A tooth and adaptor assembly for a dipper bucket includes an adaptor having a rear portion for attaching to the dipper bucket, a tooth capable of releasable attachment to the adaptor and a retainer pin for securing the tooth to the adaptor. The adaptor further includes a tapering intermediate portion that narrows to a rectangular front portion. The adaptor further includes a planar surface on a portion of its intermediate portion and a cavity on the planar surface for receiving the retainer pin. The tooth has a tip at its front end for digging and a socket at its rear end configured to receive the front and intermediate portions of the adaptor. A small opening on the rear end of the tooth aligns with the cavity when the tooth is seated on the adaptor. The retainer pin is urged outward of the cavity by a biasing element to engage the small opening on the tooth so as to secure the tooth to the adaptor.
TOOTH AND ADAPTOR ASSEMBLY

BACKGROUND OF THE INVENTION

0001 1. Field of the Invention
0002 The present invention relates to excavating equipment, more particularly, to bucket tooth and adaptor assemblies for use on dipper buckets.

0003 2. Description of the Related Art
0004 Excavation in construction and mining applications is carried out more efficiently when ground-engaging penetration attachments, such as tooth and adaptor assemblies, are securely mounted on the leading digging edge of the excavation dipper bucket and/or excavation equipment. Usually, adaptors are rigidly attached to the bucket by either welding or some form of mechanical fastener.

0005 A chisel-like tooth of the assembly reduces the initial contact mass of the bucket edge moving into the material being excavated by focussing the accumulated digging forces at the leading edges of the tooth, thereby maximizing the penetration efficiency of the excavating equipment. The loosened material can then be freely loaded into the excavation bucket or simply diverted around the assembly when materials are only being broken up. Abrasive grinding, multidirectional stresses and shock loading at exceedingly high levels can continuously and abruptly breach the integrity of the tooth and adaptor assembly during any given excavation application.

0006 Canadian Patent 1,243,059 and U.S. Pat. No. 4,481,728 are exemplary of the first generation elliptical tooth and adaptor system. This system demonstrated the use of a three-piece system in mining applications. This system enabled the user to replace the primary consumable tooth separate from the fixed carrier adaptor. Any number of consumable teeth could then be readily fitted to the adaptor and replaced as each became worn out. Although this tooth and adaptor system is functional, it requires certain installation and removal techniques that are not desirable for use in the field. Some of this assembly’s limitations include the use of an oversized locking pin that incorporates compressive elastomeric material vulcanized between two rigid members of the locking pin.

0007 Excessive force has to be applied by a sledgehammer to sufficiently compress the pin to permit full insertion into a smaller hole that receives the lock pin. Installation and removal of the locking pin is also time consuming and physically difficult, particularly if the head of the pin became flattened (mushroom shaped) from repeated hammer blows. This arduous practice of changing out worn teeth and installing new teeth has eventually become a safety concern. This original design is no longer acceptable to maintenance workers in certain mining applications. In addition, several other features of this design eventually became a concern.

0008 Another problem with this type of tooth and adaptor system is the physical properties of the vulcanized elastomeric material used in a lock pin to maintain the tooth fully on the adaptor. Deterioration of the elastomeric material is a common occurrence thereby making the locking pin non-reusable. In addition, the structural design of this tooth and adaptor system restricted the possibility of establishing a locking system that would better preserve this important component.

0009 The extreme flowing pressures (several tons) of excavated materials beneath the shovel bucket tend to force this type of locking pin upward and out of the locked position. Occasionally, these pins are actually forced out completely and allow the tooth to fall off.

0010 Other limitations of this tooth and adaptor system include its design of an aligning common-through-hole located centrally in both mated structural members when the tooth was fully fitted to the adaptor to accept the locking pin. The loss of structural mass in the tooth sidewalls weakened the tooth and, occasionally, will break when subjected to severe digging applications.

0011 Other systems include large gaps on the assembled tooth and adaptor, and within and around the lock pinholes. This leaves the mating fit surfaces of the assembly, the lock pin bearing support surfaces and its related structural members vulnerable to the extreme flowing pressures (several tons) of excavated materials that are readily forced into these gaps. The abrasive qualities of the ore, combined with any movement between the assembled components during the excavation process, create an aggressive grinding effect that can deteriorate these important dimensional load-bearing surfaces.

0012 The resulting wear can contribute to a “loose fit” condition affecting all three assembled components. This condition is especially true when certain “self-lubricated” and highly abrasive ores such as tar sand are being excavated. These ores have the inherent ability to quickly enter all gaps and internal aspects of the mated assembly. In addition, the elastomeric material incorporated in the retainer pin is exposed to the chemical effects of the ore (i.e., tar sand) and this contributes to the premature breakdown of this material diminishing its ability to lock the tooth to the adaptor. If the retainer lock pin does become loose and falls out, the tooth and adaptor can uncouple, leaving the less wear-resistant adaptor male mating nose exposed to harsh wear from the continuing excavation process.

0013 It is, therefore, desirable to provide a tooth and adaptor assembly for a dipper bucket that overcomes the limitations of the conventional equipment described above.

BRIEF SUMMARY OF THE INVENTION

0014 According to the preferred embodiment of this invention, a tooth and adaptor assembly for a dipper bucket includes an adaptor having a front portion, an intermediate portion and a rear portion. The rear portion is adapted for attaching to a conventional dipper bucket. The intermediate portion extends between the front and rear portions and has a substantially circular base adjacent to the rear portion. The intermediate portion tapers or narrows in cross-section from its base to the front portion. According to one arrangement, the intermediate portion has an elliptical cross-section and the front portion has a substantially flat front end. According to another arrangement, a portion of the exterior surface of the intermediate portion is substantially planar thereby making the intermediate portion approximately D-shaped in cross section. A cavity is disposed on the planar surface, this cavity being transverse to a longitudinal axis passing through the intermediate portion. The cavity can be circular, rectangular or square in cross-section.

0015 The preferred assembly also includes a tooth having a front tip portion adapted for excavating and a rear portion extending from the front end. The rear portion of the tooth includes a socket configured to accommodate the front and intermediate portions of the adaptor in a coupled position. Specifically, the socket has an opening adapted to mate with the base of the intermediate portion and a bottom with
a flat surface to mate with the front portion of the adaptor. The socket has an interior wall surface that is initially cylindrical at the entrance and then tapers to the bottom, the interior wall surface having a portion that is planar such that it mates with the planar portion of the exterior surface of the intermediate portion of the adaptor.

[0016] The rear portion of the tooth also has a smaller opening, which secures a retainer pin. The aperture in alignment with the adaptor passageway when the tooth is fully seated on the adaptor. In the preferred embodiment, the aperture extends through the tooth thereby providing communication from the outer tooth surface to the passageway. The retainer pin is disposed in the adaptor passageway to extend toward and engage the aperture in the tooth thereby securing the tooth on the adaptor. The retainer pin can be extracted from the smaller opening in the tooth by external means.

[0017] In an alternative embodiment, the assembly utilizes a compressible retainer pin to engage and disengage the tooth from the adaptor. There is no bottom through-hole in the bottom of the tooth to “drill” the retainer pin out in order to disassemble the tooth from the adaptor. This prevents the entry of highly pressurized compaction forces from beneath that can force the typical base exposed retainer pin upward and out of their seated position.

[0018] In yet another embodiment, the assembly includes a tooth, an adaptor, a retainer pin and a biasing element. The tooth and adaptor are configured such that the mated surfaces of the assembled components minimize debris from entering the interstitial space between the tooth and the adaptor when they are in a coupled and latched position. Preferably, the retainer pin is a solid pin, tapered at one end, having a square cross-section with rounded corners. The biasing element can consist of an elastomeric plug and/or a spring element that maintains outward pressure on the retainer pin to promote locking engagement within the small hole of the tooth. A ramp disposed in the socket between the mouth of the socket and the small hole of the tooth compresses the biasing element of the retainer pin as the tooth is seated onto the adaptor. As the small hole of the tooth begins to align with the adaptor cavity, the retainer pin passes over the crest of the ramp and is urged forward by the biasing element to engage the small hole thereby securing the tooth on the adaptor.

[0019] According to another arrangement, the adaptor front portion has a rectangular front end and enlarges in cross-section towards the substantially circular base of the intermediate portion. The intermediate portion incorporates a ¾ round cylindrical shank having a flat side surface containing a cavity formed thereon. The front and intermediate portions are adapted to conform to an interior configuration of the tooth socket so as to prevent the tooth from rotating on the adaptor in the coupled position. These additional mated-load bearing surfaces help to keep the tooth stable on the adaptor while a maintenance worker is changing out the tooth. One or more stabilizing lugs protrude outward from the adaptor thrust bearing surface that mate with positioning slot(s) positioned on the thrust bearing surface of the tooth.

[0020] The complementary shapes of the front and intermediate portions of the adaptor and the tooth socket more effectively distribute the shock and bearing loads throughout the assembly. The front and intermediate portions form multi-directional load-bearing surfaces so as to reduce the possibility of tooth and/or adaptor nose breakage.

[0021] The retainer pin can be easily manipulated externally with a simple tool, such as a drift punch, entered into the small hole of the tooth to permit installation and removal of the tooth. The configuration of the retainer pin prevents chemically active ore from entering the adaptor cavity and having an adverse effect on an elastomeric biasing element. Accordingly, the elastomeric material and/or spring mechanism and retainer pin can be used over the course of several tooth change outs, if necessary.

[0022] According to one aspect of the invention, an adaptor for releasably attaching a bucket tooth to an excavation tool includes a rear portion adapted for attaching to an excavation tool; a front portion adapted for a sliding fit with a corresponding socket disposed on a bucket tool; an intermediate portion comprising an exterior surface and a base adjacent to the rear portion, the intermediate portion narrowing in cross-sectional area from the base to front portion; a substantially planar surface disposed on a portion of the exterior surface; and a passageway extending from the planar surface at least partially into the adaptor, the passageway being adapted to receive a retainer pin for releasably attaching the bucket tooth to the adaptor.

[0023] According to another aspect of the invention, a bucket tooth for releasably attaching an adaptor to an excavation tool includes a longitudinal body that has a front tip portion adapted for excavating disposed on one end and a rear portion disposed on an opposing end; a socket disposed on the rear portion, the socket having a mouth, a side wall and an interior mating surface adapted for a sliding fit onto an exterior surface of an adaptor; a substantially planar surface disposed on a portion of the interior mating surface; an aperture disposed on the planar surface, the aperture being adapted to substantially align with a passageway disposed on the adaptor; and a catch disposed on the planar surface between the mouth and the aperture, the catch being adapted to secure a retainer pin disposed in the passageway to the aperture, the retainer pin including a biasing element adapted to urge the retainer pin to engage the aperture when the tooth is substantially seated on the adaptor thereby preventing the tooth from being removed from the adaptor.

[0024] According to yet another aspect of the invention, a retainer pin is adapted for releasably attaching a bucket tooth to an adaptor, the tooth including a socket having an interior surface and adapted for sliding fit on to the adaptor, a longitudinal body having first and second ends, the body being adapted to be inserted into a passageway disposed on an adaptor; a biasing element disposed on the first end; and the second end adapted to seat in an aperture disposed on a socket interior surface of a bucket tooth when the retainer pin is inserted first end first into the passageway of the adaptor thereby retaining the tooth on the adaptor once the tooth is substantially seated on the adaptor.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0025] FIG. 1 is a perspective view depicting a tooth uncoupled from an adaptor that is mounted to a dipper bucket.

[0026] FIG. 2 is a perspective view depicting a tooth being seated on an adaptor.
FIG. 3 is a side elevational view depicting the tooth and adaptor assembly of FIG. 1 with the tooth seated on the adaptor.

FIG. 4 is a top plan view depicting the tooth and adaptor assembly of FIG. 1 with the tooth seated on the adaptor.

FIG. 5 is a side elevational view depicting the tooth and adaptor assembly of FIG. 1 with the tooth uncoupled from the adaptor.

FIG. 6 is a top plan view depicting the tooth and adaptor assembly of FIG. 1 with the tooth uncoupled from the adaptor.

FIG. 7 is a left side elevational cross-section view depicting a tooth of FIG. 4 as shown along section lines VII-VII.

FIG. 7A is a left side elevational cross-section view depicting the tooth of FIG. 7 with a slot for a stabilizing lug.

FIG. 8 is a right side elevational cross-section view depicting the tooth of FIG. 4 shown along section lines VIII-VIII.

FIG. 9 is a top plan cross-sectional view depicting the tooth of FIG. 3 as shown along section lines IX-IX.

FIG. 10 is a left side elevational view depicting the adaptor of FIG. 1.

FIG. 10A is a left side elevation view depicting the adaptor of FIG. 10 with a stabilizing lug.

FIG. 11 is a top plan view depicting the adaptor of FIG. 1.

FIG. 11A is a top plan view depicting the adaptor of FIG. 11 with a stabilizing lug.

FIG. 12 is a side elevational view depicting a retainer pin for use with the tooth and adaptor assembly of FIG. 1.

FIG. 13 is a top cross sectional plan view depicting the tooth and adaptor assembly of FIG. 3 as shown along section lines XIII-XIII.

FIG. 13A is a top cross sectional plan view displaying an alternate embodiment of the retainer pin.

FIG. 14 is an end elevational cross-section view depicting the tooth and adaptor assembly of FIG. 4 as shown along section lines XIV-XIV.

FIG. 15 is a perspective view depicting a backhoe with a dipper bucket.

FIG. 16 is an elevational side view depicting an excavator with a dipper bucket.

FIG. 17 is an elevational side view depicting a front-end loader with a mining bucket.

FIG. 18 is a perspective view depicting a bucket-wheel trencher excavator with a plurality of toothed buckets.

FIG. 19 is a perspective view depicting a trencher with a chain equipped with a plurality of tooth and adaptor assemblies.

FIG. 20 is an elevational side view depicting a cutting head for a dredging excavator.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 and 2, a representative embodiment of the present invention is shown. The tooth/adaptor assembly 10 broadly consists of excavation tooth 12, adaptor 14, retainer pin 16, and biasing element 17. Adaptor 14 comprises elongated U-shaped member 15 that attaches to dipper bucket 18 on bucket lip 19 as well known to those skilled in the art. Tooth 12 is seated onto adaptor 14 and secured by retainer pin 16 that is forced outwardly from the adaptor cavity 20 by the biasing element 17 to fit snugly into aperture 21 on tooth 12. Tooth 12 is designed to bear the brunt of the wearing forces caused by excavating and will wear out over time. As tooth 12 wears out to the point that it is no longer serviceable, tooth 12 can be removed from adaptor 14 by inserting a tool, such as a drift punch or similarly shaped device, into aperture 21 to engage pin 16 and compress biasing element 17. This causes pin 16 to disengage from aperture 21 on tooth 12 thereby allowing tooth 12 to be removed from adaptor 14.

Referring to FIGS. 3 and 4, side and top views of assembly 10 is shown with tooth 12 fully seated on adaptor 14. Tooth 12 has a pointed tip 22 designed for excavating. As more clearly shown in FIG. 13, tooth 12 is secured to adaptor 14 with retainer pin 16 seated in cavity and engaging aperture 21. Referring to FIGS. 5 and 6, side and top views of assembly 10 is shown with tooth 12 uncoupled from adaptor 14. Adaptor 14 comprises base portion 23 that is generally circular in cross-section, intermediate elliptical tapered cone portion 24 and front block portion 35.

One side of the base 23 and intermediate portions 23 and 24 have a flat surface 25 that gives the base portion 23 and intermediate portion 24 a generally D-shaped or ¼ round cross-section. The flat surface 25 has a planar axis that can be positioned substantially vertical on adaptor 14, although other configurations can be used. Retainer pin cavity 20 on flat surface 25 can be transverse to longitudinal axis 11 of assembly 10. To couple tooth 12 and adaptor 14 together, tooth 12 comprises socket 26 that receives front, intermediate and base portions 35, 24 and 23 of adaptor 14. When tooth 12 is seated on adaptor 14, thrust bearing surface 27 of tooth 12 contacts thrust bearing surface 31 of adaptor 14. Load forces passing from adaptor 14 to tooth 12 and from tooth 12 back to adaptor 14 are transmitted via these uniform mated fit surfaces.

Moreover, when tooth 12 is seated on adaptor 14, aperture 21 aligns with cavity 20 to provide a substantially continuous passageway 28 for receiving retainer pin 16. Front portion 35 is a key adapted to prevent tooth 12 from rotating on adaptor 14 when fully seated on adaptor 14. In the embodiment described herein, front portion 35 has a rectangular cross-section. The cross-section of front portion 35 can be of any suitable cross-sectional shape that will prevent tooth 12 from rotating on adaptor 14 when fully seated on adaptor 14. Examples of suitable polygon shapes for front portion 35 include triangle, square, rhombus, trapezoid, pentagon, hexagon, heptagon and octagon. Front portion 35 can also be elliptical in cross-section in addition to any other curved cross-section that will prevent tooth 12 from rotating on adaptor 14.

In FIGS. 7 and 8, side cross-sectional views of tooth 12 are shown. FIG. 9 illustrates a top plan cross-sectional view of tooth 12. Tooth 12 is intersected by a socket-opening 26 that has a substantially circular interior load bearing surface 29 to match base 23 of adaptor 14. Relief cavity 33 is a relief groove that separates load surface 29 from elliptical cone surface 30. Relief cavity 33 is relatively circular in shape and offers additional relief clearance for adaptor transition zone edges 32 on tooth 12 when tooth 12 is fully seated on adaptor 14.

Sidewalls 34a to 34d and primary thrust bearing surface 39 of key-way 52 provide an opening to receive front block 35 of adaptor 14 in a sliding fit. In one embodiment,
front block 35 of adaptor 14 and key-way 52 are rectangular in cross section. The cross-section of key-way 52 can be of any suitable cross-sectional shape that will prevent tooth 12 from rotating on adaptor 14 when fully seated on adaptor 14. Examples of suitable polygon shapes for key-way 52 include triangle, square, rhombus, trapezoid, pentagon, hexagon, heptagon and octagon. Key-way 52 can also be elliptical in cross-section in addition to any other curved cross-section that will prevent tooth 12 from rotating on adaptor 14 so long as key-way 52 and front portion 35 are complementary in shape and fit.

[0055] Cone surface 30 and circular base 39 further comprises flat surface 38 that give this intermediate portion of socket 26 a generally D-shaped or ¼ round cross-section. Ramp 60 leads from thrust bearing surface 27 in socket 26 towards ramp crest 62 that is adjacent to aperture 21. In one embodiment, aperture 21 is tapered, or frusto-conical, in shape and configuration.

[0056] Referring to FIGS. 10 and 11, side and top views of adaptor 14 are shown, respectively. Adaptor 14 comprises of adaptor base 23, which is generally circular, elliptical body 24 and front block 35. Front block 35 is, preferably, rectangular and comprises of sidewalls 36a to 36d and primary thrust surface 37. Elliptical body 24 tapers from transition 32 to front block 35. Flat surface 25 is disposed on elliptical body 24 and adaptor base 23. Retainer pin cavity 20 is disposed on flat surface 25 and is generally transverse to the horizontal axis of adaptor 14. Retainer pin cavity 20 aligns with aperture 21 of tooth 12 when tooth 12 is fully seated onto adaptor 14. Front block 35 is adapted for a sliding fit with the bottom of tooth socket 26 which is defined by sidewalls 36a to 36d and thrust bearing surface 37. In one embodiment, adaptor front block 35 can have a generally rectangular cross section, with flat front mating surface 37 having a width that is greater than its height, that is, top and bottom mating surfaces 36a and 36c are wider than flat side mating surfaces 36b and 36d.

[0057] Referring to FIGS. 7A, 10A and 11A, another embodiment of tooth 12 and adaptor 14 are shown. As illustrated in FIGS. 10A and 11A, adaptor 14 further comprises of at least one stabilizing lug 66 extending away from base portion 23 and bearing thrust surface 31. In this embodiment, stabilizing lug 66 fits into positioning slot 67 located on tooth 12, as shown in FIG. 7A, to further stabilize tooth 12 when tooth 12 is substantially seated on adaptor 14.

[0058] A side view of retainer pin 16 is shown in FIG. 12. Retainer pin 16 comprises main body 40. O-ring groove 41, tapered tip 42 and biasing element 17. Referring to FIGS. 13 and 13A, pin tip 42 is tapered in one embodiment to ensure firm engagement into aperture 21 to prevent debris from entering cavity 20. This uniform metal-to-metal surface contact is maintained by the outward compression, as described below, that encloses passageway 28 and the interior of assembly 10. Positioned firstly within the adaptor retainer pin hole 20 is biasing element 17 which urges the retainer pin 16 outward to insert retainer pin tip 42 into aperture 21, thereby securing the tooth 12 firmly on the adaptor 14. In one embodiment, biasing element 17 can be made of corrosion resistant spring material.

[0059] In FIG. 13, front cross-sectional views of assembly 10 are shown with spring mechanism 17 and retainer pin 16 housed in the adaptor retainer pin cavity 20. The coupling of tooth 12 onto adaptor 14 forces tapered tip 42 of retainer pin 16 to travel up ramp 60 thereby compressing biasing element 17. As tapered tip 42 passes over ramp crest 62, biasing element 17 urges tapered tip 42 into aperture 21 when tooth 12 is fully coupled to adaptor 14.

[0060] In another embodiment, biasing element can be a resilient elastomeric plug made of rubber, polyurethane or any other suitable elastomer material as known to those skilled in the art that can provide the force required to urge retainer pin 16 toward and engage aperture 21 on tooth 12 when tooth 12 is seated on adaptor 14. In another embodiment, as shown in FIG. 13A, biasing element 17 can be a pair of magnets 48 and 50 placed in cavity 20 such that magnets 48 and 50 repel one another. In this manner, the magnetic force that causes magnets 48 and 50 to repel one another urges retainer pin 16 toward aperture 21 and engage it thereby retaining tooth 12 on adaptor 14. To retract retainer pin 16 from aperture 21, a simple tool is inserted into aperture 21 and inward force is applied to move retainer pin 16 back onto biasing element 17 thereby disengaging retainer pin 16 from aperture 21 so that tooth 12 can be removed from adaptor 14. Retainer pin 16 is of a rigid construction and may be manufactured from steel or alloys having suitable strength, wear and corrosion resistant properties.

[0061] Referring to FIG. 14, a cross-sectional rear view of tooth 12 seated on adaptor 14 is shown. Flat surface 38 of tooth 12 aligns and mates with flat surface 25 of adaptor 14. Cavity 20 aligns with aperture 21 to form passageway 28. Adaptor 14 is sized to provide a close fit with socket 26 of tooth 12. With tooth 12 and adaptor 14 configured in this manner, tooth 12 is prevented from rotating on adaptor 14.

[0062] The embodiments shown herein are related to tooth and adaptor assemblies for use with dipper buckets. However, it should be obvious to those skilled in the art that the tooth and adaptor assemblies described herein can be used on a variety of heavy equipment and excavating tools. As an example, tooth and adaptor assemblies can be used on backhoes 70 (FIG. 15) and excavators 72 (FIG. 16) in addition to mining shovel buckets or front-end loader buckets 74 (FIG. 17).

[0063] Other types of excavating tools include bucket wheel and chain trenched. Bucket wheel trenchers are large diameter wheels having a plurality of buckets spaced about the circumference of the wheel. Each bucket, in turn, has a number of teeth and adaptor assemblies. Bucket wheels are typically used in open-pit mining operations and to excavate pipeline trenches. An example of such a bucket wheel 76 is shown in FIG. 18. Chain trenchers are a different type of excavating tool as they comprise an endless chain having a plurality of tooth and adaptor assemblies attached around the chain not unlike a chainsaw. Trenchers are used to cut trenches in the ground. An example of such a trencher 78 is shown in FIG. 19. Yet another example of excavating tools that use tooth and adaptor assemblies are cutterheads as used on dredging equipment. These cutterheads are rotary cutting devices and have the teeth and adaptor assemblies disposed about the semispherical surface of the cutterhead such that they are pointed in the direction of cutterhead rotation. An example of a cutterhead 80 is shown in FIG. 20.

[0064] Although a few preferred embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention. The terms and expressions used in the preceding specification have been used herein as terms of description and not of
limitation, and there is no intention in the use of such terms and expressions of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims that follow.

1. The adaptor for releasably attaching a bucket tooth to an excavation tool, the adaptor comprising:
   a) a rear portion adapted for attaching to an excavation tool;
   b) a front portion adapted for a sliding fit with a corresponding socket disposed on a bucket tooth;
   c) an intermediate portion comprising an exterior surface and a base adjacent to the rear portion, the intermediate portion narrowing a cross-sectional area from the base to front portion;
   d) a substantially planar surface disposed on a portion of the exterior surface; and
   e) a passageway extending from the planar surface at least partially into the adaptor, the passageway adapted to receive a retainer pin for releasably attaching the bucket tooth to the adaptor.

2. The adaptor as set forth in claim 1 wherein the excavation tool is a tool selected from the group comprising a dipper bucket, a front-end loader bucket, a mining shovel bucket, an excavator bucket, a bucket wheel trencher, a chain trencher or a dredging cutterhead.

3. The adaptor as set forth in claim 1 wherein the rear portion is U-shaped and adapted to attach to a lip of an excavation tool.

4. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end.

5. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the flat front end is disposed substantially perpendicular to a longitudinal axis of the adaptor.

6. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the key has a cross-sectional area that is polygon-shaped.

7. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the key has a cross-sectional area in the form of a polygon selected from the group comprising a triangle, a square, a rectangle, a rhombus, a trapezoid, a pentagon, a hexagon, a heptagon or an octagon.

8. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the key has a cross-sectional area in the form of an ellipse.

9. The adaptor as set forth in claim 1 wherein the base is substantially circular in cross-section.

10. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the intermediate portion is cone-shaped between the base and the key.

11. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end, the intermediate portion is elliptical in cross-section and the key is rectangular in cross-section.

12. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the substantially flat front end is disposed substantially perpendicular to a longitudinal axis of the adaptor.

13. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the substantially flat front end comprises a planar surface that is disposed substantially vertical relative to a longitudinal axis of the adaptor.

14. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end and the substantially flat front end comprises a planar surface that is disposed substantially in parallel with a longitudinal axis of the adaptor.

15. The adaptor as set forth in claim 1 wherein the front portion comprises a key having a substantially flat front end, the substantially flat front end comprises a planar surface and the passageway is disposed substantially perpendicular to the planar surface.

16. The adaptor as set forth in claim 1 wherein the passageway is approximately rectangular in cross-section.

17. The adaptor as set forth in claim 1 wherein the passageway is approximately square in cross-section.

18. The adaptor as set forth in claim 1 wherein the passageway comprises rounded corners.

19. The adaptor as set forth in claim 1 wherein the passageway is approximately circular in cross-section.

20. The adaptor as set forth in claim 1 wherein the base further comprises at least one stabilizing lug adapted to mate with at least one positioning slot disposed on the bucket tooth when the bucket tooth is substantially seated on the adaptor.

21. A bucket tooth for releasably attaching to an adaptor attached to an excavation tool, the bucket tooth comprising:
   a) a longitudinal body comprising a front tip portion adapted for excavating disposed on one end and a rear portion disposed on an opposing end;
   b) a socket disposed on the rear portion, the socket comprising a mouth, a side wall and an interior mating surface adapted for a sliding fit onto an exterior surface of an adaptor;
   c) a substantially planar surface disposed on a portion of the interior mating surface;
   d) an aperture disposed on the planar surface, the aperture adapted to substantially align with a passageway disposed on the adaptor; and
   e) a catch disposed on the planar surface between the mouth and the aperture, the catch adapted to secure a retainer pin disposed in the passageway to the aperture, the retainer pin comprising a biasing element adapted to urge the retainer pin to engage the aperture when the tooth is substantially seated on the adaptor thereby preventing the tooth from being removed from the adaptor.

22. The bucket tooth as set forth in claim 21 wherein the excavation tool is a tool selected from the group comprising a dipper bucket, a front-end loader bucket, a mining shovel bucket, an excavator bucket, a bucket wheel trencher, a chain trencher or a dredging cutterhead.

23. The bucket tooth as set forth in claim 21 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way that substantially corresponds to a front portion of the adaptor.

24. The bucket tooth as set forth in claim 21 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way and the bottom key-way comprises a bottom flat surface that is substantially perpendicular to the longitudinal body.
25. The bucket tooth as set forth in claim 21 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way and the bottom key-way has a cross-sectional area that is polygon-shaped in profile.

26. The bucket tooth as set forth in claim 25 wherein the polygon is selected from the group comprising a triangle, a square, a rectangle, a rhombus, a trapezoid, a pentagon, a hexagon, a heptagon and an octagon.

27. The bucket tooth as set forth in claim 21 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way and the bottom key-way has a cross-sectional area that is elliptically shaped in profile.

28. The bucket tooth as set forth in claim 21 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way and the bottom key-way has a cross-sectional area that is circular in profile.

29. The bucket tooth as set forth in claim 21 wherein the socket defines a cone-shaped opening as it narrows from the mouth to a bottom key-way.

30. The bucket tooth as set forth in claim 29 wherein the cone-shaped is elliptical in cross-section and the bottom key-way is rectangular in cross-section.

31. The bucket tooth as set forth in claim 29 wherein the bottom key-way comprises a bottom flat surface that is substantially perpendicular to the longitudinal body.

32. The bucket tooth as set forth in claim 21 wherein the front portion comprises a key having a substantially flat front end and the substantially flat front end comprises a planar surface that is disposed substantially vertical relative to a longitudinal axis of the adaptor.

33. The bucket tooth as set forth in claim 21 wherein the front portion comprises a key having a substantially flat front end, the substantially flat front end comprises a planar surface and the passageway is disposed substantially perpendicular to the planar surface.

34. The bucket tooth as set forth in claim 21 wherein the catch is a ramp that compresses the biasing element of the retainer pin when the retainer pin slides along the ramp as the tooth is seated onto the adaptor until the retainer pin is urged into the aperture by the biasing element thereby securing the tooth to the adaptor.

35. The bucket tooth as set forth in claim 34 wherein the aperture is a frusto-conical opening.

36. The bucket tooth as set forth in claim 21 wherein the aperture extends through the side wall to an exterior side of the longitudinal body to provide communication to the retainer pin whereby a tool can be inserted into the aperture and engage the retainer pin to compress the biasing element and allow the retainer pin to clear the catch thereby enabling the tooth to be removed from the adaptor.

37. The bucket tooth as set forth in claim 21 wherein the socket further comprises at least one positioning slot adapted to mate with at least one stabilizing lug disposed on the adaptor when the bucket tooth is substantially seated on the adaptor.

38. A retainer pin adapted for releasably attaching a bucket tooth to an adaptor, the tooth comprising a socket having an interior surface and adapted for sliding fit on to the adaptor, the retainer pin comprising:

\( a) \) a longitudinal body having first and second ends, the body being adapted for insertion into a passageway disposed on an adaptor;

\( b) \) a biasing element disposed on the first end; and

\( c) \) the second end adapted to seat in an aperture disposed on a socket interior surface of a bucket tooth when the retainer pin is inserted first end first into the passageway of the adaptor thereby retaining the tooth on the adaptor once the tooth is substantially seated on the adaptor.

39. The retainer pin as set forth in claim 38 wherein the second end is further adapted to slide along a ramped catch disposed on the interior surface as the tooth is being seated on the adaptor thereby compressing the biasing element until the second end passes over the ramped catch and the biasing element urges the second end towards the aperture when the tooth is substantially seated on the adaptor.

40. The retainer pin as set forth in claim 38 wherein the body is substantially rectangular in cross-section.

41. The retainer pin as set forth in claim 38 wherein the body is substantially square in cross-section and further comprises rounded out side corners.

42. The retainer pin as set forth in claim 38 wherein the body is substantially circular in cross-section.

43. The retainer pin as set forth in claim 38 wherein the biasing element is a spring.

44. The retainer pin as set forth in claim 38 wherein the biasing element is an elastomer plug.

45. The retainer pin as set forth in claim 38 wherein the biasing element comprises a first magnet disposed in the passageway and a second magnet disposed on the first end, the magnets configured to repel one another when the retainer pin is inserted into the passageway, the magnets having sufficient magnetic field strength to urge the second end towards the aperture when the tooth is substantially seated on the adaptor.

46. A bucket tooth and adaptor assembly for an excavation tool, the assembly comprising:

\( a) \) an adaptor comprising:

\( i) \) a rear portion adapted for attaching to an excavation tool,

\( ii) \) a front portion adapted for a sliding fit with a corresponding socket disposed on a bucket tooth,

\( iii) \) an intermediate portion comprising an exterior surface and a base adjacent to the rear portion, the intermediate portion narrowing in cross-sectional area from the base to the front portion,

\( iv) \) a substantially planar first surface disposed on a portion of the exterior surface, and

\( v) \) a passageway extending from the planar surface at least partially into the adaptor, the passageway adapted to receive a retainer pin for releasably attaching the bucket tooth to the adaptor;

\( b) \) a bucket tooth adapted to releasably attach to the adaptor, comprising:

\( i) \) a longitudinal body comprising a front tip portion adapted for excavating disposed on one end and a rear portion disposed on an opposing end,

\( ii) \) a socket disposed on the rear portion, the socket comprising a mouth, a side wall and an interior mating surface adapted for sliding fit onto the adaptor;

\( iii) \) a substantially planar second surface disposed on a portion of the interior mating surface adapted to line up with the planar first surface when the tooth is substantially seated on the adaptor,
iv) an aperture disposed on the planar second surface, the aperture adapted to substantially align with the passageway when the tooth is substantially seated on the adaptor, and
v) a catch disposed on the planar second surface between the mouth and the aperture, the catch adapted to urge a retainer pin disposed in the passageway to seat into the aperture when the tooth is substantially seated on the adaptor thereby preventing the tooth from being removed from the adaptor; and

c) a retainer pin, comprising:
  i) a longitudinal body having first and second ends, the body adapted to be inserted into the passageway;
  ii) a biasing element disposed on the first end, the biasing element adapted to compress when the retainer pin is inserted into the passageway and the tooth is being substantially seated on the adaptor, and
  iii) the second end adapted to pass over the catch and to seat in the aperture when the retainer pin is inserted in the passageway and the tooth is being seated onto the adaptor whereupon the biasing element urges the second end to seat into the aperture once the tooth is substantially seated onto the adaptor.

47. The assembly as set forth in claim 46 wherein the excavation tool is a tool selected from the group comprising a dipper bucket, a front-end loader bucket, a mining shovel bucket, an excavator bucket, a bucket wheel trencher, a chain trencher and a dredging cutterhead.

48. The assembly as set forth in claim 46 wherein the front portion is U-shaped and adapted to attach to a lip of an excavation tool.

49. The assembly as set forth in claim 46 wherein the front portion comprises a key having a substantially flat front end.

50. The assembly as set forth in claim 49 wherein the flat front end is substantially perpendicular to a longitudinal axis of the adaptor.

51. The assembly as set forth in claim 49 wherein the key has a cross-sectional area that is polygon-shaped in profile.

52. The assembly as set forth in claim 51 wherein the polygon is selected from the group comprising a triangle, a square, a rectangle, a rhombus, a trapezoid, a pentagon, a hexagon, a heptagon and an octagon.

53. The assembly as set forth in claim 49 wherein the key has a cross-sectional area that is elliptical in profile.

54. The assembly as set forth in claim 46 wherein the base is substantially circular in cross-section.

55. The assembly as set forth in claim 54 wherein the intermediate portion is cone-shaped as it narrows from the base to the key.

56. The assembly as set forth in claim 55 wherein the intermediate portion is elliptical in cross-section and the key is rectangular in cross-section.

57. The assembly as set forth in claim 56 wherein the key further comprises a substantially flat front end that is substantially perpendicular to a longitudinal axis of the adaptor.

58. The assembly as set forth in claim 46 wherein the planar surface is substantially vertical.

59. The assembly as set forth in claim 58 wherein the planar surface is substantially parallel to a longitudinal axis of the adaptor.

60. The assembly as set forth in claim 59 wherein the passageway is substantially perpendicular to the planar surface.

61. The assembly as set forth in claim 60 wherein the passageway is substantially parallel to a longitudinal axis of the adaptor.

62. The assembly as set forth in claim 61 wherein the passageway is substantially square in cross-section.

63. The assembly as set forth in claim 62 wherein the passageway comprises rounded corners.

64. The assembly as set forth in claim 60 wherein the passageway is approximately circular in cross-section.

65. The assembly as set forth in claim 46 wherein the socket narrows in cross-sectional area from the mouth to a bottom key-way that substantially corresponds to the front portion of the adaptor.

66. The assembly as set forth in claim 65 wherein the bottom key-way comprises a bottom flat surface that is substantially perpendicular to the longitudinal body.

67. The assembly as set forth in claim 66 wherein the cross-sectional area of the bottom key-way is polygon-shaped.

68. The assembly as set forth in claim 67 wherein the polygon is selected from the group comprising a triangle, a square, a rectangle, a rhombus, a trapezoid, a pentagon, a hexagon, a heptagon and an octagon.

69. The assembly as set forth in claim 66 wherein the cross-sectional area of the bottom key-way is elliptical shaped.

70. The assembly as set forth in claim 46 wherein the mouth is substantially circular in cross-section.

71. The assembly as set forth in claim 65 wherein the socket defines a cone-shaped opening as it narrows from the mouth to the bottom key-way.

72. The assembly as set forth in claim 71 wherein the cone-shaped opening is elliptical in cross-section and the bottom key-way is rectangular in cross-section.

73. The assembly as set forth in claim 72 wherein the bottom key-way comprises a bottom flat surface that is substantially perpendicular to the longitudinal body.

74. The assembly as set forth in claim 46 wherein the planar surface is substantially vertical.

75. The assembly as set forth in claim 74 wherein the planar surface is substantially parallel to the longitudinal body.

76. The assembly as set forth in claim 46 wherein the catch is a ramp that compresses the biasing element of the retainer pin when the retainer pin slides along the ramp as the tooth is seated onto the adaptor until the retainer pin is urged into the aperture by the biasing element thereby securing the tooth to the adaptor.

77. The assembly as set forth in claim 76 wherein the aperture is a frusto-conical opening.

78. The assembly as set forth in claim 77 wherein the aperture extends through the side wall to an exterior side of the longitudinal body to provide communication to the retainer pin whereby a tool can be inserted into the aperture and engage the retainer pin to compress the biasing element and allow the retainer pin to clear the catch thereby enabling the tooth to be removed from the adaptor.

79. The assembly as set forth in claim 46 wherein the second end of the retainer pin body is further adapted to slide along a ramped catch disposed on the interior surface as the tooth is being seated on the adaptor thereby compressing the biasing element until the second end passes over the ramped
catch and the biasing element urges the second end towards the aperture when the tooth is substantially seated on the adaptor.

80. The assembly as set forth in claim 79 wherein the body is substantially rectangular in cross-section.

81. The assembly as set forth in claim 80 wherein the body is substantially square in cross-section and further comprises rounded out side corners.

82. The assembly as set forth in claim 79 wherein the body is substantially circular in cross-section.

83. The assembly as set forth in claim 46 wherein the biasing element is a spring.

84. The assembly as set forth in claim 46 wherein the biasing element is an elastomer plug.

85. The assembly as set forth in claim 46 wherein the biasing element comprises a first magnet disposed in the passageway and a second magnet disposed on the first end, the magnets configured to repel one another when the retainer pin is inserted into the passageway, the magnets having sufficient magnetic field strength to urge the second end towards the aperture when the tooth is substantially seated on the adaptor.

86. The assembly as set forth in claim 46 wherein the base of the adaptor further comprises at least one stabilizing lug and the socket of the tooth further comprises at least one positioning slot whereby the at least one stabilizing lug is adapted to mate with the at least one positioning slot when the tooth is substantially seated on the adaptor.

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