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Helton et al.

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[54] **EARTH WORKING TIP AND ADAPTER CONSTRUCTION**

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[52] **U.S. Cl.** ..... **37/142 R**; 172/713

[51] **Int. Cl.**[2] **E02F 9/28**

[58] **Field of Search** ..... 37/141 R, 141 T, 142 R, 37/142 A; 172/713, 719, 699, 700

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[57] **ABSTRACT**

An earth working tip and adapter combination constructed with capacity to withstand great loading in use while utilizing a relatively small amount of unusable construction material such that when the tip is worn and replaced, valuable material is not discarded therewith. The tip member includes a pair of transversely disposed converging ribs formed internally of a closed cavity. The adapter member includes a pair of externally disposed converging tapered grooves adapted for mating engagement with the ribs of the tip member. In operative orientation, the respective load bearing surfaces of the ribs and grooves are disposed substantially normally to the direction of the working loads applied such that such loads are transmitted uniformally from the ripper tip to the adapter without bearing upon the pin holding means used to retain the tip upon the adapter.

9 Claims, 8 Drawing Figures

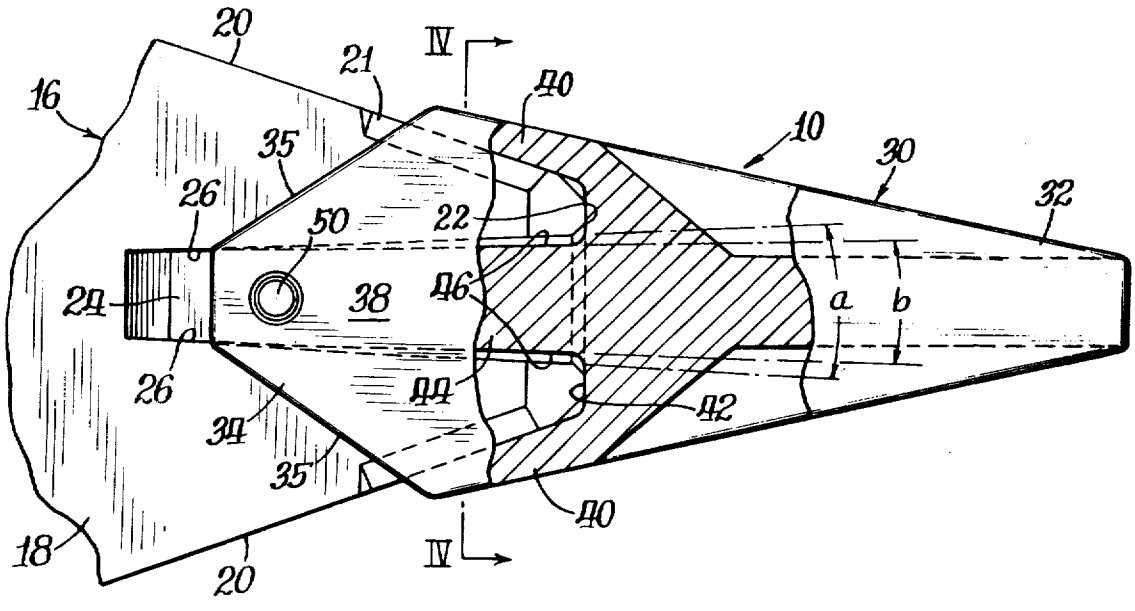


Fig-2

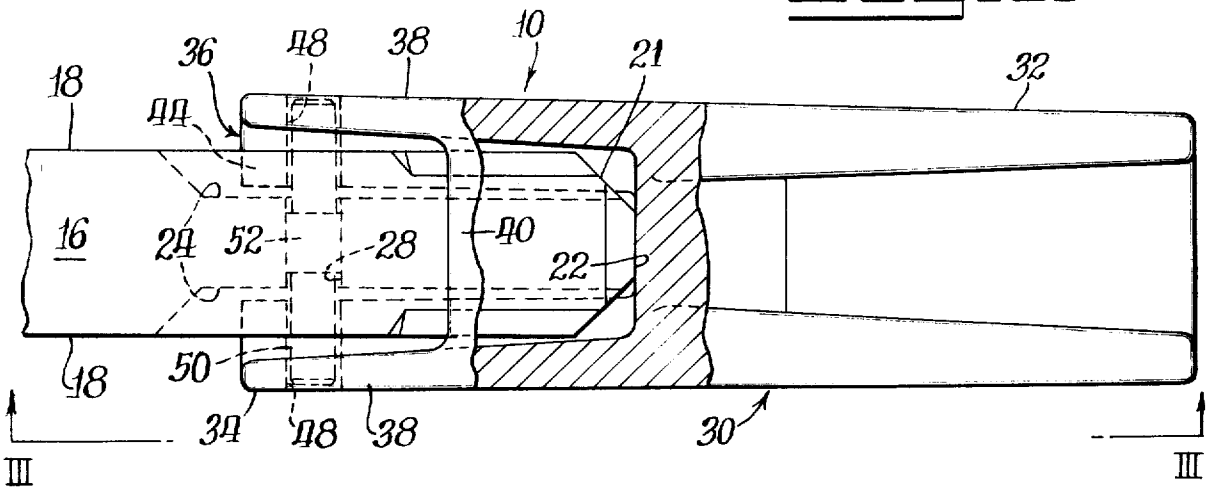


Fig-3

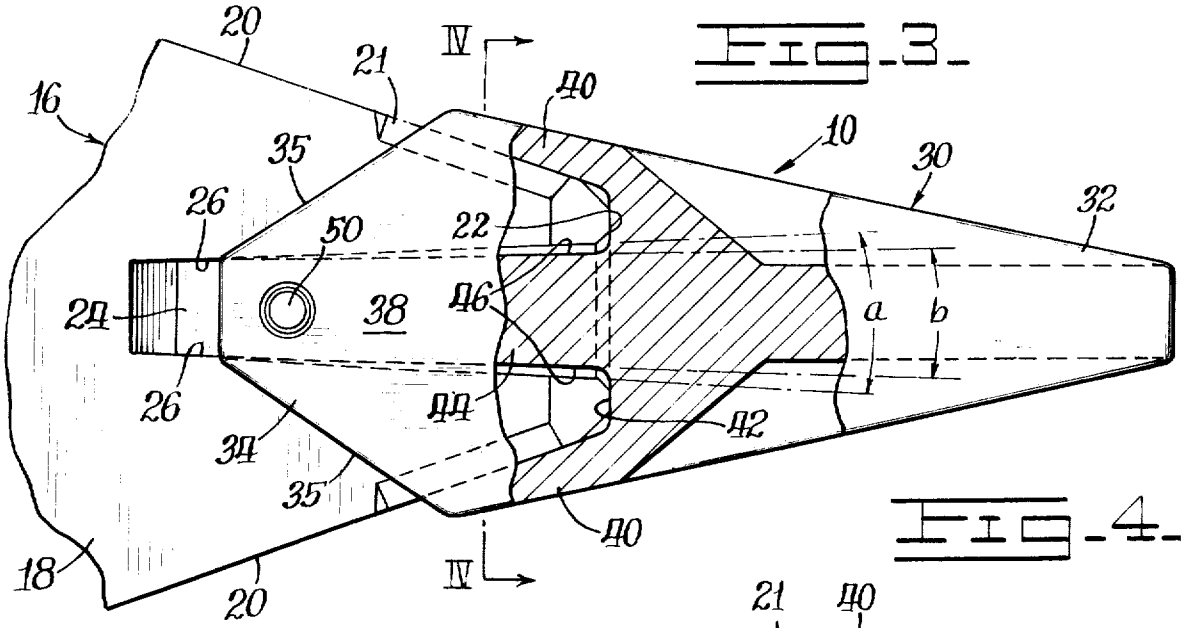


Fig-4

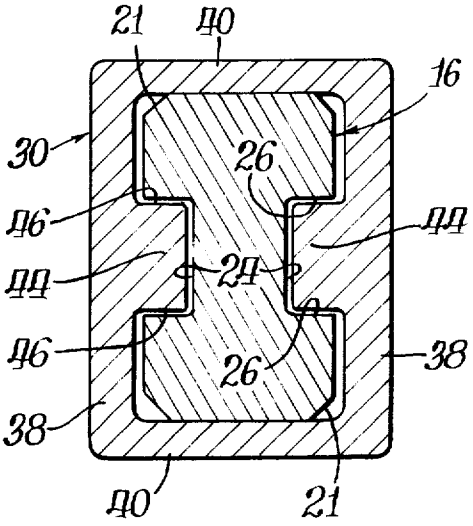


Fig-1

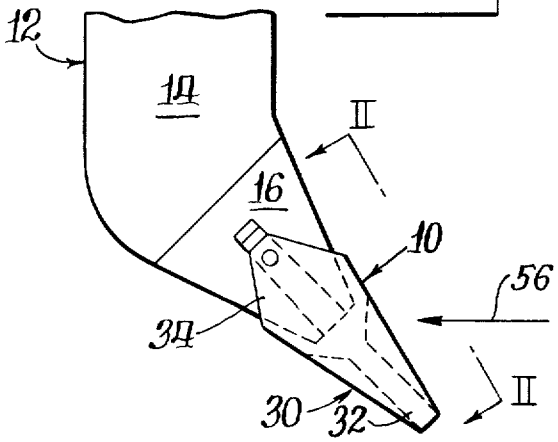


Fig. 5

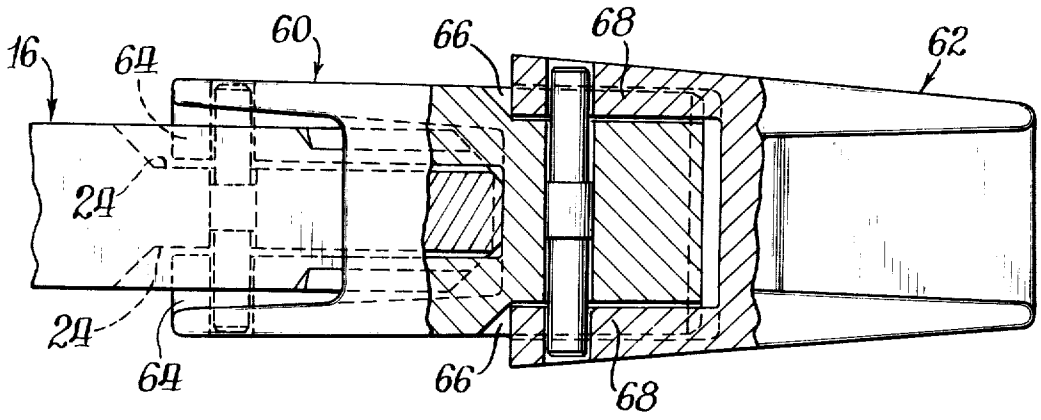


Fig. 6

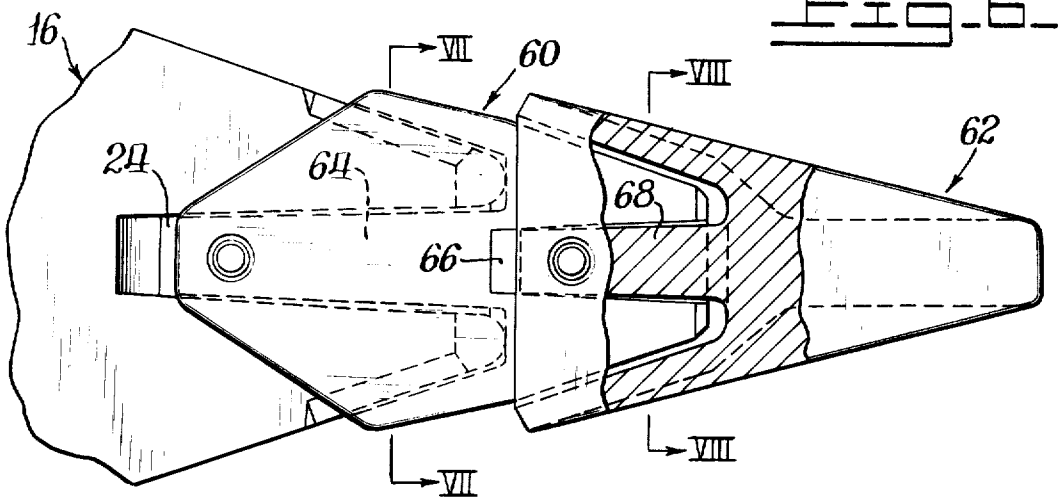


Fig. 7

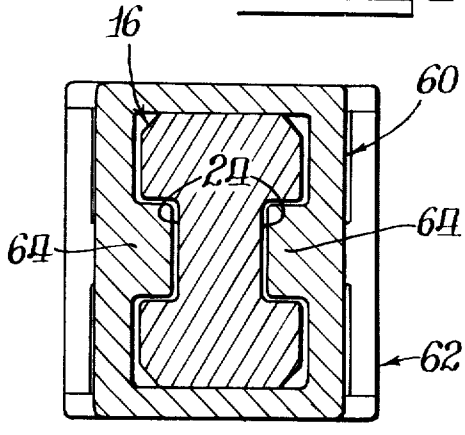
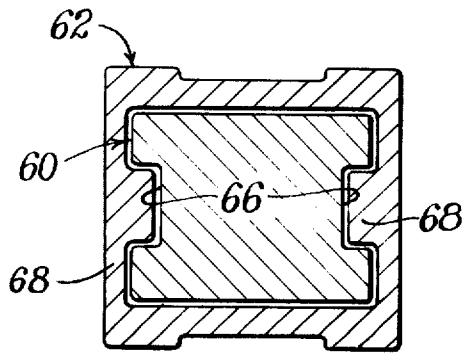


Fig. 8



EARTH WORKING TIP AND ADAPTER CONSTRUCTION

BACKGROUND OF THE INVENTION

During earthworking operations direct ground engaging tools such as ripper tips and the like are exposed to excessively high working loads. Because of this, in a usual ripper tip and adapter combination the taper angle of the wedge-shaped end portion of the adapter member must be relatively small in order to prevent the tip from "rolling off" the end of the adapter member in use. Also, the length of the skirt portion of the ripper tip, that portion proximally overlapping and enclosing the adapter member, has in the past had to be relatively large in order to provide a sufficiently secure connection between the tip and the adapter and to provide sufficient load bearing area for transmitting forces uniformly to the adapter.

Experience has shown that the smaller the taper angle of the wedge-shaped adapter end portion and the longer such end portion is, greater is its tendency to break during use. Because adapters are relatively expensive and difficult to replace, such breakage is highly undesirable. Also, the greater the dimensions of the tip skirt portion, the more material which will necessarily be discarded when the tip wears at its distal end or is broken off requiring tip replacement. Those skilled in the art have long sought an optimum adapter and tip combination designed for maximum utilization of material while retaining necessary strength characteristics and providing adapter protection during its useful life.

Some examples or prior art attempts to provide such a combination are taught by U.S. Pat. Nos. **3,624,827; 3,547,962; 3,601,203; 3,623,247; 3,675,350; 3,196,956; 2,689,419; 2,674,816; 2,167,425; 1,837,341; 821,215;** and British Pat. No. **923,828**, published Apr. **18, 1963.**

SUMMARY AND OBJECTS OF THE INVENTION

The present invention provides an improved ripper tip and adapter combination which includes a plurality of longitudinally extending grooves formed in the adapter member and adapter to supportingly engage a plurality of longitudinally extending ribs formed internally of a socket cavity in the ripper tip member. When the tip is assembled upon the adapter the load bearings surfaces of the grooves and ribs respectively are disposed generally normally toward the direction of load application. With the rib and groove construction of the present invention, the flared skirt portion of the ripper tip can be drastically reduced in size and shaped so as to reduce to an absolute minimum the amount of discarded material upon tip replacement. The inventive construction provides a wedged-shaped adapter having a taper angle relatively greater than that of prior art adapters to increase strength. The instant construction also includes pin means for removably securing the ripper tip to the adapter wherein the pin means are not exposed to full working loads applied to the tip. The grooves and ribs are constructed so that relatively close tolerances between the tip and the adapter members are exhibited in the vicinity of the pin means so as to assure protection of such pin means against undue loading.

The main object of the present invention is to provide an economical and efficient earth working tip and adapter combination concurrently fulfilling requirements for high strength and cost economy by providing the immediately above described construction.

The precise details of construction of the invention and the manner of achieving its operational objectives will become apparent from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary elevation of the instant ripper assembly showing the improved adapter and ripper tip;

FIG. **2** is a partially section oblique plan view of the ripper tip and adapter assembly taken along the line II—II of FIG. **1**;

FIG. **3** is an elevation with portions broken away taken along the line III—III of FIG. **2**;

FIG. **4** is a cross-sectional view taken along the line IV—IV of FIG. **3**;

FIGS. **5** through **7** are views similar to FIGS. **2** through **4**, respectively, but showing an alternate embodiment of the present invention; and

FIG. **8** is a cross-sectional view of such alternate embodiment taken along the line VIII—VIII of FIG. **6.**

DETAILED DESCRIPTION

Referring to FIG. **1** of the drawings, an improved ripper tip and adapter construction is generally indicated at **10** in association with a ground working ripper device partially shown at **12.** The ripper assemblage includes a generally vertically disposed shank portion **14** having an adapter portion **16** rigidly secured to the lower end thereof as by welding or like means.

As best shown in FIGS. **2** and **3**, the adapter portion is generally wedge-shaped having opposite side surfaces **18** and tapered upper and lower edge surfaces **20** diverging at a relatively large predetermined angle from a forward end surface **22.** A pair of elongated channels or grooves **24** are provided in the opposite sides **18** of the adapter portion extending from the end surface **22** toward the ripper shank portion. The grooves have opposite sidewalls **26** which are disposed normally to the side surfaces **18** and which diverge outwardly from the distal end of the grooves at a relatively small predetermined angle *a*. A transversely disposed aperture **28** is formed in the adapter and communicates with the grooves **24** adjacent their proximal ends.

The assembly includes an elongated replaceable ripper tip which is shown at **30** and which includes a substantially pointed leading end portion **32** and a trailing skirt portion **34.** The skirt portion is cut back or tapered drastically at **35** and includes a socket cavity **36** for receiving the distal end portion of the adapter **16.** Such cavity is defined by a pair of laterally spaced sidewalls **38,** a pair of oppositely disposed tapered edge walls **40** and a frontal abutment surface **42.**

The socket cavity walls **38** are provided with a pair of longitudinally extending ribs **44** which are integrally formed on the sidewalls and which extend laterally inwardly from the inner surfaces thereof. Such ribs are adapted to be received in their respective grooves **24** of the adapter. The upper and lower surfaces **46** of the ribs diverge and are disposed at a slightly more acute angle *b* than are the side surfaces **26** of the grooves for a purpose to be described hereinafter.

A pair of apertures **48** are disposed through the respective sidewalls **38** adjacent their proximal ends and are adapted for operative alignment with the aperture

28 of the adapter. Retaining means including a pin 50 and a spring washer 52 are mounted within the aperture 28 of the adapter 16. The opposite ends of the pin 50 extend into the apertures 48 formed in the skirt portion 34 for securing the tip to the adapter.

To insure that excessive load forces experienced during operation are not carried by the pin 50, the apertures 48 have a greater diameter than that of the pin 50 so that the pin has slight play within the tip apertures when the tip is under load.

In operation, high working loads are exerted upon the ripper tip generally in a direction indicated by the arrow 56 in FIG. 1. This is because of the movement of the ripper device through the earth in the opposite direction. The large moments created by such movement are normally transmitted to the adapter through the abutting engagement of the load bearing surfaces 20 of the adapter and the corresponding inner surfaces of the tapered edge walls 40 of the tip. Longitudinally directed forces are transmitted via engagement of the abutment surface 42 of the socket cavity 36 and the end surface 22 of the adapter.

In the past, the tapered edge walls of a ripper tip have had to extend a great distance back along the proximal portion of the adapter to provide sufficient load bearing area to prevent a large force moment from rolling the tip off of the adapter. Also, the taper angle of prior art adapters has conventionally been relatively small, typically 30° to 35°, to assist in preventing such roll-off condition.

By virtue of the ribs 44 formed on the ripper tip and grooves 24 formed in the adapter, the roll-off problem has effectively been eliminated by the present invention. This is because additional load bearing area is provided through the abutting engagement of the corresponding surfaces 26 and 46 of the adapter grooves and the tip ribs 44, respectively. Also, a greater wedge angle, i.e., 40° has been utilized for the adapter to yield increased strength and the extent of the tapered edge walls 40 of the tip has been shortened to reduce the amount of throwaway metal upon ripper tip replacement.

It may be noted that the side surfaces 26 and 46 of the grooves and ribs, respectively, are disposed along different diverging angles *a* and *b*. This configuration insures a closer fit between the ribs and the grooves at their proximal portions adjacent the retaining pin 50 and prohibits the exertion of undue shear stresses upon such pin. It will be seen, especially by reference to FIG. 4 that a relatively loose tolerance is provided between the sidewalls of the tip and the adapter outside the rib and groove areas in order to conserve material and to avoid the normally necessary high cost of precision machining. Such tolerance permits some rocking of the tip relative to the adapter prior to the engagement of corresponding load bearing surfaces of the components. Beveled corners 21 are provided on the adapter to relieve injurious loading at such corners and to eliminate any interference with the tip upon assembly.

An alternate embodiment of the present invention is illustrated in FIGS. 5 through 8. It will be noted that the essential difference between the alternate and primary embodiments is the presence of a boot adapter 60 which is mounted upon the adapter 16 in place of the tip 30. The boot adapter permits the use of various different size ripper tips, one of which is illustrated at 62. Also, the use of the boot adapter further minimizes possible damage to the more expensive adapter and ripper shank by making them more remote from the ground engaging tip.

As best shown in FIGS. 5 and 6, the boot adapter 60 is provided with a pair of ribs 64 for engaging the grooves 24 of the adapter 16. The boot adapter is also provided with grooves 66 which are adapted for receiving the ribs 68 which are similarly provided in the socket cavity of the alternate tip 62.

It will be appreciated that the geometric relationships and principles of operation of the alternate embodiment of FIGS. 5 through 8 are essentially identical to those described in the primary embodiment of FIGS. 1 through 4.

While the invention has been described with particular reference to the preferred embodiments, it is apparent that variations and modifications are possible within the purview of the inventive concepts. No limitations with respect to such variations and modifications is intended, except by the scope of the appended claims.

We claim:

1. An earth working device comprising in combination, tip means for directly engaging material to be worked, adapter means for supporting said tip means, retainer means for retaining said tip means upon said adapter means, said adapter means including first and second load bearing edge surfaces and first and second side surfaces contiguous with said first and second edge surfaces, said first and second side surfaces being provided with first and second longitudinally extending load supporting groove means, each of said first and second groove means including a pair of upper and lower opposed sidewalls, said upper and lower sidewalls of each of said grooves converging toward one another from a distal portion of said adapter means to a proximal portion thereof at a first predetermined acute angle, said tip means including hollow cavity means having interiorly disposed longitudinally extending rib means adapted to supportingly engage said longitudinally extending groove means of said adapter means, said rib means including upper and lower surfaces adapted to directly engage said upper and lower sidewalls of said groove means, said upper and lower surfaces of said rib means diverging from a proximal portion of said tip means toward a distal portion thereof at a second acute angle different from said first predetermined angle, said adapter means further include a distally centrally disposed nose end surface, and wherein said tip means cavity means include a frontal abutment surface for directly engaging said adapter nose end surface in load transmitting relation thereto.

2. The invention of claim 1 wherein said adapter means further include a first transpiercing aperture means, said tip means further including second and third spaced-apart aperture means in operative alignment with said first transpiercing aperture means for receiving said retainer means therein.

3. The invention of claim 2 wherein said retainer means include a pin means and a spring fastening means for retaining said pin means positioned within said first, second, and third aperture means.

4. The invention of claim 3 wherein said converging sidewalls of said adapter means groove means and said upper and lower diverging surfaces of said rib means come into a tight zero tolerance fit in the vicinity of said pin means for direct transfer of load forces from

said tip means to said adapter means without placing appreciable loading forces upon said pin means.

5. The invention of claim 1 wherein said adapter means and said tip means include relieved areas in non-loading bearing portions thereof.

6. An earthworking device comprising in combination, tip means for directly engaging material to be worked, boot means for supporting said tip means, adapter means for supporting said boot means, first and second retainer means for respectively retaining said tip means upon said boot means and said boot means upon said adapter means, said adapter means including first and second load bearing edge surfaces and first and second contiguous side surfaces, said first and second side surfaces being provided with first and second longitudinally extending groove means each including an upper and lower sidewall, said upper and lower sidewalls converging toward one another from a distal portion of said adapter means toward a proximal portion thereof at a first predetermined angle, said boot means including hollow cavity means having interiorly disposed first and second longitudinally extending rib means for engaging said first and second groove means of said adapter means, and first and second rib means having upper and lower surfaces adapted to engage said upper and lower sidewalls, said upper and lower surfaces of said first and second rib means diverging from a proximal portion of said boot means toward a distal portion thereof at a second predetermined angle which is different from said first predetemined angle, said boot means further including third and fourth externally disposed groove means, said tip means including third and fourth internally formed rib means for supportingly engaging said third and fourth groove means of said boot means.

7. The invention of claim 6 wherein said third and fourth groove means and said third and fourth rib means each include converging load-bearing surfaces, said converging surfaces of said grooves converging at an angle different from the angle of convergence of said rib means surfaces.

8. The invention of claim 7 wherein said first retainer means is located proximate a first point of zero tolerance between said first and second groove means of said adapter means and said first and second rib means.

9. The invention of claim 8 wherein said second retainer means is located proximate a second point of zero tolerance between said third and fourth groove means of said boot means and said third and fourth rib means of said tip means.

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