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Caron et al.

[11] **3,922,106**

[45] **Nov. 25, 1975**

[54] **COMPACTION WHEEL WITH TRACTION AND CRUSHING CHARACTERISTICS**

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[73] Assignee: **Caron Compactor Co.**, Stockton, Calif.

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[52] **U.S. Cl.** ..... **404/121**; 301/44 T; 172/540; 37/141 T

[51] **Int. Cl.²** **E01C 19/26**

[58] **Field of Search** ..... 404/121; 301/43 R, 44 T; 172/540, 240; 37/142 R, 141 T

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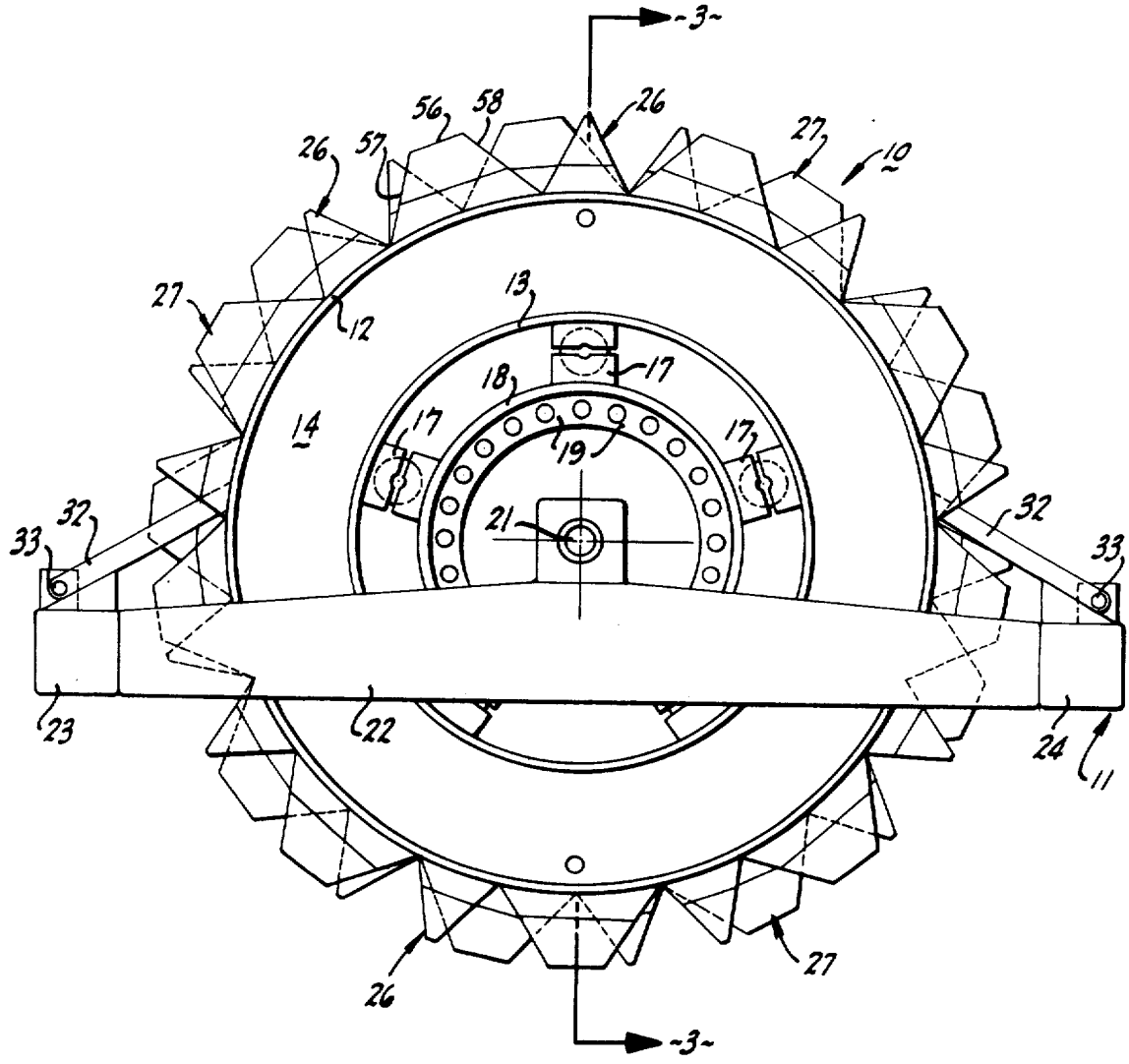
Primary Examiner—Nile C. Byers, Jr.
Attorney, Agent, or Firm—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

An earth and sanitary fill compaction roller has feet projecting from its cylindrical surface, the feet being arranged in circumferential and axially staggered relationships, and being of two different foot types: feet of high tractive characteristics with laterally disposed wedge faces organized in rows along the sides of the roller; and feet of high destructive characteristics with bodies and cutting edges elongated in the rolling direction, organized in rows intermediate the tractive feet. The arrangement of spaces between feet permits use of cleaner apparatus and reduces debris build-up between feet on the roller. Both types of feet have replaceable wear-caps.

14 Claims, 14 Drawing Figures



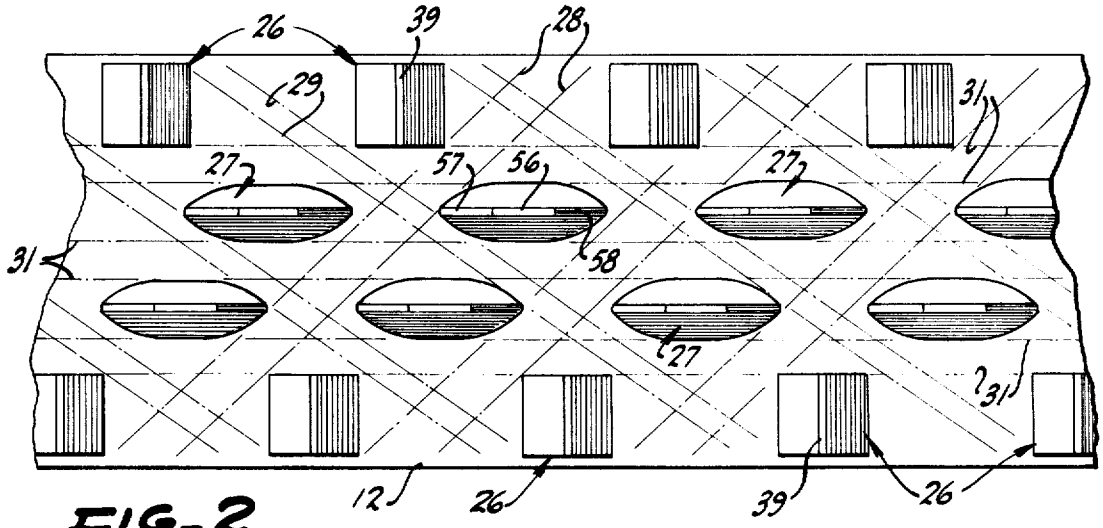

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FIG-2

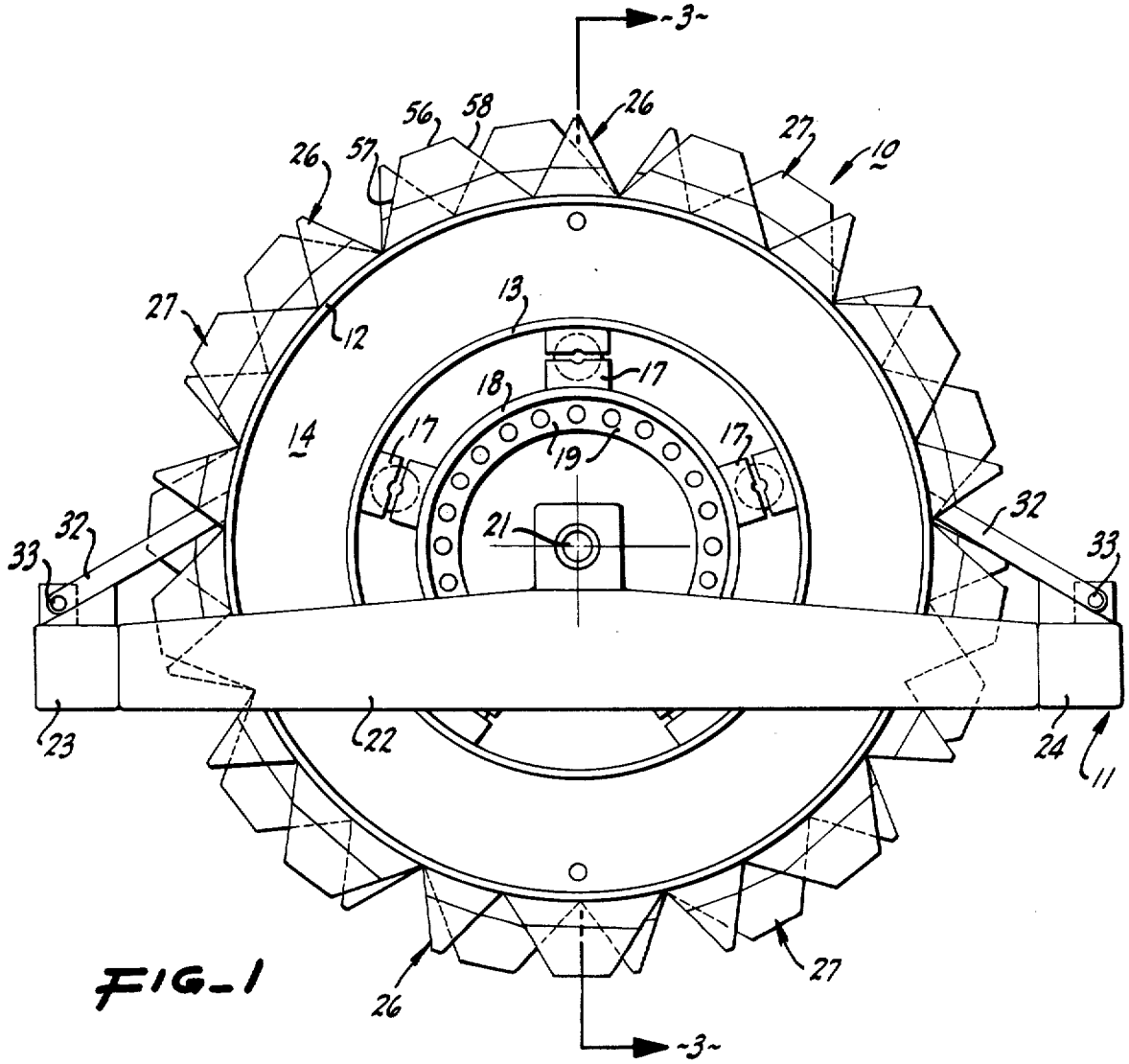
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FIG-1

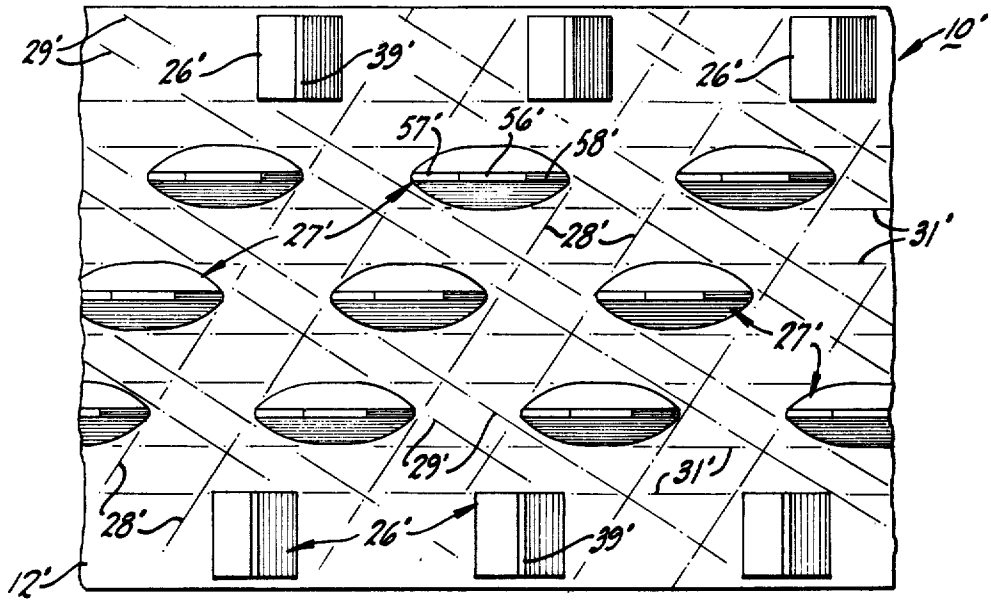
29'
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FIG-4

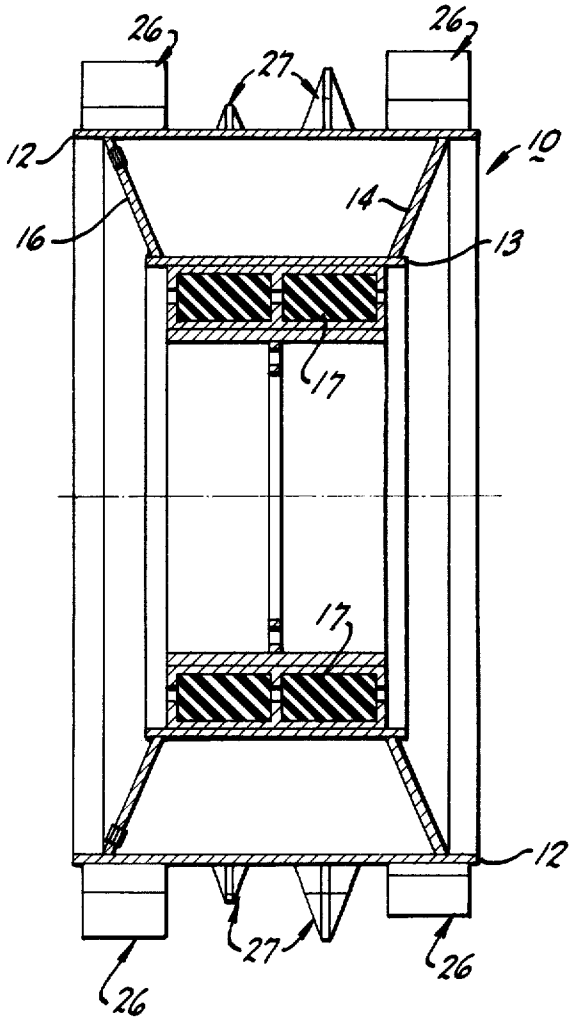
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FIG-3

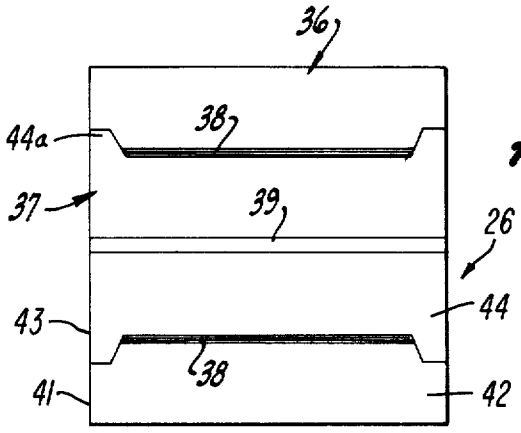

FIG-5

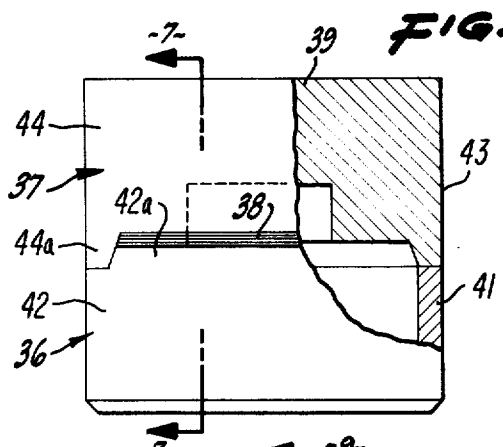

FIG-6

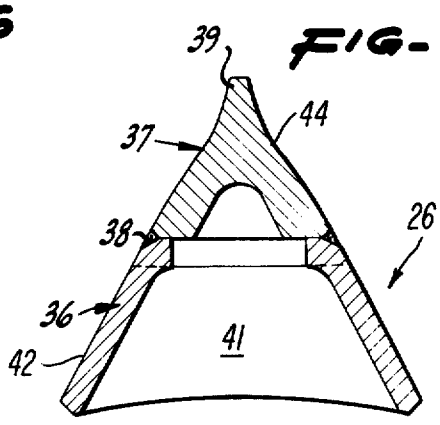

FIG-7

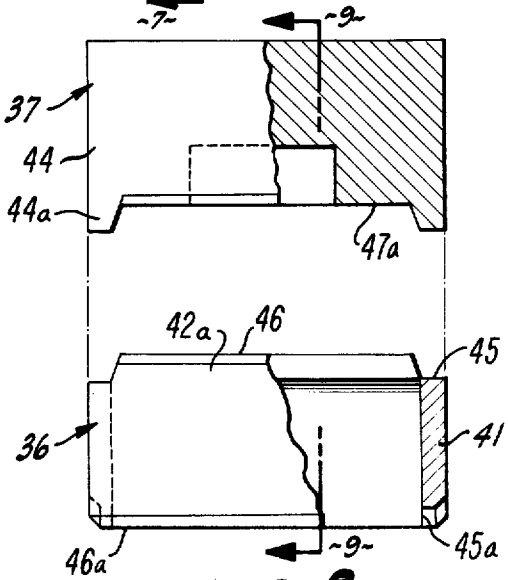

FIG-8

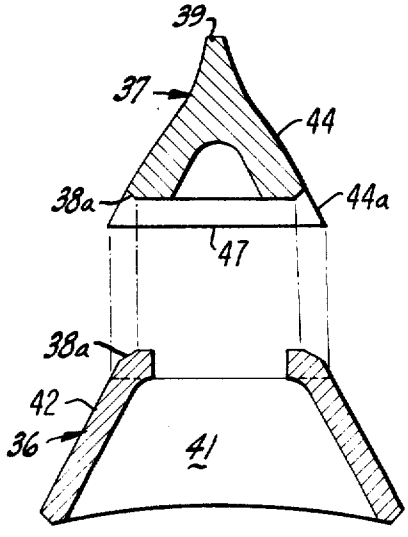

FIG-9

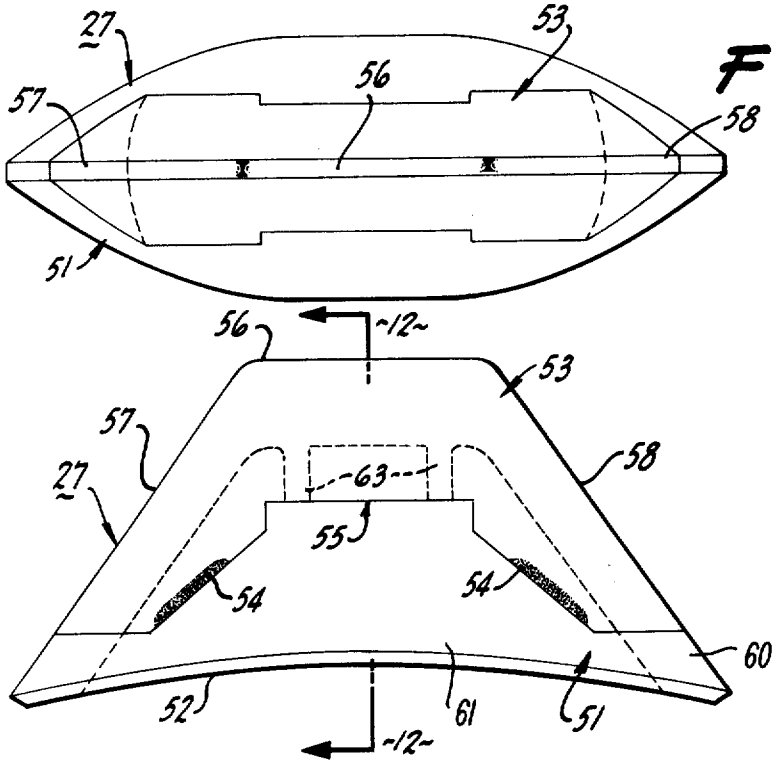

FIG-10

FIG-11

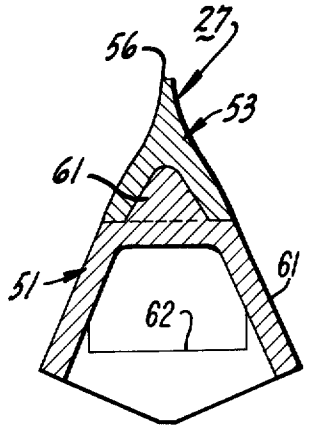

FIG-12

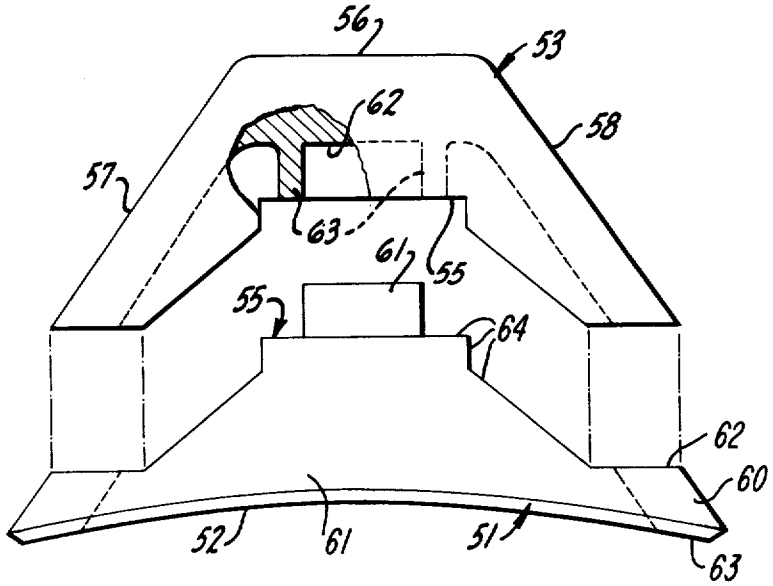

FIG-13

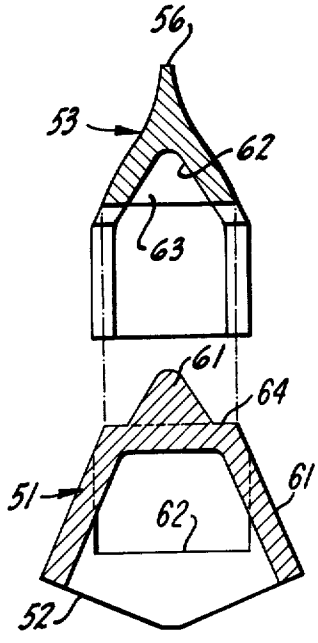

FIG-14

COMPACTION WHEEL WITH TRACTION AND CRUSHING CHARACTERISTICS

BACKGROUND OF THE INVENTION

This invention concerns generally compaction machinery and particularly relates to an improved roller for mounting upon a driven compaction vehicle, the roller having both high destructive and tractive characteristics adapted to break up, crush, grind and compact materials of the size of home appliances as encountered in sanitary land-fill operations.

Compaction rollers and wheels used on land-fill operations and particularly sanitary land-fill operations, were equipped generally with cleats or feet of a single type for each roller or wheel. The basic purpose of the feet was to grind and crush the material beneath it and thereby reduce the material in size for compaction. This purpose was thought to be achieved with feet of a single character and design for a roller but it was found that the function of the feet varied considerably according to their configuration and arrangement on the roller. Some were excellent initially for crushing material but would soon collect debris and become in effect a smooth roller. Other feet did not have suitable tractive character for use on a powered compactor when climbing steep banks.

In sanitary land-fill operations, as well as in earth compaction service, rollers with high destructive characteristics may have those characteristics substantially blunted through the wearing down of the sharp cutting edges of the feet. Thus, it is quite desirable that the cutting edge portion of the compaction feet be capable of renewal in the field so as to restore the roller to its initial high destructive capacity. Further, individual compaction feet may be dislodged from the roller or damaged reducing the usefulness of the roller. Economically, it is desirable that the wheel or roller through application of new feet structures be capable of renewal on the job site through use of tools and metal working techniques found under field conditions.

SUMMARY OF THE INVENTION AND OBJECTS

In summary, the invention concerns a fill and compaction roller comprising a rigid cylinder forming a rim, means for mounting the rim upon a vehicle for driving. Ground engaging feet of first and second types are mounted on the cylinder, the first type of feet serving to supply traction characteristics to the roller and comprising relatively permanent bases fixedly secured to the surface of the cylinder and replaceable wear-cap welded to the bases. The bases and wear-cap form units which are substantially Vee-shaped presenting tractive, cutting edges extending laterally of the rolling direction of the vehicle, the feet of the first type being arranged in at least two circumferential rows, one located along each side portion of the roller. The second type of compaction feet serve to supply high destructive crushing characteristics to the roller and comprise relatively permanent bases fixedly secured to the surface of the cylinder and replaceable wear-caps welded to the bases. The bases and wear-caps form units which are generally trapezoidal in side elevation and having fore and aft incline cutting edges merging into outer cutting edges and on the sides tapering outwardly from the outer cutting edges to the surface of the cylinder. The feet of the second type are arranged in spaced apart circumferential rows disposed intermediate the rows of feet of the first type.

An object of the invention is to provide for a powered vehicle an improved compaction roller having both high tractive and destructive characteristics and equipped with compaction feet of two different types arranged to cooperate with cleaner apparatus in an arrangement to reduce the tendency of fill material to accumulate between the feet.

Another object of the invention is to provide an improved roller of the type described and compaction feet designed and arranged for renewal in the field with tools and techniques there available, thereby maintaining the high tractive and destructive characteristics of the roller unit.

Another object of the invention is to provide an improved roller which through the deployment of compaction feet of different types provide an irregular destructive, ground contact pattern for greater destructive capacity of the roller and vehicle unit.

These and other objects of the invention will become apparent from the detailed description below taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a compaction roller of the present invention shown operatively mounted upon a power driven vehicle;

FIG. **2** is a developed, fragmentary view of the compaction roller of FIG. **1**;

FIG. **3** is a sectional view in the direction of the arrows **3—3** in FIG. **1**;

FIG. **4** is a view like FIG. **2** but showing another form of foot arrangement of the compaction roller;

FIGS. **5** through **9** are views of the Vee-shaped traction feet employed on the roller of the present invention; and

FIGS. **10** through **14** are views of the grinding and crushing cleats feet employed on the roller of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A compaction roller **10** constructed in accordance with the principles of the present invention is shown in FIGS. **1–3** and is illustrated mounted upon a power driven vehicle **11** (shown fragmentarily) and there may be three other similar wheels mounted upon the vehicle **11**. The compaction and fill roller **10** includes a rigid cylindrical rim **12** connected to a centrally disposed drum **13** by conically shaped, inwardly extending spiders **14, 16** (FIG. **3**). The outer wheel unit (rim **12**, drum **13**, spiders **14, 16** etc.) is cushioned with respect to an inner wheel unit by means of a plurality of circumferentially spaced cushioning elements **17** disposed radially between the inner surface of the drum **13** and an inner cylinder **18** which serves as a portion of the structure for connecting the roller **10** to the drive axle assembly **19** of the vehicle **11**. The cushioning elements **17** may be constructed in accordance with the principles disclosed in U.S. Pat. No. 3,724,342, granted Apr. 3, 1973, and assigned to Caron Compactor Co. The cushioning units **17** serve to isolate shocks encountered by the wheel **10** from the axle **21**. The roller unit **10** may be mounted upon a perimeter frame **22** of the vehicle including fore and aft cross members **23** and **24** extending along the operative faces of the wheel or roller as shown in FIG. **1**.

Insuring that the roller **10** functions in the desired highly destructive manner while maintaining itself substantially free of accumulated dirt, two different types of compaction feet are arranged on the outer surface of the cylinder **12**: traction feet **26** (FIGS. **5–9**) and crushing feet **27** (FIGS. **10–14**).

The traction feet **26** are arranged fixedly secured to the surface of the cylinder and are circumferentially spaced apart in rows disposed along each side portion of the cylinder. A row of traction feet **26** may be arranged in a medial portion of the rim **12** (not shown) to gain a further increase in traction. The feet **26** in each row are staggered in the same circumferential direction a distance of about one-half the circumferential spacing between feet **26** in each row so that when two rows of feet **26** are present one of the feet **26** will be entering the ground while a foot from the other row will be leaving the ground during rolling motion of the wheel **10**. This gives a continuous tractive effort for the roller **10**.

The crushing feet **27** are welded securely to the surface of the cylinder **12** and are organized into at least two circumferential rows spaced apart from each other, the rows being disposed intermediate the two outside rows of traction feet **26**. The crushing feet **27** are circumferentially spaced apart and staggered a distance of about two-thirds the stagger of the traction feet **26** so that there is provided across the surface of the cylinder **12** diagonal slots **28, 29**, FIG. **2**, facilitating ejection of debris from the roller.

Lateral spacing of the circumferential rows of feet affords circumferential slots **31** (FIG. **2**) between each adjacent row of feet into which cleaner apparatus **32** may project for assuring against the build-up of materials in the wheel (FIG. **1**). The cleaner members **32** are pivotally mounted on the vehicle frame cross members **23, 24** and oriented at an upwardly inclined attitude. An axle **33** extends along the cross members **23, 24** and a support platform **33** maintains the cleaner bars **32** at the desired upwardly inclined attitude. The cleaner bars maybe pivoted away from the roller surface when it is desired to discontinue their function. The inwardly projecting ends of the cleaner bars **32** may approach to about three-eighths to one-fourth inch the surface of the rim **12**.

The traction feet, shown in detail in FIGS. **5–9**, include base portions **36** and replaceable wear-caps **37** which are secured to the bases by welding along the double bevel welded joint **38** provided on the inclined wedge faces of the traction foot. As a unit, the traction foot **26** is Vee-shaped tapering from an outer cutting edge **39** to the bottom of the base **36**, which is provided with a curvature to facilitate welding to the rim **12**. The end walls **41** of the traction foot **26** are closed preventing dirt build-up in service. Temporary weldments **38** and a mechanical joint **42** on the ends are formed between the two portions **36, 37** fixedly securing the wear-cap **37** with respect to the base **36**. Weld areas **38***a* are provided to receive the weldments **38**.

It will be noted that the traction foot **26** is void or hollow in the interior so that the joint **38** may be broken or cut through with the air-arc gouge technique for removal of the weld metal and the expended wear-cap **37** removed from the relatively permanent base. During this operation the molten metal falls into the hollow base without removal of significant metal from the base itself. It will also be noted that the wall thickness of the wear-cap **37** is substantially greater than that of the base **36** for the reason that the wear-cap sustains greater amounts of abrasion and for this reason is constructed of a high abrasion resistant material. The base **36**, on the other hand, may be constructed of high shock resistant material. The form of the side walls insures that earth and the like material will not build-up in the inside of the cleat and also furnishes mechanical support to the wear-cap beyond that supplied by the weld metal.

More specifically, the base **36** includes generally planar, vertical end walls **41** and inwardly sloping side walls **42**. The side walls **42** include portions **42***a* which extend upwardly somewaht further than the end walls to form one part of a mortise-tenon joint. The wear cap also includes vertical end walls **43** and sloping side walls **44**, the side walls **44** including bottom edge portions **44***a* which extend downwardly beyond the side wall **44** to form the other part of a mortise-tenon joint, so that when cap and base are assembled, weldment **38** is reinforced by the interlocking mortise-tenon joint interconnection between the members. The end walls **41** of base **36** terminate at upper and lower generally flat joint interconnection surfaces **45, 45***a*, and the side walls **44** terminate at upper and lower joint interconnection surfaces **46, 46***a*. The lower edges **47, 47***a* of the end and side walls of the wear cap **37** likewise terminate along joint interface surfaces that conform in shape to the mating, contiguous surfaces of the respective adjoining portion of the base when the base and cap are assembled. The lower joint surface **46***a* of the base **36**, of course, conforms in shape to the contour of the compactor roller to which it is attached.

The crushing feet **27** are shown in detail in FIGS. **10–14** and each comprises a base member **51** curved and beveled along its bottom periphery **52** for rigidly securing it to the surface of the cylinder **12** by welding. A replaceable wear-cap **53** which is secured to the base by welding at four separated weld joints **54** as indicated in FIG. **11**. A mechanical, non-welded joint **55** of mortise and-tendon configuration is formed on each side of the foot **27** intermediate the two pair of weld joints **54**.

In side profile, the crushing foot **27** unit is trapezoidal and includes an outer (or upper, as viewed in the drawings) cutting edge **56** which merges into the inclined end cutting edges **57** and **58**. The unit is tapered outwardly downward from the outer cutting edge. In general plan form the foot **27** resembles the form of an inverted double ended boat hull.

The base **51** of the foot **27** is provided with upwardly projecting laterally rounded bridging member **61** which closely fits within complementary pocket **62** formed in the wear-cap **53**. If desired, end walls of the pocket **62** in the form of transverse rib elements **63** may be provided.

It will be observed that the base portion of the crushing cleat **27** is hollow so that the four weld joints **54** may be opened by the air-arc gouge technique and the molten weld metal will fall into the interior of the base without the arc-gouge penetrating material of the base needed to support a new, replaced wear-cap **53**. Referring now to FIGS. **2** and **3**, it will be observed that the cutting edges **39** of the traction cleats **26** extend at substantially a right angle to the cutting edges **56–58** of the crushing cleat **27** so that the fill materials will be worked upon in two direction for effective cutting and destructive action.

OPERATION

The compaction roller **10** constructed as described above to include a plurality of rows of cleats of a first or tractive type **26** and of a second or crushing type **27** is mounted upon a vehicle and power driven over sanitary fill for compaction purposes. The roller **10** may be mounted as illustrated in FIG. **1** with respect to the vehicle drive axle **21.** The cleaner apparatus **32** is arranged to project into the circumferential slots **31** defined between the adjacent rows or feet. The vehicle **11** with the rollers mounted thereto may be operated in both forward and backward directions for effective crushing action in a sanitary fill compaction operation.

After a substantial period of service, it is often necessary that the wear-caps of the feet be replaced so that the cutting edges may be renewed. With the roller of the subject invention this operation may be accomplished in the field through the use of welding equipment available on the site and carried there by pickup trucks or the like. An arc-gouge is first brought into operation to open up the weld joints formed along the faces of the traction feet **26** so that the wear-caps **37** may be removed. The wear-caps **53** of the crushing feet **27** are similarly removed through use of the arc-gouge to open up the weld joints **54** along the incline bases of feet **27.** This leaves the mechanical mortise and tendon joints **55** intact for support of the new wear-cap to be secured to the old base. In the next step, the workman would need only to apply the new wear-caps to the old bases and make the weld joints in the zones prepared by the air-arc weld metal removal technique. Metal used for mechanical support of the wear-cap with respect to the bases is left intact through the selected placement of the weld metal zones and mechanical supports for the wear-cap.

A second form of compaction roller **10'** is shown in FIG. **4** wherein there is arranged between the two outside rows of traction feet **26'** three rows of crushing feet **27'** as shown. Diagonal slots **28'** and **29'** and circumferential slots **31'** are formed by the organization of feet illustrated in FIG. **4.** The function and operation of the roller **10'** is similarly to that described above and possesses substantially greater crushing characteristics due to the greater width of the roller and the larger number of crushing feet **27.**

It will be seen from the above that there has been disclosed an improved compaction and fill roller which includes the capacity for maintaining itself in a substantially debris-free condition through the provision of an organization of diagonally extending and circumferentially extending slots along the periphery of the roller. The arrangements of two different types of crushing and compaction feet provides the roller with a high degree of tractive characteristics as well as a high destructive characteristics necessary for sanitary fill operations. A cleaner apparatus cooperates with the circumferential slots to mechanically insure that debris build-up along the feet is avoided.

We claim:

1. A fill and compaction roller comprising a rigid cylinder forming a rim, means for mounting the cylinder upon a vehicle, and ground engaging feet of first and second types mounted on said cylinder, said first type of feet serving to supply traction characteristics to said roller and comprising relatively permanent bases fixedly secured to the surface of the cylinder and replaceable wear-caps welded to said bases, said bases and wear-caps forming units which are substantially Vee-shaped presenting cutting tractive edges extending laterally of the rolling direction, the feet of the first type being arranged in at least two circumferential rows, one located along each side portion of said cylinder, the feet in the respective rows being in a non-aligned staggered relationship, said second type of compaction feet serving to afford destructive, crushing characteristics to said roller, and comprising a relatively permanent base fixedly secured to the surface of the cylinder and a replaceable wear-cap welded to said base, said bases and wear-caps forming units which are generally trapezoidal in side elevation, having fore and aft cutting edges inclined from the surface of said cylinder and merging into outer cutting edges, said cutting edges extending in the rolling direction, said units on the sides tapering laterally outwardly from the outer cutting edges to the surface of said cylinder, the feet of said second type being arranged in a circumferential row disposed intermediate the rows of feet of the first type and staggered in the same circumferential direction, the spaces between adjacent rows of feet on said roller forming circumferential slots about the rim of said roller, and the spaces between the feet in adjacent rows forming diagonally transverse slots on the surface of the cylinder facilitating dirt ejection.

2. The fill and compaction roller of claim **1** wherein raker bar means are provided and arranged to extend into the circumferential slots between adjacent rows feet on said roller, said raker bar means being disposed in a confronting, upwardly inclined attitude with respect to the surface of the cylinder and presenting ends in close proximity to the surface of said cylinder.

3. The compaction roller of claim **1** wherein the feet of the first type are arranged in each row on said cylinder staggered in the same circumferential direction a distance of at least one-half the circumferential facing between said feet in the respective row.

4. The compaction roller of claim **1** wherein at least four circumferential rows of feet are provided.

5. The compaction roller of claim **1** wherein at least five circumferential rows of feet are provided, three of said rows being destructive feet on said second type.

6. The roller of claim **1** wherein discrete welding zones are provided on said feet and beads of weld metal deposited therein, at locations on said feet laterally of the respective cutting edges thereof.

7. The roller of claim **1** wherein said feet of the first type comprise a base portion of general rectangular outline forming a platform and having support edges along two opposed sides thereof, and a linear extending welding zones on the two other sides thereof, a wear-cap of abrasion resistant material mounted on said base and welded thereto along said two sides, the sides of said feet disposed laterally of the rolling direction being of closed construction preventing the entry of debris therein.

8. A renewable foot for a compaction and crushing roller said foot comprising:

a. a generally hollow base element having sloping, upwardly converging side walls and vertical, generally planar end walls, said side and end walls terminating at their upper and lower edges at respective upper and lower joint interface surfaces lying generally in horizontal, transverse planes extending generally normal to said end walls; at least a portion of the upper edges of said side walls extending somewhat further upwardly than the upper edges

of said end walls, whereby said upper edges of the side walls of said base element form a mortise portion of a joint connection; the area between the upper edges of said side and end walls being hollow within said base element;

b. a replaceable wear cap temporarily secured to said base element, said wear cap comprising a wedge-shaped member including upwardly sloping, converging side walls, and vertical, generally planar end walls, said side walls and end walls merging together at their upward edges to form a solid cutting edge on said cap, said cutting edge extending generally parallel to said side walls and substantially normal to said end walls; the lower edges of said side and end walls of said cap terminating at joint interface surfaces contiguous to and mating with the respective upper joint interface surfaces of the side and end walls of said base element;

c. said base and wear cap being secured by temporary weldments extending along the joint interface between the side walls of said base element and wear cap;

d. the side walls of said wear cap including portions at the extremities thereof extending downwardly further than the remaining portions of said side walls of said cap for overlapping the ends of the mortise portions of the side walls of said base element to thereby form a mortise-tenon joint;

e. whereby the weldments between the wear cap and base element are reinforced by the joint interface, including the motrise-tenon joint, between said base element and wear cap.

9. A renewable foot for a compaction and crushing roller as recited in claim **8,** further wherein said side walls of said wear cap are substantially thicker in cross-section than said side walls of said base element.

10. A renewable foot for a compaction and crushing roller, said foot comprising:

a. a generally hollow, elongated base element having upstanding, connected, inwardly sloping, peripheral side and end walls terminating at their upper and lower edges respectively at upper and lower joint interface surfaces lying generally in transverse planes extending normal to the longitudinal axis of said base element;

b. a bridging member formed integrally with said base element and having a base portion attached to and bridging a portion only of the upper extremities of said side walls of said base element centrally of said base element, said bridging member having a portion extending upwardly beyond the upper extremities of said side walls;

c. the lower edges of said peripheral side and end walls terminating in a convexly curved, mutual transverse plane;

d. said end walls of said base element having narrow, inwardly sloping, wedge-like edges extending along the outer, longitudinal extremities of said base element;

e. a replaceable wear cap temporarily secured to said base element, said wear cap comprising an elongated, generally wedge-shaped hollow member including integral, connected, side and end walls terminating at their lower edges at joint interface surfaces contiguous to and corresponding in form and orientation to the said upper joint interface surfaces of said base element; said end and side walls of said wear cap converging together at their upper and longitudinal extremities to form an integral, solid, longitudinally extending wedge formation having a narrow cutting edge extending continuously from the outer, lower longitudinal extremities of said wedge element up to and including the central upper portion of said wear cap, said cutting edge lying generally in a vertical plane including the longitudinal axis of said base element, and said cutting edge of said wear cap forming an extension of the said wedge-like edges of the end walls of said base element whereby the assembled base element and wear cap provide a substantially continuous, longitudinally disposed, wedge-shaped cutting edge for said foot of said compaction and crushing roller when said foot is secured to said roller along the lower joint interface surface of said base element;

f. said wear cap having a central, lower internal surface area conforming at least in transverse contour to the shape of said upwardly extending portion of said bridging member of said base element, said upwardly extending portion of said bridging member being disposed within the internal surface area of said hollow wear cap in close-fitting relationship when said wear cap and base element are assembled;

g. said wear cap being removably secured to said base element by temporary weldments provided along portions of the joint interface between said cap and base element, said weldments not extending along the joint interface along the upper side edges of said base element adjacent said bridging member.

11. The renewable foot for a compaction and crushing roller as recited in claim **10,** further wherein said upper joint interface surfaces of said base element include:

a. generally coplanar horizontal surfaces at the upper edges of said end walls of said base element adjacent the lower edges of said end walls;

b. a pair of generally coplanar horizontally extending surfaces at the central, upper edges of said side walls of said base element, the last-said horizontal surfaces being disposed further above the lower edges of said end walls than said first-said horizontal surfaces;

c. combined vertical and inclined surfaces along the non-horizontal upper edges of said side walls for interconnecting said horizontal surfaces of said end and side walls;

d. whereby said joint interface forms a locking and stress distribution joint for the wear cap and base element of the renewable foot.

12. The renewable foot for a compaction and crushing roller as recited in claim **11,** further wherein said wear cap extends upwardly from the upper edges of said side walls of said base element a distance at least substantially as great as the height of said base element, and wherein the overall height of said wear cap is greater than the height of said base element below said bridging member.

13. The renewable foot for a compaction and crushing roller as recited in claim **10,** further wherein that portion of the cutting edge of said wear cap extending along the central upper portion of said wear cap extends substantially parallel to the horizontal surfaces of said central, upper edges of the side walls of said base element and corresponds in length at least to the length of said horizontal surfaces at the central, upper edges of said side walls.

14. The renewable foot for a compaction and crushing roller as recited in claim 10, further wherein said wear cap includes a pair of transverse rib elements extending across said central, lower internal surface area, said rib elements being disposed at opposite ends of said bridging member to additionally reinforce the interconnection between said base element and wear cap.

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