June 1, 1943. H. MAGINN 2,320,944

SEPARATOR CYLINDER

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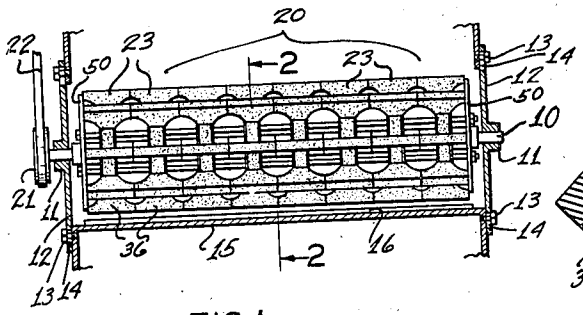


FIG.1.

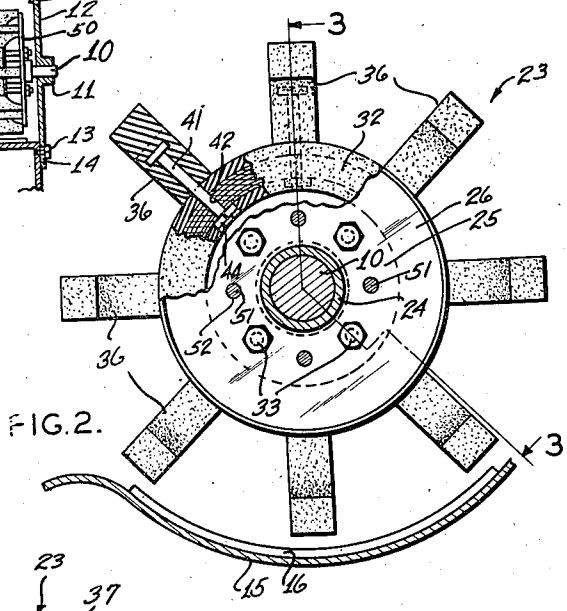


FIG.2.

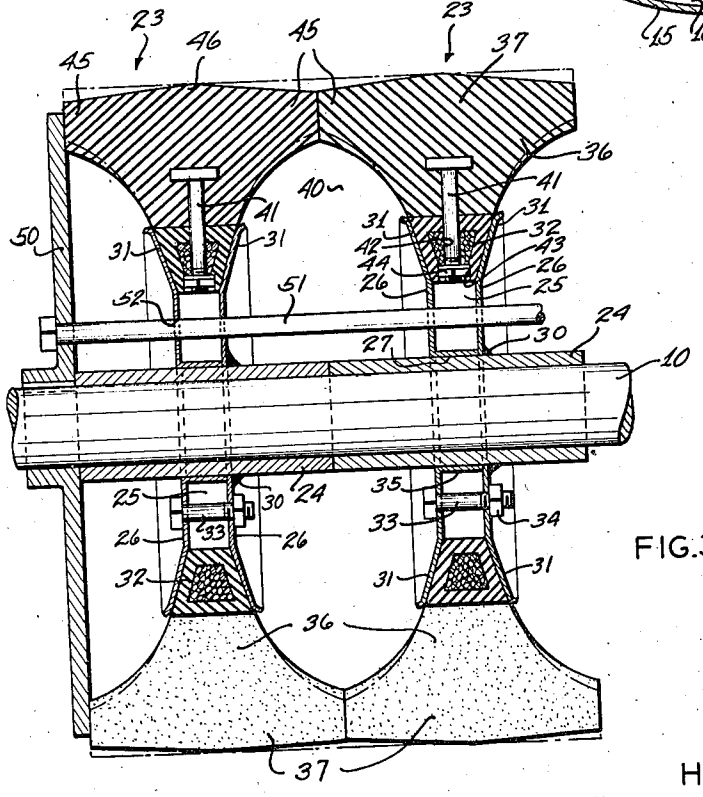


FIG.3.

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SEPARATOR CYLINDER

Harold Maginn, Waverly, Ill.

Application May 21, 1941, Serial No. 394,454

17 Claims. (Cl. 130—27)

This invention relates to improvements in separator cylinders, and more particularly to an improved threshing cylinder of rotary type, built up of horizontally stacked, separately constructed units which coact in assembly, to form a bar-type threshing cylinder.

The present application constitutes a continuation of a co-pending application of this applicant, bearing Serial No. 259,089, filed March 1, 1939, and entitled "Threshing cylinder assembly," now Patent 2,265,380, dated December 9, 1941. The present application covers certain modifications of the structure disclosed in Serial No. 259,089. Attention is also directed to a companion application of this applicant, filed concurrently herewith, covering certain generally similar improvements and bearing Serial No. 394,455, filed May 21, 1941.

Among the more important objects of the present invention may be noted the prevention or minimization of damage to the threshed grain or seed, such as has heretofore resulted from the use of metal, or metal-backed threshing elements. This object is attained in what may be termed a softer threshing action in removal of the hull, straw or stalk portions of grain or seed crops, and the isolation of the grain or seed, with a minimum of crushing or otherwise damaging action thereon.

Expressed in terms of structure, the present invention serves to attain all of the several objects stated in connection with the aforesaid copending application, and in addition results in a lower cost threshing cylinder of built-up type, having all of the advantages of resilient beater elements or flailing members, and yet which serves markedly to reduce the fixed charges for mold equipment and other production tooling, in comparison even with cylinder structures heretofore evolved and disclosed by this applicant.

A still further object of the invention is attained in an improved combination of a plurality of cylinder-forming units, so built up that a plurality of individual flailing or beater elements are each detachably secured in assembly peripherally of the unit, and hence in the cylinder. In the event of damage, as by impact of stones or other unyielding objects in the cylinder casing, the improved arrangement enables individual replacement of any damaged or worn beater elements.

Yet another object of the invention is attained in a novel form of attachment of an angularly related group of flailing or beater elements, in frictionally retained assembly to a spider element of an individual unit, the stacked plurality of which units collectively constitutes a bar-type separator cylinder. The arrangement referred to in this object enables, under all ordinary operating conditions, a positive propulsion or rotation of the grain-engaging beaters, and yet enables in the event of extreme impact, the yieldable displacement of the group of threshing bar sections thus affected, and so prevents irreparable damage to any part of the structure except the beaters and possibly the immediate beater-supporting agencies.

Yet another object of the invention is attained in an improved cylinder construction comprised of sectional units, the several units being susceptible of construction at low cost, of standard stock materials, and with readily individually replaceable, resilient grain-engaging elements.

The foregoing and numerous other objects will more clearly appear from the following detailed description of a presently preferred embodiment of the invention, when considered in connection with the accompanying drawing, in which:

Fig. 1 is a sectional elevation in an axial plane, of a separator cylinder of bar type, together with portions of the cylinder casing, and a portion of the concave; Fig. 2 is a somewhat enlarged transverse sectional elevation, partly in section, as viewed along line 2—2 of Fig. 1, and Fig. 3 is a fragmentary section through two adjacent units of the cylinder assembly, showing in section certain of the features of construction as viewed along line 3—3 of Fig. 2.

Reference characters are herein noted for correlation of the drawing and present description, the separator shown in assembly in Fig. 1, being built up of a plurality of individual units or sections horizontally stacked on a cylinder shaft 10, the ends of shaft 10 being journalled for rotation in bearing portions 11 of end plates 12. The latter are secured as by cap screws or bolts 13 extending through slots 14 in the casing or housing structure about the cylinder. The housing structure, not of itself material except in combination, is not shown in full, but a portion thereof consists of the concave or breast structure generally designated at 15. The provision of slotted openings 14 for screws 13, enables a reasonable adjustment in the spacing of the cylinder and concave as may at times be desirable for setting the apparatus to handle different products to be threshed, such as grains, grass crops or seed, beans, peas, and the many other products ordinarily recovered by separator or threshing action.

The bar elements or other coacting projections on the concave 15 which coact with the cylinder

in the threshing of grain or other products are not of themselves, material to the invention. One suitable form of the concave carried threshing elements consists of a series of biased, staggered bars 16, one of which appears in Fig. 2.

Rotation of the cylinder, generally indicated at 20, may be effected by any suitable form of drive, being herein shown for completeness as embodying a drive pulley 21 and a drive belt 22 which serves as a power takeoff from a suitable driving pulley (not shown). It may be noted as a preference, but by no means necessary, that the present improvements be embodied in a substantially high speed separator, the design illustrated being particularly suitable for threshers in which the cylinder rotates within a speed range of the order of 1300–1700 R. P. M. It will be apparent from this relatively high speed of operation, in comparison with older forms of threshing cylinders, that the provision of resilient beater arms or flailing elements, is of particular advantage in obviating both damage to the grain or seed, as well as any large scale damage to the rapidly rotating cylinder parts in the event of entrapment of hard foreign objects in the casing.

It may be further noted, solely for completeness, that a preferred arrangement of cylinder casing or housing is such that the material to be threshed is fed into an axially elongate opening (not shown) extending horizontally along one side of the cylinder casing, there being provided a similar companion opening at the opposite side of the casing from which the materials discharged by the cylinder are driven out of the casing structure, thence onto a straw rack or the like, as will be readily appreciated by those acquainted with the present art.

Each of the plurality of units collectively constituting the threshing portions of the present cylinder, is designated generally at 23. Each such unit, best shown in its detail in Figs. 2 and 3, includes, by preference, mounting sleeve 24 fitted over the shaft 10. Each of the sleeves 24 projects axially of the central portion of each unit to an extent such that each of the units, except those at the ends of the cylinder, has its sleeve 24 abutting at its opposite ends, the sleeves of the laterally adjacent, similar units as clearly appears in Fig. 3. Carried by each of the sleeves 24 is a wheel-like spider 25 comprised of a pair of spaced, opposed, similar plate-like or web elements 26. These are centrally apertured as at 27, and one of the elements 26 may be welded as indicated at 30, to the sleeve 24. As will be readily seen from Fig. 3, the peripheral portion of each of the webs or plates 26 is flared outwardly to provide an outwardly dished annular portion 31, the two webs 26 in each unit being assembled so that the flared portions 31 coact to provide a groove of substantially the sectional shape shown, the resultant grooved seat serving to receive and laterally snugly frictionally to engage a beater-supporting band 32, hereinafter described more in detail as to construction and purpose. One of the web or plate elements 26 being unsecured to the sleeve 24, may be assembled to the companion element 26 as by a plurality (shown as four) of assembly bolts 33 each provided with a nut 34. An inturned portion 35 on one of the webs or plates 26, serves to fit the spacing of the two elements 26 in assembly when the nuts 34 are taken up on bolts 33.

Referring further to the mounting band 32 for the beater elements or flailing members, this band is preferably of endless form and may be of the familiar or conventional V-belt stock, possessing some compressive and tensile resilience, the slope of the side walls of the band 32 approximating that of the portions 31 of the paired webs, so that normally the V-belt band 32 is snugly frictionally retained between the portions 31 and within the groove constituted thereby.

In the present example there are illustrated in each unit, eight individual beater or flailing elements constituting when substantially aligned in assembly, sections of the cylinder bars collectively formed thereby. Each of the arms or beater bars 36 is of generally T-shape when viewed in a plane parallel to the axis of rotation of the cylinder. Each of the elements 36 is preferably of a quite tough stock of rubber or rubberlike material of a type resistant to abrasion and yet possessing a distinct resilience under compression or impact. The stock of which the members 36 is composed is also of such resilience that, in the event any of the peripheral bar-forming sections or beaters, being the outer portions 37 of each of the members 36, encounters a hard unyielding object such as rock, in the cylinder casing, the extremities of the arm will yield and pass the object, rather than to break the arm. It is a preference in the present construction that the length, or dimension axially of the cylinder, of each of the bar-forming sections 37 of the arms 36, should approximate the length of the sleeve 24 of the unit. This results in a relation of the several units in the assembly such that the portions 37 preferably, but by no means necessarily, endwise abut the corresponding portions of adjacent units, and so that the portions 37 coact with the sleeves 24 in axially spacing the several units. It will be observed that the portions 37 and the sleeve 24 are considerably the widest portions of the units; hence in assembly there results a substantially free space 40 between adjacent units for the circulation of air. It will appear that the rotation of the cylinder itself, due to the centrifugal air-displacing action of the portions 37, will create a substantial air current when operating at high speeds, and if desired the air-displacing function of the cylinder may be augmented by a centrifugal or propeller type fan (not shown).

Assembly of each of the several beater elements 36 to the V-band 32, is preferably effected as by a special mounting bolt 41, individual to the connected beater. This bolt is conveniently vulcanized in place at the time of curing the element 36, so that the bolt is fixedly and positively secured in place in the bar-forming element. A substantial portion of the bolt 41 projects inwardly of the unit and exteriorly of the element 36, and there is provided therefor a suitable opening 42 in the V-band 32, and a somewhat larger recess, opening from the under surface of the V-band and indicated at 43, this recess serving as a socket for the nut 44 on the end of bolt 41. Thus it appears that, through the provision of bolt 41 and nut 44, each of the beater elements is individually attachable to, removable from, and replaceable on the band 32. It will have been noted as appears from Fig. 2, that a number of evenly spaced bolt apertures 42 are provided in each band 32, from which it results that the several beaters are evenly angularly spaced about and radially project from the mounting structure of the unit of which they form a part.

An important and valuable feature in the shaping of the beater elements 36, particularly the outer or bar-forming sections 37 thereof, appears in Fig. 3, wherein it will be noted that the

end portions 45 are, with the cylinder at rest, at a lesser radial distance from the axis of cylinder-shaft 10, than are the intermediate or central portions 46. This results in a crowned contouring of the beater bars, with the advantage that, when the cylinder is brought up to speed, the centrifugal effect upon the more remotely supported overhung portions 45, brings the latter to a radial level with the portions 46, thus resulting in a uniform separating action throughout the length of the cylinder and concave. But for this provision, where a sufficiently resilient stock is employed in the beater elements, the latter will, at speed, be likely to assume a hollowed or dished aspect, resulting in an unequal threshing action in different zones lengthwise of the assembly.

The procedure in assembling the elements 36 involves merely the insertion of the several bolts 41 in their respective openings 42, and application of the nuts 44. Then with the V band and bars assembled, the free web or plate 26 is removed from sleeve 24, the V band located in temporary position next to the flared flange 31 of the fixed web 26, the free web moved to final position wherein it is secured by bolts 33 and nuts 34 to complete the assembly of the unit.

The manner of assembly of the several units 23 to form the complete cylinder, is thought to have been fully apparent from the foregoing description of parts, but it may be noted that in building up the cylinder at the time of manufacture, or incident to service or replacement of parts therein, one of a pair of end plates 50, both of which are keyed to shaft 10, is abutted by the first unit, the successive and desired number of units, according to length of cylinder employed, then being inserted over the shaft 10, the second end plate 50 added to the shaft and keyed in place. Following this a plurality, at least a pair and preferably four tie rods as indicated at 51, are projected through the end plates 50 and the several spiders, and are provided with takeup nuts (not shown). It is further to be noted that each of the web or plate elements 26 of the pair thereof in each unit, is suitably apertured somewhat outwardly of the shaft 10 as shown at 52, to receive the tie rods in the number desired. The rods 51, it may be noted, serve not only the purpose of angularly tying together the several spiders of the individual units into an integral rotatable mass, but since it is often desirable to apply the present improvements to existing combines and separators, the stiffening effect of several of the tie rods 51, obviates the need for any change in size of original cylinder shaft. Otherwise expressed, the employment of the tie rods enables the use of a smaller shaft than would otherwise be necessary to avoid possible whip, shaft distortion or deflection of any form when operating at high speeds.

After the two end plates 50 are keyed to the shaft with the units 23 properly aligned and held between the plates as through the tie rod 51, the cylinder is assembled and ready for operative installation in the separator or combine.

The advantages in operation, of the present improvements, are thought to have been generally outlined from the foregoing description, but it may be noted that, particularly when threshing grain, beans or grass crops in localities characterized by rocky soils, in the event a stone or like object is encountered by one of the portions 37, the latter will be sufficiently deflected to avoid damage thereto, and the collective action of the several resilient beater bars is such that any hard foreign object is usually passed through the separator without damage. However, in the case of unusually large and hard objects in the separator casing, extreme impacts can, because of present construction, serve angularly to displace the group of beaters of the one or more units encountering the object. This is possible because of the frictional retention of the V-band 32 in its grooved seat in the spider, the frictional relation between band and seat being normally such as to preserve the assembled relation of the beaters of the several units, even under the heaviest possible loading of grain.

The compressive resilience and susceptibility to deformation of each of the portions 37 of the beater elements is such as to produce a relatively gentle rubbing action on the grain or grass crop, rather than the more usual impact or striking effect, familiar to users of bar-type cylinders provided with metal bars or metal backed rubber elements which extend the full length of the cylinder. There results from this relatively gentle or softer threshing action, a virtually full recovery of undamaged grain, seed or beans.

Although the invention has been described by making specific reference to a selected exemplary embodiment, the details of description are to be understood solely in an informative and not in a restrictive sense, due to the many changes possible in the parts as well as in their combinations and relations within the intended scope of the appended claims.

I claim as my invention:

1. A threshing assembly for grain and the like, including a rotary threshing cylinder and a stationary concave structure coacting therewith, the cylinder including a shaft, a plurality of wheel-like spider elements, horizontally stacked along the shaft, a plurality of bar assemblies, each such assembly being attached to one of the spiders, and carried solely thereby, each bar assembly consisting of a plurality of resilient beater arms, means for assembling the beater arms in angularly displaceable relation on the spider by which they are carried, and means, arranged radially outwardly of the shaft, for assembling the spiders together and retaining them against relative angular displacement.

2. In a grain separator cylinder, a stationary concave, a rotary cylinder coacting with the concave in the threshing process, the cylinder including a shaft, a plurality of spiders carried by the shaft, a plurality of angularly spaced separator bar elements on each spider, a band frictionally engaging each of the spiders, a grooved seat for the band formed on each spider, a plurality of securing elements projecting through the band and into each said bar element in such manner that the separator bar elements are fixed in position on the band, the band being normally positively driven by the spider, and frictionally retained in the grooved seat in a manner to permit angular displacement of the band and connected bar elements in response to extreme impacts on the bar elements.

3. In a grain separator cylinder adapted to cooperate with a concave in threshing, a cylinder shaft, an assembly of axially stacked spiders on the shaft, a plurality of angularly spaced beater elements associated with each spider, the beater elements being of a resilent material in their grain-engaging portions, a mounting band on each spider for the beater elements, a series of bolts projecting depthwise through and radially

outwardly of the band each into the body of one of the beater elements, and means forming a grooved seat for the band on each spider.

4. The combination and arrangement of parts as recited by claim 3, further characterized in that the band is of V-type belt stock and the grooved spider seat for the band conforming substantially in sectional contour to that of the belt stock, whereby the band and bars connected thereto are frictionally retained on the spider against angular displacement thereon.

5. A threshing cylinder adapted to coact with a stationary concave in the threshing of grain or the like, the cylinder including a plurality of peripheral beater bars, each of said bars being formed of a plurality of axially aligned individually mounted resilient sections, each section being fastened intermediately of its length to a bar-supporting element of the cylinder and having its ends free, the peripheral surface of each of said sections being of greater radius in its intermediate portion than at its free ends.

6. In a cylinder adapted for use with a stationary concave in the threshing of grain or the like, a cylinder shaft, a plurality of beater-supporting spiders on the shaft, a sleeve for each spider projecting laterally of the opposite sides thereof, whereby the sleeves serve as spacers between the spiders in assembly on the shaft, each spider being formed of spaced coacting web elements detachably secured together, and each flared at its periphery so that the web elements constitute a seating groove for a V-type band, a V-type band in said groove, a plurality of rubber beater arms, a bolt in each arm projecting depthwise through the V-type band, the spiders, bands and beater arms being assembled so that the arms are normally in substantial alignment and coact to form the separator bars of the cylinder, the spiders being provided with rod apertures outwardly of the shaft, and a plurality of tie rods extending through the several spiders.

7. In a thresher for grain and the like, and including a separator casing and concave structure, a bar-type separator cylinder assembly including a shaft, a plurality of wheel-like units mounted in lateral adjacence on the shaft, said units having a plurality of resilient arms projecting radially and transversely of each of said units, means by which the resilient arms are individually detachably assembled in the unit, and means whereby the assembly of arms in each unit is normally frictionally retained against angular displacement with respect to other units, yet frictionally yieldable under extreme impacts, the units being assembled on the shaft with the arms of the several units normally and substantially in end-to-end relation so that the arms collectively form the bars of the cylinder assembly.

8. In a grain separator including a concave and separator casing, a cylinder assembly of bar type, including a rotatable shaft, a plurality of units of generally disc form mounted on the shaft, each of said units being provided with a plurality of resilient deformable beater arms, each arm being of a generally T-shape and projecting radially and laterally of the unit of which it forms a part, the peripheral portions of the arms coacting in assembly to constitute cylinder bars, the T-shaping of the individual arms resulting in a length of arm, axially of the unit, such that each arm projects beyond the arm-supporting portion of the unit, and the units being so assembled that the arms of adjacent units substantially abut and serve as spacers for the units in assembly, means forming a common resilient support for the arms of each unit, and means for mounting said support in the unit so that the group of arms therein is yieldably displaceable about the shaft in the event of extreme impact on the arms.

9. In a thresher for separating grain and the like, a concave and a cylinder assembly rotatably mounted adjacent thereto, said cylinder assembly including a spider having a recessed annular seat, a band mounted in the seat and frictionally engaging the spider, and a plurality of projecting arms secured to the band in substantially evenly spaced relation therearound, the outer extremities of the arms being formed to provide beater elements and the band, supporting the arms, being formed to fit relatively snugly, yet in angularly displaceable relation in said seat.

10. In a thresher for separating grain and the like, a stationary structure and a rotary flailing assembly mounted to coact with the structure, said assembly including a spider and projecting beaters mounted on the spider, and means having connection with the beaters and interfitting with the spider by which the beaters are normally frictionally driven by the spider and by which the beaters, under severe thrusts, can be displaced angularly about the spider, axial displacement of the beaters during angular displacement thereof being limited by said interfitting of the drive means and the spider.

11. In a rotatable cylinder for coacting with a stationary structure in the threshing of grain and the like, a spider, a threshing bar assembly, and means by which the assembly is frictionally driven by and yieldably mounted on the spider for angular movement thereabout incident to extreme impacts and thrusts on the threshing bar assembly, said means including means for limiting axial displacement of the assembly on the spider.

12. In a thresher for separating grain and the like, a concave and a cylinder assembly rotatably mounted adjacent thereto, said cylinder assembly including rotatable supporting means and a plurality of beater bar units frictionally mounted on said means, each beater bar unit, under extreme impact or thrust, being angularly yieldable for circumferential displacement about the supporting means relative to the other beater bar units.

13. In a thresher for separating grain and the like, a concave and a cylinder assembly rotatably mounted adjacent thereto, said cylinder assembly including a wheel comprising an annular band of modified V-shape in transverse section having a plurality of projecting beaters secured thereto, and a spider provided with a peripheral groove of a form laterally and frictionally to grip the band, said band being circumferentially shiftable in the groove upon the application of severe impacts or thrusts to the beaters and the V shape of the band providing for an increase in the grip of the spider on the band upon a normal increase in resistance to rotation of any of the beaters.

14. In a rotatable cylinder for coacting with a stationary structure in the threshing of grain and the like, a spider peripherally formed to provide an annular groove having confronting side walls, an endless band disposed in said groove for rotation with the spider, the band being frictionally engaged by the side walls only of the spider groove to provide for limited radial

shifting of the band in the groove, and a plurality of projecting beaters on the band.

15. In a rotatable cylinder for coacting with a stationary structure in the threshing of grain and the like, a spider, a band mounted on the spider, a series of bolts extending depthwise through and projecting radially from the band, and a plurality of angularly spaced beaters disposed about the spider and secured to the bolts, the grain engaging portions of the beaters being of resilient deformable composition.

16. A rotary beater wheel for grain separators and the like comprising a plurality of elongated, deformable and resilient beater elements of rubber or the like and rotatable means having connection with said beater elements only at a point or points spaced from at least one end of each element whereby at least one end of each beater element is supported cantilever fashion for yielding radial movement with respect to the rotational axis of said means, and each of the beater elements being crowned in a direction along its length to compensate for outward radial movement of the cantilever ends of the beaters produced by centrifugal forces upon rotation of the beater wheel.

17. In a rotary beater wheel for grain separators and the like, a spider by means of which the wheel is adapted for mounting on a shaft, a plurality of peripherally spaced beater arms, means seated on the spider for supporting the several beater arms, the outer portions of the beater arms being arranged to be yieldably deflected, as upon minor impact with foreign objects in the separator, and the beater arms and supporting means being arranged to yield by shifting movement of the mounting means angularly about the spider in response to major impacts against the beater arms, the spider including portions for limiting axial movement of the arms and mounting means.

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