresponding flat abutment surface for mating engagement with said abutment surface of said mounting portion.

5. Apparatus as claimed in claim 4, wherein the or each said tooth mounting portion includes opposed first and second surfaces converging toward said flat abutment surface of said mounting portion, and wherein the or each said tooth means includes opposed third and fourth surfaces converging toward said flat abutment surface of said tooth means, said third and fourth surfaces converging more steeply than said first and second converging surfaces.

6. Apparatus as claimed in any of claims 4 to 5, wherein the or each said tooth means is removably attached to its said mounting portion by an attachment member passing through an aperture in said tooth means and through a bore in said mounting portion.

7. Apparatus as claimed in claim 6, when dependent on claim 5, wherein said attachment member is a pin and wherein the arrangement is such that loading resultant from operation of said earth working apparatus is not transmitted from said tooth means to said pin when said flat abutment surfaces of said mounting portion and said tooth means are in mating engagement.

8. Cutting edge and tooth mounting members substantially as hereinbefore described with reference to the accompanying drawings.

9. Members as claimed in claim 8, in combination with tooth members substantially as hereinbefore described with reference to the accompanying drawings.

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