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(54) **TIP AND ADAPTER FOR AN EARTHWORKING BUCKET**

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(57) **ABSTRACT**

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(52) **U.S. Cl.** ..... **37/455**

(58) **Field of Search** ..... 37/455, 456, 452, 37/458

A tip and adapter assembly for an earthworking bucket has a replaceable tip mounted on an adapter. The adapter has a mounting end fitted into a socket cavity of the tip, which are provided with suitable mating surfaces for transferring loading forces from the tip to the adapter. The adapter is provided with an ear that projects into a U-shaped notch in each side of the tip. A gap is provided between the ear and the notch to indicate that excessive wear has not occurred in the tip/adapter interface. However, contact between the ear and notch serves as a visual indicator that excessive wear has occurred. The notch also serves as a fuse to ensure that the tip breaks due to excessive loads before the adapter.

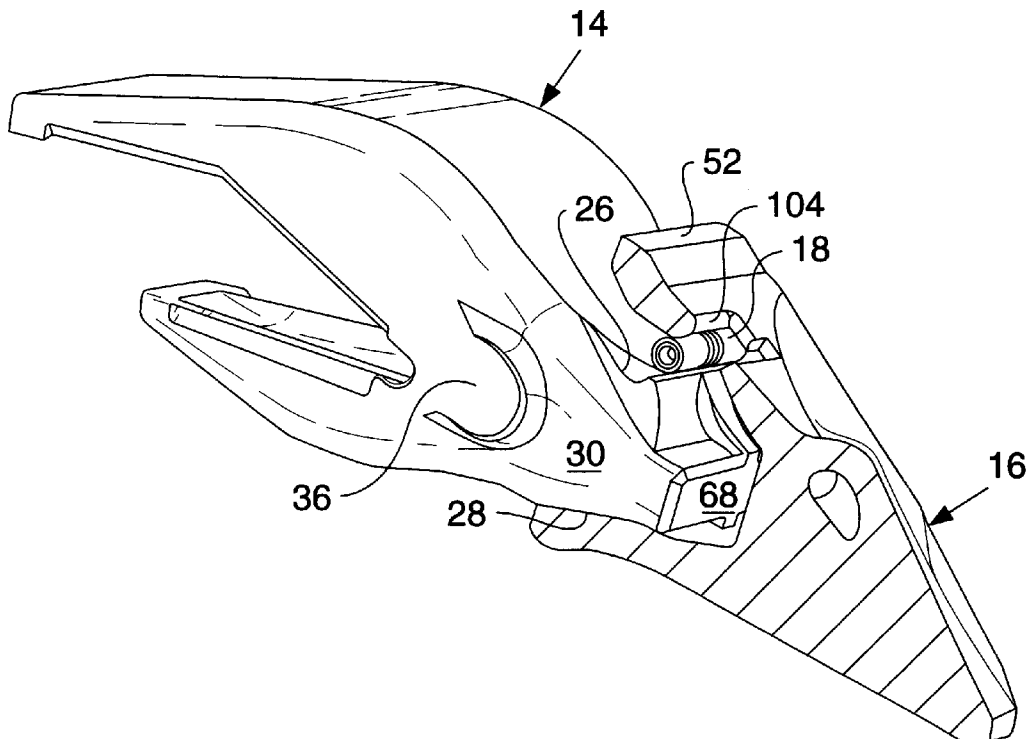
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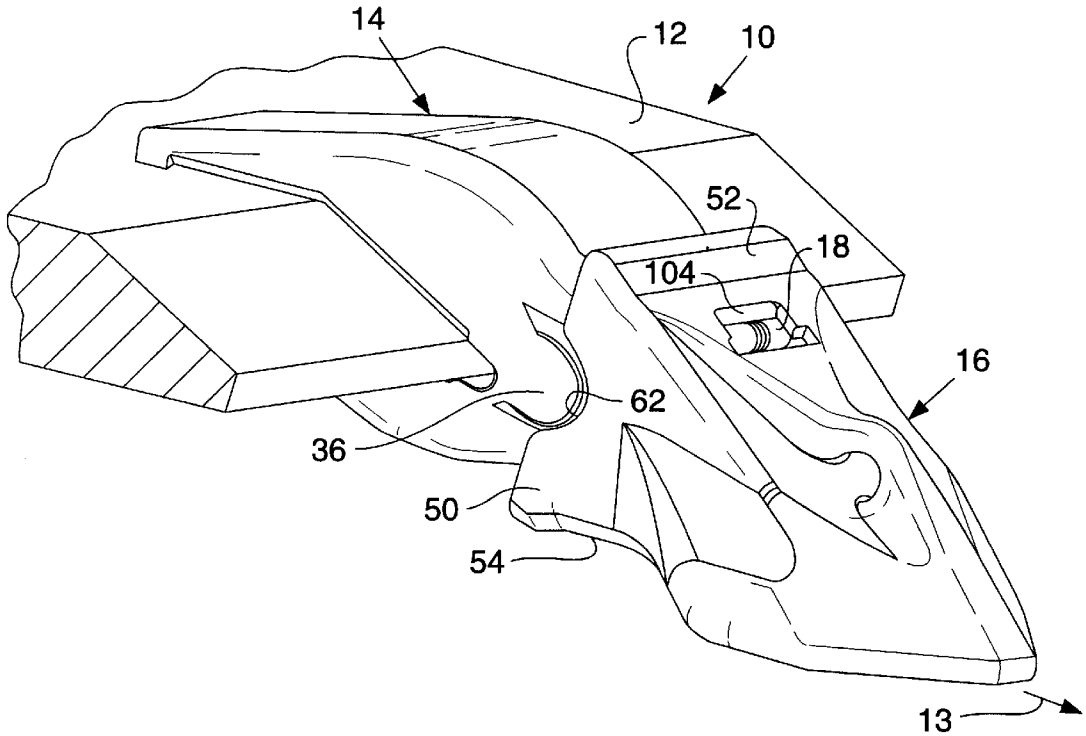
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**12 Claims, 3 Drawing Sheets**

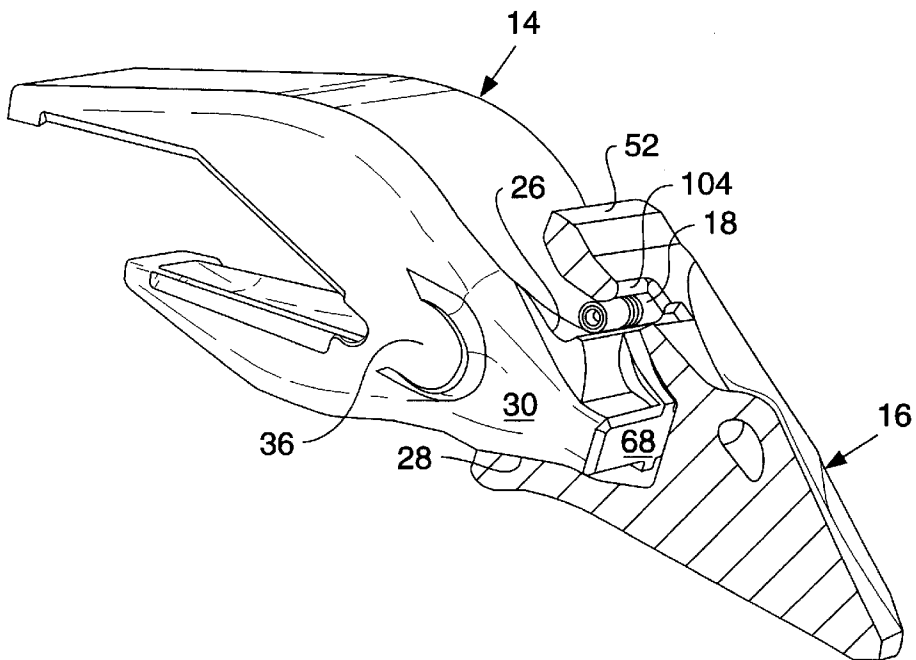
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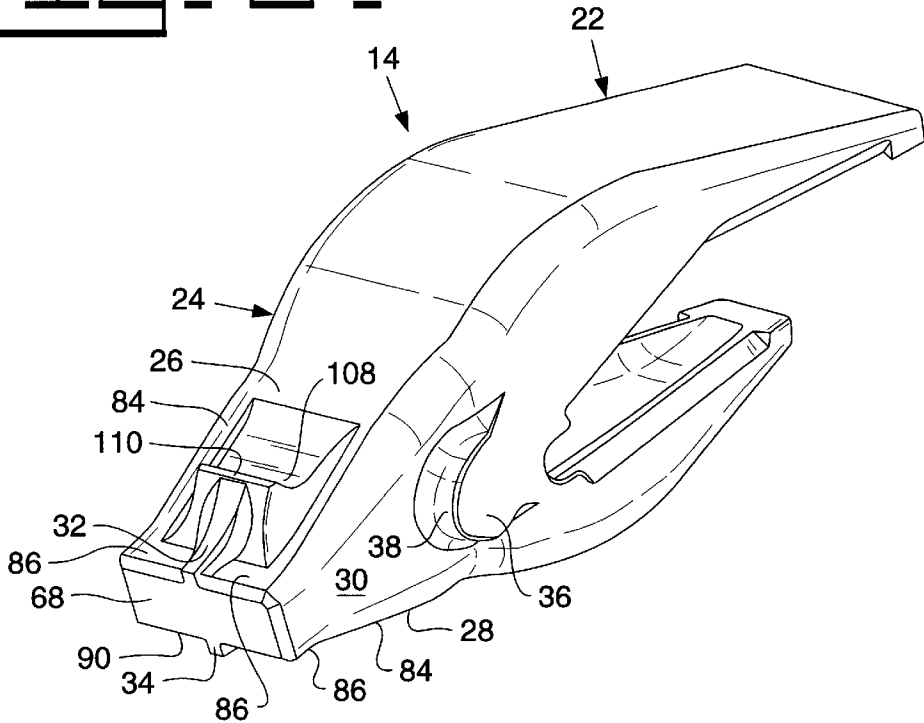
**FIG. 1.**



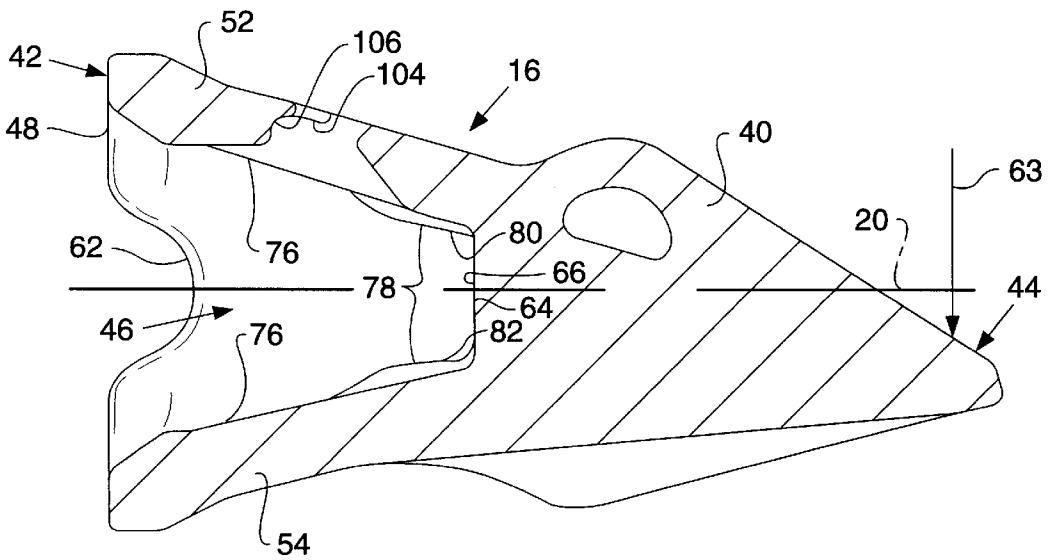
**FIG. 2.**



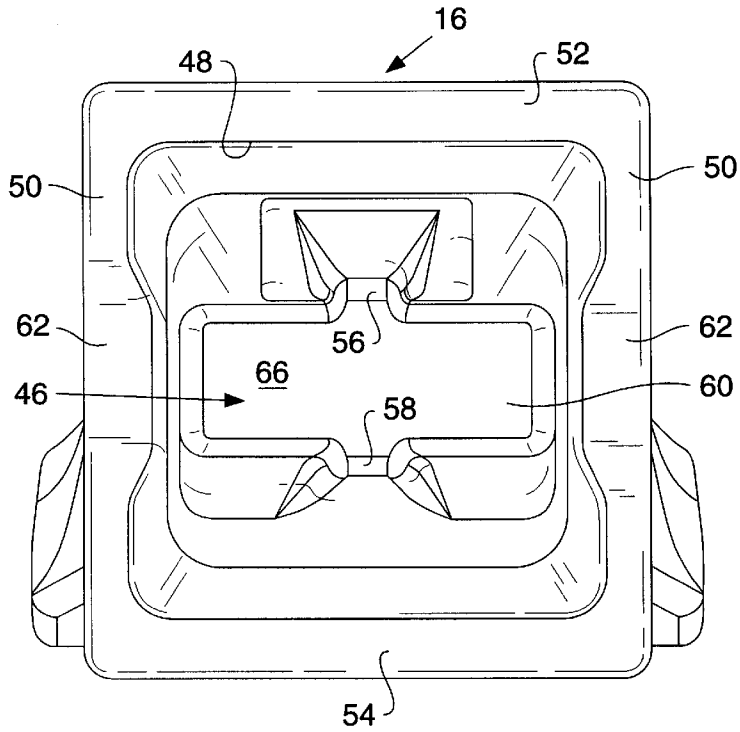
**FIG. 3**



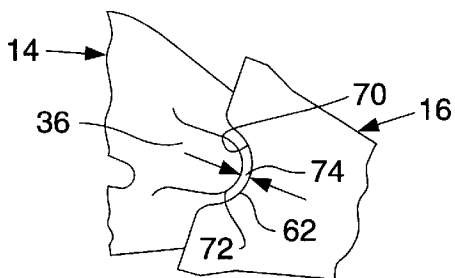
**FIG. 4**



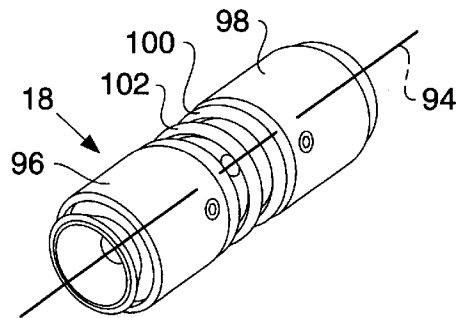
**FIG. 5.**



**FIG. 6.**



**FIG. 7.**



## TIP AND ADAPTER FOR AN EARTHWORKING BUCKET

### TECHNICAL FIELD

The present invention relates generally to a tip and adapter assembly for an earthworking bucket and the like and, more particularly, to a novel interface between a tip adapter carried on the bucket and a bucket tip.

### BACKGROUND ART

Earthworking implements, such as buckets for loaders and excavators commonly employ replaceable tips or teeth that engage the earth being worked or materials being excavated or loaded. Because of the highly abrasive materials encountered, bucket tips wear out rapidly and need to be replaced in order to protect the parent material of the bucket and to keep the bucket working at peak efficiency. Bucket tips are typically mounted on mounting structures referred to as tip adapters and are frequently subjected to high impact and prying forces that must be transferred from the tip into the adapter. To accomplish this, the adapter has a mounting nose that is received into a socket cavity of the tip. However if the forces acting on the tip become so great as to cause either the tip or adapter to break, it is more desirable to have the tip break, rather than the adapter as the adapter is more costly and more time consuming to replace.

The forces and impact loads on the tip also cause wear between the mating surfaces between the socket cavity of the tip and the mounting nose of the adapter. Therefore, it is also desirable to provide a tip/adapter interface with adequate load carrying surfaces to minimize such wear and to extend the usable life of both the tip and adapter as a result of such wear.

While it is desirable to minimize such wear on the adapter, it cannot be completely eliminated. In addition, such wear is not readily apparent as the adapter nose is hidden from view due to being encased within the socket cavity of the tip. If too much wear occurs on the interface surfaces, the tip becomes exceedingly loose and wear between the tip and adapter interface surfaces accelerates and frequently results in premature tip failure or the loss of the tip from the adapter. Consequently, it is also advantageous to be able to visually determine when the contacting interface surfaces of the adapter become worn to a point that replacement of the adapter is desirable to prevent the premature failure of the tip or its loss.

Because tips are quite frequently replaced due to rapid external wear, it is desirable to be able to quickly and easily remove the worn tip and replace it with a new one. Many types of retention devices, such as pins and the like, have been used in the past to retain the tip onto the adapter. Some typical examples of retention devices used for retaining bucket teeth are disclosed in U.S. Pat. No. 5,068,986 issued Dec. 3, 1991 to Larren F. Jones for Excavating Tooth Point Particularly Suited for Large Dragline Buckets; U.S. Pat. No. 5,272,824 issued Dec. 28, 1993 to Erwin D. Cornelius for Tooth Assembly with Leaf Spring Retainer; and U.S. Pat. No. 5,423,138 issued Jun. 13, 1995 to Richard E. Livesay, et al for Tip to Adapter Interface.

Many such prior retention devices perform satisfactorily, but are either complex and expensive, or require special tools or the large exertion of effort to remove and replace the retainers. Other retainers may simply fail during use do the high loads exerted on such retainers during use, resulting in the loss of the tool from the implement. It is therefore highly advantageous to use a hammerless type of retainer. One such

hammerless retainer is the compression spring retainer disclosed in U.S. Pat. No. 5,937,549, issued May 19, 1997 to John L. Bender et al and assigned to the assignee hereof.

The present invention is directed to overcoming one or more of the problems encountered in the use of prior art tools and retention devices.

### DISCLOSURE OF THE INVENTION

In accordance with one aspect of the present invention, a tip and adapter assembly is provided for an earthworking bucket that includes an elongated adapter and a replaceable tip. The adapter has a rear mounting portion adapted for mounting the adapter to the bucket and a front tip mounting nose for receiving a bucket tip. The tip mounting nose has a top surface, a bottom surface and a pair of side surfaces, each of the top and bottom surfaces having a longitudinally extending, centrally disposed rib protruding therefrom. Each of the side surfaces have a centrally located ear protruding therefrom. The replaceable tip has an elongated body disposed along a longitudinal axis and tapering from a wide rearward mounting end portion to a narrow forward ground engaging end portion. The mounting end portion has a rearwardly opening socket cavity for receiving the front tip mounting nose of the adapter. The socket cavity has pair of side walls, a top wall and a bottom wall. The top and bottom walls each have a central, longitudinally disposed recessed groove therein for receiving a respective one of the ribs of the adapter. Each of the side walls has a notch therethrough adapted to receive a respective one of the ears of the adapter.

In another aspect of the present invention, a replaceable bucket tip is adapted to be detachably mounted to a mounting nose of a bucket adapter by means of a retainer. The replaceable bucket tip includes an elongated body disposed along a longitudinal axis and tapering from a wide rearward mounting end portion to a narrow forward ground engaging end portion. The mounting end portion has a rearwardly opening socket cavity having a rectangularly shaped open end. The cavity is defined by pair of side walls, a top wall and a bottom wall. Each of the top and bottom walls have a central, longitudinally disposed recessed groove therein, and each of the side walls are generally parallel to each other and each have a notch extending forward from the open end toward the ground engaging end. The notch has a length sufficient to weaken the tip so as act as a fuse whereby before a vertical force acting upon the ground engaging end portion of the tip that would be sufficient to cause the breaking of the adapter on which the tip is mounted will result in the breakage of the tip first.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a bucket tip and adapter assembly embodying the principles of the present invention;

FIG. 2 is a perspective view similar to FIG. 1, but with the tip shown in section;

FIG. 3 is a reverse perspective view of the adapter shown in FIG. 1 by itself;

FIG. 4 is a side sectional view of the tip shown in FIG. 1;

FIG. 5 is a rear end view of the tip illustrated in FIG. 1;

FIG. 6 is a fragmentary side elevational view of a portion of the tip and adapter assembly of FIG. 1 illustrating an ear and notch thereof; and

FIG. 7 is an enlarged perspective view of a retainer for retaining the tip to the adapter of FIG. 1.

### BEST MODE FOR CARRYING OUT THE INVENTION

Referring to the drawings, one exemplary embodiment of the present invention is disclosed in FIGS. 1 and 2 where a

bucket tip and adapter assembly is shown at **10** for an earthworking bucket (not shown).

Earthworking implements, such as an excavator/loader/dragline bucket, are adapted to normally engage the ground in a primary direction of travel. In other words, they are manipulated to dig or scoop material in a particular direction by the earthworking machine and/or the operator of such machine. In the present case, the primary direction of travel is typically parallel to and in a direction away from a cutting edge **12** of the bucket, as designated by arrow **13** in FIG. **1**.

The tip and adapter assembly **10** includes an adapter **14**, a bucket tip **16** and an elongate retainer **18** for detachably retaining the tip **16** onto the adapter **14**.

The adapter **14** has a rear mounting portion **22** adapted for mounting the adapter to the bucket cutting edge **12** and a front tip mounting nose **24** for receiving the bucket tip **16**. As shown in FIG. **3**, the tip mounting nose **24** has a top surface **26**, a bottom surface **28** and a pair of side surfaces (one of which is shown at **30**), each of the top and bottom surfaces **26**, **28** have one of a pair of longitudinally extending, centrally disposed ribs **32**, **34** protruding therefrom. Each of the side surfaces **30** have a centrally located ear **36** protruding therefrom, with each ear **36** having a rounded forwardly facing end **38**.

As best seen in FIG. **4**, the replaceable tip **16** of the tip and adapter assembly **10** has an elongated body **40** disposed along a longitudinal axis **20** and tapers from a wide rearward mounting end portion **42** to a narrow forward ground engaging end portion **44**. The mounting end portion **42** has a rearwardly opening socket cavity **46** for receiving the front tip mounting nose **24** of the adapter **14**. As seen in FIG. **5**, the socket cavity **46** has a rectangularly shaped open end **48**, a pair of side walls **50**, a top wall **52** and a bottom wall **54**, the top and bottom walls **52**, **54** each having one of a pair of central, longitudinally disposed recessed grooves **56**, **58** therein for receiving a respective one of the ribs **32**, **34** of the adapter **14**. Each of the side walls **50** are generally parallel to each other and have a generally U-shaped notch **62** therethrough adapted to receive a respective one of the ears **36** of the adapter **14**.

The notches **62** extend forward from the open end **48** toward the ground engaging end portion **44** of the tip **16**. Each notch **62** is provided with a length sufficient to weaken the tip so as act as a fuse whereby before a vertical force acting in the direction of arrow **63** upon the ground engaging end portion **44** of the tip **16** that would be sufficient to cause the breaking of the adapter **14** on which the tip **16** is mounted will result in the breakage of the tip **16** first.

The socket cavity **46** has an end wall **64** that defines a planar force transmitting surface **66** oriented perpendicular to the longitudinal axis **20** and facing in a direction opposite to the direction of travel **13**. The tip mounting nose **24** of the adapter has a planar front end surface **68** (FIG. **3**) disposed in abutting contact with the planar surface **66** of the cavity **46** when the tip **16** is mounted on the adapter **14**, whereby longitudinally oriented forces on the tip **16** in a direction opposite to the direction of travel **13** are transmitted into the adapter **14** through the abutting planar end surfaces **66**, **68** of the tip **16** and adapter **14**.

As shown in FIG. **6**, each of the notches **62** have an interior peripheral surface **70** and each of the ears **36** have an exterior peripheral surface **72**. The ears **36** are configured so as to create a predetermined clearance gap **74** between its exterior peripheral surface **72** and the corresponding interior surface **70** of its respective notch **62** during use until an predetermined amount of wear has occurred on the abutting

end surface **68** of the adapter **14**, whereby contact between the peripheral surfaces **70**, **72** of the ears **36** and notches **62** provides a visual indicator that the adapter **14** needs replacing due to an excessive amount of wear on the abutting end surface **68** thereof.

The top and bottom walls **52**, **54** of the socket cavity **46** each have a first portion **76** and a second stepped down forward end portion **78** (FIG. **4**). The first portions **76** generally taper toward each other from the open end **48** toward the end wall **64**. The second stepped down forward end portions **78** are disposed adjacent the end wall **64** and define a pair of spaced apart and generally parallel end surfaces **80**, **82**. As best shown in FIG. **3**, the top and bottom surfaces **26**, **28** of the adapter **14** each have a first portion **84** disposed in a mating relationship with a respective one of the first portions **76** of top and bottom walls **52**, **54** of the socket cavity **46** and a second portion **86** transitioning from the first portion **84** to a generally flat orientation disposed in a mating relationship with the end surfaces **80**, **82** of second stepped down end portions **78** so as to define a pair of load bearing surfaces **88**, **90** disposed in abutting contact with the end surfaces **80**, **82** respective of the socket cavity, through which vertical loads on the tip **16** are transferred into the adapter **14**.

As mentioned earlier, the compression retainer **18** is used to detachably retain tip **16** onto adapter **14**. The elongate retainer **18** is compressible in a longitudinal direction, but substantially non-compressible in a transverse direction. As shown in FIG. **7**, retainer **18** is disposed along a longitudinal axis **94** and has a pair of solid steel opposite end portions **96**, **98** and a compressible middle portion **100**. Each of the end portions **96**, **98** have a circular cross-section with centers coincident to the longitudinal axis **94** and are capable of carrying, in compression, a high load oriented radially to the end portions **96**, **98**. The compressible middle portion **100** is disposed between the opposite end portions **96**, **98** and includes a coil compression spring **102** whereby the retainer **18** is provided with a predetermined free length along its longitudinal axis **94** when the spring **102** is in a noncompressed state and a shorter compressed length when the spring **102** is in a compressed state.

As shown in FIGS. **1** and **2**, one of the top and bottom walls **52**, **54** of the socket cavity **46** has an elongate retainer opening **104** adapted for receiving the elongate retainer **18**. Retainer opening **104** is oriented in a direction transverse to the longitudinal axis **20** of the tip **16**. Preferably, the retainer opening **104** is provided in the top wall **52** as shown in FIGS. **1** & **2**. The retainer opening **104** defines a transversely extending, forwardly facing first abutment surface **106** (FIG. **4**) along the rearward side thereof adapted for engagement with the retainer **22**. The adapter **14** is provided with a retainer pocket **108** on its top and through the upper rib **32**. As best shown in FIG. **3**, the retainer pocket **108** is disposed in alignment with the retainer opening **104** when the tip **16** is mounted onto the adapter **14** and provides a second abutment surface **110** disposed in a generally spaced, diametrically opposing relationship to the first abutment surface **106** in the tip **16**.

It should be noted at this point that the retainer opening **104** in the tip **16** is provided with a predetermined length that is less than the free length but greater than the compressed length of the retainer **18** in order to permit the insertion of the retainer **18** through the opening **104** when in the compressed state but to prevent the escape of the retainer **18** therethrough when in the noncompressed state.

#### INDUSTRIAL APPLICABILITY

The tip and adapter assembly **10** constructed in accordance with the present invention affords many advantages of

prior devices. For instance, excessive loads can be exerted on the tip 16 when it is used to pry out large rocks or boulders from the earth. Such forces can break either the tip or adapter 14. As the adapter is more costly and takes longer to replace in view of being welded to the bucket cutting edge 12, it is much more desirable to have the tip 16 break, rather than the adapter 14. The construction of the tip 16 with the longitudinally extending notches 62 in the side walls 50 of the socket cavity 46 ensures that the tip 16 will break first before the adapter 14 by significantly, but controllably, weakening the tip against vertical loads, i.e., loads normal to the direction of travel 13. Such notches 62 also serve a second purpose in conjunction with the ears 36 on the side surfaces 30 of the adapter 14. Such purpose is to provide a visual indicator of wear on the end surface 68 of the nose 24 of the adapter 14. This visual indicator is provided by the disappearance of the gap 74 when the interior peripheral surface 70 of the notch 62 comes into contact with the exterior peripheral surface 72 of the ears 36. The disappearance of the gap 74 is gauged to occur when a certain amount of wear occurs on the end surface 68 through abutting contact with end surface 66. This certain amount of wear correlates with the desired time to replace the adapter 14 so as to prevent excessive looseness of the tip on the adapter that would otherwise result in accelerated wear and damage to the tip 16 and even failure or loss of the tip.

The combination of the ribs 32,34 and grooves 56,58 provide additional load bearing surfaces for transferring torsional loads on the tip 16 into the adapter 14. The grooves 56,58 also provide a second purpose by serving as visual wear indicators for the tip 16 by creating a hole when sufficient material has been worn away on the top and/or bottom walls 52,54 so as to wear through to the grooves.

The present retainer 18 is easily installed onto and removed from the retainer opening 104 of the tip 16 without the use of special tools and without the exertion of a large amount of effort so as to make tip replacement quick and easy. To install, the retainer 18 is compressed to its compressed length so as to pass through the retainer opening 104. This may be accomplished by placing the retainer 18 in the retainer opening 104 and tapping down with a hammer to compress the compressible middle portion 100 of the retainer so as to insert the retainer into retainer pocket 108. Once in the pocket 108, the retainer 18 will re-expand to its longer noncompressed length so as to prevent its escape from the pocket through the retainer opening. Once in the pocket, the solid end portions 96,98 are adapted to abut the first and second abutment surfaces 106,110, respectively to prevent the tip from coming off the adapter in the primary direction of travel 24.

Other aspects and advantages of the present invention of this invention can be obtained through a study of the drawings, the disclosure and the appended claims.

What is claimed is:

1. A tip and adapter assembly for an earthworking bucket, comprising:

an elongated adapter having a rear mounting portion adapted for mounting the adapter to said bucket and a front tip mounting nose for receiving a bucket tip, said tip mounting nose having a top surface, a bottom surface and a pair of side surfaces, each of said top and bottom surfaces having a longitudinally extending, centrally disposed rib protruding therefrom, and each of said side surfaces having a centrally located ear protruding therefrom; and

a replaceable tip having an elongated body disposed along a longitudinal axis and tapering from a wide rearward

mounting end portion to a narrow forward ground engaging end portion, said mounting end portion having a rearwardly opening socket cavity for receiving the front tip mounting nose of said adapter, said socket cavity having pair of side walls, a top wall and a bottom wall, said top and bottom walls each having a central, longitudinally disposed recessed groove therein for receiving a respective one of said ribs of said adapter, and each of said side walls having a notch therethrough adapted to receive a respective one of said ears of said adapter.

2. The tip and adapter assembly of claim 1 wherein said socket cavity has an open end and wherein each of said notches are generally U-shaped and extend forward from said open end toward said ground engaging end portion of the tip, each notch having a length sufficient to weaken said tip so as to act as a fuse whereby before a vertical force acting upon the ground engaging end portion of the tip that would be sufficient to cause the breaking of said adapter on which said tip is mounted will result in the breakage of the tip first.

3. The tip and adapter assembly of claim 2 wherein said cavity has an end wall defining a planar force transmitting surface oriented perpendicular to said longitudinal axis and said tip mounting nose of said adapter has a planar front end surface disposed in abutting contact with said planar surface of said cavity when said tip is mounted on said adapter, whereby longitudinally oriented forces on said tip are transmitted into said adapter through said abutting planar end surfaces of said tip and adapter.

4. The tip and adapter assembly of claim 3 wherein each of said notches has an interior peripheral surface and each of said ears has an exterior peripheral surface, said ears being configured so as to create a gap between its exterior peripheral surface and the corresponding interior surface of its respective notch during use until an predetermined amount of wear has occurred on the abutting surface of the adapter, whereby contact between the peripheral surfaces of the ears and notches provides a visual indicator that the adapter needs replacing due to an excessive amount of wear on said abutting surface thereof.

5. The tip and adapter assembly of claim 4 wherein said top and bottom walls of the socket cavity each have a first portion, said first portions generally tapering toward each other from said open end toward said end wall and a second stepped down forward end portion adjacent said end wall defining a pair of spaced apart and generally parallel end surfaces, and said top and bottom of said adapter each having a first portion disposed in a mating relationship with a respective one of said first portions of top and bottom walls of the socket cavity and a second portion transitioning from said first portion to a generally flat orientation disposed in a mating relationship with said end surfaces of second stepped down end portion so as to define a pair of load bearing surfaces disposed in abutting contact with said end surfaces of the socket cavity, through which vertical loads on said tip are transferred into said adapter.

6. The tip and adapter assembly of claim 1 including an elongate retainer for detachably retaining said tip on said adapter, said retainer being compressible in a longitudinal direction, but substantially non-compressible in a transverse direction.

7. The tip and adapter assembly of claim 6 wherein one of said top and bottom walls of the socket cavity has an elongate retainer opening adapted for receiving said retainer in a direction transverse to said longitudinal axis, said retainer opening defining a transversely extending, forwardly facing abutment surface along a rearward side thereof adapted for engagement with said retainer.

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8. The tip and adapter assembly of claim 7 wherein said retainer is a compression spring retainer having a pair of solid steel end portions and a compressible middle portion.

9. A replaceable bucket tip adapted to be detachably mounted to a mounting nose of a bucket adapter by means of a retainer, said replaceable bucket tip comprising:

an elongated body disposed along a longitudinal axis and tapering from a wide rearward mounting end portion to a narrow forward ground engaging end portion, said mounting end portion having a rearwardly opening socket cavity having a rectangularly shaped open end, said cavity being defined by pair of side walls, a top wall and a bottom wall, each of said top and bottom walls having a central, longitudinally disposed recessed groove therein, and each of said side walls being generally parallel to each other and each having a generally U-shaped notch extending forward from said open end toward said ground engaging end, said notch having a length sufficient to weaken said tip so as act as a fuse whereby before a vertical force acting upon the ground engaging end portion of the tip that would

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be sufficient to cause the breaking of said adapter on which said tip is mounted will result in the breakage of the tip first.

10. The replaceable bucket tip of claim 9 wherein said socket cavity includes an end wall defining a planar force transmitting surface oriented perpendicular to said longitudinal axis.

11. The replaceable bucket tip of claim 9 wherein said top and bottom walls each having a first portion generally tapering toward each other from said open end toward said end wall and a second stepped down forward end portion adjacent said end wall defining a pair of spaced apart and generally parallel end surfaces.

12. The replaceable bucket tip of claim 10 wherein one of said top and bottom walls includes an elongate retainer opening therethrough, said retainer opening having a transversely extending, forwardly facing side with an arcuately shaped abutment surface thereon adapted for engagement with said retainer.

\* \* \* \* \*