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(54) **MECHANICALLY ATTACHED TIP ASSEMBLY**

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(57) **ABSTRACT**

A tip assembly has a replaceable wear member mounted to an adapter carried on the cutting edge of an implement of an earth-working machine. The adapter has an external surface formed to engage a complementary internal cavity of the wear member and includes a pair of transversely spaced sides at least one of the transversely spaced sides include a guide arrangement and a retainer pocket positioned therein. The wear member has a body with an exterior ground-engaging surface, a mounting end, an adapter receiving cavity and at least one ear extending from the mounting end. The at least one ear is configured to be received by the guide arrangement when the wear member is positioned on the adapter.

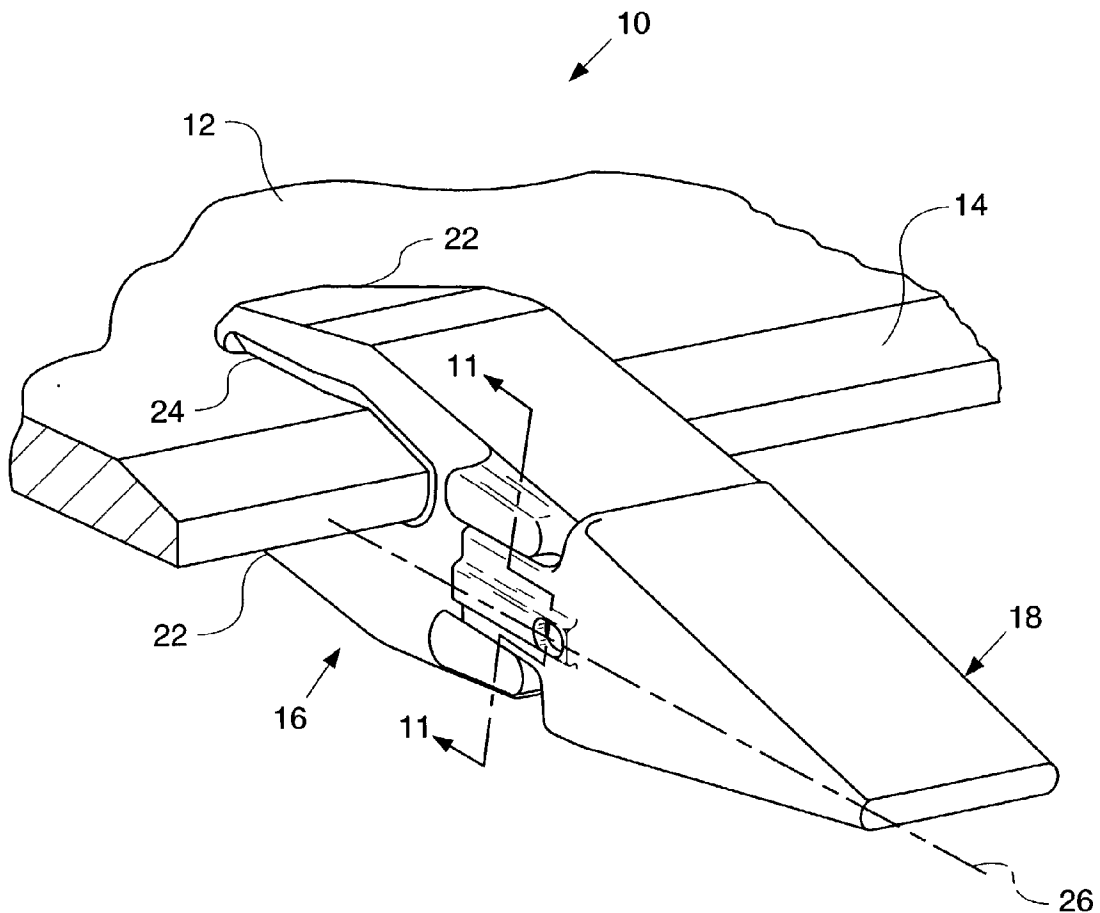


FIG. 1

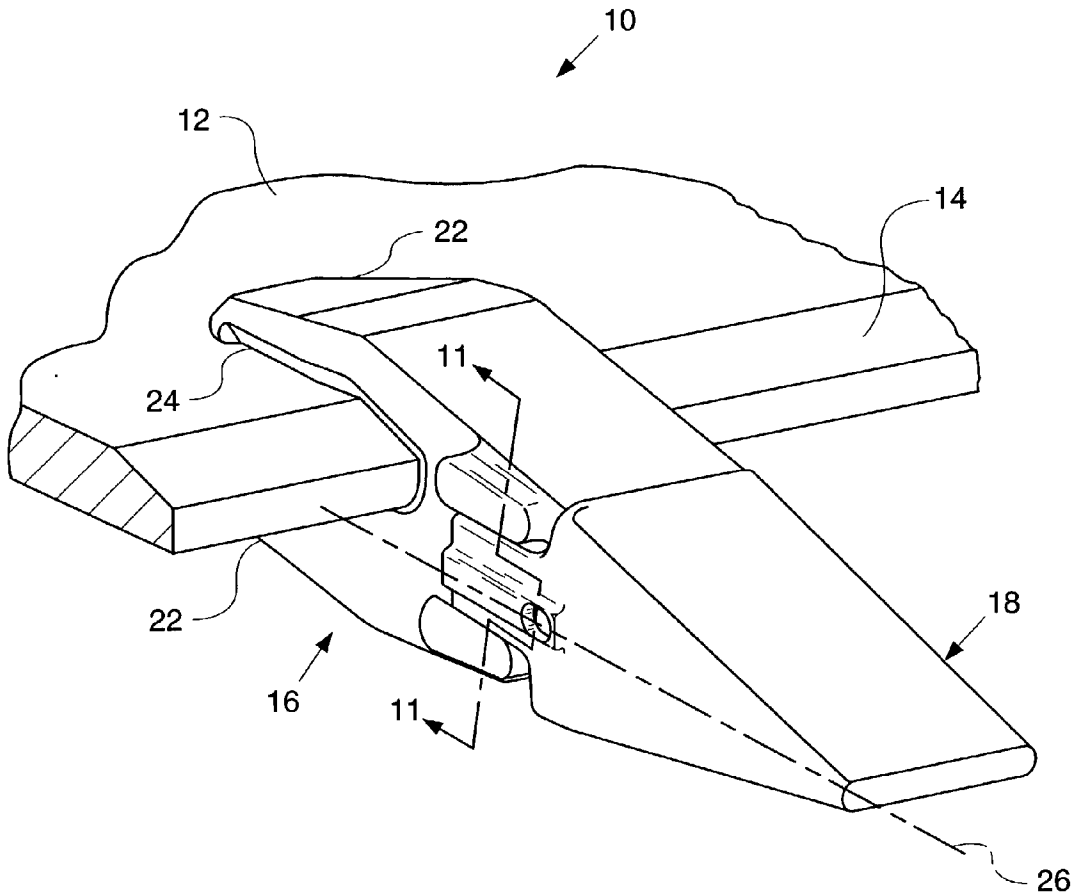


FIG. 2.

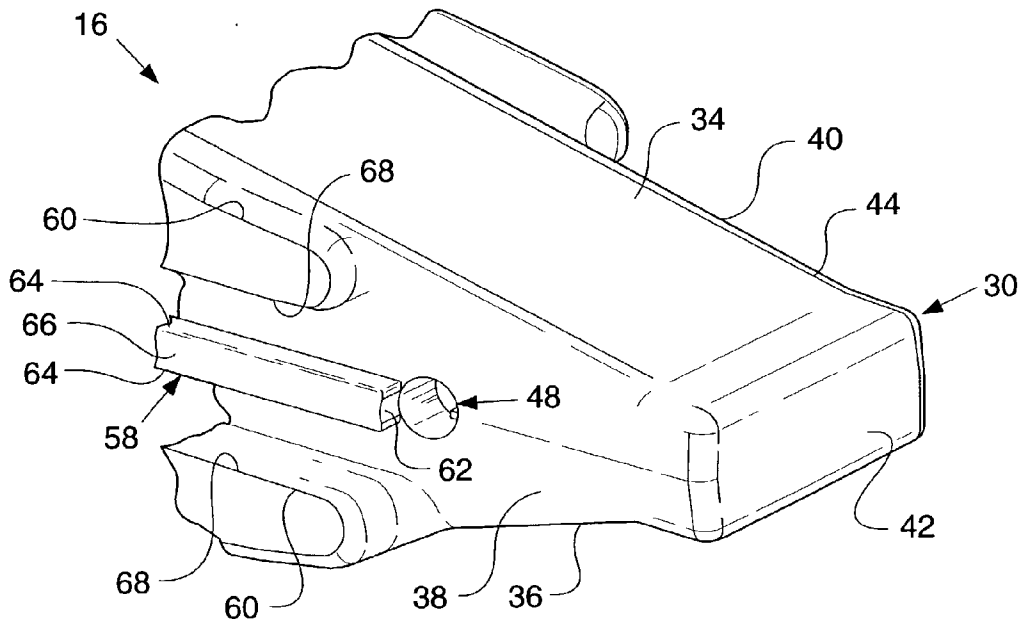


FIG. 3.

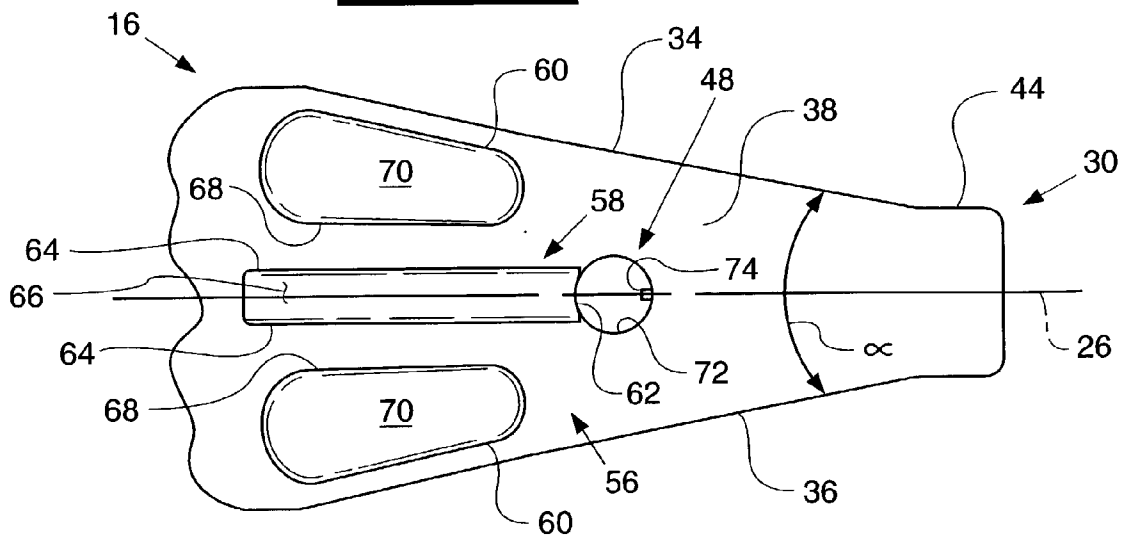


FIG. 4.

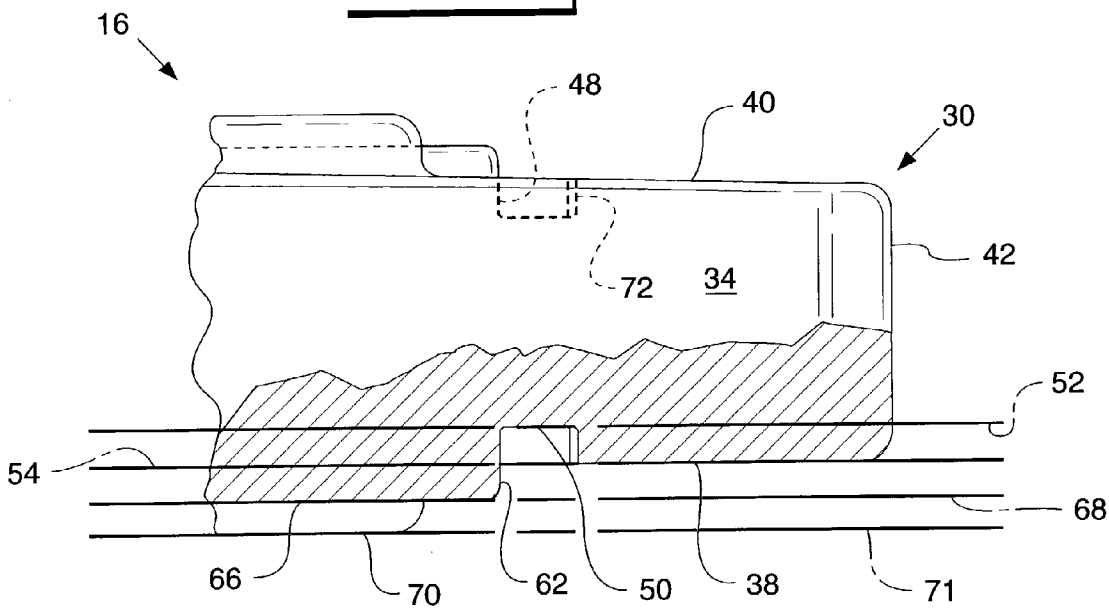


FIG. 5.

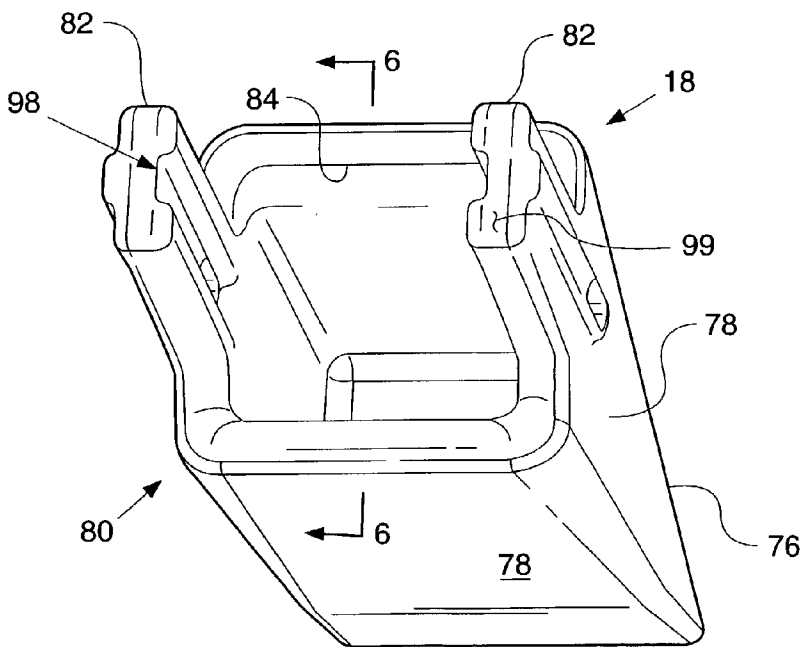


FIG. 6.

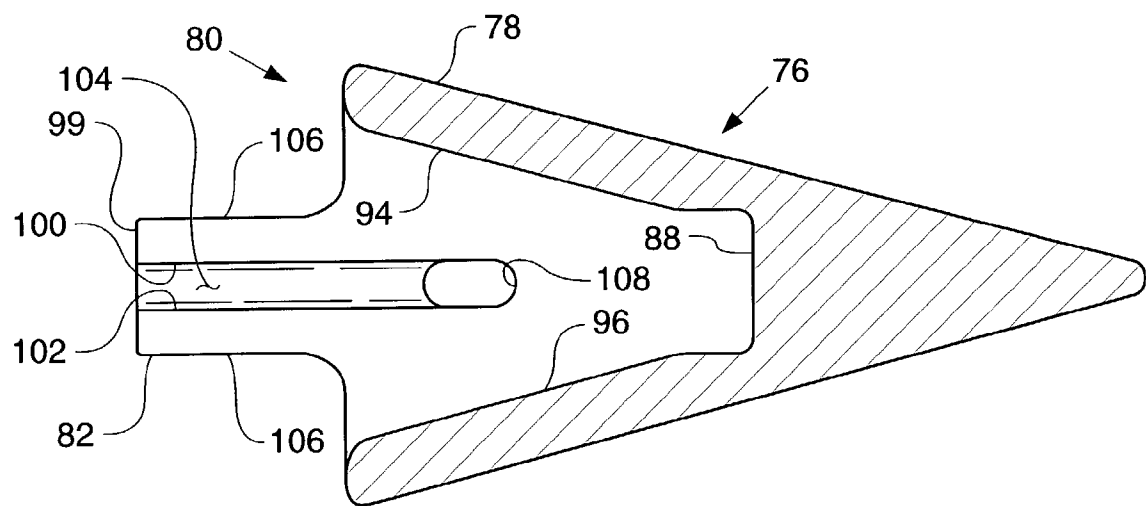


FIG. 7.

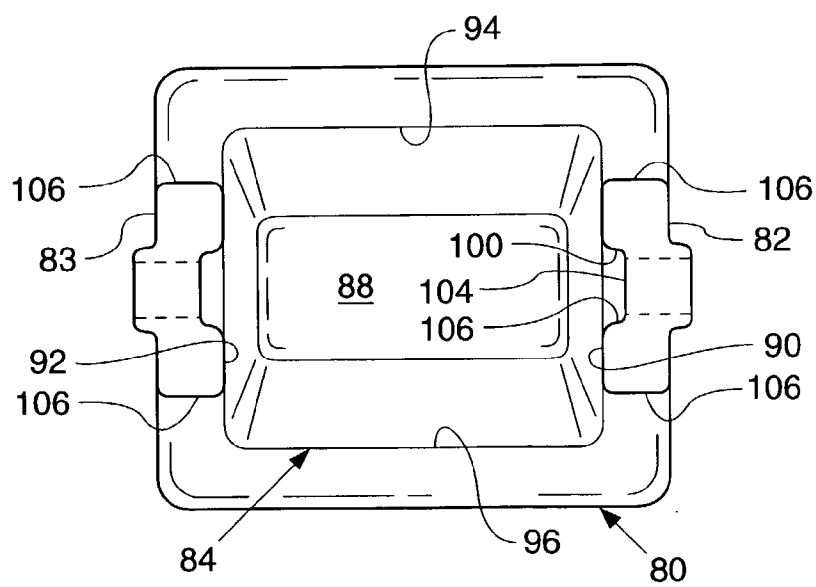


FIG. 8.

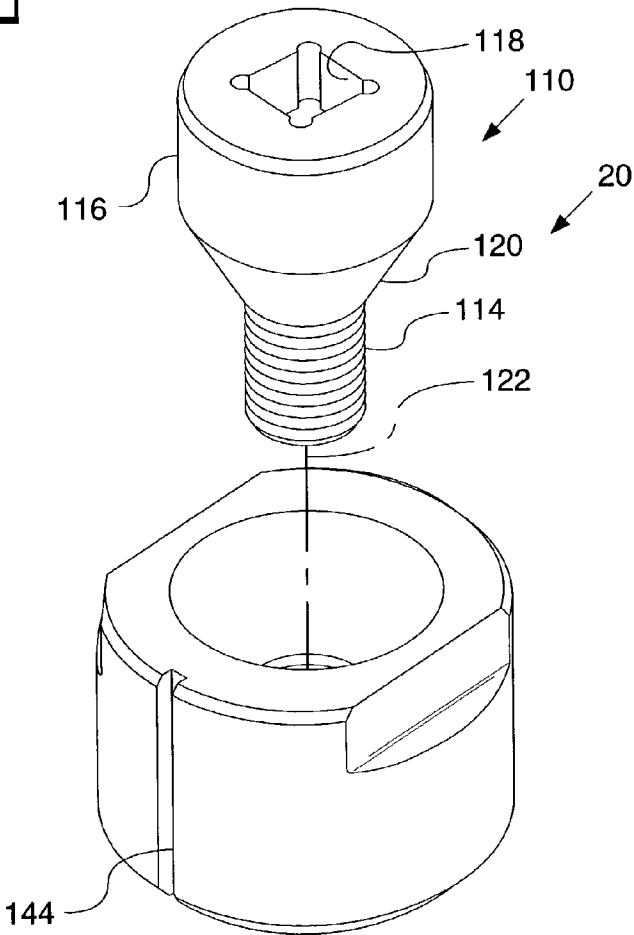


FIG. 9.

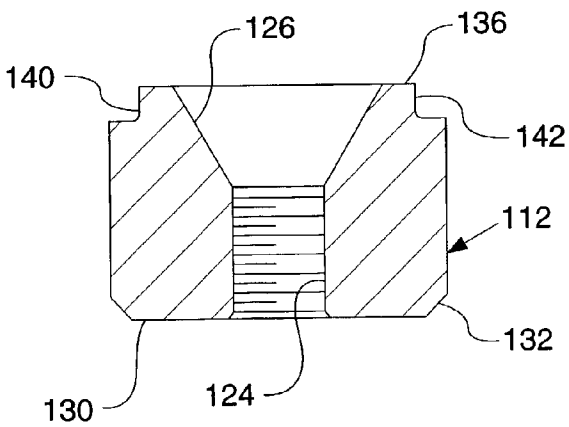


FIG. 10.

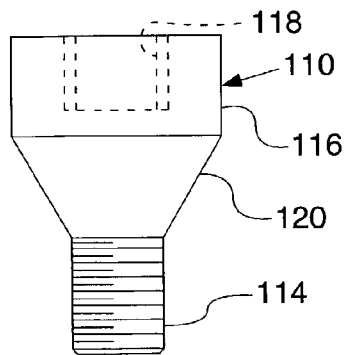
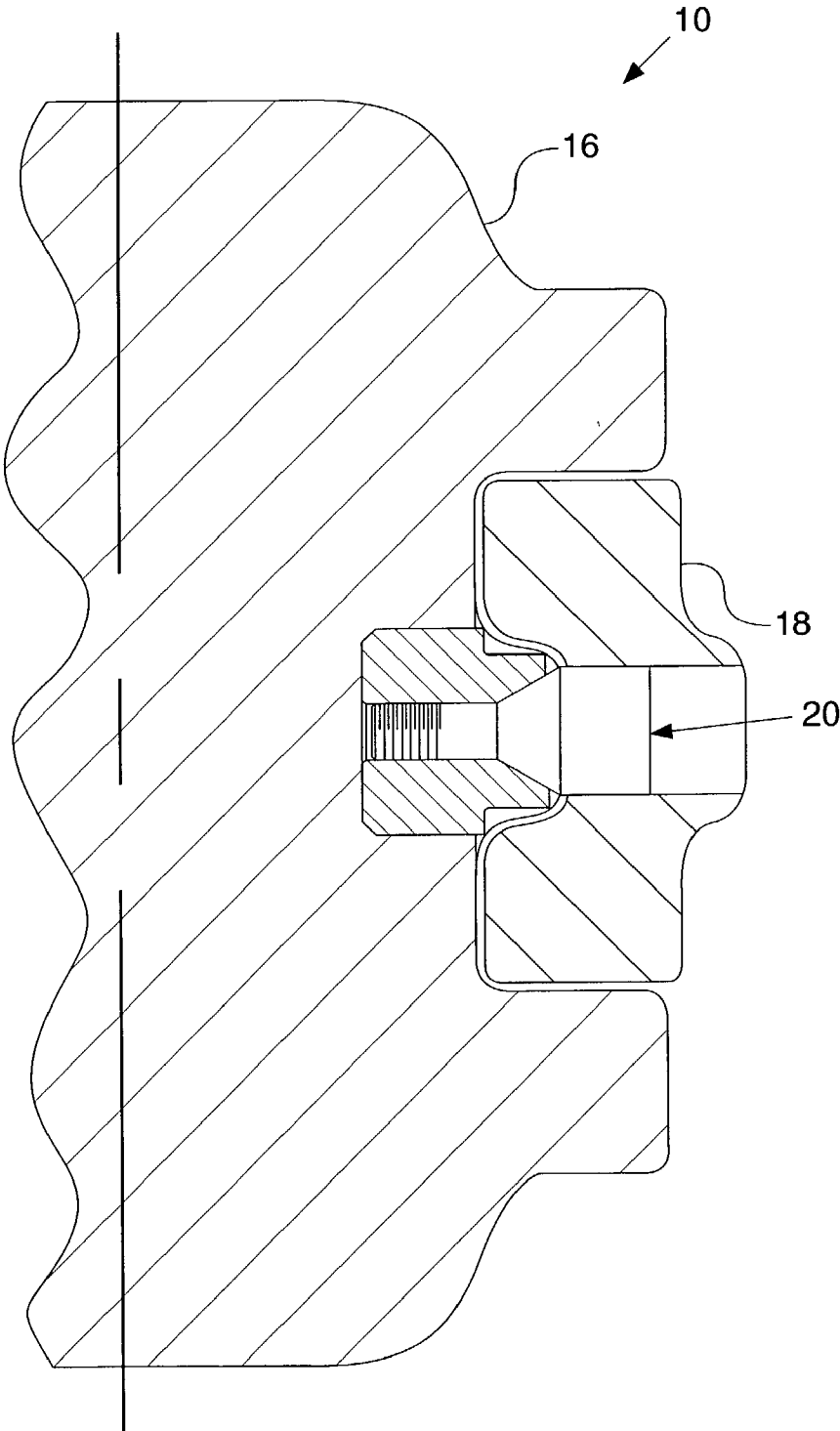


Fig. 11



MECHANICALLY ATTACHED TIP ASSEMBLY

TECHNICAL FIELD

[0001] The present invention relates generally to a tip and an adapter assembly for an earth working implement such as a bucket and, more particularly, to a novel interface between a tip and an adapter and the mechanical retainer therefore.

BACKGROUND

[0002] Excavating tooth assemblies have long been mounted along the digging edge of buckets used on earth working machines, such as excavators, backhoes and the like, to break up the ground and enhance the digging operation. The tooth assemblies are ordinarily formed of a plurality of parts to reduce the size of the outerwear member that frequently needs to be replaced. In general, a tooth assembly comprises an adapter, a wear member, and a retainer typically in the form of a pin to secure the wear member to the adapter. The adapter has a rear end, which is secured to the digging edge of an excavator bucket and a forwardly projecting nose for mounting the wear member. The wear member is typically a tapered wedge-shaped member provided with a forward digging edge and a rearward opening socket adapted to be received over the adapter nose.

[0003] The tooth assemblies are commonly subjected to heavy loading by large forces applied in a wide variety of directions. As a result, the wear member must be firmly secured to the adapter to withstand the applied forces, but yet be easily removed and installed for effective replacement in the field. Further, wearing of the tooth components causes looseness in the connection which in certain circumstances can result in the retainer failing, and hence, the wear member being lost. In an effort to increase the life of the tooth assembly, the retainer is usually set very tightly in the defined opening. Consequently, in the event of the retainer being a pin, the retainer must be forcibly driven into and out of an opening. The retainer is typically installed through the wear member and adaptor by repeated blows with a heavy sledgehammer. As can be appreciated, this is an onerous and time-consuming task, especially in the larger sized teeth.

[0004] The construction of prior tip assemblies enabled forces acting on the wear member to be exerted on the retainer, causing such retainer to break or loosen during operation. One of the reasons for this is that the primary load transmitting surface, employed on the wear member of prior designs and the mating load carrying surface on the adapter of such tip assembly, is disposed at too great of an angle or distance relative to the forces acting on the wear member. As a consequence, a component of the forces acting in an upward or downward direction is created. This upward or downward component force tends to rotate the wear member about and pull the wear member away from the adapter.

[0005] One example of an excavating tooth assembly that strives to simplify the installation procedure is disclosed in U.S. patent Publication 2002/0000053 A1 issued Jan. 3, 2002 to Dwight L. Adamic et al. In this publication a frustoconical opening is positioned in one side of a wear member. An internally threaded retainer, preferably made of polycarbonate, is positioned in the frustoconical opening in a non-rotatable fashion. The wear member is positioned over an adapter that is attachable to a cutting edge of an imple-

ment, such as a bucket. The adapter has a retainer receiving opening that generally aligns with the opening in the wear member. With the wear member positioned over the adapter an externally threaded fastener, having a tapered end portion, is threaded into the retainer. The fastener is tightened into the retainer until the tapered end portion of the fastener makes contact with the anterior surface of the retainer receiving opening. However, this publication does not address any features of the interface between the adapter and wear member that helps to distribute the heavy loads that the assembly is subjected to during use.

[0006] The present invention is directed to overcoming one or more of the problems as set forth above.

SUMMARY OF THE INVENTION

[0007] In one aspect of the present invention a tip assembly is provided.

[0008] The tip assembly includes an adapter configured to be secured to a cutting edge of an implement. The adapter has a forward end portion, a pair of elevationally spaced surfaces, and a pair of transversely spaced sides. At least one of the transversely spaced sides has a retainer pocket and a guide arrangement positioned thereon. The tip assembly also includes a wear member. The wear member has a body with an exterior ground-engaging surface, a mounting end, at least one ear extending from said mounting end and an adapter receiving cavity opening through said mounting end. The cavity is configured to receive the adapter. The ear is configured to be received in close abutting relationship with the guide arrangement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a diagrammatic perspective view of a tip assembly embodying the present invention;

[0010] FIG. 2 is an enlarged partial perspective view of the adapter block of the tip assembly of FIG. 1;

[0011] FIG. 3 is a side view of the adapter illustrated in FIG. 2;

[0012] FIG. 4 is a top view of the adapter of FIG. 2, with a portion shown in section;

[0013] FIG. 5 is a rear perspective view of the wear member from the tip assembly illustrated in FIG. 1;

[0014] FIG. 6 is a side cross-sectional view of the wear member taken generally along line 6-6 in FIG. 5;

[0015] FIG. 7 is a rear planar view of the tip;

[0016] FIG. 8 is an exploded perspective view of the retainer of the present invention;

[0017] FIG. 9 is a cross-sectional view of the barrel member of the retainer shown in FIG. 8;

[0018] FIG. 10 is a side elevational view of the fastener member of the retainer shown in FIG. 8; and

[0019] FIG. 11 is a partial cross-sectional view of the tooth taken along line 11-11 of FIG. 1.

DETAILED DESCRIPTION

[0020] Referring now to FIG. 1, there is illustrated a mechanically attached tip assembly 10 for use on an imple-

ment 12 such as a bucket of a backhoe loader, excavator, or wheel loader (not shown). While only one such tip assembly 10 is shown, those skilled in the art will understand that generally a plurality of such tip assemblies 10 are distributed along the cutting edge 14 of such an implement 12. Each tip assembly 10 includes an adapter 16 and a replaceable wear member 18, which is selectively retained on the adapter 16 by a retainer 20, as best seen in FIGS. 8-11.

[0021] As depicted in FIGS. 1-4, the adapter 16 has a pair of bifurcated straps 22 that fit in mating contact with the cutting edge 14 of the implement 12. The adapter 16 is secured to the cutting edge 14 of the implement 12 by welding along a chamfered edge surface 24 on both sides of the straps 22. However, the adapter 16 may also be a half strap or a bolt on type design without departing from the functionality of the present design. While not shown, it should be understood that the straps 22 of the adapter 16 might be configured so as to position the adapter 16 at an angle with respect to a central axis 26, either upward or downward for different implement 12 applications. For example, if the tip assembly 10 is used on a wheel loader bucket, the tip assembly 10 may be positioned so that the bottom of the wear member 18 is parallel with the bottom of the wheel loader bucket. However, if the tip assembly 10 is used on an excavator bucket the tip assembly 10 may be angled with respect to the bottom of the bucket.

[0022] The adapter 16 has a forward end portion 30 positioned distally from the implement 12, a pair of elevationally spaced surfaces 34,36 and a pair of transversely spaced sides 38,40. The forward end portion 30 defines a blunt end 42 and a generally rectangular body 44 that extends outward a predetermined distance from the elevationally spaced surfaces 34,36 and the transversely spaced sides 38,40. For purposes hereinafter described, the elevationally spaced surfaces 34,36 are non-parallel surfaces that extend at an angle with respect to the central axis 26 and are divergent from the forward end portion 30. In this manner, the elevationally spaced surfaces 34,36 form an included angle α of about 30 degrees. In one embodiment, at least one of the transversely spaced sides 38 of the adapter 16 has a retainer pocket 48 formed therein having an inward or bottom surface 50 lying along a first plane 52. Such one transverse side 38 lies along a second plane 54 that is slightly angled with respect to the first plane 52. Preferably, the second plane 54 of transverse side 38 is positioned at about a one to two degree angle with respect to first plane 52 so as to facilitate removal from a mold or die during manufacturing.

[0023] Interposed the straps 22 and the forward end portion 30 is a guide arrangement 56. The guide arrangement 56 includes a raised rib 58 and an upper and a lower raised shoulder 60. Raised rib 58 is interposed the upper and lower raised shoulders 60 and extends along central axis 26 rearward from the retainer pocket 48 towards the straps 22. The forward end of raised rib 58 forms part of a wall surface extension 62 of the retainer pocket 48. Raised rib 58 projects outward from the one transverse side 38 a predetermined distance and forms a pair of spaced sides 64, and an outer raised surface 66. The outer surface 66 lays along a third plane 68 that is spaced outward from and parallel to second plane 54, as best seen in FIG. 4. Upper and lower raised shoulders 60 both include an inner surface 68 that is positioned inward towards and parallel to central axis 26. An

outer edge 70 of the upper and lower raised shoulders 60 lie along a fourth plane 71 that is spaced outward from and parallel to third plane 68.

[0024] The retainer pocket 48 defines a bore 72 that extends inward from the second plane 54 adjacent the raised rib 58 and terminates at inner surface 50. The bore 68 has a predetermined diameter so that it extends radially outward at a distance greater than the predetermined width of the raised rib 58. Located in the bore 68, the retainer pocket 48 may have an alignment configuration 74 represented as being a raised surface or key member. It should be recognized that the alignment configuration 74 is not required for function of the disclosed arrangement, and may consist of a groove, flat surface or any of a number of other configurations, the use of which will be described in more detail below. In addition, the opposite transverse side 40 of the mounting block 16 may be configured as described above for the one transverse side 38.

[0025] As best depicted in FIGS. 5-7, the replaceable wear member 18 has a body 76 with an exterior ground-engaging surface 78, a mounting end 80, a pair of ears 82,83 and an adapter-receiving cavity 84 opening through the mounting end 80. The exterior ground-engaging surface 78 has a generally wedge shaped profile so as to better penetrate the materials it engages during a digging operation.

[0026] The adapter-receiving cavity 84 of the wear member 18 is configured to receive the adapter 16 and has a forward surface 88 disposed for axial load transferring abutting engagement with the blunt end 42 of the adapter 16. The adapter-receiving cavity 84 also has sidewalls defining a pair of transversely spaced side surfaces 90,92 and a pair of elevationally spaced surfaces 94,96. The elevationally spaced surfaces 94,96 are configured to be in close abutting relationship to a respective one of the elevationally spaced surfaces 34,36 of the adapter 16 for transferring vertical load forces generated during a digging operation.

[0027] At least one of the pair of ears 82 of the wear member 18 includes a groove 98 positioned in ear 82 that extends from an end 99 along the axial length thereof towards the adapter-receiving cavity 84. The groove 98 defines a pair of opposed surfaces 100,102 and an inner surface 104. The raised rib 58 on the adapter 16 is adapted to be received by and positionable in relationship with the groove 98. Specifically, the spaced sides 64 and the outer surface 66, of the raised rib 58, are positioned in close abutting relationship to the opposed surfaces 100,102 and the inner surface 104 respectively of the groove 98 when the wear member 18 is mounted on the adapter 16. Upon such mounting, an upper and a lower surface 106 of the one ear 82 is positioned in close relationship to the inner surface 68 of the upper and lower raised shoulders 60. The raised rib 58 and the groove 98, and the upper and lower surfaces 106 of the ear 82 and the inner surfaces 68 of the upper and lower raised shoulders 60 are also configured to assist in the transferring of vertical load forces generated during a digging operation.

[0028] A through-hole 108 extends from the exterior ground engaging surface 78 through to the adapter receiving cavity 84 and is positioned at the end of the groove 98 centrally positioned in the body 76 of the wear member 18. The through-hole 108 is alignable with the retainer pocket 48 in the adapter 16 and is generally coaxial with the bore

70, the purpose of which will become subsequently apparent. Preferably, the through-hole **108** is configured to be a slot so that as the adapter **16** wears, and replacement wear members **18** are mounted thereon, the through-hole **108** will align with the retainer pocket **48** thus providing extended life of the adapter **16**. The ears **82,83** also aid in transferring side loads between the adapter **16** and the wear member **18**. In addition, the opposite other ear **83** may be configured as described above for the one ear **82**.

[0029] As best shown in FIGS. **8-10**, the retainer **20** is used for detachable retaining the wear member **18** to the adapter **16**. In one embodiment, retainer **20** includes a fastening member **110** and a barrel member **112**. The fastening member **110** is provided with a threaded stud portion **114** and a generally cylindrical head portion **116**. The cylindrical head portion **116** includes a tool socket **118** in the end thereof. Disposed between the threaded stud portion **114** and the cylindrical head portion **118** is a tapered portion **120** that blendingly connects the threaded stud portion **114** to the cylindrical head portion **118**.

[0030] The barrel member **112** is generally cylindrical in shape and of a predetermined diameter. The barrel member **112** is disposed along a central axis **122** and has a threaded bore **124** in one end thereof that is adapted to be threadably engaged by the threaded stud portion **114** of the fastening member **110**. Positioned in the other end of the barrel member **112** is a tapered socket **126** that is adapted to be engaged by the tapered portion **120** of the fastening member **110**. A first end **130** of the barrel member **112**, adjacent the threaded bore **124**, includes a chamfer **132** that provides a lead for insertion into the retainer pocket **48**. A second end **136**, adjacent the tapered socket **126**, includes a pair of spaced surfaces **140,142**. A mating configuration **144** may be coaxially positioned on the generally cylindrical outer surface of the barrel member **112** shown as being a groove. It should be recognized that the mating configuration **144** could be a raised surface or a flat on the generally cylindrical surface of the barrel member **112** or any of a number of other configurations that will mate with the alignment configuration **74** in the bore **72** of the retainer pocket **48**.

[0031] The barrel member **112** is adapted for receipt into the retainer pocket **48** of the adapter **16** and to engage one of the wear member **18** or the adapter **16** to prevent the rotation of the barrel member **110** upon the application of a torquing or tightening force thereto by means of a suitable tool which is placed in the tool socket **126** of the fastening member **110**. If the alignment configuration **74** and the mating configuration **144** are used, the alignment configuration **74** in the bore **72** of the retainer pocket **48** and the mating configuration **144** of the barrel member **112** allow only a specific orientation so that the replaceable wear member **18** is able to be placed on the adapter **16**. Otherwise, the pair of spaced surfaces **140,142** of the barrel member **112** need to be aligned with the spaced side surfaces **64** of the raised rib **58**. In this manner, the opposed surfaces **100, 102** of the groove **98** in the one ear **82** can be positioned adjacent the spaced surfaces **140,142** and the spaced side surfaces **64** of the barrel member **112** and the raised rib **58**, respectively. Once the wear member **18** is mounted, the fastener member **110** is inserted into the through-hole **108** of the wear member **18** and screwed into the threaded bore **124** of the barrel member **110**. The predetermined diameter of the cylindrical

surface **116** of the fastener member **110** is selected for close receipt of the fastener member **110** in the through-hole **108**.

[0032] Once assembled, the wear member **18** is retained on the adapter **16** through engagement of the barrel member **112** of the retainer **20** by the fastening member **110** through the through-hole **108** in the wear member **18**. While not essential, two retainers **20** may be employed in retaining the wear member **18**, on either side of tooth assembly **10**.

[0033] Industrial Applicability

[0034] The benefits mentioned above are accomplished by various features of the present tip assembly **10**. In particular, the elevationally spaced surfaces **34,36**, the transversely spaced sides **38,40** and the guide arrangement **56** of the adapter **16** and the respectively corresponding elevationally spaced surfaces **94,96**, the spaced inner sides **90,92** and the ears **82,83** of the wear member **18** provide the primary load transferring surfaces for transferring forces therebetween. Such configurations are oriented substantially perpendicular to vertical and side forces acting on the wear member **18**. As a consequence, minimal components of force are created, thereby reducing the tendency of the wear member **18** to pivot relative to the adapter **16**. Also, the mounting end **84** of the wear member **18** is constructed so as not to contact the adapter **16** when the wear member **18** is mounted thereon. This prevents the mounting end **80** of the wear member **18** from acting as a fulcrum that is located at a distance from the retainer **20**. Thus, any resulting pivotal movement of the wear member **18** at the retainer **20** is reduced as compared to prior tip assemblies.

[0035] Retainer breakage is also reduced by the fact that the loads exerted on the retainer **20** are exerted on the generally cylindrical head portion **116** of the fastening member **110** through the through-hole **108** in the wear member **18** on one side and exerted on the barrel member **112** through the concave surface **62** of the raised rib **58** of the adapter **16** on the other side.

[0036] The tip assembly **10** of the present invention has a construction especially adapted for transferring forces exerted on the wear member **18** into the adapter **16** in a manner so as to isolate the transmission of such forces from the retainer **20**, thus reducing the breakage of such retainer **20**. The construction of the present retainer **20** and its containment in the wear member **18** maximizes its load carrying capabilities, while at the same time relieving such retainer **20** from experiencing the high loads exerted on the retainers of prior tip designs. Additionally, the adapter **16** and the wear member **18** are constructed in such a manner as the wear member **18** to move backwards on the adapter **16** as the adapter wears during use.

What is claimed is:

1. A tip assembly comprising:

an adapter having a forward end portion, a pair of spaced surfaces, and a pair of spaced sides, at least one of said spaced sides having a retainer pocket positioned therein and a guide arrangement positioned thereon; and

a wear member having a body with an exterior ground-engaging surface, an adapter receiving cavity, a mounting end, and at least one ear extending from said mounting end, said cavity being configured to receive

said adapter thereinto, said one ear being configured to be received in relationship with said guide arrangement.

2. The tip assembly of claim 1 wherein of said guide arrangement includes a raised rib.

3. The tip assembly of claim 2 wherein said guide arrangement includes an upper and lower raised shoulder positioned on each side of said raised rib.

4. The tip assembly of claim 3 wherein said one ear is positioned between said upper and lower raised shoulders and over said raised rib when said wear member is positioned on said adapter.

5. The tip assembly of claim 3 wherein said retainer pocket has a bottom surface lying along a first plane, said at least one spaced sides lying along a second plane outboard of said first plane, said raised rib includes a raised surface lying along a third plane outboard of said second plane, and said upper and lower raised shoulder each include an outer edge lying along a fourth plane outboard of said third plane.

6. The tip assembly of claim 2 wherein said wear member further includes a through-hole located in said body, said through-hole extending from said ground engaging surface to said adapter receiving cavity and alignable with said retainer pocket in said adapter.

7. The tip assembly of claim 6 wherein said raised rib has a pair of spaced sides being spaced apart a predetermined distance and wherein said retainer pocket defines a bore having a predetermined diameter, said bore extending radially outward at a distance greater than said predetermined distance so as to be disposed outboard of said spaced sides of said raised rib.

8. The tip assembly of claim 7 wherein said one ear includes a groove facing the adapter receiving cavity, said groove includes a pair of opposed sides and an inner surface, said spaced sides and said outer surface of said raised rib are disposed in close abutting relationship to said opposed sides and said inner surface of said groove, respectively when said wear member is positioned on said adapter.

9. The tip assembly of claim 1 including a retainer for selectively retaining said wear member to said adapter.

10. The tip assembly of claim 9 wherein said retainer includes a barrel member adapted for engagement with said adapter to prevent the rotation of said barrel member upon the application of a retaining force thereto.

11. The tip assembly of claim 10 wherein said barrel member includes a threaded portion and wherein said retainer includes a fastening member having a threaded stud portion on one end thereof and a tool socket in the other end thereof, and said fastening member is adapted to be threadably engageable with said threaded portion of said barrel member.

12. The tip assembly of claim 11 wherein said barrel member includes a tapered socket and wherein said fastening member includes a tapered portion that lockingly engages said tapered socket in said barrel member.

13. The tip assembly of claim 12 wherein said barrel member includes a pair of spaced surfaces positioned on a second end thereof that align with a pair of spaced sides on a raised rib of said adapter.

14. A wear member for a tip assembly, said wear member comprising:

an exterior ground-engaging surface;

a mounting end;

a pair of ears extending from said mounting end;

an adapter receiving cavity opening through said mounting end, said adapter receiving cavity including a forward end portion a pair of spaced surfaces and a pair of spaced sides; and

a through-hole extending from said exterior ground-engaging surface to at least one of said spaced sides.

15. The wear member of claim 14, wherein at least one of said pair of ears including a groove positioned thereon facing toward said adapter receiving cavity opening and extending from said through hole along a central axis.

16. The wear member of claim 15, wherein said groove includes a pair of opposite side surfaces and a transverse surface.

17. The wear member of claim 16, wherein said other ear includes a groove positioned thereon facing toward said adapter receiving cavity opening and extending from said through hole along a central axis.

18. The wear member of claim 14, wherein said through hole is a slot.

19. The wear member of claim 18, including a through hole extending from said exterior ground-engaging surface to the other one of said spaced sides.

20. An adapter for a tip assembly, said adapter comprising:

a forward end portion;

a pair of spaced surfaces;

a pair of spaced sides; and

wherein said at least one of said spaced sides having a retainer pocket positioned therein and a guide arrangement positioned thereon.

21. The adapter of claim 20, wherein of said guide arrangement includes a raised rib.

22. The adapter of claim 21, wherein said guide arrangement includes an upper and lower raised shoulder positioned on each side of said raised rib.

23. The adapter of claim 22, wherein said retainer pocket has a bottom surface lying along a first plane, said at least one spaced sides lying along a second plane outboard of said first plane, said raised rib includes a raised surface lying along a third plane outboard of said second plane, and said upper and lower raised shoulder each include an outer edge lying along a fourth plane outboard of said third plane.

24. The adapter of claim 23, being a one of a bolt on and a weld on type adapter.

* * * * *