

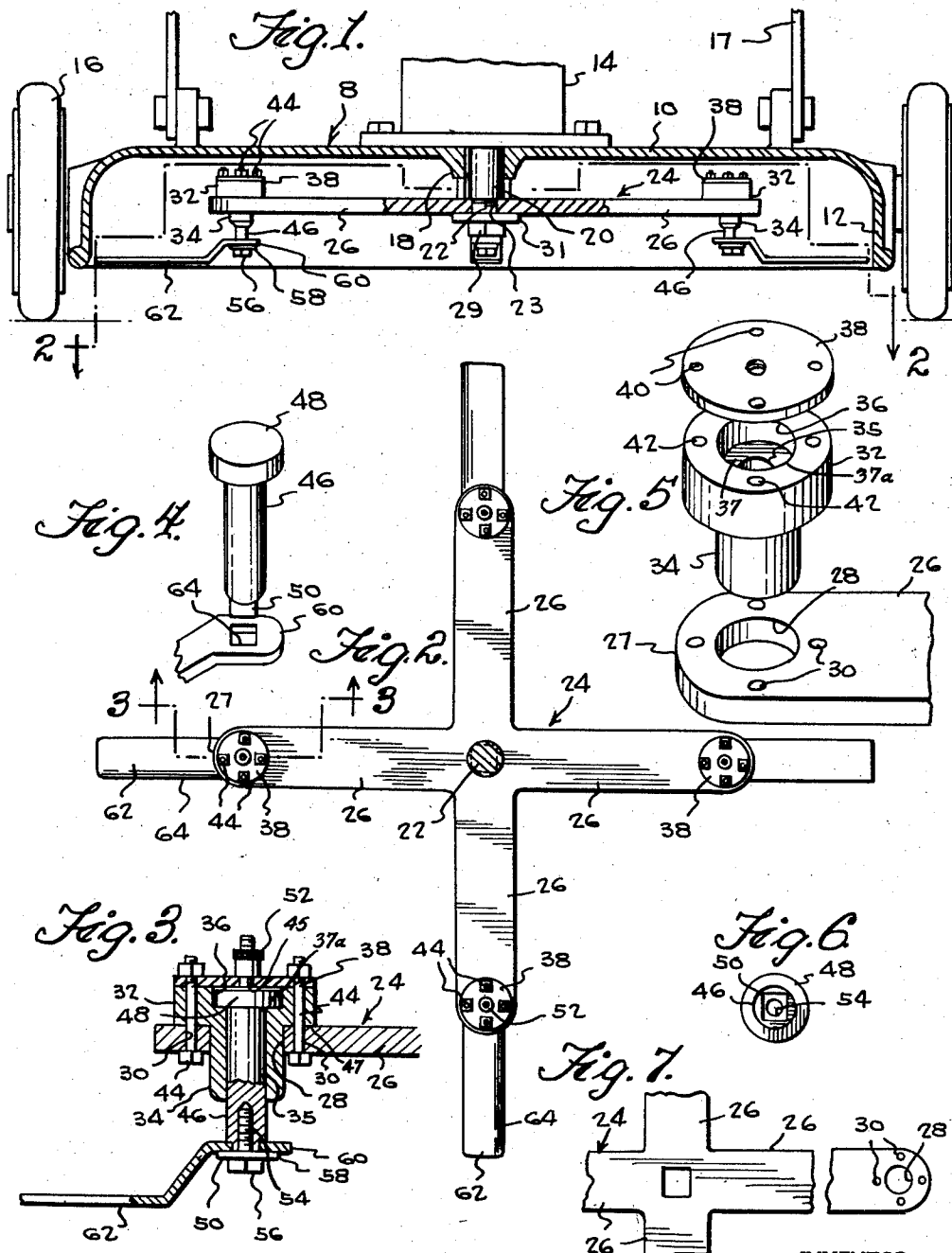
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FLOATING KNIFE UNIT FOR ROTARY CUTTING MACHINES

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FLOATING KNIFE UNIT FOR ROTARY CUTTING MACHINES

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4 Claims. (Cl. 56—295)

This invention relates to rotary cutting machines, such as rotary lawn mowers of the type having a vertically disposed drive shaft extending downwardly within a housing and adapted to rotate a cutting blade assembly.

Heretofore, the general practice in the construction of rotary cutting machines of the character described has been to utilize entirely rigidly constituted cutting blades, that is, cutting blades that have not had any flexibility whatever fully from the axis of rotation thereof to their tips. As a result, should the blade strike an unyielding obstruction such as a rock embedded in the soil, the blade may be seriously dulled or damaged. Further, in such cases, if the rock or stone is loose, it may be thrown laterally at high speed by the cutting blade, in a manner that might tend to injure one standing nearby. Still further, a conventional blade tends to clog up with grass and other fine material. Yet another disadvantage noted in connection with conventional blade assembly design has been the fact that although the blades cut only at the tips, they are one-piece members, most usually, making inadvisable the construction of the same from relatively high-priced, tempered steel, even though tempered steel is obviously desired since it tends to retain its cutting edge longer.

The main object of the present invention is to provide a cutting blade assembly for rotary machines which will have none of the disadvantages noted above. In this connection, the cutting assembly of the invention includes a plurality of arms radiating from the drive shaft, on the outer ends of which are pivotally mounted the cutting blades. The cutting blades tend to swing outwardly to positions to which they are extended radially of the axis of rotation of the cutting blade assembly by centrifugal action. In this connection, while this arrangement is not new in and of itself, it is proposed in carrying out the invention to provide an improved connection between the pivoted blade and the associated support arm.

More specifically, it is an object of the present invention to incorporate, in the connection, means that will offset the cutting blade downwardly a substantial distance from the plane of rotation of the associated support arm, so that the cutting blade can extend close to the ground while the arm will be disposed at a substantial elevation above the ground, where it cannot strike obstructions.

Another specific object is to so form the connection as to facilitate lubrication thereof, with the arrangement being one which will insure, at all times, that the lubricant deposited in the connection will be used to its maximum advantage.

A further object is to provide a connection of the character described wherein the bearing means carrying the centrifugally swinging blade will be securely affixed to the support arm, but will nevertheless be designed for swift and easy detachment from the support arm, in the event the structure needs maintenance or repair or replacement of parts.

A further object is to associate, with the centrifugal

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blade, a rotary, vertically disposed stub shaft which will be held against axial displacement by means of a particular formation of the shaft and by means of a novelly designed and arranged cover plate of the bearing, the means that holds the bearing to the support arm being designed to also hold the cover plate on the bearing body, so that all parts will be automatically disassembled when the bearing is detached from the support arm.

Still another object is to provide, on the support arm or propeller means, rounded ends designed particularly to prevent hooking of the same on objects, with said rounded arms further being designed to produce a tendency to impel the mower rearwardly after the knives or cutting blades swing back, thus to cause less breakage of shafts and to reduce other types of damage.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawing, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a sectional view diametrically through a rotary lawn mower, showing the cutting blade assembly constituting the present invention;

Figure 2 is a plan sectional view substantially on line 2—2 of Figure 1;

Figure 3 is an enlarged, detail sectional view substantially on line 3—3 of Figure 2;

Figure 4 is an enlarged, fragmentary, exploded perspective view of one of the cutting blades or knives and its associated stub shaft;

Figure 5 is an enlarged, exploded perspective view showing the bearing;

Figure 6 is a bottom plan view of one of the stub shafts, per se; and

Figure 7 is a fragmentary top plan view of the propeller or support arm means, on the same scale as Figure 2, shown per se.

Referring to the drawing in detail, designated generally at 8 is a rotary cutting machine which in the present instance constitutes a rotary lawn mower. Of course, the invention can be applied to other types of cutting machines, though as will be apparent it would probably have its main application to rotary lawn mowers.

In any event, in the illustrated example the mower includes a downwardly opening, generally flat housing 10 integrally formed at its periphery with a depending guard flange 12. A conventional internal combustion engine or electric motor 14 is mounted upon the housing 10, centrally thereof, and rollably supporting the housing are ground wheels 16. A handle 17 is pivotally connected to the housing, in the usual manner. This, in and of itself, is conventional construction, and does not, per se, constitute part of the present invention.

In accordance with the invention, housing 10 is centrally formed with a hub or boss 18, in which is rotatable a drive shaft 20 of motor 14 that extends vertically downwardly within the housing and has, at its lower end, a reduced, non-circular, axial extension 22 engaging in a mating opening 23 of the propeller assembly generally designated 24, which rotates in a horizontal plane. Assembly 24 is of one-piece construction in the present case, and is of cruciform shape, including a plurality of radially extending, flat, wide arms 26 angularly spaced 90 degrees apart about the axis of rotation of the same, said arms being formed with rounded ends 27 to insure to the maximum extent against the same becoming hooked on objects encountered during the mowing operation. The extension 22, below the plane of the arms 26, has a threaded projection extending downwardly in an axial direction, said projection receiving a nut 29 bearing against a washer 31 to hold the propeller assembly on the non-circular extension 22.

In the outer end portion of each arm 26 there is formed

a circular opening 28 about which smaller openings 30 are angularly spaced 90 degrees apart. A circular bearing block 32 has a reduced, axially extending lower end portion 34 the diameter of which is substantially equal to that of opening 28, said said extension projecting below arm 26 a substantial distance, as shown in Figure 3. In block 32, there is a shallow, circular, upwardly opening recess 36 communicating with an axial bore 35 that extends fully from the recess or counterbore 36 to the lower extremity of the axial projection 34. The provision of the recess or counterbore 36 defines a shoulder 37 facing upwardly and extending about the axial bore 35 so as to define an abutment 37a for a purpose to be made presently apparent. Shoulder 37 is wholly flat, and is continuous through the full circumference of the axial bore 35. A flat, circular cover plate 38 overlies the bearing block, and has openings 40 spaced about the margin thereof in registration with openings 42 of the bearing block, the openings 42 in turn being registered with openings 30, thus to permit connecting bolts 44 to be extended through the several registering openings. As will be noted from Figure 3, the cover plate 38 is spaced upwardly from and is parallel to the shoulder 37. The cover plate thus defines, in vertically spaced relation to the abutment 37a, a downwardly facing abutment 45. With further reference to the bearing block 32, this has a second shoulder 47. Shoulder 47 is of annular form, and is defined by the provision of a reduced, axially extending lower end portion 34 hereinbefore described. Shoulder 47 faces downwardly, and in use of the device, bears against the top surface of the blade support arm 26 throughout the area of arm 26 immediately surrounding end opening 28 thereof.

Removably, rotatably bearing in the bore 35 and counterbore 36 is a stub shaft 46 formed at its upper end with a flat, circular head 48 that seats in the counterbore to support the shaft against downward, axial movement. The cover plate 38 of course engages the stub shaft against endwise or axial displacement in an upward direction. The engagement of the stub shaft against upward, axial movement by cover plate 38 results from disposition of the abutment 45 defined by said cover plate in overlying relation to the head 48 of the stub shaft. At the same time, the stub shaft is limited against endwise or axial displacement in a downward direction by the upwardly facing shoulder 37, on which the head 48 seats, said shoulder 37 defining an upwardly facing abutment 37a which serves as the means limiting the head 48 against downward movement, viewing the same as in Figure 3. At its lower end, shaft 46 has a reduced, non-circular axial projection 50. A grease fitting 52 of the zerk type is mounted in a center opening of the cover plate 38, so that lubricant can be forced into the counterbore 36 to flow about the head 48 and shaft 46, whereby to maintain the shaft 46 properly lubricated for free rotational movement within the bore 35.

In the lower end of shaft 46 there is an axial, threaded recess 54, receiving a connecting screw 56 that bears against a washer 58, the washer in turn bearing against the upwardly offset inner end portion 60 of an elongated cutting blade or knife 62, the outer end of which is offset downwardly from the lower end of the shaft 46 as clearly shown in Figures 1 and 3. Thus, knife 62 and shaft 46 are caused to rotate as a unit upon the outer end of the support arm 26.

The knife 62 could be formed of a tempered steel or the like, so as to reduce sharpening to a minimum and as will be apparent, when the motor is placed in operation the support arms 26 are caused to rotate at a high speed so that the cutting blades swing outwardly into radial alignment with their associated support arms by centrifugal force. The leading edges of the cutting knives are sharpened, as shown at 64 in Figure 2, and in the event an obstruction is struck, the knives 62 will yield, swing-

ing backwardly to clear the obstruction. The arrangement has the further desirable characteristic that full lubrication of the pivotal connection between each knife and its associated support arm is assured. Still further, the rounded ends on the propeller or support arms 26 tend to impart rearward movement to the mower in the event an obstruction is struck, after the knives swing back, reducing the possibility of shaft breakage, etc.

Still further, the construction is designed to facilitate assembly or disassembly of the device. Merely by removal of the several connecting bolts 44, not only is the bearing block disengaged from the support arm 26, but also, the cover plate is free to be taken off, so that one need thereafter merely exert an upward pressure against the head of the screw 56 tending to shift the stub shaft upwardly so that the head 48 moves upwardly out of the counterbore 36, to facilitate cleaning of the counterbore and of the head 48 without effecting a complete disconnection of the blade 62 from the shaft 46. Of course, one can effect such complete disconnection merely by removal of the bolt 56.

A further desirable characteristic resides in the further provision of the elongated, depending stub shaft 46, which provides a highly effective pivotal connection having a maximum bearing area, so as to prevent binding of the knife 62 relative to the support arm during operation, the knife 62 being free to swing at all times relative to the support arm 26.

Yet another important feature resides in the fact that the means that prevents endwise displacement of the stub shaft 46 also serves to provide a lubricant cavity. In other words, the counterbore 36, receiving head 48, is covered by a plate 38 so as to define said lubricant cavity, and lubricant is free to flow about the head 48 to lubricate the shaft 46 within the bore 35.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. A bearing structure for use with a rotary lawn mower of the type that includes a blade support arm formed with an end opening, and that further includes a blade swinging on the arm to cutting position by centrifugal force, comprising: a bearing block adapted to seat in an end opening of a blade support arm of a rotary lawn mower; fastening elements extending through the block adapted for fixedly connecting the same to a blade support arm, said block having an axial bore and a counterbore at one end of the axial bore to define a shoulder extending about the axial bore; a stub shaft rotatable in the axial bore including at one end a head seating on said shoulder in the counterbore, the stub shaft at its other end projecting beyond the other end of the axial bore; a removable cover plate on the block overlying said head and cooperating with the shoulder in limiting the shaft against axial movement; and means disposed wholly exteriorly of the axial bore at said other end of the shaft, adapted for detachably connecting a centrifugally swinging cutting blade of a rotary lawn mower to the shaft.

2. A bearing structure for use with a rotary lawn mower of the type that includes a blade support arm formed with an end opening, and that further includes a blade swinging on the arm to cutting position by centrifugal force, comprising: a bearing block adapted to seat in an end opening of a blade support arm of a rotary lawn mower; fastening elements extending through the block adapted for fixedly connecting the same to a blade

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support arm, said block having an axial bore and having at one end of the axial bore a shoulder; a stub shaft rotating in the axial bore and including at one end a head seating on said shoulder, the stub shaft at its other end projecting beyond the other end of the axial bore; a removable cover plate secured to the block in position overlying said head and cooperating with the shoulder in limiting the shaft against axial movement in opposite directions; and means disposed wholly exteriorly of the axial bore at said other end of the shaft, adapted for detachably connecting a centrifugally swinging cutting blade of a rotary lawn mower to the shaft.

3. A bearing structure for use with a rotary lawn mower of the type that includes a blade support arm formed with an end opening, and that further includes a blade swinging on the arm to cutting position by centrifugal force, comprising: a vertically extending bearing block the upper end portion of which is of greater outer diameter than the lower end portion thereof, whereby to define an external shoulder adapted to engage a blade support arm of a rotary lawn mower on extension of the lower end portion through an end opening of a blade support arm, for supporting the block in the end opening; fastening elements extending through the upper end portion of the block adapted for fixedly connecting the block to a blade support arm, said block having an axial bore counterbored at one end within the upper end portion to define an internal shoulder extending about the axial bore; a stub shaft rotating in the axial bore including at one end a head seating on said internal shoulder in the counterbore, the stub shaft at its other end projecting beyond the other end of the axial bore; a removable cover plate on the block overlying said head and cooperating with the internal shoulder in defining abutments above and below the head for limiting the shaft against axial movement in opposite directions within the axial bore; and means disposed wholly exteriorly of the axial bore at said other end of the shaft adapted for detachably connecting a centrifugally swinging cutting blade of a rotary lawn mower to the shaft.

4. A bearing structure for use with a rotary lawn mower of the type that includes a blade support arm formed with an end opening, and that further includes a blade swinging on the arm to cutting position by centrifugal force, comprising: a vertically extending bearing

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block the upper end portion of which is of greater outer diameter than the lower end portion thereof, whereby to define an external shoulder adapted to engage a blade support arm of a rotary lawn mower on extension of the lower end portion through an end opening of a blade support arm, for supporting the block in the end opening; fastening elements extending through the upper end portion of the block adapted for fixedly connecting the block to a blade support arm, said block having an axial bore counterbored at one end within the upper end portion to define an internal shoulder extending about the axial bore; a stub shaft rotating in the axial bore including at one end a head seating on said internal shoulder in the counterbore, the stub shaft at its other end projecting beyond the other end of the axial bore; a removable cover plate on the block overlying said head and cooperating with the internal shoulder in defining abutments above and below the head for limiting the shaft against axial movement in opposite directions within the axial bore; and means disposed wholly exteriorly of the axial bore at said other end of the shaft adapted for detachably connecting a centrifugally swinging blade of a rotary lawn mower to the shaft, said fastening elements extending through the cover plate to provide the detachable connection of the cover plate to the block while at the same time providing for connection of the block to a blade support arm of a rotary mower, said stub shaft on removal of the cover plate being adapted for extraction from the block in an upward direction following detachment of the blade from said other end thereof, the means detachably connecting the blade to the shaft being removable from the shaft with the shaft disposed in the axial bore with its head between the internal shoulder and cover plate.

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