US 20080201995A1

(19) **United States**

(12) **Patent Application Publication**

Browder

(10) **Pub. No.: US 2008/0201995 A1**

(43) **Pub. Date: Aug. 28, 2008**

(54) **EXCAVATOR ATTACHMENT APPARATUS FOR LOADER BUCKET**

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(21) Appl. No.: **12/072,194**

(22) Filed: **Feb. 25, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/903,557, filed on Feb. 27, 2007.

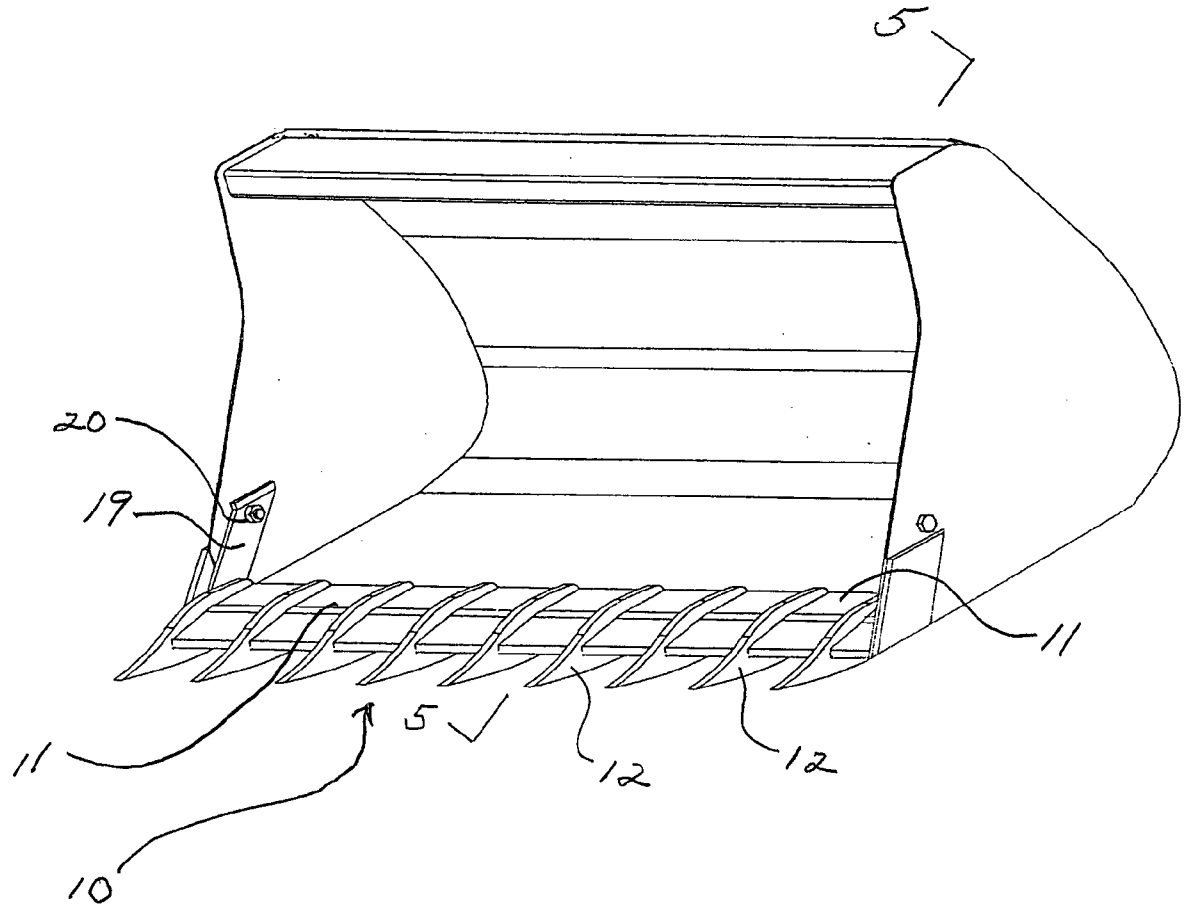
Publication Classification

(51) **Int. Cl.**
E02F 9/28 (2006.01)

(52) **U.S. Cl.** **37/450**; 37/455

(57) **ABSTRACT**

An excavator attachment apparatus for converting a loader bucket to an excavator bucket and from an excavator bucket back to a loader bucket includes an elongate mounting bar to be connected only to the side walls of the bucket and extend along the lip of the bucket between the side walls, and a plurality of teeth connected to the mounting bar, with each tooth having an open groove extending into the tooth, the groove to be extended over the lip of the bucket to firmly hold the excavator attachment on the lip of the bucket without direct connection to the lip.



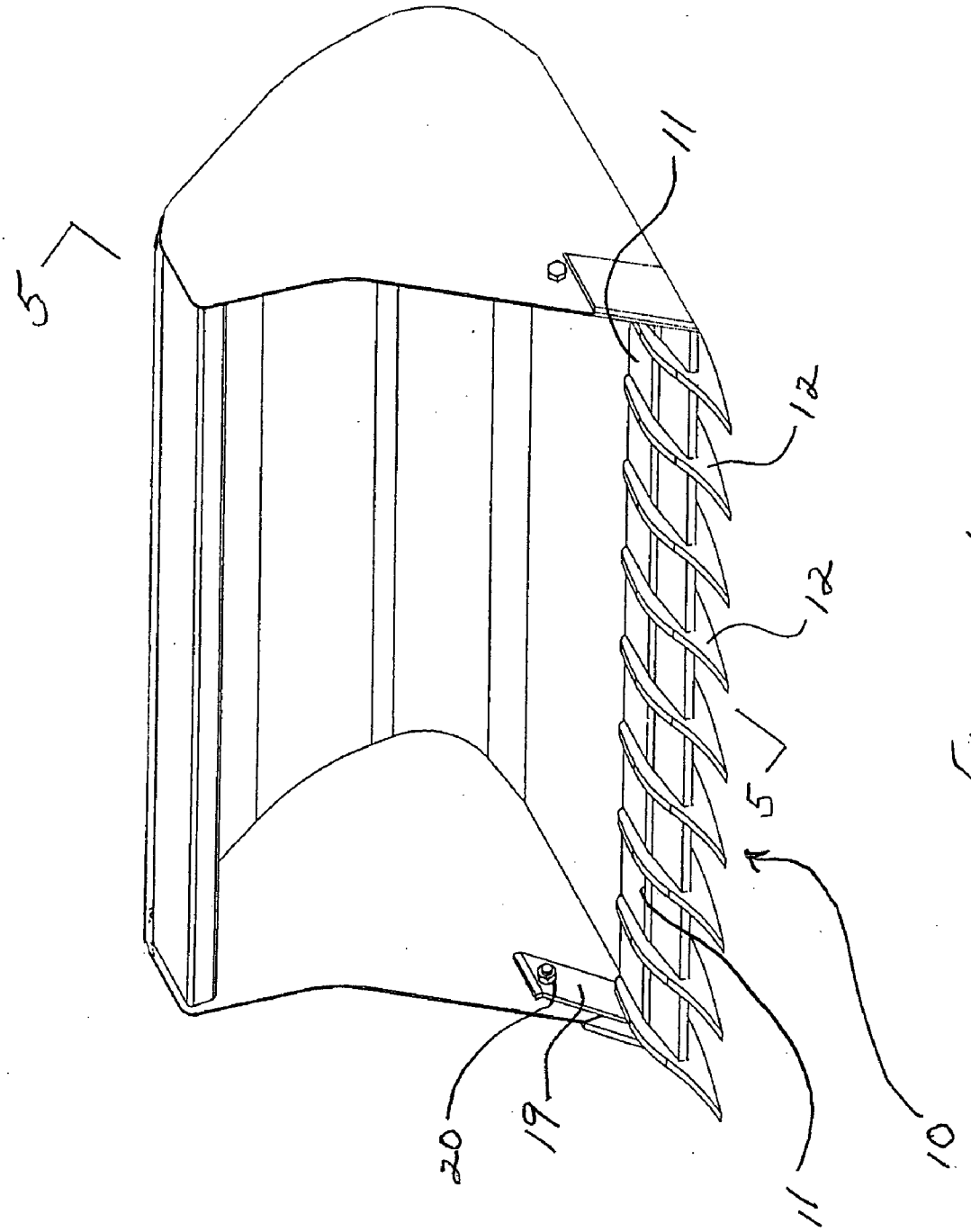


FIGURE 1

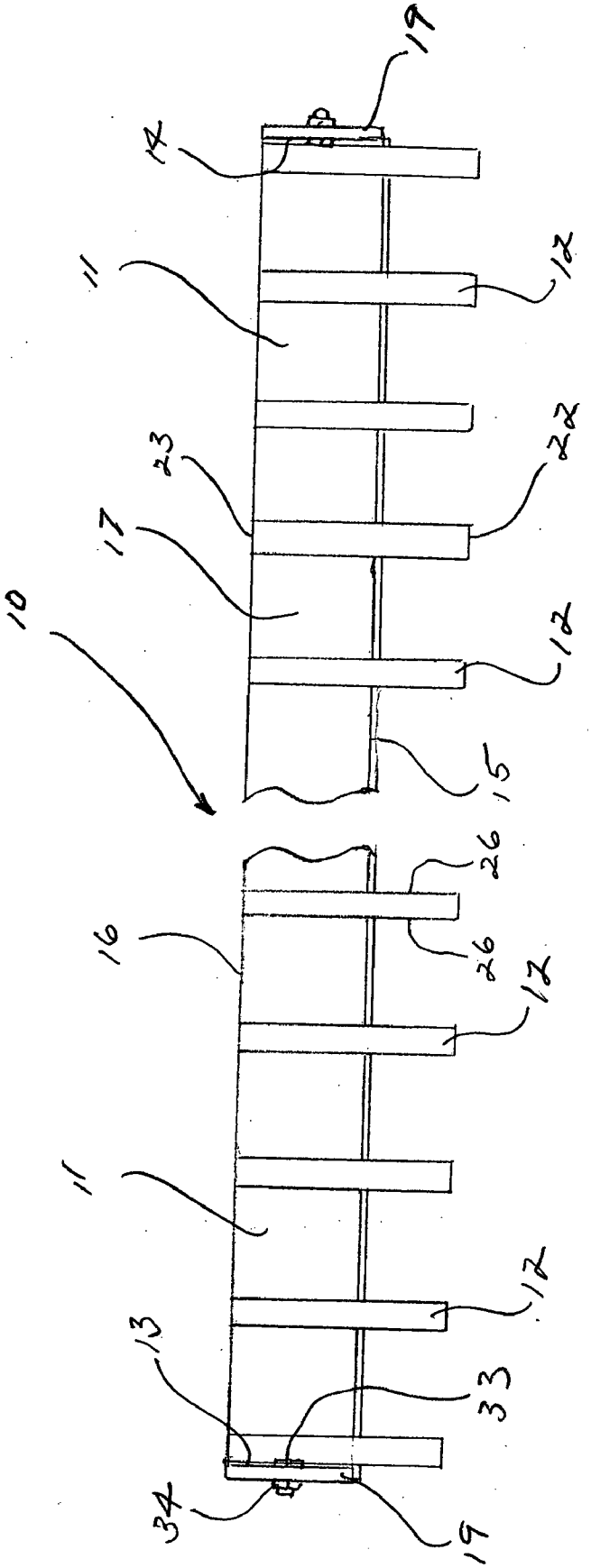


FIGURE 2

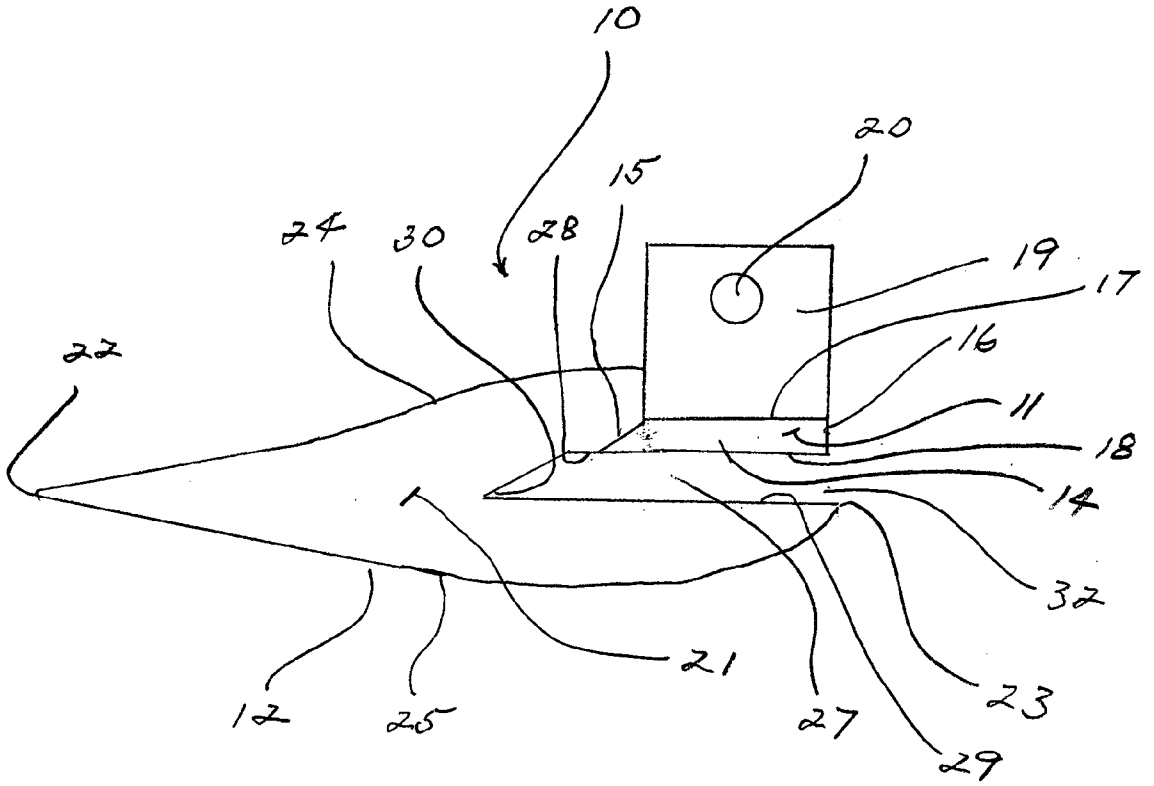


FIGURE 3

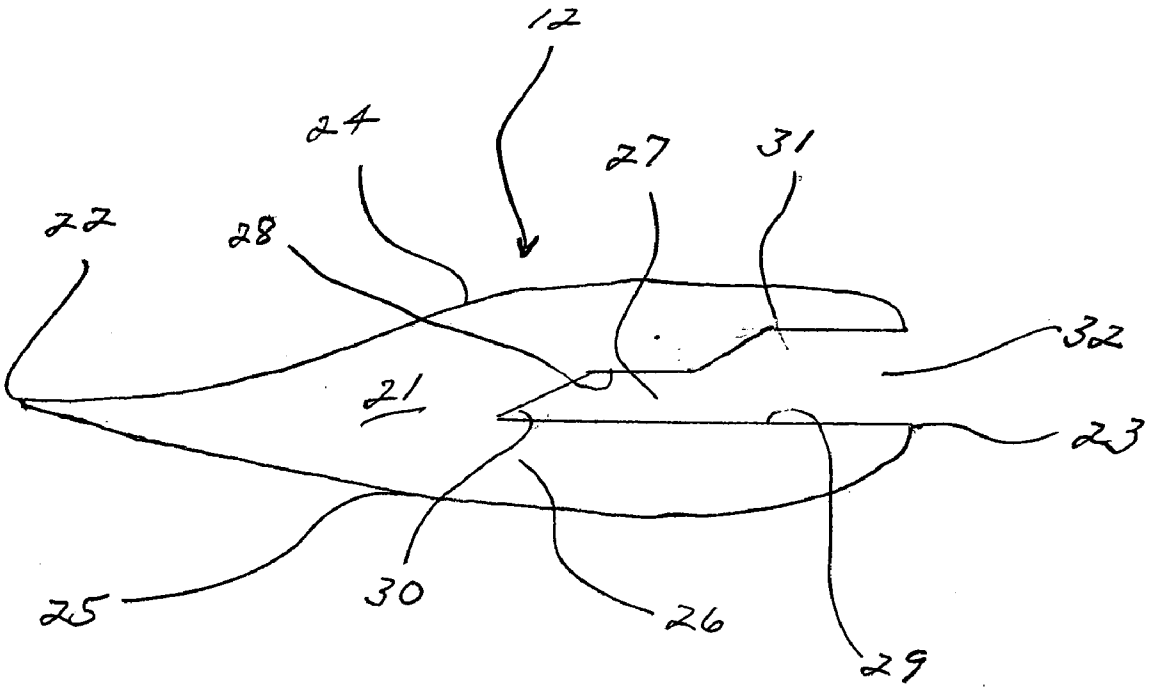


FIGURE 4

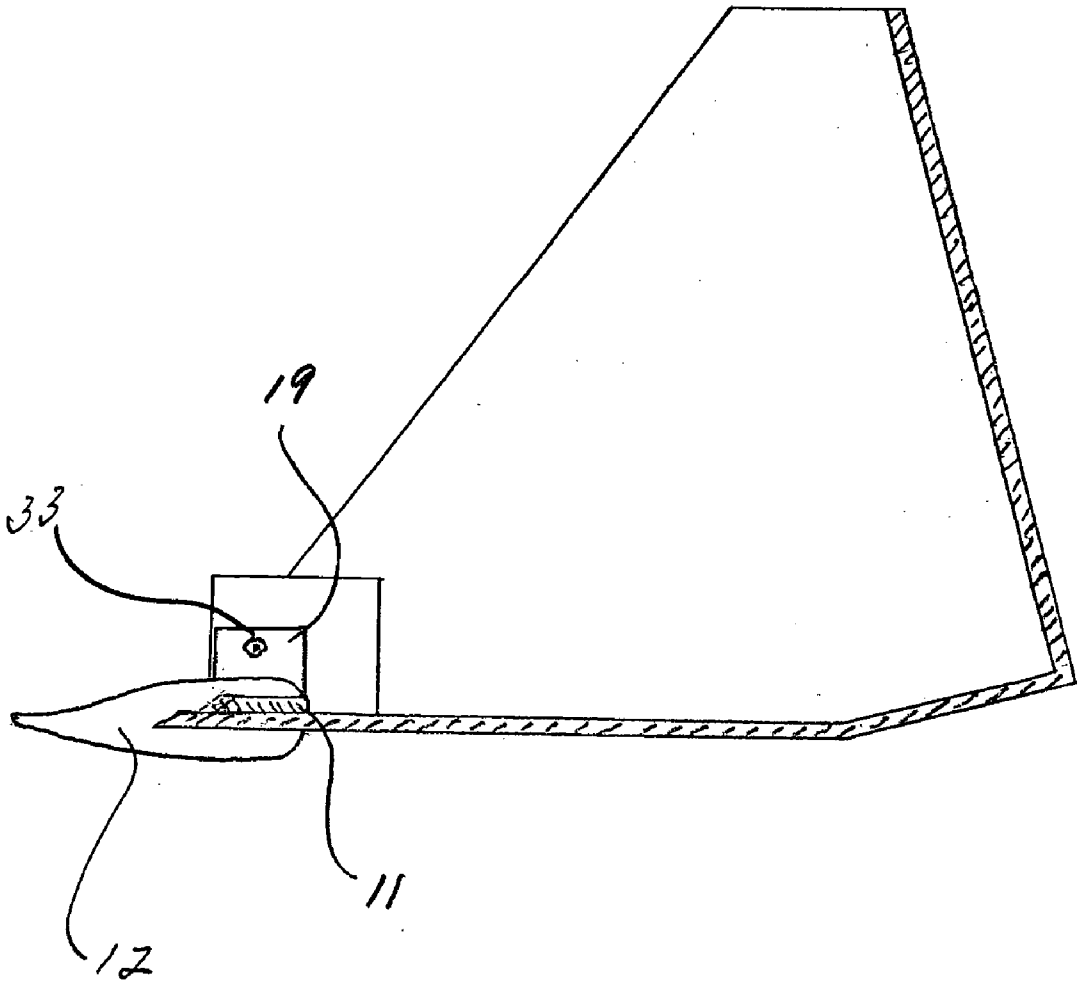


FIGURE 5

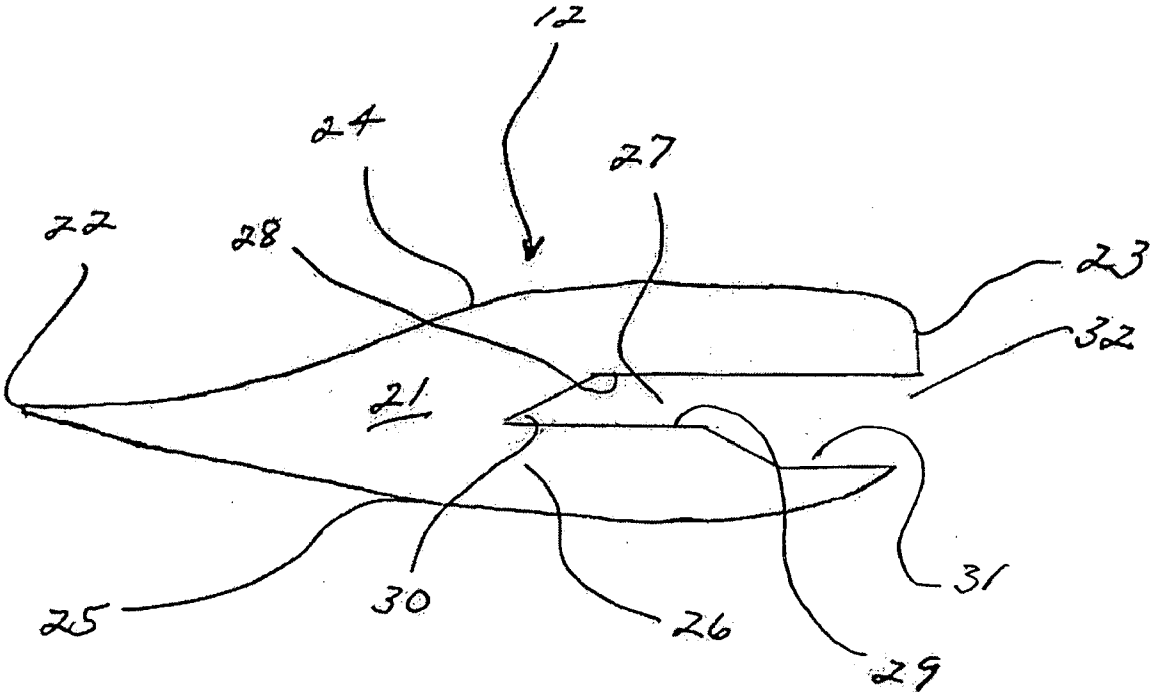


FIGURE 6

EXCAVATOR ATTACHMENT APPARATUS FOR LOADER BUCKET

RELATED APPLICATION DATA

Priority Claim

[0001] This application claims the benefit of U.S. Provisional Patent Application Ser. No. 60/903,557, filed Feb. 27, 2007.

FIELD OF THE INVENTION

[0002] The present invention generally relates to excavating equipment and machinery, and in its preferred embodiments more specifically relates to an excavating attachment for the forward lip of a front end loader bucket.

BACKGROUND

[0003] Front end loaders, whether dedicated pieces of equipment or general purpose tractors with a front end loader attachment, are widely used in a variety of activities, including construction, farm and ranch work, and landscaping work. A typical front end loader bucket has a relatively flat bottom wall, a rear wall, and a pair of opposed side walls connected between the rear wall and side edges of the bottom wall. The front of the loader bucket is open, over a planar forward lip. Most commonly, a front end loader is used to scoop, lift, and transport relatively loose materials that have previously been loosened or placed with another piece of equipment. However, in many instances it is desirable or expedient to use a front end loader for at least shallow excavation work, with the forward lip of the loader bucket performing a digging or breaking function. Front end loaders are also commonly used to lift and transport heavy items such as stumps, log sections, and large rocks.

[0004] The flat, straight forward lip of a loader bucket is not well suited for excavation, and use of a front end loader with a conventional lip is inefficient and often ineffective for that purpose. It can also be difficult to engage objects such as logs and rocks to move them into the loader bucket for transport. Most excavating implements are provided with forward extending teeth connected along the forward lip of the excavator bucket or shovel, to break up the soil or other material so it can be more easily scooped into the bucket. In excavator implements the teeth may be individually mounted to the forward lip of the bucket, or the teeth may be mounted on a plate that is attached to the forward lip of the bucket.

[0005] Excavator attachments for a front end loader bucket are known in the prior art, provided for the purpose of converting a conventional loader bucket to a more effective excavator bucket. Such attachments include a bar with a plurality of teeth connected to the bar, which is itself connected to the forward lip of a loader bucket by a plurality of bolts extending through the bar and the bottom wall of the bucket adjacent to the forward lip, to secure the attachment tightly against the lip. Individual teeth may also be mounted on the forward lip of a loader bucket, also by bolts. Although such attachments can be effective for excavation, the use of bolts through the lip of a loader bucket for connecting excavator attachments has disadvantages and drawbacks. The placement and removal of an array of bolts along the entire lip is a time consuming procedure. In addition, bolts and nuts arrayed along the forward lip of the bucket are exposed to continuous wear and abrasion, and after even a relatively short period of use removal of the bolts can be both difficult and time consuming. Further, conventional, wedge-shaped excavator teeth can be ineffective in engaging an object such as a log and flipping it into the bucket, because the object tends to slide forward off the teeth in the process of attempting to tilt and lift the bucket.

SUMMARY OF THE INVENTION

[0006] The present invention provides an excavator attachment for a loader bucket that does not require the use of bolts along the forward lip of the loader bucket for attachment. The attachment of the invention includes a plurality of teeth disposed along and connected to a bar. Each tooth is formed with a groove to be received over the forward lip of a loader bucket, with a portion of each tooth above the lip and a portion below the lip. The bar includes a connection flange at each end and is connected to the bucket by bolting the flanges to the side walls of the bucket. The bar is not connected to the bottom wall of the bucket, eliminating bolts through the lip, and is retained in place by the extension of the lip into the grooves formed in the teeth.

[0007] The teeth connected to the bar are preferably formed with a slightly concave upper surface to facilitate engaging and lifting objects. The concave curvature of the upper surface of the teeth allows the point of the teeth to slide under an object more readily than wedge-shaped teeth with a straight upper surface. When the bucket is tilted the object to be lifted will roll slightly into the concavity and can be much more easily flipped backward into the bucket.

[0008] The structure and features of the excavator attachment of the invention will be described below with reference to the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a front perspective view of a preferred embodiment of the excavator attachment of the invention, connected to a loader bucket.

[0010] FIG. **2** is a top plan view of a preferred embodiment of the excavator attachment of the invention.

[0011] FIG. **3** is a side elevation view of a preferred embodiment of the excavator attachment of the invention.

[0012] FIG. **4** is a side elevation view of a preferred embodiment of a tooth component of the excavator attachment of the invention.

[0013] FIG. **5** is a sectioned side elevation view of a preferred embodiment of the excavator attachment of the invention in place on and connected to a loader bucket, viewed along line **5-5** of FIG. **1**.

[0014] FIG. **6** is a side elevation view of an alternative embodiment of a tooth component of the excavator attachment of the invention.

DESCRIPTION OF THE INVENTION

[0015] The preferred embodiment of the excavator attachment of the invention, generally designated by reference number **10**, includes as its primary components a mounting bar **11** and a plurality of teeth **12**.

[0016] Mounting bar **11** is formed as an elongate planar, generally rectangular plate of substantially greater length than width, and of greater width than thickness, with a first end **13**, a second end **14**, a forward edge **15** and a trailing edge **16**. Forward edge **15** is preferably beveled or inclined to form a chisel point, as illustrated in the drawing figures, so as to provide a smooth transition for materials to move past the

mounting bar. Mounting bar **11** also has an upper face **17** and a lower face **18**. A planar, generally rectangular attachment flange **19** is connected to each end of bar **11**, with the plane of each attachment flange generally perpendicular to the plane of bar **11**, and with the attachment flanges extending in mutually parallel relation upward from upper face **17** of the bar. Each of attachment flanges **19** is penetrated by a bolt aperture **20**. In the preferred embodiment bar **11** is continuous, without any apertures or other penetrations for connecting bar **11** to a loader bucket.

[0017] Flanges **19** may be formed as separate components and connected to bar **11** by, e.g., welding, or flanges **19** may be integrally formed with bar **11** by bending the ends of the bar to form the flanges. Bar **11** and flanges **19** are preferably formed of steel-plate, but it is to be understood that the scope of the invention is not limited to any particular material of construction, and other materials with suitable strength and rigidity could be used if desired. The total length of bar **11** with flanges **19** is generally equal to the width of the forward lip of the loader bucket, between the side walls of the bucket.

[0018] Each tooth **12** is preferably formed as a solid body **21** with a leading end or point **22**, a rear end **23**, an upper face **24**, a lower face **25**, and side faces **26**. Upper face **24** and lower face **25** converge at the leading end **22** of the tooth to join and form a chisel or cutting tip at the leading end. It is preferred that the upper face **24** of each tooth be formed with a concave curvature, in order to facilitate "flipping" solid objects, such as logs or rocks, into the bucket. The concave curvature of the upper face allows the leading ends of the teeth to more easily slip under such an object, so that the object tends to roll backward onto the teeth and is slightly cradled in the concavity. The object is then more likely to roll backward into the bucket when the bucket is rotated upward, rather than slipping forward off the teeth as is often the case with teeth having a linear or convex upper face. However, although the concave configuration of the upper face of the teeth is preferred, it is to be understood that other configurations may be used within the scope of the invention.

[0019] A groove **27** is formed in each tooth **12**, extending into the body of the tooth from the rear end **23** toward the leading end, intermediate between upper face **24** and lower face **25**. Groove **27** extends across the full width of tooth **12** between side faces **26** and through those faces, so that groove **12** is open at the rear and the sides of the tooth. Each groove **27** has an upper face **28** and a lower face **29** The depth of each groove **27** from the rear of the tooth to the inner end **30** of the groove is greater than the width of bar **11** between leading edge **15** and trailing edge **16**. In the preferred embodiment the depth of each groove is approximately twice the width of bar **11**, but it is to be understood that the specific proportional relationship is not critical and may be varied within the scope of the invention.

[0020] In the preferred embodiment the distance between the upper and lower faces **24** and **25** of groove **27** is not the same through the depth of the groove, but is increased through the portion of groove **27** adjacent to the rear of tooth **12** to form a notch **31** in the upper face of the groove. Notch **31** is configured and dimensioned to receive bar **11** in the notch, with the distance of extension of notch **31** inward from the rear of the tooth approximately equal to the width of bar **11** between edges **15** and **16**, and the distance of extension of notch **31** toward the upper face of the tooth approximately equal to the thickness of bar **11** between its upper and lower faces. Although it is preferred that notch **31** be formed in the upper face of the groove, it is to be understood that the notch could readily be formed in the lower face of the groove. With the notch formed in the upper face of the groove, the mounting bar will be disposed above the lip of the bucket, whereas with the notch formed in the lower face of the groove, the mounting bar will be disposed beneath the lip of the bucket.

[0021] Each tooth is disposed on bar **11** with bar **11** received in notch **31**, and each tooth **12** is connected to bar **11**. The preferred manner of connection is welding, but other means of connection, such as counter-sunk nuts and bolts, could be used. After connection of each tooth **12** to bar **11**, the lower face **18** of the bar within each groove **27** is parallel to and aligned with the upper face **28** of the portion of the groove between notch **31** and the inner end **30** of the groove. Each groove **27** is configured and dimensioned to match the configuration and dimensions of the forward lip of the loader bucket to which the excavator attachment is to be connected, since there are variations among different manufacturers. Generally, the height of each groove between its lower face and either the upper face of the groove or the lower face of bar **11** is approximately equal to the thickness of the forward lip of the loader bucket.

[0022] The excavator attachment of the invention is connected to a loader bucket by positioning the attachment parallel to the forward lip of the bucket, with the rear of teeth **12**, and the opening **32** of grooves **27** facing the lip of the bucket. The attachment is moved toward the bucket so that the lip of the bucket is received in grooves **27**, and bar **11** is received along the upper face of the bottom wall of the bucket adjacent to the forward edge with the lower face of bar **11** flat against the bottom wall of the bucket. With the forward lip of the bucket fully received in grooves **27**, flanges **19** are received against the respective side walls of the bucket. A bolt aperture is formed in each side wall of the bucket in alignment with the respective bolt aperture **20** in the respective flange. A bolt **33** is extended through each set of aligned apertures in flanges **19** and the bucket side walls and secured by a nut **34**, to securely connect the excavator attachment to the loader bucket. Bolts **33** serve primarily to retain the excavator attachment in place, and the primary strength of the connection between the attachment and the loader bucket is provided by the interlock of the lip of the bucket in grooves **27**, eliminating any need to secure bar **11** to the loader bucket along the length of the bar.

[0023] The excavator attachment of the invention is removed from the loader bucket by removing nuts **34** from bolts **33** and removing the bolts from the apertures in flanges **19** and the side wall of the bucket, freeing the attachment from connection to the bucket and allowing it to be easily pulled forward from the lip, or the bucket to be pulled away from the attachment, removing the lip of the bucket from grooves **27**, fully disengaging the attachment from the bucket.

[0024] With the excavator attachment of the invention, bolts **33** and nuts **34** are relatively isolated from the abrasion and wear to which bolts and nuts used to connect attachment devices of the prior art are subjected, and the risk of damage to bolts **33** and nuts **34** is substantially reduced if not fully eliminated. Because the placement of only two bolts and nuts is required for connection of the excavator attachment, and the removal of only two bolts and nuts for disconnection, the excavator attachment of the invention can be connected and disconnected much more easily, and in much less time, than loader bucket attachments of the prior art.

[0025] The foregoing description of the excavator attachment of the invention is intended to be illustrative and not

limiting. The excavator attachment is susceptible to alternative embodiments and variations within the scope of the invention, as set out in the following claims.

1. An excavator attachment apparatus for a loader bucket, the bucket having a rear wall, two side walls, and a bottom wall with a planar lip, without penetrations, at the leading edge of the bucket, comprising,

a mounting bar for connection of the attachment to the lip of a loader bucket between the side walls of the bucket, said mounting bar formed as an elongate planar generally rectangular plate having a first end and a second end, an upper face and a lower face, a leading edge, and a trailing edge, said mounting bar being of substantially greater length between said first and second ends than width between said leading and trailing edges, and being of greater width than thickness between said upper and lower faces;

a plurality of teeth, each of said teeth formed as a solid body with a leading end, a rear end, an upper face, a lower face, and a pair of opposed side faces, each of said teeth having a groove extending into said body from said rear end between said upper and lower faces, and through said first and second side faces, said groove configured and dimensioned to be inserted over the lip of a bucket in closely fitting relationship therewith, said groove having an upper face, a lower face, and an inner end, with the distance between said rear end of said tooth and said inner end of said groove being greater than said width of said mounting bar, said groove including a notch formed in a face of said groove and extending through said side faces of said tooth, said notch open at said rear end of said tooth and extending toward said leading end of said tooth a distance generally equal to said width of said mounting bar, each of said teeth being connected to said mounting bar with said mounting bar received in said notch; and

connection means at said first and second ends of said mounting bar for releasably connecting said mounting bar between the side walls of the bucket with the lip of the bucket received in said grooves of said teeth so as to firmly retain said mounting bar against the lip of the bucket without direct connection between said mounting bar and the lip of the bucket.

2. The attachment apparatus of claim **1**, wherein said upper face of each of said teeth is formed with a concave curvature.

3. The attachment apparatus of claim **1**, wherein said connection means comprises a pair of flanges, each connected to a respective end of said mounting bar and extending outwardly from said upper face of said mounting bar in perpendicular relation to said mounting bar and in parallel relation to each other, each of said flanges to be connected to a respective one of the side walls of the bucket.

4. The attachment apparatus of claim **3**, wherein each of said flanges is penetrated by an aperture, and wherein said connection means further includes a pair of bolts and nuts, each bolt to be extended through a respective one of said apertures in said flanges, through a matching aperture formed in the side walls of the bucket, and secured by a respective one of said nuts.

5. The attachment apparatus of claim **1**, wherein said teeth are connected to said mounting bar by welding.

6. The attachment apparatus of claim **1**, wherein said notch is disposed between said upper face of said groove and said upper face of each of said teeth.

7. The attachment apparatus of claim **1**, wherein said notch is disposed between said lower face of said groove and said lower face of each of said teeth.

8. The attachment apparatus of claim **1**, wherein said leading edge of said mounting bar is beveled, wherein said notch formed in each of said teeth has an inner end, and wherein said inner end of said notch in each of said teeth is formed with a matching bevel.

9. An excavator attachment apparatus for a loader bucket, the bucket having a rear wall, two side walls, and a bottom wall with a planar lip at the leading edge of the bucket, comprising,

a mounting bar for connection of the attachment to the lip of a loader bucket between the side walls of the bucket, said mounting bar formed as an elongate planar generally rectangular plate having a first end and a second end, an upper face and a lower face, a leading edge, and a trailing edge, a planar first connection flange connected to said first end of said mounting bar in perpendicular relation with said mounting bar, to be connected to one of the side walls of the bucket, and a second connection flange connected to said second end of said mounting bar in perpendicular relation with said mounting bar and in parallel relation to said first connection flange, to be connected to the opposite one of the side walls of the bucket, said connection flanges providing the sole means of connection of said mounting bar to the bucket; and

a plurality of teeth, each of said teeth formed as a solid body with a leading end, a rear end, an upper face, a lower face, and a pair of opposed side faces, each of said teeth having a groove extending into said body from said rear end between said upper and lower faces, and through said first and second side faces, said groove configured and dimensioned to be inserted over the lip of a bucket in closely fitting relationship therewith, said groove having an upper face, a lower face, and an inner end, with the depth of said groove between said rear end of said tooth and said inner end of said groove being greater than the width of said mounting bar between said leading edge and said trailing edge, said groove including a notch formed in a face of said groove and extending through said side faces of said tooth, said notch open at said rear end of said tooth and extending toward said leading end of said tooth a distance generally equal to said width of said mounting bar, each of said teeth being connected to said mounting bar with said mounting bar received in said notch.

10. The attachment apparatus of claim **9**, wherein said upper face of each of said teeth is formed with a concave curvature.

11. The attachment apparatus of claim **9**, wherein said leading edge of said mounting bar is beveled, and wherein said notch is configured and dimensioned to match the dimensions and configuration of said mounting bar, such that said mounting bar is received fully in said notch.

12. The attachment apparatus of claim **9**, wherein said notch in each of said teeth is disposed between said upper face of said groove and said upper face of said tooth, such that said lower face of said mounting bar is received against the upper surface of the lip of the bucket when said mounting bar is connected to said bucket.

13. The attachment apparatus of claim **9**, wherein said notch in each of said teeth is disposed between said lower face

of said groove and said lower face of said tooth, such that said upper face of said mounting bar is received against the lower surface of the lip of the bucket when said mounting bar is connected to the bucket.

14. The attachment apparatus of claim **9**, wherein said teeth are permanently connected to said mounting bar.

15. The attachment apparatus of claim **9**, wherein said teeth are removably connected to said mounting bar.

16. A method of temporarily converting a loader bucket having a rear wall, opposed side walls, and a bottom wall connected to the rear wall and side walls, the bottom wall having a straight lip without teeth, from loader configuration to an excavator bucket configuration with teeth extending outwardly from the lip, and converting the bucket from the excavator configuration to the loader configuration, comprising the steps of,

providing an excavator attachment having an elongate planar, generally rectangular mounting bar with first and second ends, the length of said mounting bar between said first and second ends being equal to the distance between the side walls of the bucket at the lip, and a plurality of excavator teeth connected to said mounting bar between said first and second ends, each of said teeth having a rear end and a leading end, and each of said teeth having a groove extending into said tooth from said rear end toward said leading end, said groove configured and dimensioned to be received over the lip of the bucket with said mounting bar received against said lip;

placing said excavator attachment over the lip of the bucket with the lip extending into said grooves of said teeth in closely fitting relationship, and with said leading ends of said teeth extending outwardly from the lip of the bucket;

releasably connecting said mounting bar at said first and second ends to only the side walls of the bucket such that the connection of said ends of said mounting bar to the side walls and the close fit of the teeth over the lip of the bucket cooperatively retain the attachment apparatus firmly on the bucket without direct connection between said mounting bar and the lip of the bucket, completing conversion of the loader bucket from loader configuration to excavator configuration;

releasing the connection between said first and second ends of said mounting bar and the side walls of the bucket; and

removing the excavator attachment from the bucket by moving the attachment away from the lip of the bucket so as to withdraw said grooves in said teeth from the lip of the bucket, completing conversion of the bucket from excavator configuration to loader configuration.

17. The method of claim **16**, wherein the excavator attachment is removed from the bucket by moving the bucket away from the attachment rather than by moving the attachment away from the bucket.

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