United States Patent

[11] 3,624,827

[72] Inventors **Richard K. Liess;**
Max J. Teasdale, both of Joliet, Ill.

[21] Appl. No. **782,845**
[22] Filed **Dec. 11, 1968**
[45] Patented **Nov. 30, 1971**

[73] Assignee **Caterpillar Tractor Co.**
Peoria, Ill.

[54] EARTHWORKING TOOTH AND SUPPORTING ADAPTER

16 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **37/142,** 172/713
[51] **Int. Cl.** **E02f 9/28**
[50] **Field of Search** 37/142; 172/713

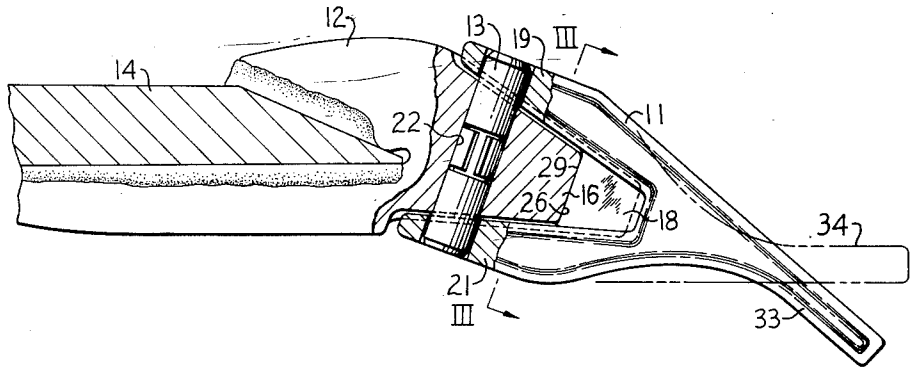
[56] **References Cited**

UNITED STATES PATENTS

1,202,806	10/1916	Clark	37/142
1,438,001	12/1922	Van Buskirk et al.	37/142
1,780,397	11/1930	McKee et al.	37/142
1,787,695	1/1931	McKee	37/142
2,256,488	9/1941	Murtaugh	37/142
2,385,395	9/1945	Baer	37/142
2,934,842	5/1960	Van Buskirk	37/142
3,079,710	3/1963	Larsen et al.	37/142

Primary Examiner—Edgar S. Burr
Attorney—Fryer, Tjensvold, Feix, Phillips & Lempio

ABSTRACT: An earthworking tip suitable for mounting on an adapter which is wedge-shaped in vertical cross section. The tip defines a rearwardly facing V-shaped projection which mates with a V-shaped opening in the adapter to transfer loads from the tip to the adapter. The tip has rearwardly extending upper and lower flanges to generally mate with the wedge-shaped adapter. Retaining means secure the tip upon the adapter.



PATENTED NOV 30 1971

3,624,827

SHEET 1 OF 2

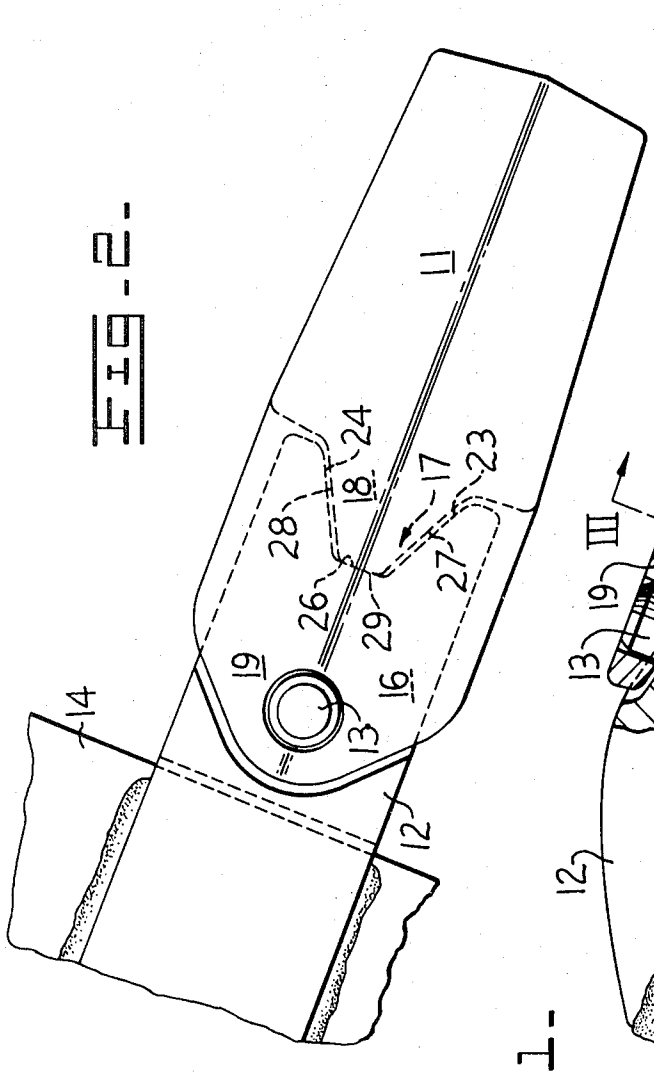


FIG. 2.

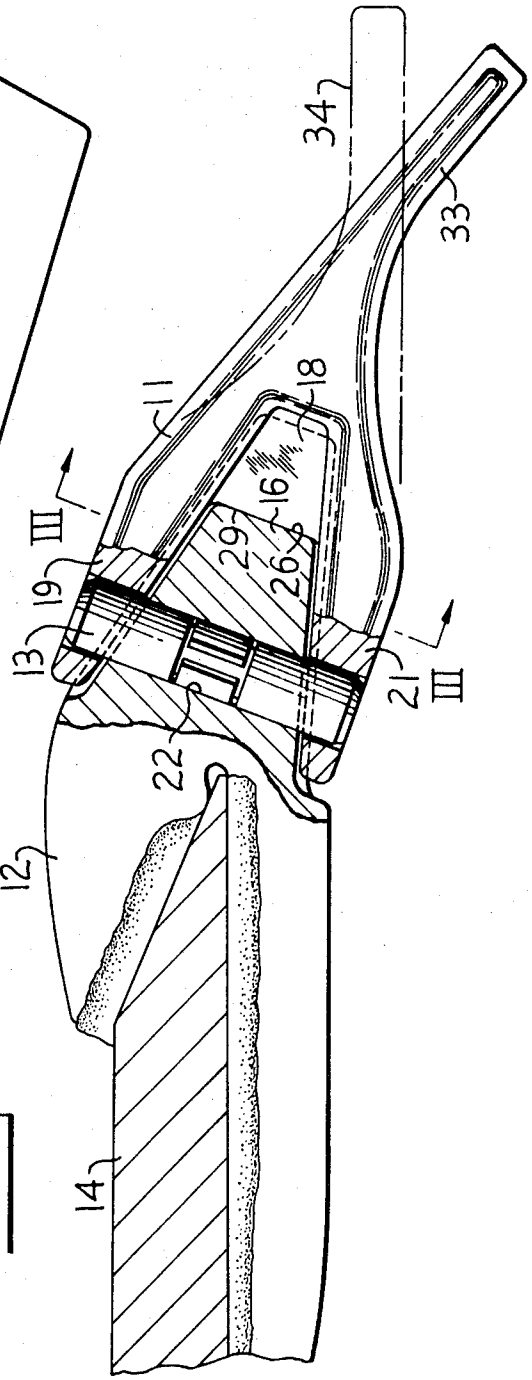


FIG. 1.

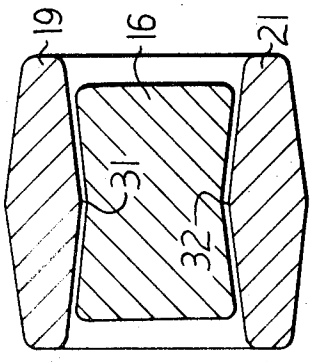


FIG. 3.

INVENTORS
MAX J. TEASDALE
RICHARD K. LIESS

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

Fig-7-

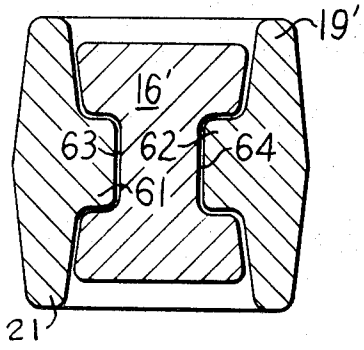


Fig-6-

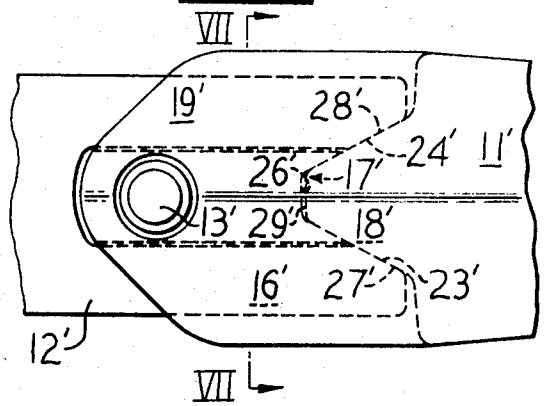


Fig-4-

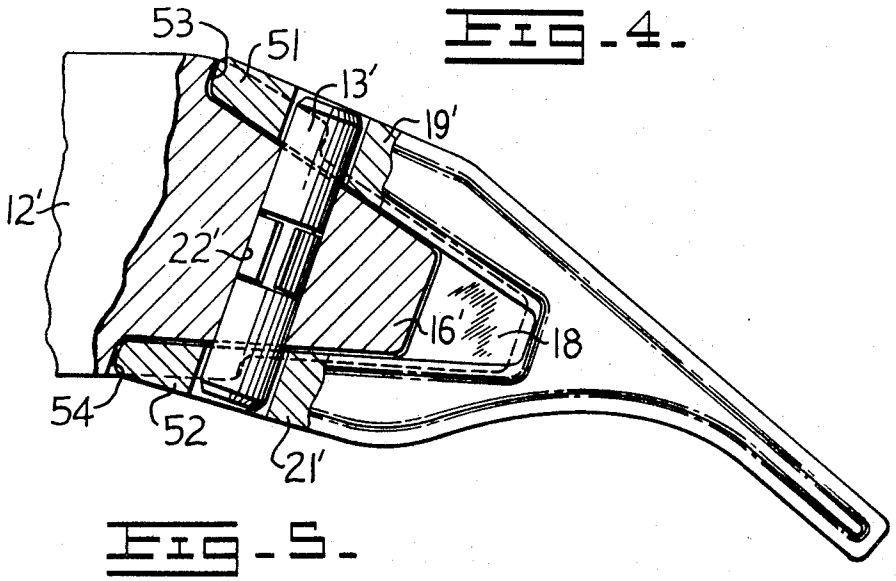
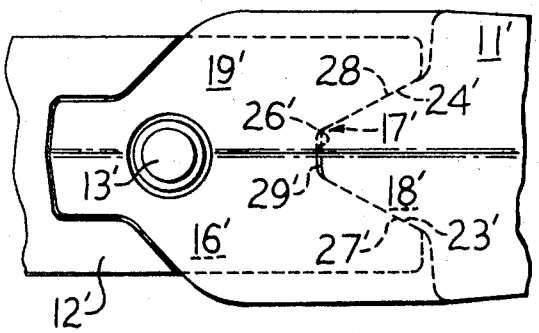


Fig-5-



INVENTORS
MAX J. TEASDALE
RICHARD K. LIESS

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

EARTHWORKING TOOTH AND SUPPORTING ADAPTER

Earthworking tips or teeth are commonly employed upon various types of machinery for ripping or loosening earth as well as other materials. Very substantial load forces result within the tips from their engagement with the earth. The tips must be structurally sound in order to withstand these forces. In addition, even tips constructed of highly abrasion-resistant materials tend to wear away and must be replaced at frequent intervals. Accordingly, it is desirable to replaceably mount the tips upon a suitable supporting adapter in a manner so that the tips may be readily removed in the field without the need for special tools or equipment.

The present invention is directed toward the provision of an earthworking tooth and supporting adapter having a design which permits economical production in view of the large number of such teeth employed as replacement parts. In addition, the design of the present earthworking tooth is particularly designed to resist side loads on the tooth and to minimize the effect or bending forces arising at the juncture between the tooth and its supporting adapter. In this manner, the present invention provides a novel design permitting economy in manufacture and providing additional strength for withstanding normal operating conditions.

A commonly employed earthworking tip in the prior art has a deep-tapered cavity which receives a tapered nose portion of the shank. The tip is commonly secured upon the shank by a retaining pin or other means.

It is generally desirable to forge or fabricate retaining tips to order to provide increased strength and improved wear properties. Tips of the above design have been found to be unsatisfactory at least from the standpoint of economy since the deep cavity is particularly difficult and expensive to form by either of these processes.

An additional problem arises from the complete enclosure of the supporting adapter within the tooth. It is difficult for the operator to determine when the tip is nearly worn through. For this reason, the tooth frequently wears away during operation so that the supporting adapter is exposed to highly abrasive engagement with the earth. Severe deformation of the adapter commonly results so that it must sometimes be replaced along with the earthworking tooth.

It is accordingly an object of the present invention to provide an earthworking tooth which may be economically formed by fabrication or forging, for example, and which exhibits increased strength for resisting side loads acting upon the tooth.

Other objects and advantages of the invention are made apparent in the following description having reference to the accompanying drawings.

In the drawings:

FIG. 1 is a side view with parts in section of an earthworking tooth mounted upon a supporting adapter;

FIG. 2 is a plan view of the earthworking tooth and adapter of FIG. 1;

FIG. 3 is a view taken along section lines III—III of FIG. 1;

FIG. 4 is a fragmentary side view of another embodiment of the present earthworking tooth and supporting adapter;

FIG. 5 is a plan view of the earthworking tooth and adapter of FIG. 4;

FIG. 6 is a fragmentary plan view of still another embodiment of the present earthworking tooth and supporting adapter; and

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

Referring now to FIGS. 1–3, an earthworking tooth 11 is secured upon an adapter 12 by means of a conventional retaining pin 13. The adapter 12 is in turn secured to an earthworking machine (not shown). In FIG. 1, the adapter is welded to the leading cutting edge 14 of a loader-bucket. A variety of loading forces may act upon the tooth 11. The configuration of the tooth 11 and adapter 12 must be suitable for transferring these forces into the supporting adapter. Large loading forces act longitudinally upon the tooth and tend to drive it rearwardly onto the adapter. However, the tooth is also subject to side loads and generally vertical loads in either direction which tend to pivot the tooth upon the adapter.

In order to transfer these loading forces from the tooth to the adapter, a nose portion 16 of the adapter is wedge-shaped in vertical cross section. The forward end is the tapered adapter nose 16 defines a vertically arranged V-shaped opening 17. The tooth 11 has a rearwardly facing V-shaped projection 18 which is vertically arranged to generally mate with the V-shaped opening 17. Integral upper and lower flanges 19 and 21 extend rearwardly of the V-shaped projection 18. The flanges 19 and 21 are arranged in diverging relation to generally mate with the wedge-shaped nose portion 16 of the adapter 12. The retaining pin 13 is disposed within a generally vertical bore 22 defined by the adapter nose portion 16 and the flanges 19 and 21 to secure the tooth 11 upon the adapter 12.

Numerous advantages for the design of the present invention may be realized from the features summarized above. The relation of the flanges 19, 21 with the tapered adapter nose portion 16 tend to prevent pivoting of the tooth in a vertical plane and may also be employed to assist in transferring longitudinal loading forces from the tooth 11 to the adapter 12. The generally forwardly facing surfaces of the V-shaped opening 17 and the generally rearwardly facing surfaces of the V-shaped projection 18 cooperate to transfer to the adapter at least a substantial portion of longitudinal loading forces acting upon the tooth 11. In addition, the same surfaces are particularly effective to transfer side loads from the tooth to the adapter 12. In performing this function, the V-shape of the opening and projection offer several advantages. Initially, the V-shape provides a broad juncture between the V-shaped projection 18 and the remainder of the tooth 11 so that side loads acting upon the tooth will not fracture the projection from the tooth. Further, the V-shape of the opening 17 and the projection 18 tends to reduce the longitudinal length of the dominant load-transferring juncture between the tooth 11 and the adapter 12. In this manner, side loads acting upon the tooth are transferred to the adapter with a substantially reduced moment arm so that the likelihood of fracture or failure within the adapter nose portion 16 is further reduced. The manner in which the V-shaped projection 18 cooperates with the V-shaped opening 17 and the diverging flanges 19, 21 cooperate with the wedge-shaped nose portion 16 also tends to prevent the tooth from becoming wedged or locked upon the adapter and facilitate removal of the tooth from the adapter when necessary.

To further insure against locking of the tooth 11 upon the adapter 12, the V-shaped opening 17 as seen in FIGS. 1–3 includes a pair of diverging surfaces 23 and 24 separated by a substantial root surface 26. The V-shaped projection 18 includes a pair of surfaces 27 and 28 which converge rearwardly to generally mate with the surfaces 23 and 24. The converging surfaces 27 and 28 are also separated by a root surface 29 which mates with the forwardly facing root surface 26. As seen in FIG. 2, the rearwardly facing root surface 29 is slightly narrower than the root surface 26 so that engagement of the two root surfaces tends to insure at least limited spacing between the surfaces 24, 28 and 23, 27.

As best seen in FIG. 3, the flanges 19 and 21 are of irregular cross section so that they extend inwardly toward the nose portion 16 along their longitudinal centerline as indicated at 31 and 32 respectively. The nose portion 16 is formed to generally mate with the flanges 19 and 21 so that these structures may cooperate to resist generally horizontal pivoting of the tooth upon the adapter.

Referring also to FIGS. 1 and 2, the tooth 11 and adapter 12 are generally symmetrical along their longitudinal centerline so that the tooth 11 may be reversibly mounted upon the adapter 12. The tooth is illustrated in FIG. 1 as having a nonsymmetrical cutting edge 33 so that the reversible tooth may be mounted upon the adapter to provide either a digger tip or a runner tip for finish work. Reversing of the tooth 11 would position the cutting tip 33 to provide a runner tip as shown by the broken lines at 34.

Features of the embodiments in FIGS. 4, 5 and 6, 7 which are similar to those in FIG. 1, for example, are indicated by

primed numerals. Both of these embodiments are modified slightly from that shown in FIG. 1 in order to transfer loading forces from the tooth to the adapter in a somewhat different manner. Having particular reference to FIGS. 5 and 6, the opposing surfaces of the V-shaped opening 17' and the V-shaped projection 18' serve to transfer a substantial portion of the loading forces from the tooth 11' to the adapter 12'. However, in both of these embodiments, the rearwardly facing root surface 29' of the V-shaped projection 18' is of approximately the same width or somewhat wider than the forwardly facing root surface 26'. In this manner, loading forces acting between the tooth 11' and adapter 12' tend to be transferred by the larger area of the surfaces 24', 28' and 23', 27'.

In both of these embodiments, the flanges 19', 21' and the tapered nose portion 16' are formed to provide greater assistance in resisting forces which tend to pivot the tooth 11' upon the adapter 12'. Referring first to FIGS. 4 and 5, the flanges 19' and 21' of that embodiment have rearwardly extending lugs 51 and 52 which mate respectively with slots 53 and 54 formed respectively at the top and bottom of the adapter 12'.

In the embodiment shown in FIGS. 6 and 7, the flanges 19' and 21' are formed with longitudinal keys 61 and 62 respectively which face inwardly toward the tapered adapter nose portion 16'. The nose portion 16' is formed with key ways 63 and 64 which mate respectively with the keys 61 and 62. Coaction between the keys 61, 62 and key ways 63, 64 and between the lugs 51, 52 and slots 53, 54 similarly serve to transfer a portion of any side loads on the tooth and thus strengthen the tooth and adapter assembly.

What is claimed is:

1. An earthworking tip and supporting adapter for mounting the tip, the adapter having a forward portion which is wedge-shaped in vertical cross section and defines a vertically aligned truncated V-shaped opening, the tip having rearwardly extending upper and lower flanges which diverge to generally mate with the wedge-shaped adapter portion and a rearwardly extending truncated V-shaped projection integrally formed between the flanges, said flanges extending past the truncated V-shaped projection, the adjacent surfaces between said flanges and the upper and lower faces of said adapter being tapered inwardly from their sides toward their longitudinal center lines, said flanges being wider than and overhanging said adapter, the truncated V-shaped projection of the tip generally mating with the truncated V-shaped opening of the adapter to permit load-transferring engagement between the surfaces of the truncated V-shaped opening in the adapter and the truncated V-shaped projection of the tip, and means for securing the tip upon the adapter comprising a retaining pin disposed in a generally vertical bore formed through the wedge shaped adapter portion and tip flanges to the rear of the V-shaped opening in the adapter.

2. The invention of claim 1 wherein the load-transferring means includes keys integrally formed in both of the flanges and mating keyways formed in the adapter, said keys and keyways being formed along said inwardly tapering surfaces.

3. The invention of claim 2 wherein the keys are directly opposed to each other.

4. The invention of claim 1 wherein portions of the tip adjacent the wedge-shaped adapter portion are substantially symmetrical about a longitudinal, generally horizontal plane through the tip to permit reversible mounting of the tip upon the adapter.

5. The invention of claim 4 wherein a ground-engaging leading portion of the tip is in nonsymmetrical relation with the portions of the tip adjacent the adapter.

6. The invention of claim 1 wherein at least one of the rearwardly extending tip flanges and a portion of the adapter mating therewith include means effective to assist in transferring side loads on the tip to said mating adapter portion.

7. The invention of claim 6 wherein the load-transferring means include rearwardly extending lugs on the tip flanges and mating slots formed by the adapter.

8. The invention of claim 1 wherein the engagement between the surfaces of the V-shaped opening in the adapter and the V-shaped projection in the tip is along root surfaces formed in said adapter and tip.

9. The invention of claim 8 wherein the truncated V-shaped opening in the adapter and the truncated V-shaped projection of the tip have substantially equal angles of inclination and the rearwardly facing root surfaces of the truncated V-shaped projection having a smaller horizontal width than the forwardly facing root surfaces of the truncated V-shaped opening in the adapter.

10. An earthworking tip and supporting adapter for mounting the tip, the adapter having a forward portion which is wedge-shaped in vertical cross section and defines a vertically aligned truncated V-shaped opening, the tip having rearwardly extending upper and lower flanges which diverge to generally mate with the wedge-shaped adapter portion and a rearwardly extending truncated V-shaped projection integrally formed between the flanges, said flanges extending past the truncated V-shaped projection, said flanges being wider than and overhanging said adapter, the truncated V-shaped projection of the tip generally mating with the truncated V-shaped opening of the adapter along keys integrally formed in both of the flanges and mating keyways formed in the adapter to permit load-transferring engagement between the surfaces of the truncated V-shaped opening in the adapter and the truncated V-shaped projection of the tip, and means for securing the tip upon the adapter comprising a retaining pin disposed in a generally vertical bore formed through the wedge-shaped adapter portion and tip flanges to the rear of the V-shaped opening in the adapter.

11. The invention of claim 10 wherein at least one of the rearwardly extending tip flanges and a portion of the adapter mating therewith include means effective to assist in transferring side loads on the tip to said mating adapter portion.

12. The invention of claim 10 wherein the keys are directly opposed to each other.

13. The invention of claim 10 wherein portions of the tip adjacent to the wedge-shaped adapter portion are substantially symmetrical about a longitudinal, generally horizontal, plane through the tip to permit reversible mounting of the tip upon the adapter.

14. The invention of claim 13 wherein a ground-engaging leading portion of the tip is in nonsymmetrical relation with the portions of the tip adjacent the adapter.

15. The invention of claim 10 wherein the engagement between the surfaces of the truncated V-shaped opening in the adapter and the truncated V-shaped projection in the tip is along root surfaces formed in said adapter and tip.

16. The invention of claim 15 wherein the truncated V-shaped opening in the adapter and the truncated V-shaped projection of the tip have substantially equal angles of inclination and the rearwardly facing root surfaces of the truncated V-shaped projection has a smaller horizontal width than the forwardly facing root surfaces of the truncated V-shaped opening in the adapter.

* * * * *