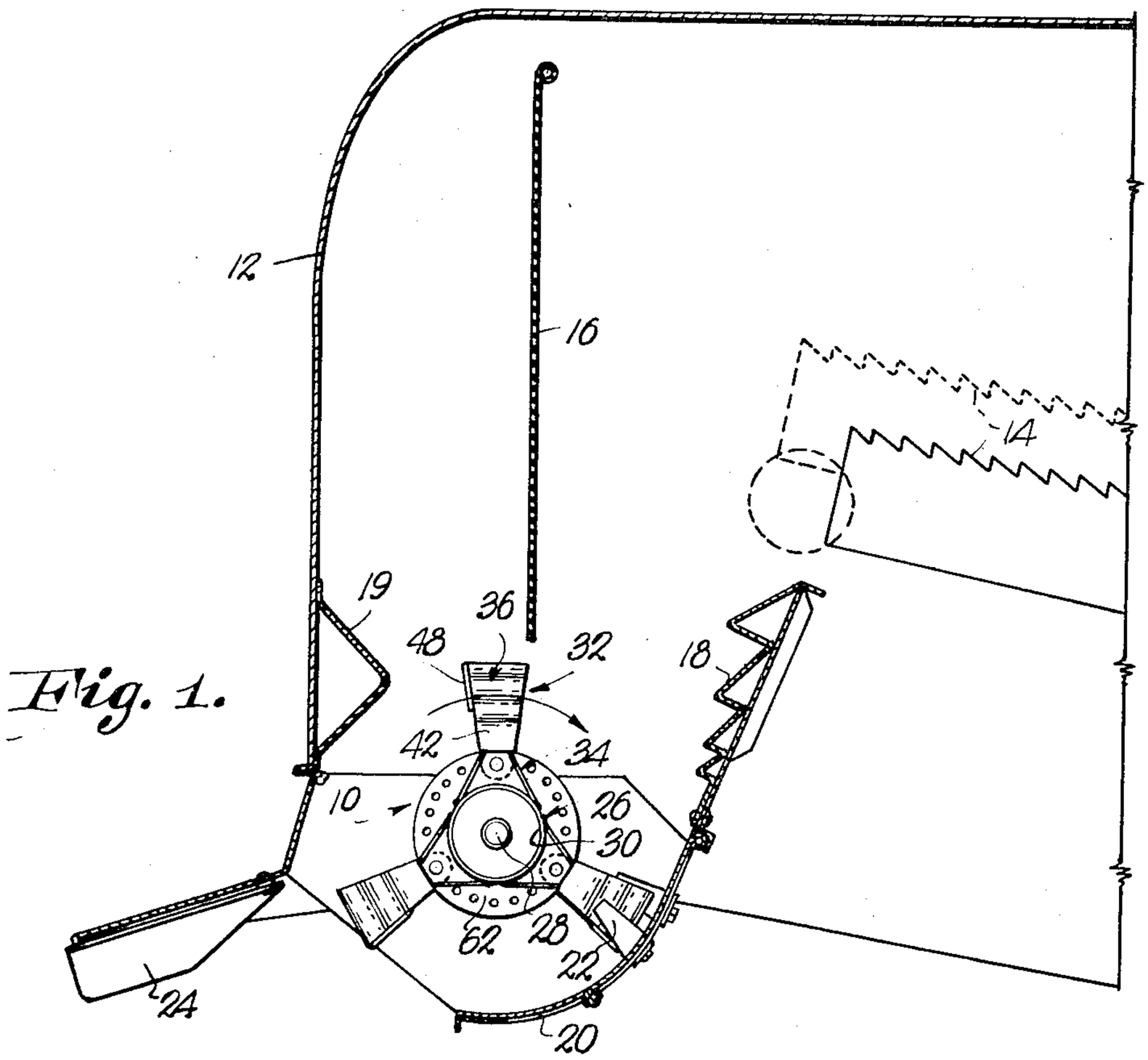

Fig. 1.

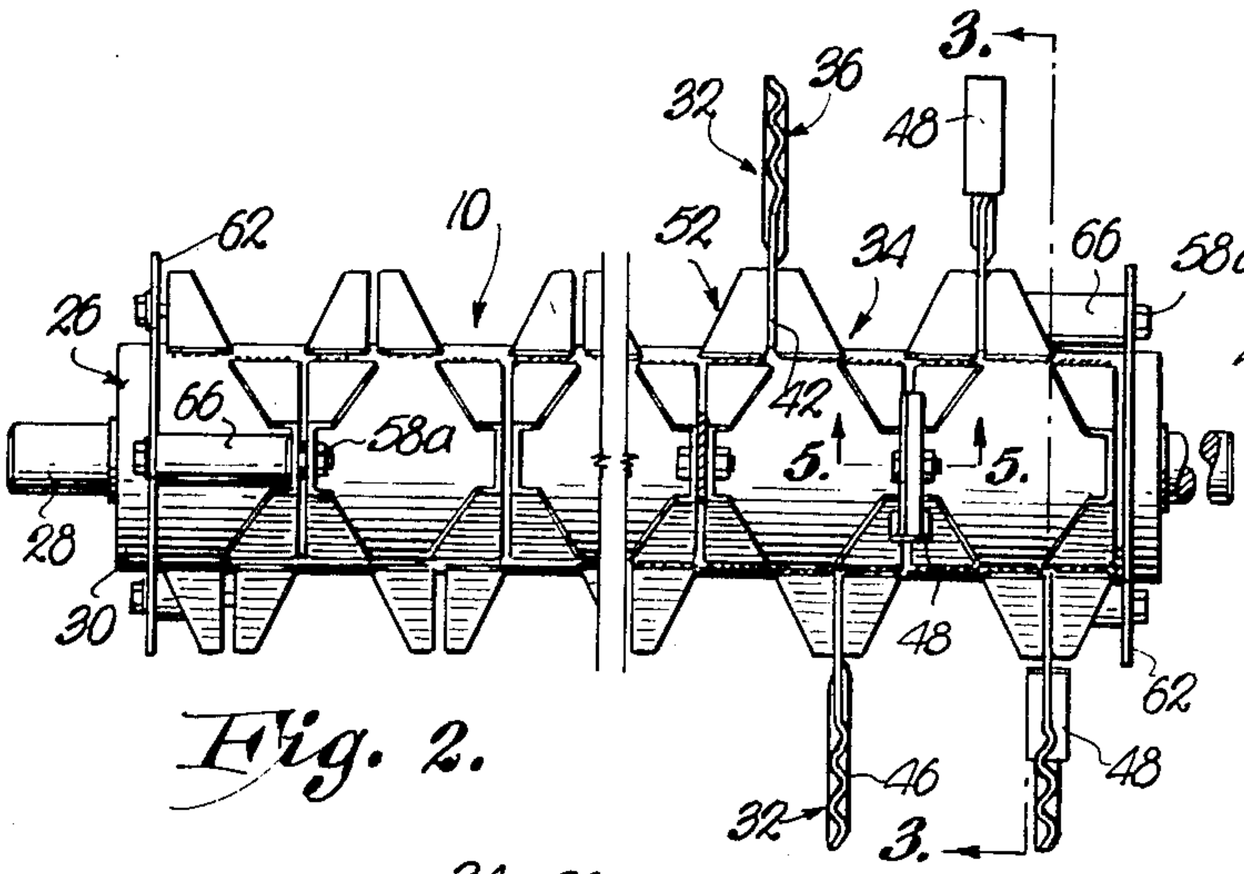

Fig. 2.

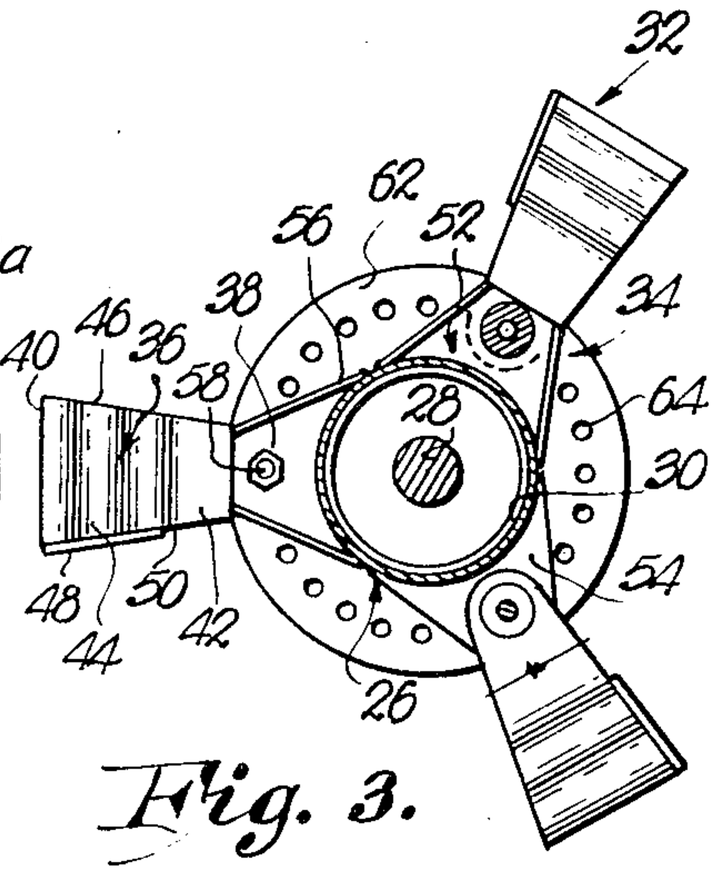

Fig. 3.

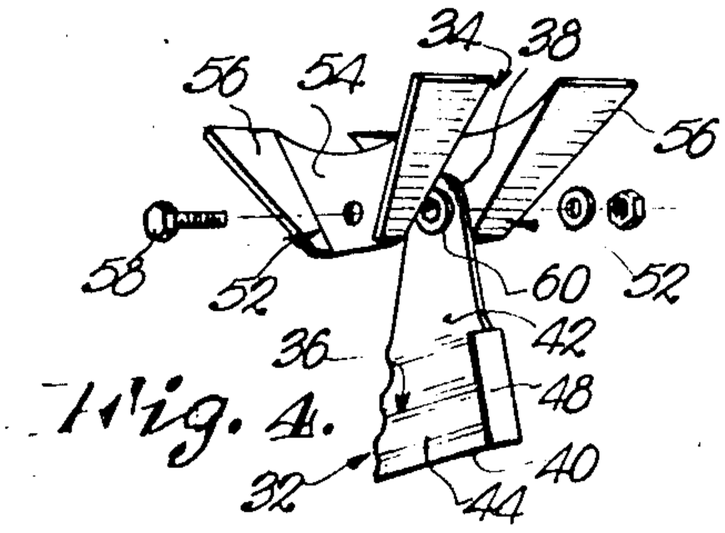

Fig. 4.

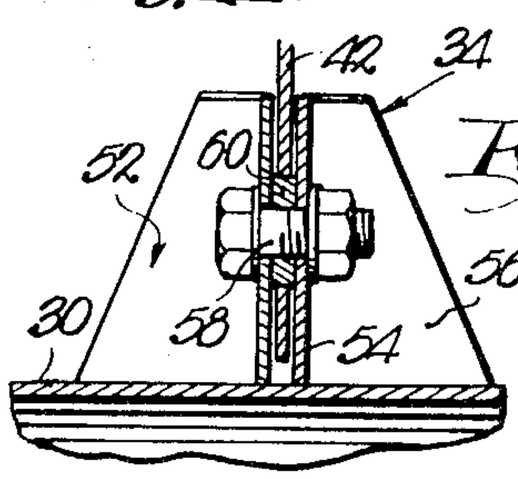

Fig. 5.

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United States Patent [19]

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[11] **3,717,062**

[45] **Feb. 20, 1973**

[54] **ROTOR FOR CHOPPING RESIDUE FROM COMBINES**

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[73] Assignee: **Hesston Corporation,** Hesston, Kans.

[22] Filed: **Oct. 6, 1970**

[21] Appl. No.: **78,446**

[52] **U.S. Cl.** **146/107,** 146/123

[51] **Int. Cl.** **A01d 55/18**

[58] **Field of Search** ... 146/117, 121, 138, 102 A, 146/102 K, 146/107; 241/291

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Primary Examiner—Willie G. Abercrombie
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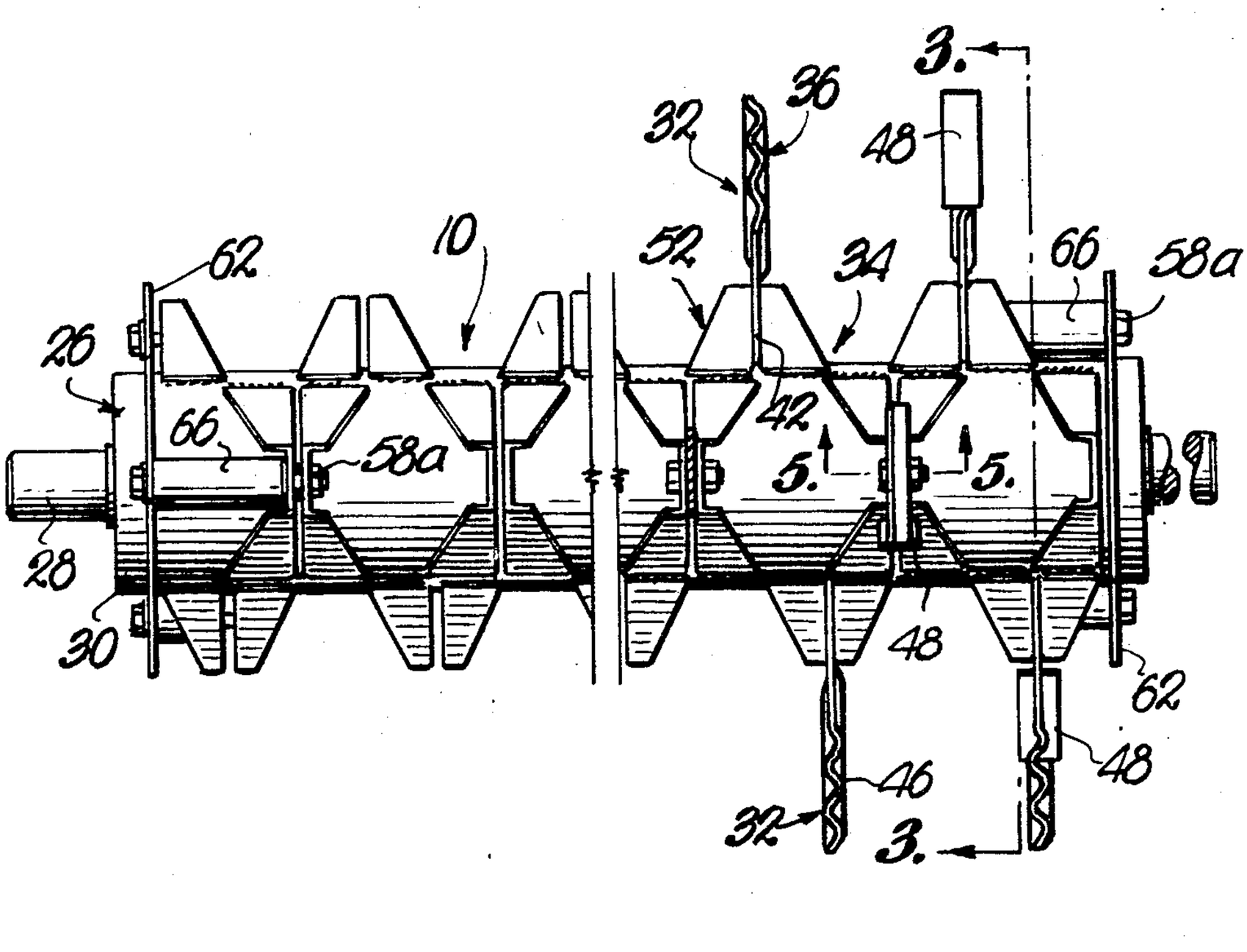
[57] **ABSTRACT**

The rotor of a residue-chopping unit for combines cuts wider paths by virtue of the provision of laterally corrugated blades for increasing the amount of surface area in the knife-like edges which contact the residue during rotation of the rotor, all without appreciably increasing the masses of the blades. Each blade is shaped to concentrate the mass thereof at its outermost free end outside its center of gravity. A vane on certain of the blades creates an increased airflow through the chopping unit.

12 Claims, 5 Drawing Figures



ROTOR FOR CHOPPING RESIDUE FROM COMBINES

This invention relates to combine attachments for chopping residue such as wheat straw, corn stalks, cobs and other threshed material and, more particularly, to improvements in the rotor assembly of such attachments.

It is the primary object of the instant invention to improve upon the chopper attachments disclosed in U.S. Pat. No. 2,986,186 dated May 30, 1961 and U.S. Pat. No. 3,521,687 dated July 28, 1970, both of which are incorporated herein by reference, as need be, for a better understanding of my present invention.

Conventional hammer mills using several rows of steel hammers revolving at high speed are commonly used as grinders for pulverizing feeds and other products. They are also used as crushers to break up such materials as ores, rock and coal by the impact of the swinging hammers hinged to the rapidly rotating shaft of the rotor.

Because of the relatively high speeds at which the rotor assembly of residue chopping units should be rotated to effect proper chopping, shredding or cutting of the residue, it is desirable to maintain the mass of the individual chopping elements of the rotor below a certain selected level. This facilitates balancing of the rotor so as to avoid damage to the chopping unit through excessive vibration at high rotor speeds. On the other hand, it has been found that the best chopping and shredding results are obtained when the impact surface area of the elements engaging the residue is maximized.

Accordingly, an important object of the present invention is to increase the impact surface area of each chopping element of the rotor without a corresponding increase in the mass of the element, while at the same time maintaining a knife-like cutting edge and providing a low cost chopping element that can be quickly and easily produced by modern metal stamping and forming methods.

Another important object of the instant invention is the provision of means on a number of the chopping elements for increasing the volume and velocity of the residue-carrying current of air flowing from the residue outlet of the combine and through the discharge of the chopping unit for propelling the chopped residue through the discharge with adequate and sustained velocity.

A further important object of the invention is to provide substantially triangular chopping elements having increased masses at their outermost, free ends whereby to decrease the tendency of the elements to yield upon impact with the material being cut.

In the drawing:

FIG. 1 is a fragmentary, vertical cross-sectional view through a portion of a combine equipped with a residue chopping unit having a rotor that embodies the principles of this invention;

FIG. 2 is an enlarged, fragmentary, elevational view of the rotor in FIG. 1;

FIG. 3 is a cross-sectional view of the rotor taken along line 3—3 of FIG. 2;

FIG. 4 is an exploded view of the mounting structure for each chopping element; and

FIG. 5 is an enlarged, fragmentary, cross-sectional view taken along line 5—5 of FIG. 2.

A rotor 10 is disposed across the outlet of a hood 12 of a combine for receiving residue coming from strawwalkers 14. Included within the hood 12 may be structures for rebounding and deflecting heavy corncobs and stalks in the nature of a hanging, flexible baffle 16 and a series of saw-toothed, angle deflectors 18 as taught in my said U.S. Pat. No. 3,521,687. Baffle 16, deflectors 18 and a V-shaped deflector 19 extend entirely across the hood 12 and are coextensive in length with the rotor 10.

The rotor 10 is located within a housing 20 suspended beneath the hood 12 and cooperates with a series of upstanding concaves 22 on one interior wall of the housing 20 to thoroughly chop and shred residue emanating from the walkers 14 during operation, and to discharge the chopped residue through the open lower end of housing 20 for subsequent engagement by spreader fins 24. An axle of rotor 10, broadly denoted by the numeral 26, comprises a central elongated shaft 28 which is adapted to be journaled by suitable bearings within the sidewalls of housing 20, and a tubular hub 30 which surrounds the shaft 28 and is coaxial therewith for rotation in the direction indicated by the arrow in FIG. 1. A plurality of elongated, free-swinging, substantially triangular-shaped chopping elements or blades 32 are spaced along the outer periphery of hub 30 in staggered rows by a mounting structure 34 for each element 32 respectively.

Each of the reversible elements 32 may be easily stamped and punched from a relatively thin sheet of metal and formed with a corrugated body portion 36 between its inner and outer ends 38 and 40 respectively and a flat shank 42 between the body 36 and the inner end 38. The corrugated body 36 presents a number of parallel, alternately concave and convex corrugations 44 which extend across each element 32 parallel to the outer end 40, the longitudinal boundary of the outermost of the corrugations 44 defining the outer end 40 of the element 32 and the innermost of the corrugations 44 merging with the shank 42.

The corrugations 44 pressed into the body 36 terminate in undulating impact edges 46 having effective residue-engaging widths that extend from the convex side of each corrugation 44 to the opposed, convex side of adjacent corrugations 44 as shown most clearly in FIG. 2. Certain of the elements 32 are provided with an elongated, flat sheet metal vane 48 welded to trailing edge 50 of the body 36 and extending from the outer end 40 to the shank 42. The remaining elements 32 may be mounted with either of their edges 46 or 50 leading, or reversed when wear dictates the advisability of such reversing.

Each element 32 is individually secured at its inner end 38 to the axle 26 by its own separate mounting structure 34 for swinging about an axis parallel to and spaced radially outwardly from the shaft 28. Each structure 34 for each individual element 32 includes a pair of opposed saddles 52 (which may also be quickly and inexpensively stamped, formed and punched from sheet metal) having a flat radial panel 54 in turn provided with a pair of integral, opposed, planar, lateral legs 56 which straddle the hub 30. The inner edge of the panel 54 has an arcuate cutout portion which is disposed to complementally receive the arcuate peripheral surface of hub 30. Each of the legs 56 and

the panel **54** are welded to the hub **30** along its lines of contact with hub **30**, whereby the legs **56** hold the panels **54** radial to the hub **30** and strengthen the panels **54** so as to permit the use of relatively thin, lightweight, inexpensive sheet metal stock. The legs **56** diverge as the surface of hub **30** is approached at a tangent thereto in order to provide a sturdy base for the element **32** saddled on the hub **30**.

The mounting structure **34** also includes a pivot bolt **58** interconnecting the opposed panels **54** of a pair of the saddles **52** and projecting through a bushing **60** in the shank **42** of a corresponding chopping element **32**. The close spacing of the opposed panels **54** limits lateral movement of the element **32** along pivot **58** for the full extent of its swinging movement, while the spaced-apart nature of the panels **54** permits free-swinging of the element **32** about the bushing **60** during rotation of the rotor **10**.

Rotor **10** may also be provided with a balance ring **62** on the hub **30** at each end thereof having a series of circumferentially spaced holes **64**. Each ring **62** may be held in place by substituting a longer bolt **58***a* for the pivot bolt **58** of proximal mounting saddles **52** and inserting a weighted spacer **66** between the ring **62** and panel **54** of one of the selected saddles **52**.

During rotation of the rotor **10**, the free-swinging elements **32** extend radially from axle **26** by centrifugal force, and the leading impact edge **46** of each element **32** strikes residue emanating from walkers **14** to chop and literally tear apart or thoroughly disintegrate each individual particle of the residue along its length as the element **32** passes between concaves **22**. The laterally undulating nature of edge **46** assures that an increased amount of residue surface area will receive the impact force of each element **32**, while the outer surfaces of the laterally extending corrugations **44** pass through the residue and, to a certain extent, tend to abrade the latter in conjunction with concaves **22** to produce the desired shredded and lacerated condition of the residue. This results in faster decomposition of the residue and thereby speeds up the transfer of vital soil-building nutrients from the residue into the ground. It will be appreciated that the maximization of the residue surface area engaged by impact edge **46** has now been obtained without an increase in the total mass of each element **32** and, further, that corrugations **44** reinforce the elements **32** so that they may be readily constructed from lightweight sheet material which permits rapid, low-cost fabrication.

The increased mass of body **36** only, by use of corrugations **44**, and the progressively increased width of blade **32** as its outer tip edge is approached, concentrate the mass outside of the center of gravity, thereby decreasing the tendency to yield on impact. The impact edges **46** have an appreciably greater effective width than the thickness of the metal from which the blades **32** are produced, presenting impact surfaces that are quite adequate in total area without need for thick, heavy and expensive bars as is common practice in hammer mills, for example. Moreover, the total length of each edge **46** is increased by use of the corrugations **44**.

In certain instances it may be desirable to remove the spreader fins **24** and attach an enclosed delivery tube (not shown) or the like to the discharge of housing **20** in order to accumulate the chopped residue rather than spread the latter on the ground. In this event, the vanes **48** provided on certain of the elements **32** are particularly beneficial in creating a residue-carrying current of air flowing from the outlet of hood **12**, through the housing discharge **20** and into the delivery tube. This assures that the chopped residue issues from discharge **20** with sufficient velocity to be carried through the tube and thereby eliminates the need for an auxiliary blower attachment. It has been found, for example, that if nine blades **32** (three at each end and three at the center of the rotor **10**) are provided with vanes **48**, such is normally quite adequate.

The special saddle-like construction of the element mounting structure **34** along axle **26** assures that the elements **32** are rigidly and safely secured to hub **30**. This manner of construction increases the stability of rotor **10** during rotation and resists shock-loads on the chopping mechanism which may occur when slugs or solid objects are encountered during chopping. Further, the aligned legs **56** of the saddles **52** serve to rebound and deflect residue which tends to pass through housing **20** near hub **30**, thereby assuring that the residue is properly chopped by impact and between the corrugated body portions **36** of elements **32** and the concaves **22**.

Centrifugal forces acting on the blades **32** will not pull the structures off the hub **30** nor will they be torn loose from the hub **30** by the impact on the material being chopped. Individual mounts **34** permit attachment of the blades **32** to the hub **30** in any desired random location without need for exact alignment by any series or row of bolts **58**. Bushings **60**, bolts **58** and blades **32** may be easily and quickly replaced individually without need for taking entire assemblies apart each time that but a few small parts require replacement. Damage to any certain blade **32** or its mount **34** by rocks and the like in the residue will not necessarily damage other components as has been the problem in prior chopping units now in common use.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a residue chopping rotor provided with an axle mounted for rotation about its longitudinal axis, a plurality of elongated, individual chopping plates, each having an inner end, an outer end, a leading impact edge and a trailing edge opposed to the leading edge, said edges extending between said ends, and structure pivotally securing the plates adjacent their respective inner ends to the axle for individual, edgewise swinging movement about axes in spaced parallelism to the axis of rotation of the axle, wherein the improvement comprises:

providing each plate with a corrugated, relatively thin, sheet material body having a number of alternately concave and convex corrugations extending laterally of the plate from said leading edge toward said trailing edge and transversely of a radius from the pivotal axis of the plate to its outer end, at least said leading edge of each plate being undulated and having an increased length and an increased effective residue-engaging width that is substantially greater than the thickness of said material, said edge extending from the convex side of one corrugation to the opposed convex side of an adjacent corrugation, and

spacing said plates along the axle so that, as the axle is rotated, each plate has the full length and the full, effective width of said leading edge of the body effecting an edgewise chop of residue presented to the rotor while the corrugations, in trailing relationship to said leading impact edge, pass through the residue, to thereby thoroughly disintegrate the latter.

2. The invention of claim 1, wherein said corrugations of each plate are substantially parallel with one another and with said outer end of the plate.

3. The invention of claim 1, wherein a number of said plates are each provided with a vane intermediate the inner and outer ends thereof for creating a residue-carrying current of air when the axle is rotated.

4. The invention of claim 1, wherein said corrugations are elongated, the outermost corrugation of the body having a longitudinal terminus that defines said outer end of said plate.

5. The invention of claim 1, wherein each plate is provided with a shank intermediate said body of the plate and said inner end thereof, the outer end of said shank merging with the innermost corrugation of the body.

6. The invention of claim 5, wherein a number of said plates are each provided with a vane secured to the trailing edge of the plate extending from the outer end of the plate to the shank thereof for creating a residue-carrying current of air when the axle is rotated.

7. The invention of claim 3, wherein each of said vanes is mounted on said trailing edge of its plate projecting outwardly from the plane of the plate.

8. The invention of claim 7, wherein each vane extends outwardly in opposite directions from the plane of its plate.

9. In a residue chopping rotor:

a rotatably mounted axle;

a plurality of individual chopping plates each having an inner and an outer end, and a pair of opposed, normally leading and trailing edges extending between said ends;

means mounting said plates adjacent their respective inner ends on the axle at spaced locations therealong for edgewise rotation with the axle to thereby impart an edgewise chop to residue presented to the rotor when the latter is rotated; and

an airflow-producing vane on one or more of said plates mounted on said trailing edge thereof and extending outwardly from the plane of the plate to impinge air otherwise slipping past the edgewise rotating plates.

10. In a rotor as claimed in claim 9, wherein each vane projects outwardly in opposite directions from the plane of its plate.

11. In a rotor as claimed in claim 9, wherein each vane is elongated and planar in configuration extending along said trailing edge of its plate from said outer end thereof toward said inner end thereof.

12. In a rotor as claimed in claim 9, wherein each of said plates is corrugated laterally from the leading edge toward said trailing edge rendering said leading edge undulated.

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