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Brewer

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[54] **CUTTER AND SHEARING MECHANISM**

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[52] **U.S. Cl.** **241/32**, 241/191, 241/197, 241/298

[51] **Int. Cl.**.....**B02c 23/04**

[58] **Field of Search**.....241/32, 191, 197, 221, 294, 241/298, 300

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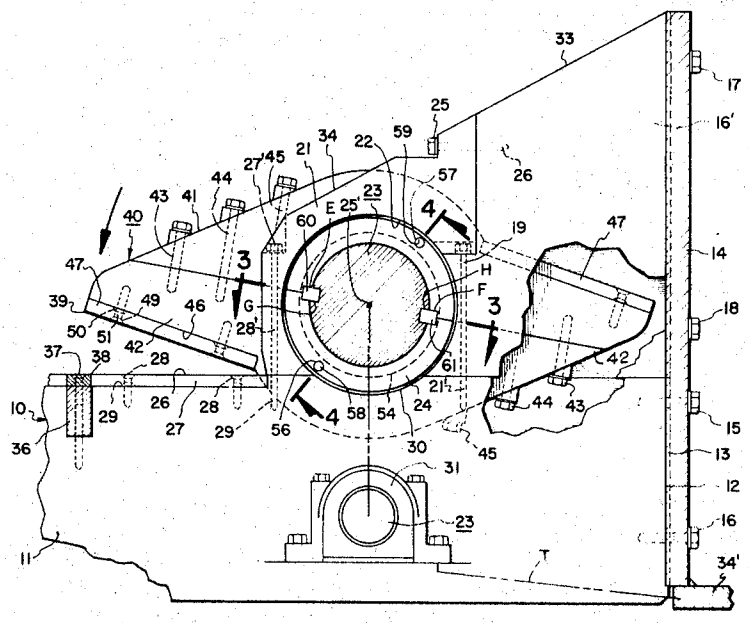
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[57] **ABSTRACT**

Cutting and shearing structure incorporating cutter blade structure which, upon pin release or failure, can be freed from shaft revolvement even though the shaft upon which it is mounted is still turning. This is preferably accomplished through a split blade construction mounted upon a hub which is keyed to a revolving shaft. The blade construction itself is connected by pin means, such as shear pins, to the hub. These shear pins are designed to break along their respective shear planes upon overloading the blade structure. Both cutter blade and cutter-bar structure includes replaceable and reversable, inter-cooperating cutting means. A multiple member, cutter bar — or stationary support structure — affords necessary rigidity as well as supplying direction of incoming materials to appropriate operative areas of the structure.

6 Claims, 5 Drawing Figures



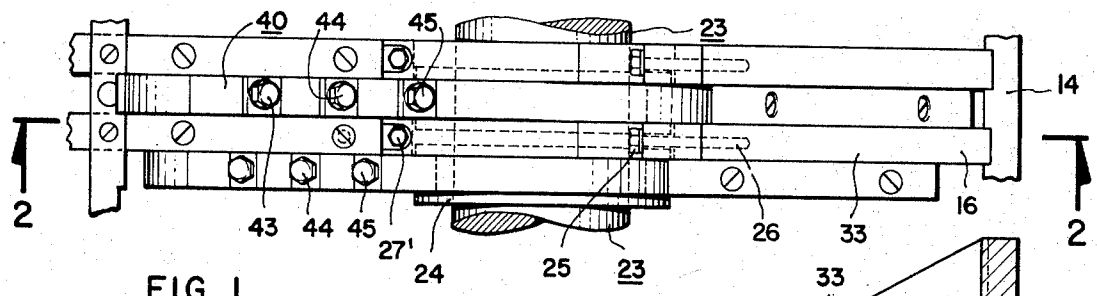


FIG. 1

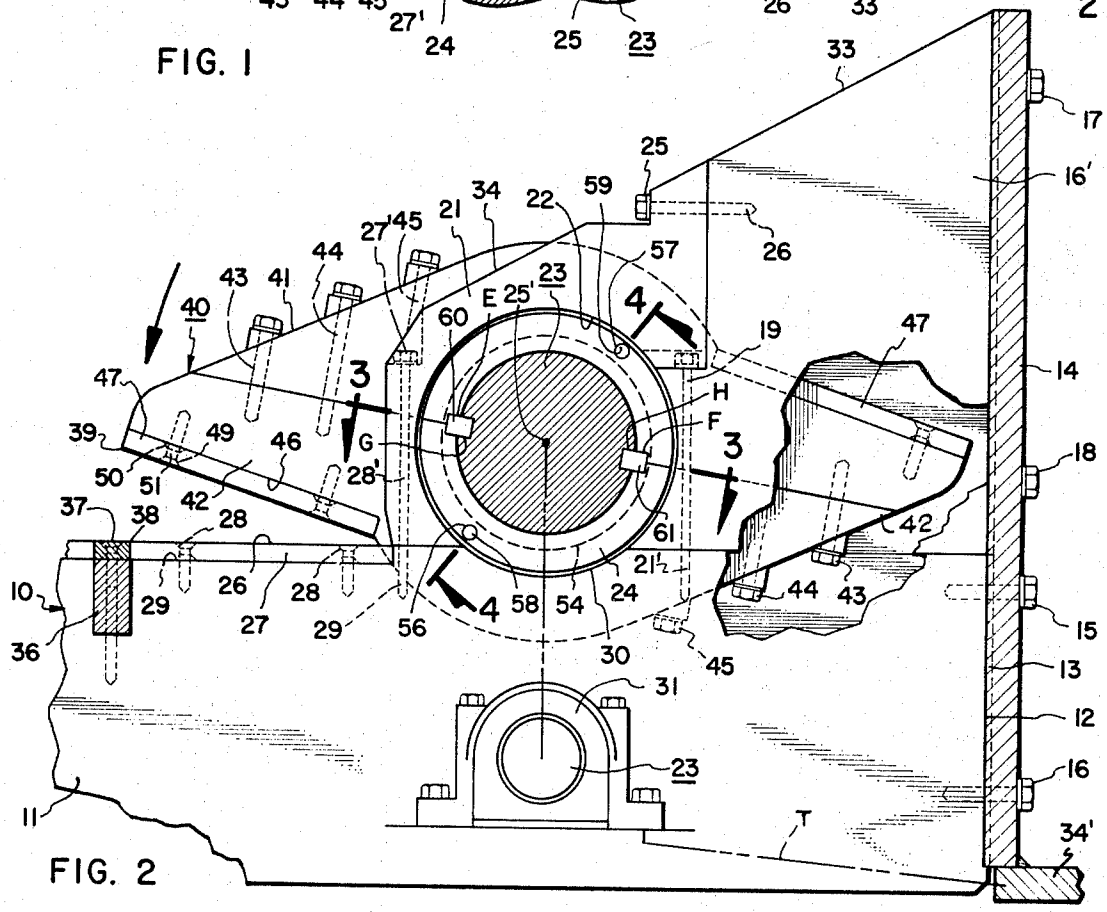


FIG. 2

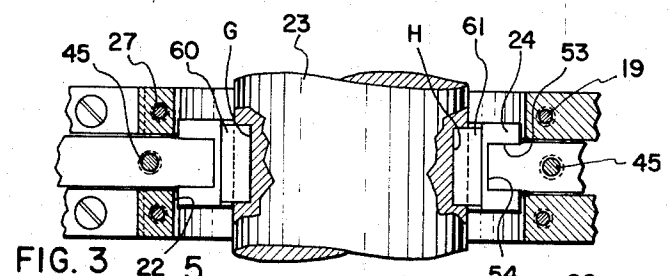


FIG. 3

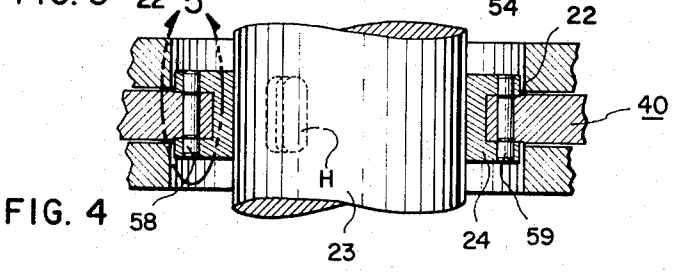


FIG. 4

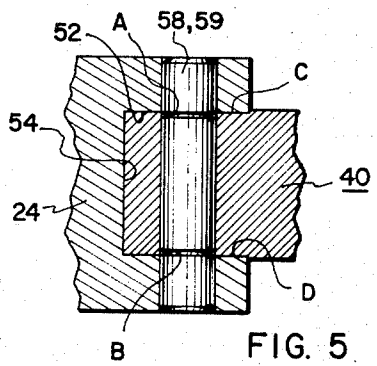


FIG. 5

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CUTTER AND SHEARING MECHANISM

The present invention relates to cutting and shearing mechanisms and, more particularly, to new and improved structure which affords a number of advantages both as to operation and maintenance.

Cutting or shearing structure, especially that used in the waste disposal industry, will include one or more cutter bars as well as one or more cutting blades cooperating therewith. The blades are mutually spaced upon a revolving shaft; thus, when the shaft revolves the cutter blade or blades descend to cooperatively coact with the cutter bars provided. This facilitates a sissor-type action so that material such as paper, municipal garbage, and so forth, may be sheared prior to subsequent processing. Prior structures have had measurable deficiencies, this owing primarily to lack of ease of maintenance. When the cutting edges of the equipment become dull, then there is, first, the problem of dis-assembling a major portion of the machine so that suitable blades and/or bars can replace the old ones. In the present invention, contrasting with prior structures, the revolving cutter blade mechanisms, as well as the stationary cutter bar structures, are provided with replaceable and reversible, preferably hardened steel segments. These are counterbored or counter-sunk on opposite sides, for attachment bolts or screws so that the segments can be independently reversed to provide new cutting edges for the equipment.

Further advantages in the present invention reside in a split construction for the blade such that opposite halves may be joined together conveniently and secured as by appropriate machine bolts.

Also, a problem has arisen heretofore, in connection with prior equipment, when one or more blades becomes overloaded, either due to lack of driving power or because a very hard object is present for cutting. In such event, the shaft or cutting equipment or journals themselves may be seriously damaged. This results in extensive expense for maintenance and/or replacement. The present invention avoids these prior difficulties by constructing the blade structure and shaft mount therefor such that the blade can be caused to slip upon pre-determined excess loading of the blade through the latter's inability to shear through the offending article. In a preferred construction, the revolving shaft is provided with one or more keyed hubs. The hubs, themselves, are pinned to the split-half blade assemblies. Such pinning is preferably accomplished through the use of shear pins. The shear pins themselves may be peripherally grooved so as to facilitate clean breaks or shear planes which are well defined and which will not mar or scratch either hub or blade assembly.

When overloading does occur, the shear pins will each shear in two mutually spaced planes so that the blade structure can slip freely around its hub relative to the shaft. Hence, the shaft is permitted to revolve until the end of a shift or other time when it becomes convenient for the users to check the equipment. At this time the blades can all be inspected and, should the shear pins of one blade assembly be in fact sheared, then the user can easily punch out the pieces of the broken shear pins and install new pins so that the blade structure may be again keyed to the shaft hub. If desired, of course, the hubs may be made integral with

the shaft. However, such is not desirable for optimum assembly and maintenance purposes. It is desired that the hubs, themselves, be keyed to the shaft at mutually spaced points, and the blade assemblies respectively pinned as by shear pins to the respective hubs in the manner hereinafter shown and described.

Accordingly, a principal object of the present invention is to provide new and improved cutting and/or shearing.

A further object of the invention is to provide cutting and shearing equipment wherein replaceable segments can be used to provide the cutting edges necessitated.

An additional object is to provide, in cutting and shearing equipment, hardened segments which are reversable relative to the seats to which they are releasably mounted.

An additional object is to provide stationary structural support for revolving cutters wherein such structural support affords the necessary rigidity, simplicity, and ease of construction, and also directivity such that incoming materials may be forwarded to advantageous areas in the equipment, for cutting purposes.

A further object of the invention is to provide improved cutting and shearing equipment wherein the revolvable shafts thereof are provided with suitably designed blade structures that are caused to slip upon overloading.

A further object is to provide a revolvable cutting equipment, blade structures held to their respective shaft mounts by pins, such as shear pins, which pins release upon an overloading present.

An additional object is to provide a revolving shaft provided with one or more hubs in cutting equipment, such hubs accommodating the shear pin mounting of blade structures, such that, upon shearing of such shear pins, the blade structures can be relieved so as to remain stationary despite continued shaft revolvement.

The features of the present invention may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a fragmentary top plan of a portion of cutting or shearing structure incorporating the principles of the present invention.

FIG. 2 is an enlarged fragmentary elevation, shown partially in section, and taken along the line 2—2 in FIG. 1.

FIG. 3 is an enlarged section, as shown in fragmentary view, and is taken along the line 3—3 in FIG. 2.

FIG. 4 is an enlarged fragmentary section taken along the line 4—4 in FIG. 2.

FIG. 5 is an enlarged fragmentary detail indicating the manner of connection of the rotating blade structure, as by shear pin means, to the hub of the revolving shaft.

In the drawings, see particularly FIG. 2, certain stationary structure designated as cutter-bar assembly **10** is shown to be provided with a cutter-bar base member **11**. The latter is keyed at its outer edge **12**, and its construction is typical at both sides, to a respective groove **13** of side support **14**. Securement bolts **15** and **16** may be provided to tighten the cutter-bar base member **11** securely to side support **14**. In a similar manner a cutter-bar side support **16'** is also provided and similarly secured to the side support groove hereinbe-

fore mentioned. Bolts 17 and 18, likewise are employed to secure the side support 16' in place as indicated in FIG. 2. For alignment as well as for securement purposes, bolt 19 is disposed through aperture 20 and cooperates with a tapped aperture 21' in cutter-bar base member 11 for additionally securing the cutter-bar side support 16' to the cutter-bar base member 11.

Likewise provided in the stationary structure is an enclosure member 21 having an arcuate interior surface 22 defining a relief area for shaft 23 with its hub 24. This structure will be more fully explained hereinafter. In returning to the enclosure member 21, it is seen that the same is secured by bolt 25 to a drilled and tapped aperture 26 disposed in cutter-bar side support 16'. In the same fashion, a bolt 27' is disposed through its aperture 28' into drilled and tapped aperture 29' of cutter-bar base member 11.

The shaft 23 may be journaled to the stationary assembly 10 or, as shown, and as is preferable, the latter may simply afford a relief area such that the axis 25' of shaft 23 can be disposed closely to the horizontal plane of the upper surface 26 of cutter-bar segment 27.

To effect proper maintenance, the cutter-bar segment 27 is preferably made of hardened steel and is counter-bored or preferably counter-sunk on opposite sides at 28 and 29 at each of two or more places, so that the cutter-bar segments may be selectively reversed. This affords the practical advantage of being able to have a reversable cutter-bar insert or segment which can be periodically reversed or replaced so that a sharp cutter-bar edge can be preserved for the cutter-blade assembly.

The relief area at 30, again, accommodates both the hub 24 and shaft 23 so that a sufficient relief area is provided.

Suitable bearing means 31 will be provided the shaft 23 and mounted or otherwise tied, as indicated by phantom line T, to base support 34', such that the combination of the over-all stationary structure, with the journal shaft and its knife or knives disposed thereon, may act in concert in shearing or cutting materials introduced in proximity of the combination.

Beveled edges 33 and 34 ideally serve as a means whereby introduced debris or other matter to be cut, and disposed between adjacent cutter blades, may slide down such compound beveled surface so that the material falls or is deflected into the area of the cutting activity of the structure.

When desired, a transverse cutter-bar 36 may be secured as by a counter-sunk bolt 37 to cutter-bar base member 11. This would provide a sharp edge at 38 for co-action with tip 39 of the cutter blade mechanism.

The cutter blade 40, itself, is made up of a pair of opposite cutter blade halves 41 and 42, which are bolted together by a succession of bolts 43, 44 and 45, at each of two places, respectively.

The blade is thickened about the hub 24 to provide for strength. A seat 46 is supplied each of the congruent cutter blade halves for accommodating the reversable mounting of cutter-blade segments 47. As with the cutter-bar segments, the cutter-blade segments 47 are preferably made of hardened steel, are reversable, and have counter-bore or counter-sunk portions at 49 and 50 to accommodate reversability. Machine screws 51 accommodate securement of the cutter-blade segments at each of two places, as shown, to their respective seats.

Of special importance is the provision of hub 24 which, as indicated in the drawings, particularly FIGS. 2–4, resembles a thickened washer having an outer central peripheral groove 52. The base 54 of the groove is shown in dotted-line configuration in FIG. 2.

It is to be noted that the cutter-blade assembly is of two-piece or split construction. Thus, the cutter-blades are mounted together by their bolts at 43–45, only after the blades are positioned about the shaft hub 24.

The combination of the hub and the cutter-blade halves are line-drilled at 56 and 57 to accommodate the placement therethrough of shear pins 58 and 59. These shear pins, themselves, are grooved at A and B, as indicated in FIG. 5, so that a clean shear surface will be presented to the junctures C and D of blade 40 and hub 24, such that the former may freely revolve about the latter without chance of scoring the surfaces forming junctures C and D.

The hub 24, itself, is keyed by means of keys 60 and 61 to shaft 23. This obtains by virtue of hub key-slots E and F, as well as shaft key-slots G and H.

Accordingly, let it be assumed that plural blade assemblies are spacedly mounted upon the shaft 23 as seen in FIG. 1. Assume, further, that the shaft 23 is externally driven, and that the shaft is supported at opposite ends by bearings 31 mounted to fixed structure tied to base support 34'.

The blade assemblies keyed to shaft 23 will revolve in a counter-clockwise direction relative to FIG. 2 so that material sliding down compound angulated surfaces 33 and 34, and otherwise dropping into a hopper in which the shreading structure is disposed, will fall into an area proximate the respective cutter-bar segments 27. A shearing or cutting of such material is effected by virtue of the close proximity of the cutter blade segments 47 as the same operatively co-act with, and pass the cutter-bar segments 27.

It is noted that cutting is accomplished each half cycle of the shaft for each individual blade, because cutter blade segments are disposed 180° apart on each blade construction; where the blades are staggered in a helical pattern, then an essentially continuous cutting operation can be effected.

Let it be assumed that a hardened steel, or other hard object, fall into the hopper containing the subject mechanism as shown in FIG. 2, and that such hardened object is disposed between one or more cutter blade segments and their respective cutter bar segments. In such event, let it be assumed that the structural strength of the facility and/or the shaft driving source, will not permit a shearing or cutting of such material. In such event, damage is likely to result unless the blade or blades affected can in some way be caused to turn freely. This is accomplished in the present invention by the provision of shear pins 59 and 58 and their co-action as between the individual blade assembly affected and hub 24. Thus, overloading will prompt a shearing of the shear pins, see again FIG. 5, proximate the peripheral grooves of the shear pins so that once these pins are sheared then the blade structure can be made stationary, i.e., the hub and shaft can continue to revolve, and such condition will remain until the operator desires to shut down the equipment at the end of the

shift, by way of example. At this point the affecting object in the hopper can be removed, the old shear pins segments punched out and new shear pins installed, so that for a subsequent shift all blades will be operative.

Such a structural technique prevents the necessity of having dual equipment installations, or chancing shut downs during shifts so as to repair or otherwise maintain the equipment.

Thus, the shear pins afford a blade release when over-loading present would otherwise damage or interfere with the operation of the equipment. This is a most important feature.

Note is to be made that the shear pin axes are preferably parallel to the axis of the shaft rotation; thus, the hub can remain keyed to the shaft and be operative therewith without affecting the release of the blade structure. Correspondingly, release of such blade structure, as through a shearing of its pins relative to the hub, will not chance to score either the hub or damage the shaft or its bearing supports.

What is provided, hence, is new and improved cutting or shearing structure having reversible and replacible cutter blade and cutter bar segments, a split-blade construction comprising identical blade halves and facilitating ease of installation, and, most important, a shear or other pin-type release whereby to permit a blade structure, which is temporarily overloaded, to be freed from rotative movement by virtue of the revolvement of the shaft upon which it is mounted. Thus, the shaft can turn freely within an affected blade structure, and the blade remains stationary, so that any interferring materials underneath such blade structure can be removed and the blade structure mounting serviced only after a shift has been completed, or other convenient time for such maintenance. It is to be noted that the maintenance is extremely simple and that the pins need only be conveniently replaced for the blade structure to be fixed for rotation with the shaft upon which it is mounted.

While particular embodiments of the particular invention have been shown and described, it will be obvious to those skilled in the art the various changes and modifications which may be made without departing from the essential features of the present invention and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. In combination, a revolvable shaft, a split hub positioned medially upon and keyed to said shaft for revolvement therewith, split blade means mounted to an circumscribing said hub and constructed for securing said hub together and for revolvement upon said hub and pins means for releasably securing said blade means to said hub for operative revolvement therewith, said pin means being constructed for release upon the presence of a pre-determined overload relative to said blade means.

2. In combination, a shaft; hub means keyed to said shaft, comprising opposite halves, and provided with a central peripheral groove; blade means seated within said groove and dimensioned for securing said opposite halves of said hub means together in mutual abutment; and shear pin means pinning said blade means to said hub.

3. Structure according to claim 2 wherein said shear pin means are oriented parallel to said shaft and are provided with annular grooves aligned with the side junctures of said blade means with said hub.

4. Structure according to claim 2 wherein said blade means comprises essentially identical opposite halves, and means for securing said opposite halves together to encompass said shaft.

5. Structure according to claim 4 wherein said blade means includes oppositely facing, oppositely extending cutting means.

6. Structure according to claim 2 wherein said opposite halves of said hub means each include opposite-end key-receiving recess means for facilitating the keying of said hub means to said shaft.

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