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(54) **MOUNTING PLATE ATTACHMENT FOR EXCAVATING DEVICE**

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(71) Applicant: **Flem Justice, JR.**, Raccoon, KY (US)

(72) Inventor: **Flem Justice, JR.**, Raccoon, KY (US)

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(57) **ABSTRACT**

A plate adaptable for use on an excavating device having an appendage with a leading edge. The plate includes a rigid body and a plurality of tips removably connected to the body. Each of the plurality of tips connected to the body extends in a direction substantially perpendicular to the leading edge of the appendage. A related method of attaching a plurality of tips to a bucket of an excavating device.

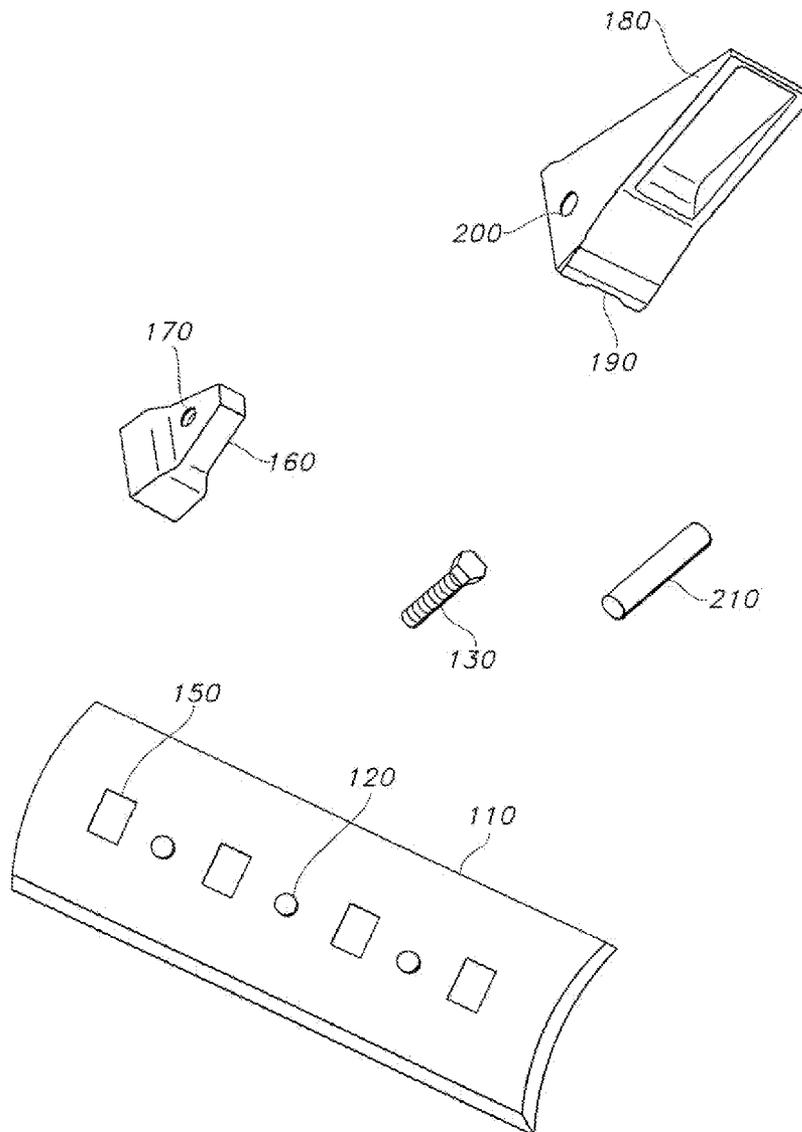
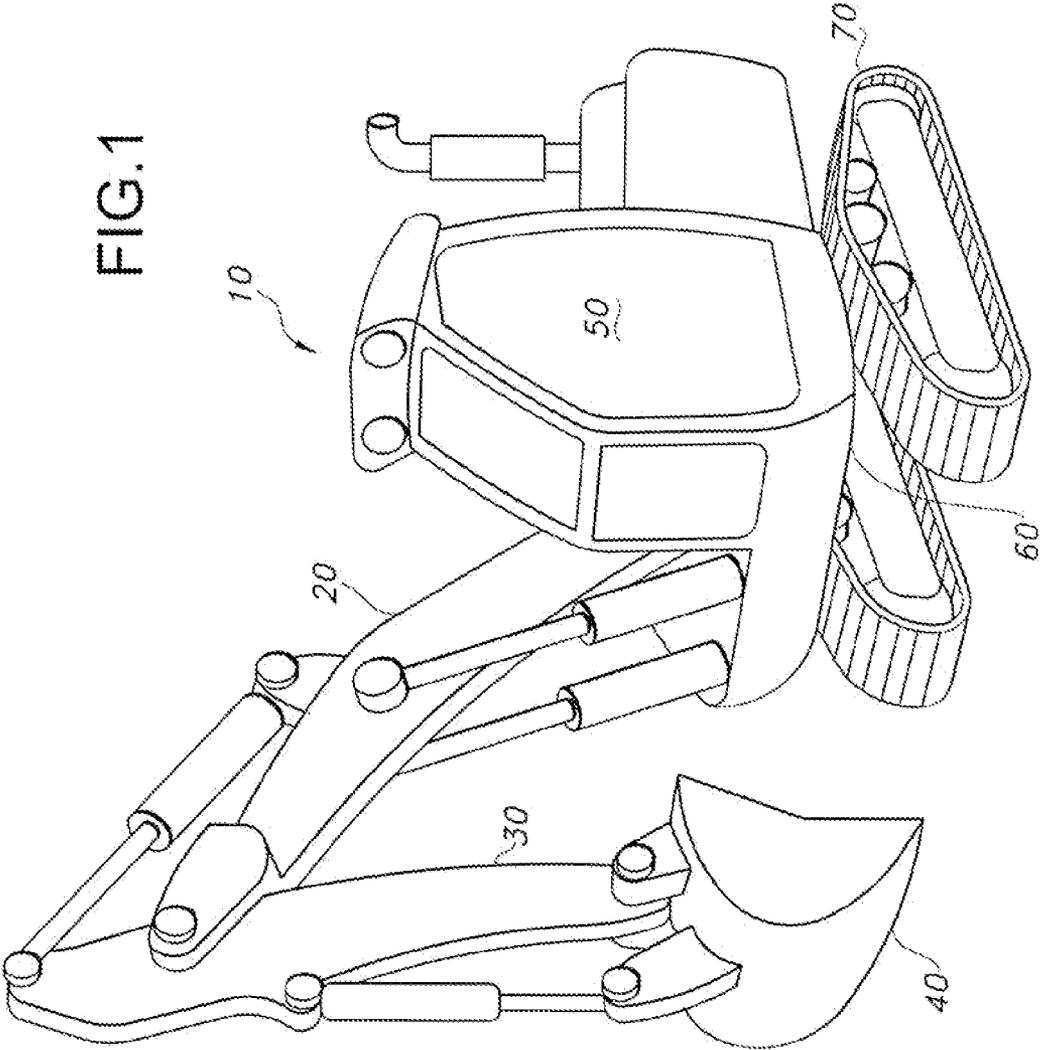


FIG.1



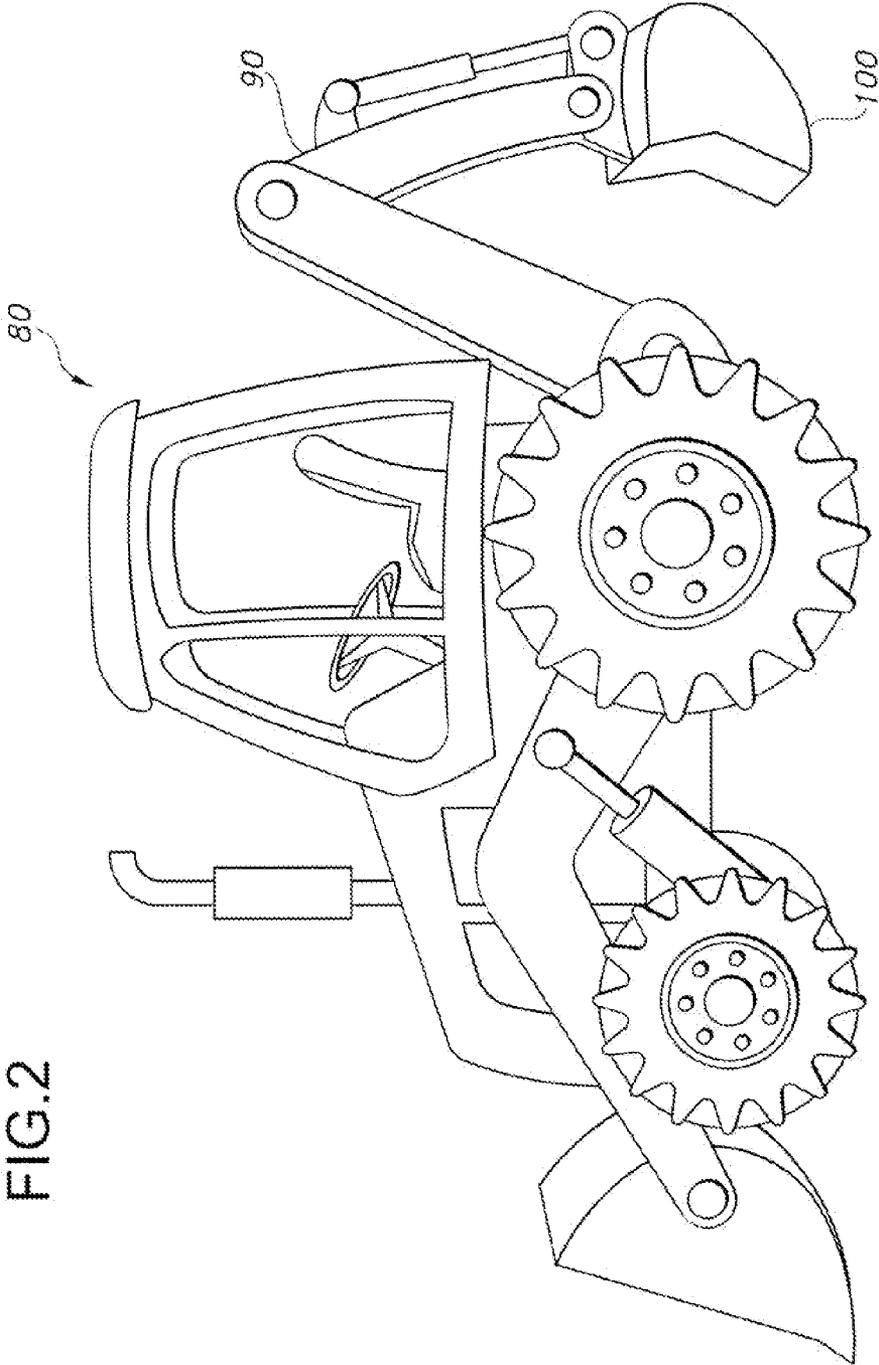
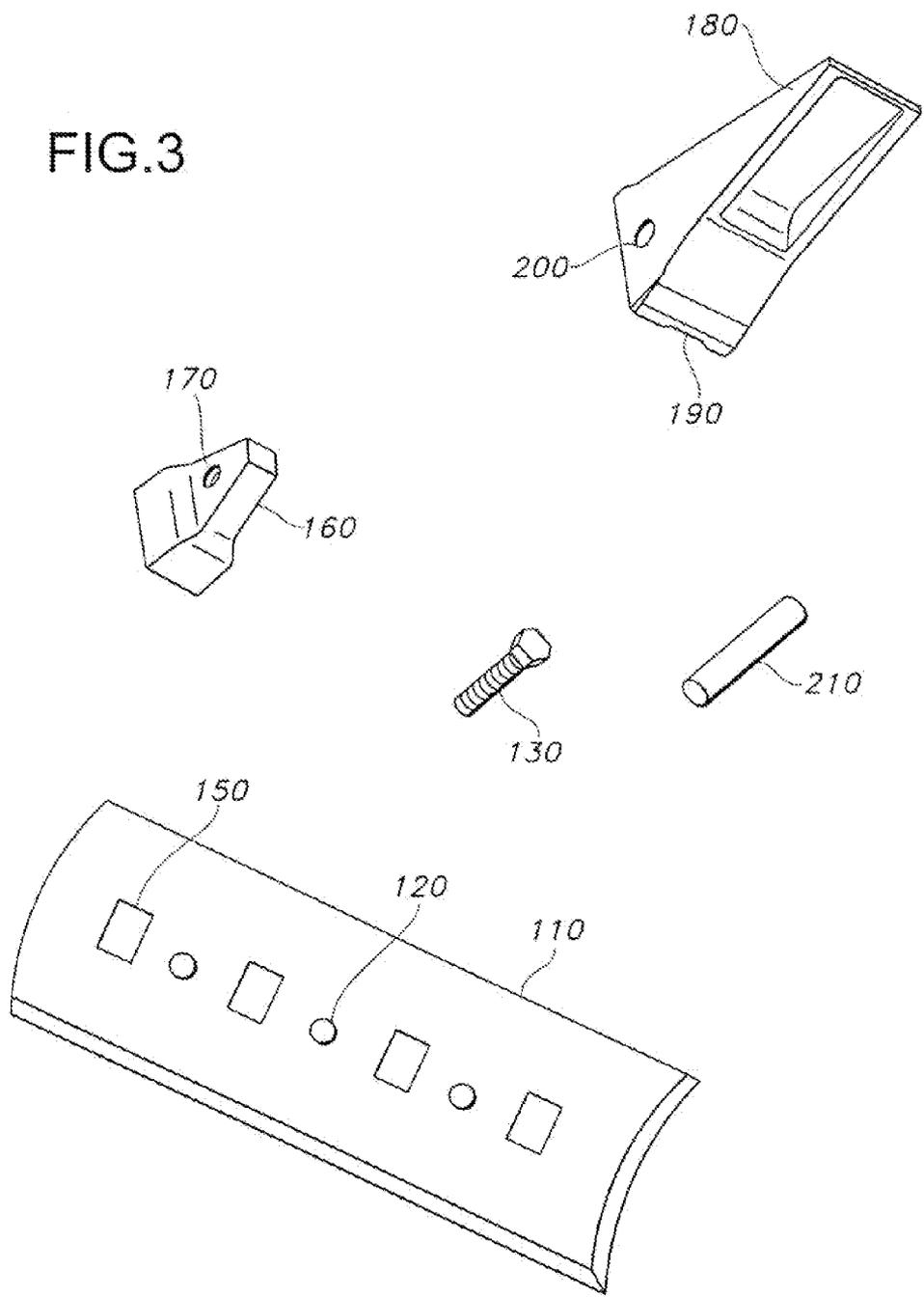


FIG.3



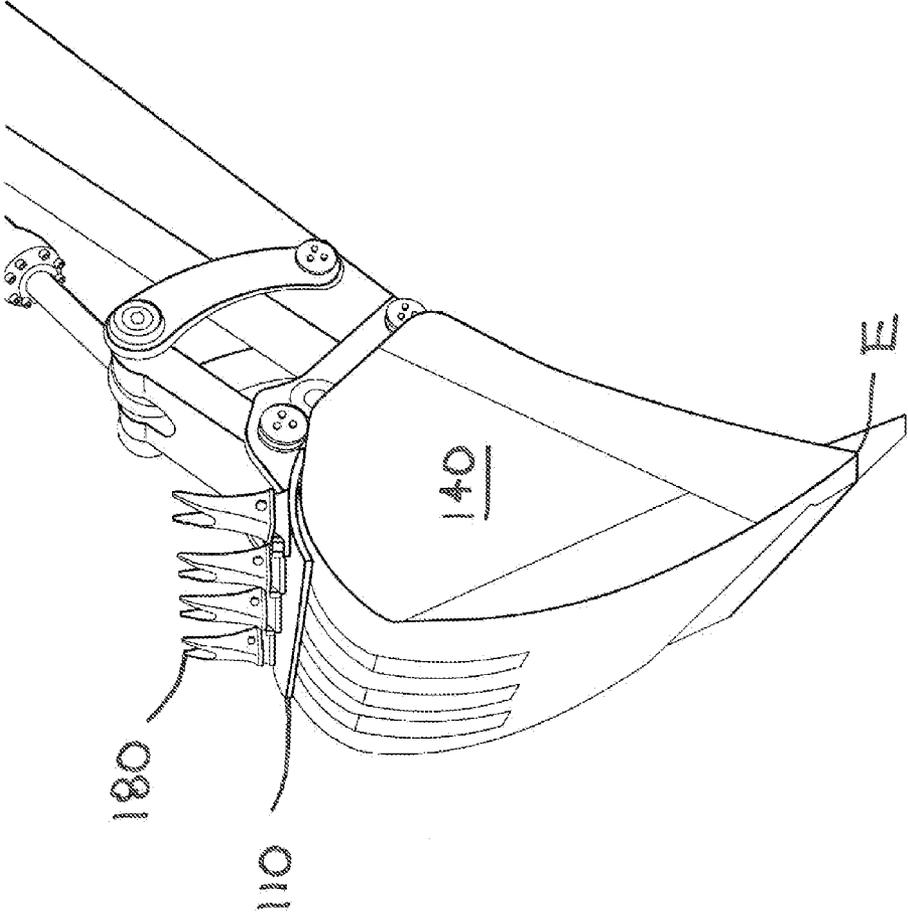


Fig. 4

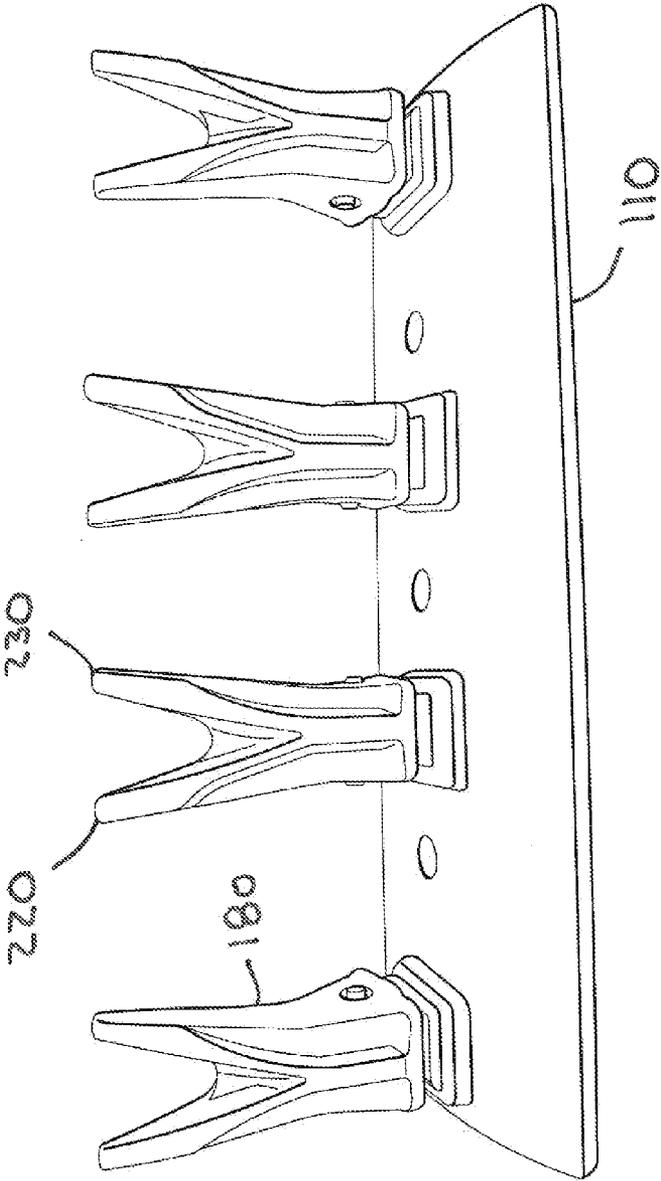


Fig. 5

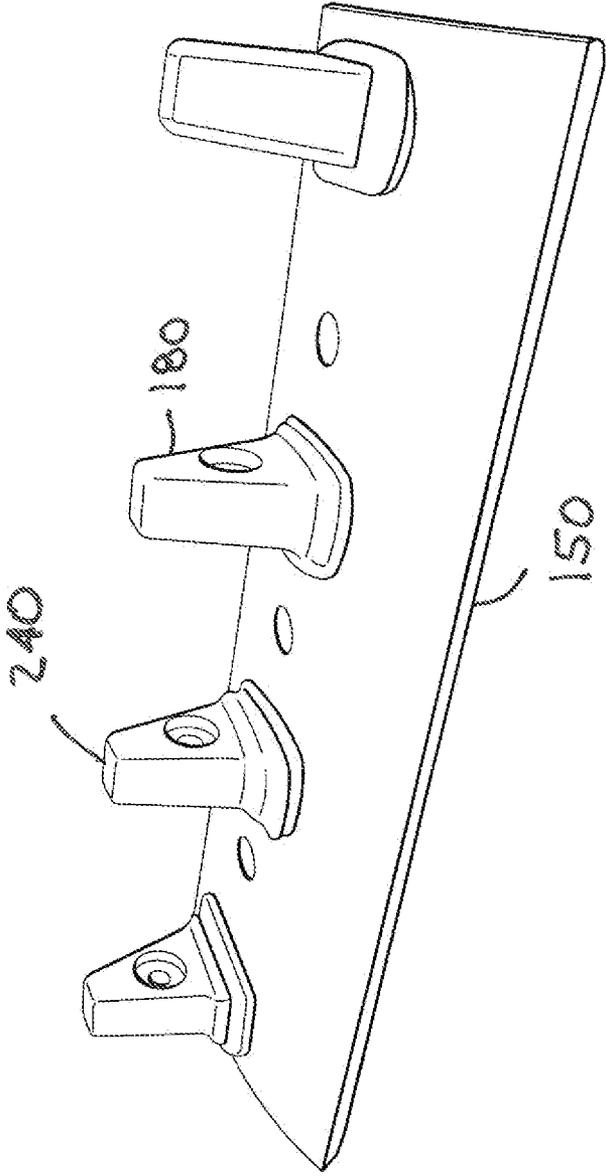


Fig. 6

## MOUNTING PLATE ATTACHMENT FOR EXCAVATING DEVICE

**[0001]** This application claims the benefit of U.S. Provisional Patent Application Ser. No. 61/601,021, filed Feb. 21, 2012, the disclosure of which is incorporated herein by reference.

### TECHNICAL FIELD

**[0002]** This disclosure relates to heavy construction equipment for earth moving and working purposes, such as an excavator, backhoe and the like and, more particularly, to a mounting plate for attachment to an excavating device configured to receive tips or teeth for various uses, including breaking rocks and clearing an area.

### BACKGROUND

**[0003]** Heavy construction equipment, such as excavators and backhoes are used for a variety of earth moving and working purposes. For example, excavators and backhoes may be used for removal of earth, digging of trenches, material handling, brush cutting, forestry work, demolition, general grading, heavy lifting, mining, river dredging and other excavation. Most excavators are usually either cable-operated or hydraulically operated. A cable-operated excavator uses winches and steel ropes to accomplish the movements, while the movement and functions of a hydraulic excavator is accomplished through the use of hydraulic fluid.

**[0004]** Generally, an excavator includes a boom, stick, appendage and cab on a rotating platform or “house,” which sits on top of an undercarriage with tracks or wheels. The primary sections of the excavator are the undercarriage and the house. The main boom attaches to the house and attached to the end of the boom is the stick or dipper arm. On the end of the stick is usually the appendage, such as a bucket. The buckets may come in different sizes, shapes and configurations to accomplish the work for which they are designed. For example, a wide, large capacity bucket with a straight cutting edge on its leading edge is used for cleanup, leveling and digging into softer materials. Alternatively, a general purpose bucket is smaller, stronger and has hardened side cutters and teeth on the leading edge to break through harder materials.

**[0005]** These appendages, such as buckets, have a limited range of motion due to the close proximity between the bucket and the excavating device. The limited range of motion for the appendages is further based on the articulating arm requiring significant strength and hydraulic pressure to accomplish earth moving functions. Consequently, a greater range of motion would result in diminished load capacity of the articulating arm and require more complicated and expensive hydraulic power transfer systems, which are less reliable in the field. Due to their limitations, a particular work site may require the use of additional heavy construction equipment to accomplish similar tasks outside the range of motion of the first piece of equipment. Not only is the use of additional equipment more expensive and time-consuming, but construction sites where earth moving is often performed can be small and narrow, which inhibits the use of multiple pieces of heavy construction equipment in the work site.

**[0006]** As discussed above, the appendages used with excavating devices are often buckets. These buckets may have tips or teeth positioned on the leading or scooping edge of the bucket to loosen and scoop materials. In use, the buckets are typically oriented so as to articulate downward and toward the

equipment cab of the excavating device so as to force the tips or teeth of the bucket down into the earth followed by a dragging motion back to the cab and up to complete the earth moving function. The limited range of motion of the bucket, i.e., the leading edge of the bucket always moves toward the cab, prevents the excavator from utilizing the tips in an outward and upward manner similar to that of a loader and, therefore, limits the function of the tips and the bucket. An additional limitation is the forward scoop of the loader is typically wider than the bucket of an excavator, which limits its application to larger projects wherein finesse is not required.

**[0007]** Accordingly, a need is identified for a more versatile and efficient appendage for heavy construction equipment, such as an excavating device that reduces expenses of using multiple pieces of equipment and allows the excavating device to perform a number of different earth moving operations. Specifically, a need exists for a mounting plate that may be easily attached to the rear of the bucket, i.e., the side opposite the open-face (or scoop) of the bucket. Further, there is a need for the mounting plate to be configured for receiving different types of tips or teeth for various types of earth moving functions such that the position of the mounting plate and teeth on the rear of the bucket allows the operator to utilize the teeth in an outward and upward direction, i.e., opposite the direction of the leading edge of the bucket.

### SUMMARY

**[0008]** In accordance with one aspect of the disclosure, a plate adaptable for use on an excavating device having an appendage with a leading edge is provided. The plate includes a rigid body and a plurality of tips removably connected to the body. Each of the plurality of tips extends in a direction substantially perpendicular to the leading edge of the appendage. The body of the plate may be mounted to the appendage, which may be a bucket. The body of the plate may be mounted to a side of the appendage opposite the leading edge. Furthermore, the body of the plate may be mounted to a top portion of the appendage.

**[0009]** In one embodiment, the plurality of tips may be aligned in a single row. Furthermore, the plurality of tips may be spaced equidistant from one another. The plate may have a plurality of openings for mounting the body of the plate to the appendage. The plate may also have a plurality of openings for removably connecting the plurality of tips to the body. Each of the plurality of tips may have a coupling at a proximal end. The plate also may have a plurality of adapters corresponding to each of the plurality of tips. Each of the plurality of adapters may be positioned with the plurality of openings and the coupling for each of the plurality of tips may attach to a corresponding one of the plurality of adapters.

**[0010]** Another related aspect of the disclosure is an improvement in an excavating device including a dipper arm with a bucket having a leading edge attached to the dipper arm. Specifically, the improvement is a plate connected to the bucket for receiving at least one tip configured to move in a direction away from the leading edge. The at least one tip extends from the plate in a direction substantially perpendicular to the leading edge of the bucket. The plate may be curved to fit substantially flush with the bucket. Furthermore, the plate may be welded to the bucket.

**[0011]** Related methods also form a part of the disclosure.

## BRIEF DESCRIPTION OF THE DRAWINGS

- [0012] FIG. 1 is a perspective view of a representative excavator forming one aspect of this disclosure;
- [0013] FIG. 2 is a perspective view of a representative backhoe forming one aspect of this disclosure;
- [0014] FIG. 3 is an exploded view of a mounting plate forming one aspect of this disclosure;
- [0015] FIG. 4 is a perspective side view of the mounting plate attached to the bucket forming one aspect of this disclosure;
- [0016] FIG. 5 is a perspective front view of the mounting plate with tips attached forming one aspect of this disclosure; and
- [0017] FIG. 6 a perspective front view of the mounting plate with tips attached forming one aspect of this disclosure;

## DETAILED DESCRIPTION

[0018] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration, specific embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and like numerals represent like details in the various figures. Also, it is to be understood that other embodiments may be utilized and that process or other changes may be made without departing from the scope of the disclosure. The following detailed description is not to be taken in a limiting sense, and the scope of the invention is defined only by the appended claims and their equivalents. In accordance with the disclosure, a removable mounting plate for heavy construction equipment is hereinafter described.

[0019] Reference is now made to FIGS. 1 and 2, which are perspective views illustrating various embodiments of representative heavy construction equipment. Namely, FIG. 1 illustrates an excavator 10 having a boom 20, stick 30, bucket 40 and cab 50 on a rotating platform 60, which sits on top of an undercarriage 70 with tracks or wheels. Similarly, FIG. 2 illustrates a backhoe 80, which includes a stick 90 with a bucket 100 attached thereto. Although not shown in FIGS. 1 and 2, the bucket 40 or 100 may have teeth on the open-end of the bucket at or near the leading or cutting edge for loosening and scooping material as the bucket moves towards the excavating device and through the material to be excavated.

[0020] As should be appreciated from FIGS. 1 and 2, excavators and backhoes having buckets attached to the sticks are relatively limited in their movement and, therefore, restrict how the teeth may be utilized. As discussed above, in excavators and backhoes having teeth located on the bucket, they are positioned on the leading or cutting edge of the bucket. The articulate arm of the equipment prevents the bucket from moving outward and upward in a direction opposite the leading edge. Instead, the teeth move in the same direction as the leading edge of the bucket. As a result, the teeth are not effective at a number of tasks important to earth moving operations, such as breaking or cracking rocks, raking, clearing an area of debris and working on highwall areas.

[0021] Turning to FIG. 3, a mounting plate 110 is illustrated, which is attached at the top of the back-side of the bucket near the arm of the excavating device. The mounting plate 110 is substantially rectangular-shaped and typically curved to substantially conform to the shape of the bucket on the excavator or backhoe such that it is substantially flush

with the bucket. It should be appreciated that the mounting plate may be made in different sizes and shapes to conform to the particular bucket to which it is being attached or alternatively, the mounting plate may be configurable to adjust the mounting plate angle to the surface geometry onto which it will be mounted. The mounting plate 110 is made of a rigid material, such as metal. The mounting plate has a plurality of openings 120 on its top face to allow a bolt 130 or other fastening device to be inserted therethrough to temporarily attach it to the bucket 140. Alternatively, the mounting plate 110 may be permanently attached to the bucket 140 by welding or some other suitable means.

[0022] A plurality of substantially rectangular holes 150 may be aligned with the plurality of openings 120 and separated equidistant from one another. As shown in FIGS. 5 and 6, the openings 120 and holes 150 may be positioned approximately in the center of the mounting plate 110. However, they may be offset or staggered if desired for a particular function. The plurality of substantially rectangular holes 150 are configured to receive a male coupling or adapter 160 having an aperture 170.

[0023] A penetration or mounting tip or tooth 180 is typically made of a rigid material, such as hardened steel. The tip 180 includes a female coupling 190 including a matching aperture 200 near its base for mating with or receiving the adapter 160 via a coupling pin 210 or other similar mechanical means for removable connection or welded for permanent installation. Specifically, the tip 180 is positioned over the adapter 160 such that the aperture 170 and matching aperture 200 are aligned such that the pin 210 may be placed through to removably connect the tip 180 to the mounting plate 110.

[0024] As shown in FIGS. 4-6, four tips 180 may be used with the mounting plate 110. However, other embodiments may use a fewer or greater number of tips depending upon the particular use desired by the operator and the number of tip receptacles located on the mounting plate. For example, the mounting plate 110 may have multiple rows of openings corresponding to multiple rows of tips 180. The tips 180 may be aligned in a single row or staggered or tapered depending on the particular operation. With respect to the tips 180 shown in FIGS. 5 and 6, it should be appreciated that different types of tips may be used depending on the particular operation being conducted by the operator of the excavator. For example, the tips 180 shown in FIG. 5 have a prong-like shape with two points 220, 230 at the distal end while the tips 180 shown in FIG. 6 are shaped like teeth having a single point or flat blade 240 at the distal end. It should be appreciated that the tips may be in a number of different sizes, shapes and lengths. The tips 180 extend upward in a direction substantially perpendicular to the leading or scooping edge (E) of the bucket.

[0025] Typically, the tips 180 may be appropriately angled based on their orientation relative to the bucket wall geometry. Furthermore, the tips 180 may be mounted in different positions on the mounting plate, such as the front, bottom or sides of the excavator bucket. In various embodiments, the tips 180 and mounting plate 110 are oriented so as to angle the tips slightly downward relative to the bottom of the bucket, the tips may be oriented substantially perpendicular to the outside bucket wall, or the tips may be oriented upward relative to the bottom of the bucket. In other embodiments, the tips 180 may be mounted on the bottom of the bucket to allow for ground scraping or ripping. Engagement of the tips with

the ground is useful for asphalt removal or other aspects of road construction or ground preparation.

[0026] Although the particular geometry of the tips 180 may be varied, the tips may be progressively tapered from a point of greatest cross-sectional area at the tip base which mounts to the mounting plate to a point of least cross-sectional area at the tip end which engages the wall or ground. The tips 180 mounted on the rear of the bucket (i.e., opposite the open end of the bucket) and in a direction away from the bucket's leading or scooping edge, which is especially useful for clearing unstable highwall mining material. The collapse of unstable highwall material is responsible for a number of injuries and deaths of highwall coal miners. Since stable highwall mining may become unstable due to erosion, the need for clearing the highwall is continuous and often immediate.

[0027] In use, once the mounting plate 110 and tips 180 are assembled and then attached to the bucket 140 typically near the articulating arm such that the operator of the excavator may perform a number of operations. Advantageously, the operator may use the articulating arm of the excavator to extend outward and/or upward (i.e., away from the base of the excavator) to engage the tips with the ground in a direction opposite of the bucket's scooping edge in order to break or crack rocks, rake the ground, clear an area of trees and debris or work on a highwall area. Since the tips 180 extend outward and/or upward and away from the excavating device, the excavating device does not restrict the movement of the tips 180.

[0028] The foregoing descriptions of various embodiments are provided for purposes of illustration, and are not intended to be exhaustive or limiting. Modifications or variations are also possible in light of the above teachings. The embodiments described above were chosen to provide the best application to thereby enable one of ordinary skill in the art to utilize the disclosed inventions in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention.

- 1. A plate adaptable for use on an excavating device having an appendage with a leading edge, comprising:
  - a rigid body; and
  - a plurality of tips removably connected to the body, whereby each of the plurality of tips extends in a direction substantially perpendicular to the leading edge of the appendage.
- 2. The plate according to claim 1, wherein the appendage is a bucket.
- 3. The plate according to claim 1, wherein the plurality of tips are aligned in a single row.

4. The plate according to claim 1, wherein the plurality of tips are spaced equidistant from one another.

5. The plate according to claim 1, wherein the body of the plate is removably mounted to the appendage.

6. The plate according to claim 1, wherein the body of the plate is mounted to a side of the appendage opposite the leading edge.

7. The plate according to claim 1, wherein the body of the plate is mounted to a top portion of the appendage.

8. The plate according to claim 1, further including a plurality of openings for mounting the body of the plate to the appendage.

9. The plate according to claim 1, further including a plurality of openings for removably connecting the plurality of tips to the body of the plate.

10. The plate according to claim 9, wherein each of the plurality of tips has a coupling at a proximal end.

11. The plate according to claim 10, further including a plurality of adapters corresponding to each of the plurality of tips.

12. The plate according to claim 11, wherein each of the plurality of adapters are positioned with the plurality of openings.

13. The plate according to claim 12, wherein the coupling for each of the plurality of tips attaches to a corresponding one of the plurality of adapters via a fastening device.

14. In an excavating device including a dipper arm with a bucket having a leading edge attached to said dipper arm, the improvement comprising a plate connected to the bucket for receiving at least one tip configured to move in a direction away from the leading edge.

15. The improvement of claim 14, wherein the plate is welded to the bucket.

16. The improvement of claim 14, wherein the plate is curved to fit substantially flush with the bucket.

17. The improvement of claim 14, wherein the at least one tip extends from the plate in a direction substantially perpendicular to the leading edge of the bucket.

18. A method of attaching a plurality of tips to a bucket of an excavating device, comprising:

- mounting a plate to the bucket; and
- removably attaching the plurality of tips to the plate.

19. The method according to claim 18, further including the step of positioning the plate on a side of the bucket opposite an open end of the bucket.

20. The method according to claim 18, further including the step of positioning the plurality of tips such that each of the plurality of tips extend in a direction substantially perpendicular to a leading edge of the bucket.

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