

PATENT SPECIFICATION

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(54) HIGH STRENGTH EARTH WORKING PENETRATION TOOTH

(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 61629, 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:—

The invention is concerned with single piece unitary high strength earth working teeth. More particularly it is concerned with such teeth as are useful for penetrating soil. Teeth of this nature are used in a number of earth working machines such as for example scraper, rippers, excavator buckets, rock buckets and the like. Still more particularly, the invention is concerned with teeth which are commonly referred to in the trade as "self-sharpening". Such teeth do not really sharpen themselves as they are used but instead retain a substantially constant or slowly increasing cross section as they wear away so that they are still sharp enough to be useful even after considerable metal has been removed from them during the usual rough usage to which they are subjected.

A number of so-called self-sharpening teeth are known for use with earth working equipment. Such prior art teeth generally include a proximal end for attachment to an earth working machine and a distal end for penetrating the ground. Such teeth, generally include a flat trapezium shaped member extending from the proximal end of the tooth and forming a penetrating portion at the distal end of the tooth. In order to maintain sufficient strength for the tooth, it is customary in such a prior art tooth to provide a pair of ridges one on either side of the generally trapezium

shaped member, each of the ridges extending from adjacent the soil penetrating portion of the distal end of the tooth to the proximal end of the tooth. This provides an overall cross-section for the ridge-containing portion of the distal end of the tooth which is of cruciform shape. The two ridges in such a prior art tooth generally extend in a straight line in the same plane as the top of the proximal end of the tooth. Thus, the trapezium shaped member in such teeth can be symmetrically bisected by a plane passing through the member and through the proximal end of the tooth, the plane being perpendicular to a plane defined by the pair of ridges. Because of the symmetrical nature of such teeth, they do not provide a high penetration angle for the soil penetrating end thereof.

Teeth which are self-sharpening and which also allow for the provision of a relatively high penetration angle are also commercially available. For example, H & L Tooth Company of Montebello, California produces a number of commonly designed teeth of this nature. The distal end of such a tooth, however, generally intersects the proximal end thereof at an obtuse angle rather than meeting along a common straight line adjacent a lower portion of the proximal end. Adjacent the upper portion, the proximal end and the distal end generally have a common substantially straight line intersection. Strengthening for such teeth is generally provided by a ridge which is upraised to a point adjacent the earth penetrating end of the distal end of the tooth. The ridge then proceeds towards the proximal end of the tooth and eventually merges therewith. The ridge which supplies rigidity for such teeth is not supported by and does not end adjacent the junction of the proximal and distal ends of the tooth but instead con-

tinues well on to an upper portion of the proximal end of the tooth.

An improved unitary high strength earth working tooth which would be self sharpening and which would be highly penetrating while at the same time providing added strength over the existing prior art teeth would be highly desirable.

According to the present invention a unitary high strength earth working tooth comprises integrally formed, a first end part for attachment to a earth working machine and a second end part for penetrating the ground, the first end part including substantially trapezium or rectangularly shaped upper and lower portions and substantially trapezium shaped side portions each side portion extending from an edge of the upper portion to an edge of the lower portion, a closure interconnecting the shorter leading bases of the upper, lower and side portions and a pair of aligned holes, one through each side portion and positioned substantially on the axis of symmetry of each side portion; the second end part including a substantially flat member having trapezium-shaped side portions and extending forward symmetrically at an obtuse angle from the lower portion of the first end with the rearward longer base of the member coextensive with the shorter leading base of the lower portion, the member extending generally parallel to a plane defined by the axes of symmetry of the side portions of the first end part; the second end part also including a substantially right triangularly shaped ridge upraised perpendicularly from the axis of symmetry of the flat member and terminating at an acute angle short of the shorter leading base thereof, which part of the flat member ahead of the ridge comprises a ground penetrating portion of the tooth, the hypotenuse of the ridge extending from its acute angle termination with the flat member towards and terminating at the closure of the first end part.

One example of an earth working tooth according to the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 illustrates in exploded perspective a tooth of the present invention as it attaches to a shank communicating with an earth working machine;

Figure 2 illustrates in cross section a view taken from the plane II-II of Figure 1;

Figure 3 illustrates in top view the tooth of the present invention; and,

Figure 4 illustrates in side elevation the tooth of the present invention.

The improved unitary high strength earth working tooth of the present in-

vention is indicated generally by the numeral 10. The tooth 10 includes a proximal end 12 and a distal end 14. The tooth 10 is of unitary construction and is generally integrally formed as for example by being forged in a single piece. The proximal end 12 includes a generally trapezium or rectangularly shaped upper portion 16 and a similarly shaped a lower portion 18 and a pair of generally trapezium-shaped sides 20. Each of the trapezium-shaped portions 16 and 18 and the trapezium-shaped sides 20 includes a longer base and a shorter base parallel to one another and a pair of equal edges. In the limit of rectangular shape, the two bases are equal. Each of the sides 20 extend from an edge 21 of the upper portion 16 to an edge 22 of the lower portion 18 of the proximal end 12. A closure 23 interconnects the shorter base 24 of the upper portion 16 with the shorter base 26 of the lower portion 18 and the shorter bases 28 of the pair of sides 20. The closure 23, as will be explained below, serves a very important supportive purpose. A pair of aligned holes 30 pass through each of the sides 20 generally on the bisecting axis 32 of the sides 20. The generally trapezium shaped sides 20 usually include a triangular portion 33 extending therefrom in a direction removed from the distal end 14 of the tooth 10. The triangular portion 33 aids in alignment and mating of the tooth 10 with a shank 34 of an earth working machine through use of a pin 35 and one or more lock rings 36.

The distal end 14 of the tooth includes a member 37 having generally trapezium shaped side portions extending at an obtuse angle, A, from the lower portion 18 of the proximal end 12 with the longer base 38 of the trapezium-shaped member 37, as seen from above being coextensive with the shorter base 26 of the lower portion 18 of the proximal end 12. The member 37 extends generally parallel to a plane defined by the bisecting axes 32 of the sides 20 for strength. The tooth 10 includes a generally right triangularly shaped ridge 40 upraised perpendicular from a bisecting axis 42 of the member 37, the ridge 40 terminating at an acute angle, B, short of the shorter base 44 of the member 37. The shorter base 44 of the member 37 comprises a soil penetrating portion of the distal end 14. A hypotenuse 46 of the ridge 40 extends from the acute angle, B, towards and terminating at a point adjacent the closure 23 of the proximal end 12. The ridge 40 supportedly extends from the closure 23. Thus, forces exerted upon the ridge 40 are generally equally distributed to the upper portion 16, the lower portion 18 and the pair of sides 20 of the proximal end 12.

This provides great strength and structural integrity to the tooth 10.

The distal end 14 of the tooth 10 will generally include a ramp 48 extending from the position of the acute angle, B, to the shorter base 44 of the trapezoidal member 37. The ramp 48 is generally coplanar with the hypotenuse 46 thus providing a relatively sharp penetrating edge for easy penetration of soil and the like. The ramp 48 generally ends bluntly at the shorter base 44 of the flat member 37.

To assure the high strength and structural integrity of the earth working tooth 10 of the present invention, said tooth is so designed whereby an imaginary extension coplanar with the outer surface of the upper portion 16 and another imaginary extension coplanar with the outer surface of the lower portion 18 of the proximal end 12 meet in a line 49 which is intermediate said shorter base 44 of the member 37 and a termination point 50 of the hypotenuse 46. Preferably, the line 49 of meeting is nearer to the shorter base 44 of the member 37 than to the termination point 50 of the hypotenuse. This assures that the effective lever arm of dirt acting upon the shorter base 44 of the flat member 37 is braced as effectively as possible by the upper portion 16 and the lower portion 18 of the proximal end 12.

To assure relatively easy and effective penetration of the tooth 10, even after considerably wear (to make the tooth 10 "self sharpening") the ridge 40 is generally rectangular in cross section and is generally no more than about two thirds in width of the width of the shorter base 44 of the member 37 and usually is about one half in width of the shorter base 44.

In a preferred embodiment of the invention as illustrated the ridge 40 extends for yet added strength supportedly from the closure 23 via a curved reinforcing brace 52 having a width at least about as wide as the width of the shorter base 44 of the member 37.

50 WHAT WE CLAIM IS:—

1. A unitary earth working tooth comprising, integrally formed, a first end part for attachment to an earth working machine and a second end part for penetrating the ground, the first end part including substantially trapezium or rectangularly shaped upper and lower portions and substantially trapezium shaped side portions each side portion extending from an edge of the upper portion to an edge of the lower portion, a closure interconnecting the shorter leading bases of the upper, lower and side portions and a pair of aligned holes, one through each side portion and positioned substantially on the

axis of symmetry of each side portion; the second end part including a substantially flat member having trapezium-shaped side portions and extending forward symmetrically at an obtuse angle from the lower portion of the first end part with the rearward longer base of the member coextensive with the shorter leading base of the lower portion, the member extending generally parallel to a plane defined by the axes of symmetry of the side portions of the first end part; the second end part also including a substantially right triangularly shaped ridge upraised perpendicularly from the axis of symmetry of the flat member and terminating at an acute angle short of the shorter leading base thereof, which part of the flat member ahead of the ridge comprises a ground penetrating portion of the tooth, the hypotenuse of the ridge extending from its acute angle termination with the flat member towards and terminating at the closure of the first end part.

2. A tooth according to claim 1, wherein the part of the tooth ahead of the ridge is chamfered to form a ramp, the ramp being coplanar with the hypotenuse of the ridge.

3. A tooth according to claim 2, wherein an imaginary extension of the outer surface of the upper portion and an imaginary extension of the outer surface of the lower portion meet in a line which is intermediate the leading shorter base of the flat member and the termination point of the hypotenuse adjacent the closure.

4. A tooth according to claim 3, wherein the line is nearer to the leading shorter base of the flat member than to the termination point of the hypotenuse.

5. A tooth according to any one of claims 1 to 4, wherein the ridge is substantially rectangular in cross-section and has a width no more than about two thirds the width of the shorter leading base of the flat member.

6. A tooth according to claim 5, wherein the ridge extends supportedly from the closure via a curved reinforcing brace having a width at least about as wide as the width of the leading shorter base of the flat member.

7. A tooth according to claim 1, substantially as described with reference to the accompanying drawings.

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4. A tooth according to claim 3, wherein the line is nearer to the leading shorter base of the flat member than to the termination point of the hypotenuse.

5. A tooth according to any one of claims 1 to 4, wherein the ridge is substantially rectangular in cross-section and has a width no more than about two thirds the width of the shorter leading base of the flat member.

6. A tooth according to claim 5, wherein the ridge extends supportedly from the closure via a curved reinforcing brace having a width at least about as wide as the width of the leading shorter base of the flat member.

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