A movable guard and mounting for portable motor driven circular saws in which the movable guard is directly journalled on the blade arbor shaft through an end thrust resisting antifriction bearing means arranged to isolate the movable guard from the rotational forces of the arbor shaft and accommodate the side thrust forces transmitted to the movable guard in use during its retractive movement effected by abutting engagement with the workpiece. The antifriction bearing means, being directly carried by the blade arbor shaft, is of minimal diameter permitting its installation well within the normal centrifugal discharge path of the chips and sawdust defined by the peripheral blade enclosure lips of the fixed and movable guard in closely adjacent relation to the cutter blade mounting to form a labyrinth passage with the cutter blade mounting excluding entry of chips and sawdust.
MOVABLE BLADE GUARD AND MOUNTING FOR PORTABLE CIRCULAR SAW

BACKGROUND OF INVENTION

The present invention is directed to an improvement in the blade guard structure universally employed in portable circular saws to enclose the peripherally disposed teeth of the cutter blade except for the arcuate portion of the peripheral teeth that are required to effect the cutting of the workpiece. In the prior art, the conventional practice is to provide a stationary guard enclosing the upper periphery of the cutter blade lying above the guide base or shoe plate which engages the work and a movable guard normally spring biased to a position to enclose the remaining lower periphery of the cutter blade whenever the saw is not in actual use. This movable guard, in most prior art structures, is journaled for arcuate movement around the axis of the cutter blade arbor shaft on a journal structure formed on the motor housing or the stationary guard, including in some instances a simple sleeve bearing structure. Typical constructions of this type are disclosed in U.S. Letters Patent to Richards et al U.S. Pat. Nos. 2,671,476 and 2,737,213.

The only known prior art in which the movable guard has been journaled on the blade arbor shaft is Australian Pat. No. 200,052 published Apr. 21, 1965. In this construction, the movable guard is loosely journaled on a shoulder of a blade mounting hub force fitted on the blade arbor shaft and is adapted, by means of a spring washer, to be biased to its extended position by the rotational frictional drag imposed by the spring washer. Movement of the movable guard to its retracted position is effected by the engagement of the forward end of the guard with the workpiece and the foreward feed movement of the saw across the workpiece requiring a feed force of sufficient magnitude to overcome the frictional biasing force as well as the force required to feed the saw through the workpiece. In both of the prior art structures, use of the saw in making either bevel cuts or angle cuts across the workpiece or any combination of such cuts applies severe side thrusts to the movable guard causing it to bind on the sleeve bearing or the blade mounting hub. As a consequence, the force required to feed the saw through the workpiece and overcome the biasing of the movable guard results in undue fatigue of the operator and makes it impossible to accurately follow a scribed line of cut applied to the workpiece.

The present invention provides an improved mounting of the movable guard which reduces the binding forces to an unobjectionable level and at the same time isolates the movable blade guard from the biasing forces of the blade arbor shaft while permitting the mounting of the movable guard directly on the blade arbor shaft assuring a more compact mounting further removed from the centrifugal discharge path of the chips and sawdust defined by the fixed and movable guards. It follows, therefore, that the present invention not only reduces operator fatigue but provides a portable motor driven circular saw that may be more accurately guided along a scribed path of cut across the workpiece and a journal mounting which is less subject to fouling by chips and sawdust in use.

SUMMARY OF THE INVENTION

A principle object of the present invention is to provide a portable motor driven circular saw which will assure greater accuracy in cutting a workpiece to a predetermined scribed line of cut and at the same time reduce fatigue of the operator in continuous day-to-day use of the saw on the job.

Another object of the present invention resides in the provision of a blade guard structure for portable motor driven circular saws that completely encloses the peripheral blade cutter teeth in its normal extended position and includes a retractable guard journalled for retractive movement from a spring biased extended position upon contacting a workpiece by an end thrust resisting antifriction bearing means isolating the movable guard from the blade arbor shaft rotational forces.

A further object of the present invention resides in providing the antifriction bearing means of the previous object in the form of a ball or roller bearing of minimal diameter having an inner race dimensioned to have a driving fit with the blade arbor shaft and an outer race dimensioned and constructed to be received in end-buttoed, full peripheral, driving relation within an end opening stepped bore in the mounting hub of the movable guard thereby limiting axial shifting and canting of the movable guard under operating pressure forces to that permitted by the antifriction bearing means and locating the bearing means well inwardly of the centrifugal discharge path of the chips and sawdust.

BRIEF DESCRIPTION OF THE DRAWINGS

Still further objects of the invention will appear from the following description and appended claims when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a side view of a conventional portable circular saw having a drive motor disposed with its rotor shaft paralleling the plane defined by the circular cutter blade which is mounted on a right angularly related cutter blade arbor shaft formed as the output shaft of a speed reducing gear box provided to impart to the circular cutter blade a high torque, slow speed rotation and showing an application of the present invention employing a ball bearing mounting;

FIG. 2 is a front end view of the portable circular saw of FIG. 1 with the protruding end of the cutter blade arbor shaft and blade guard structure broken away to show the antifriction bearing mounting the movable guard and the movable guard in cross section; and

FIG. 3 is a front end view of a conventional portable circular saw having a drive motor disposed with its rotor shaft at right angles to the plane defined by the circular cutter blade and illustrating an application of the present invention employing a roller bearing mounting on the blade arbor shaft which could be either the output shaft of a speed reducing gear box as here illustrated or the protruding end of the rotor shaft of the motor the axis of which parallels the gear box output shaft of this illustrated embodiment.

DESCRIPTION OF PREFERRED EMBODIMENT

With continued reference to the drawings wherein the same reference numerals are employed throughout to indicate the same parts and with particular reference
3,721,141 3 to FIGS. 1 and 2 for the moment, a portable circular saw 10 of generally conventional structure is shown provided with a movable guard assembly 11 constructed in accord with the present invention. Saw 10 includes the customary motor housing 12 provided with a handle 13 housing the motor (not shown) and electrical supply wiring 14 fitted with the usual plug fitting (not shown) at its free end and a finger type trigger switch 15. Motor housing 12 is conventionally pivotally connected forwardly and rearwardly through respective pivot brackets 16 to upstanding ears of brackets 17 fixed to a support base or shoe plate 18 provided to slidingly support saw 10 on the upper surface of a workpiece (not shown) when the saw is used for cutting the workpiece. In conventional manner, base or shoe plate 18 is provided with an elongated passage 19 (FIG. 2) through which the lower portion of a circular saw blade 21 (FIG. 2) extends to a greater or lesser extent to determine the depth of cut to be made in the workpiece. The blade periphery is shown by dot dash lines in FIG. 1 where the blade itself is omitted to disclose the movable guard construction of this invention. Adjustment of the depth of cut is conventionally provided for by the hinge link 22 at the rear of motor housing 12 and the upstanding slotted bracket 23 fixedly carried by base or shoe plate 18 along the front inside edge of passage 19 upon loosening and tightening clamp screw 24. As best seen in FIG. 2, brackets 17 are also located along the inside edge of passage 19 and the front bracket includes an arcuate segment 25 arcuately slotted at 26 and provided with an arcuate scale 27 graduated in angular markings from 0° at the lower corner to 45° along the upper quadrant. This permits the included angle between the lower projecting portion of blade 21 (FIG. 2) and the undersurface of base or shoe plate 18 to be varied in customary fashion to effect either 90° cuts in the illustrated position or selected bevel cuts when desired. Clamp nut 28 cooperating with arcuate segment 25 of front bracket 17 and carried by front bracket 16 fixed to motor housing 12 is provided to clamp base or shoe plate 18 in a selected angular relation to blade 21.

The circular saw blade 21 is driven counterclockwise as indicated by the arrow 31 (FIG. 1) formed on the lower movable guard 32 which is shown in FIG. 1 in its fully extended forward position substantially enclosing the cutting teeth of the portion of the blade extending below base or shoe plate 18. The remainder of the cutting teeth of blade 21 are enclosed by a stationary guard 33 which is fixedly bolted at 35 (FIG. 1) to a speed reducing gear box 34 fixed to the forward end of motor housing 12 by screws 36 (FIG. 2). The fixed guard back wall forms a closure for the gear box 34 surrounding the blade arbor shaft 45 and provides a bearing seat (not shown) for the front bearing of the blade arbor shaft.

Movable guard 32 includes a partial sidewall 37 the peripheral edge of which is provided with an axial outwardly directed, intumised, blade enclosing lip 38 and is formed along its upper forward corner as shown in FIG. 1 with an annular hub 39 extending axially away from the face of sidewall 37 opposite that carrying lip 38. As best seen in FIG. 2, hub 39 is peripherally inset from the top edge of sidewall 37 and is provided with a stepped through bore 41 the major diameter section of which opens through the distal end of hub 39. A resulting axially facing shoulder 42 is thus provided at the end of stepped bore 41 lying in the plane of sidewall 37 to define an abutment shoulder at one end of the bearing seat formed by the major diameter section of stepped bore 41. An end thrust resisting antifriction bearing means in the form of a ball bearing 43 is shown assembled in the bearing seat of hub 39 in FIG. 2 with its inner race press fitted to the large diameter portion 44 of the multi-stepped end of a blade arbor shaft 45 which is formed outwardly of bearing 43 with reduced diameter stepped shaft portions conventionally formed to mount cutter blade 21 between the usual mounting washers 46. A conventional clamp bolt and washer assembly 47 conventionally threaded into a tapped end opening blind bore (not shown) in arbor shaft 45 clamps cutter blade 21 to the free end of arbor shaft 45 to drivingly connect cutter blade 21 to arbor shaft 45.

While arbor shaft 45 in the embodiment of FIGS. 1 and 2 comprises the output shaft a worm driven speed reducing gear train (not shown) housed in gear box 34, it is to be understood that arbor shaft 45 could be the output shaft of any other form of speed reducing gear box or even the motor rotor shaft of a portable circular saw. The outer race of ball bearing 43 is fixedly secured in the bearing seat of hub 39 by a snap ring 51 engaged in an annular ring groove inset from the distal ends of hub 39 a predetermined distance to assure that the outer bearing race is firmly clamped between shoulder 42 and snap ring 51. As a consequence, axial end play between hub 39 and the outer bearing race is eliminated assuring that side thrusts imposed on movable guard 32 in use will be confined to bearing 43 assuring free rotation of movable guard 32 between its extended and retracted position at all times. This is of particular importance when the saw is employed to bevel cut a workpiece or to make a slant cut across the workpiece or a combination of such cuts since in such usages in the prior art constructions these side thrust forces add a severe binding force to the retractile rotation of the movable guard effected by engagement of the leading end of the movable guard and workpiece. It will be appreciated that any substantial binding of the movable guard during cutting operations necessitates a substantial increase in the feed force that the operator must apply through his hands and arms. Due to variations in the position of the operator relative to the plane of the cut being made, any feed force additional to that required to merely guidingly advance the cutter blade through the workpiece results in the application of side thrust components on the handle and housing which effectively divert the blade from a predetermined line of cut. It follows, therefore, that the elimination of binding forces in the retractile movement of the movable guard as provided by this invention not only reduces the physical effort imposed on the operator in using portable circular saws but assures more accuracy on the operator's part in following a predetermined scribed line of cut along the workpiece.

A coil spring 53 partially encircling hub 39 at its juncture with movable guard sidewall 37 and anchored at 54 to a corner formed by the backwall of fixed guard 33 and at 55 to movable guard 32 is provided to normally bias movable guard 32 to its extended position.
This biasing spring assures return of movable guard 32 to its extended guarding position whenever the guard is released from its contact with the workpiece. Since the bearing 43 effectively isolates movable guard 32 from the rotational forces of both blade arbor shaft 45 and cutter blade 21 at all times that the saw is in operation, the sole force required of the operator, in addition to the feed force needed to operate a saw, is that needed to overcome the biasing spring when the present invention is employed. There is, therefore, no possibility of imposing any portion of the rotational forces of the saw to movable guard 32 and its return to full extended position determined by cooperating stops 56, 57 on guards 32 and 33 is assured.

DESCRIPTION OF ALTERNATE EMBODIMENT

Referring now to FIG. 3, a disclosure of an application of this invention to a portable circular saw 10a in which the motor and motor housing are fixed to a base or shoe plate 18 at right angles to the direction of feed of the saw. Conventional saws of this type could be either of the type employing a spur gear type speed reducing gear box or a saw in which the cutter blade is directed mounted on the motor rotor shaft. In either case, the motor and motor housing 12a longitudinal axis is at right angles to the cutting plane of cutter blade 21 and the arbor shaft 45a is parallel to this longitudinal axis. Handle 13a is conventionally disposed at right angles to this longitudinal axis and the fixed guard 33a would be bolted either to the gear box and support the arbor shaft bearing as in the embodiment of FIGS. 1 and 2 or would be bolted to the motor end bell. Since the basic components are generally the same and perform similar functions to the corresponding components of FIGS. 1 and 2, the same reference numerals followed by the letter A are used to indicate corresponding parts which may not be of identical construction.

In this embodiment of the invention, the connecting structure between the motor housing 12a and base or shoe plate 18 as well as the bevel cut adjustment are omitted. These parts will be the same as conventionally provided in the two types of saws to which reference has been made. In either type of saw cutter blade 21 will be secured to the end of arbor shaft 45a by similar clamp washers 46a and clamp screw assembly 47 on the reduced diameter end immediately adjacent the enlarged diameter portion 44 upon which the end thrust resisting antifriction bearing means is mounted. While a ball bearing like that disclosed in FIGS. 1 and 2 may be used in this embodiment, a double row roller bearing 43a is illustrated in FIG. 3. The inner race is force fitted to arbor shaft portion 44 as in FIG. 1 and the outer race is clamped between shoulder 42 of the bearing seat formed in hub stepped bore 41 and snap ring 51 as previously described in connection with FIGS. 1 and 2. Hub 39 is formed on the back face of sidewall 37 of movable guard 32 inset from the upper edge of sidewall 37 and an inturnd enclosing lip 38 is provided as in the previously described embodiment. A biasing spring 53 partially surrounding hub 39 and anchored at its opposite ends as previously described is provided to normally bias movable guard 32 to its extended position providing a movable guard assembly 11. The operation of this form of the invention is the same as that previously described and the same beneficial results are obtained. As a consequence, a repetition of the previous description is omitted here.

Comparing FIGS. 2 and 3, it will be further noted that the present invention in both illustrated forms, by directly mounting the bearings on the arbor shafts 45 and 45a and directly housing them in the rearwardly facing stepped bore of movable guard hub 39, permits the use of relatively small diameter bearings. The bearings are, therefore, remotely located with respect to the peripheral centrifugal path defined by the inverted lips of the movable and stationary guard members through which the chips and sawdust are discharged by the normal centrifugal fanning effect of the cutter blade 21. Furthermore, the portion of the movable guard sidewall 37 forming shoulder 42 overlaps slightly the peripheral edge of the adjacent blade clamp washer 46 or 46a forming a narrow labyrinth path between these high speed rotating clamp washers and the adjacent related end of the bearings. As a consequence, the bearings are disposed well out of the normal discharge path of the resulting chips and sawdust and, with the labyrinth seal just described, there is little chance of discharged chips and sawdust entering into the bearings and clogging them to prevent their intended friction free operation. The present invention, therefore, provides a construction which assures long trouble free operation of the bearings.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. In a portable power driven circular saw conventionally providing a motor housing, motor means including a blade arbor shaft projecting outwardly from one end of said motor housing and mounting a cutter blade on its free end, a base adjustably suspended from the housing for guiding said blade along the workpiece and adjusting the cutter blade with respect to the work to effect bevel cutting, and stationary guard means fixed to the one housing end in partial surrounding relation to the cutter blade: an improved movable guard and mounting for directly mounting said movable guard on said cutter blade arbor shaft comprising a movable guard disposed to normally surround the remainder of the cutter blade and arranged for telescoping retraction at least partially within said fixed guard upon engagement with the workpiece, means biasing said movable guard to its normal extended cutter blade surrounding position, and mounting means for said movable guard journalling said movable guard on said blade arbor shaft for arcuate movement between its normal extended position and retracted position comprising end thrust resisting antifriction bearing means encircling said arbor shaft free end inwardly of said cutter blade and means mounting said movable guard on said bearing means, said movable guard normally being isolated by said bearing means.
from the rotational forces of said blade arbor shaft tending to move said movable guard to its normal extended position thereby facilitating movement of said movable guard from its normal extended position with minimum effort upon engagement of said movable guard with the workpiece.

2. The movable guard and mounting of claim 1 wherein said end thrust resisting antifriction bearing means comprises a bearing having an inner race directly encircling said blade arbor shaft so as to rotate with said blade arbor shaft and an outer race directly mounting said movable guard so said movable guard will be freely rotate from its extended position relative to said inner race and blade arbor shaft under influence of its engagement with the workpiece as said saw is guided along the workpiece.

3. The movable guard and mounting of claim 1 wherein said end thrust resisting antifriction bearing means comprises a roller bearing having an inner race directly encircling said blade arbor shaft so as to rotate with said blade arbor shaft and an outer race directly mounting said movable guard so said movable guard will freely rotate from its extended position relative to said inner race and blade arbor shaft under influence of its engagement with the workpiece as said saw is guided along the workpiece.

4. The movable guard and mounting of claim 2 wherein said movable guard is formed with a hub portion having a through stepped bore coaxially disposed with respect to said blade arbor shaft with its major diameter bore portion at its distal end and dimensioned to closely receive said outer race of said end thrust resisting antifriction bearing means with one end of said outer race in end abutted relation to the axially facing shoulder defined by said stepped bore and formed inwardly from its distal end with an inwardly opening annular ring groove located in juxtaposition to said other end of said outer race and a snap ring supported in said annular ring groove in overlapping relation to the marginal portion of said other end of said outer race whereby side thrust forces applied to said movable guard due to engagement of said movable guard and workpiece in making bevel cuts and angle cuts of said workpiece and resisted by said antifriction bearing means thereby enabling the operator to accurately cut along a scribed line applied to said workpiece.

5. The movable guard and mounting of claim 4 wherein said biasing means comprises tensioned spring means disposed in surrounding relation to said movable guard hub portion having its opposite ends respectively anchored to said movable guard and to a fixedly related portion of said saw whereby the sole force to be overcome in retractive movement of said movable guard is the biasing force of said tensioned spring means.

6. The movable guard and mounting of claim 1 wherein said end thrust antifriction bearing means is press fitted on said arbor shaft immediately adjacent the mounting for said cutter blade and said movable guard includes a wall portion adjacent to related to said cutter blade mounting and formed on the face remote from said cutter blade mounting with a hub providing a stepped bore defining a seat for said antifriction bearing means delimited in the plane of said wall portion by an inwardly directed annular abutment shoulder which partially overlaps said cutter blade mounting in close radially spaced relation to form therewith a labyrinth passage which, due to the high speed rotation of said cutter blade mounting, substantially negates the possibility of chips and sawdust entering said antifriction bearing means.