United States Patent [19]

Reed

[11] **3,908,499**

[45] **Sept. 30, 1975**

[54] **KNIFE RETAINER**

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[22] Filed: **Aug. 1, 1973**

[21] Appl. No.: **384,492**

[52] **U.S. Cl.** **83/665;** 83/481; 83/699

[51] **Int. Cl.²** **B23D 19/00**

[58] **Field of Search** 83/481, 698, 699, 665, 83/666, 676

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[57] **ABSTRACT**

A knife retainer device for conveniently rigidly securing a generally circular, thin cutting knife blade to an elongated arbor while facilitating ready access to and removal of the knife for knife maintenance and changing purposes. The retainer includes a body portion adapted to be closely received over and affixed to an elongated arbor and the body portion itself has a radially outwardly extending flange defining a first blade engaging surface with the end of the body portion adjacent the engaging surface being threaded. The flange includes a plurality of peg-like members extending outwardly from the first engaging surface axially of the body portion toward the threaded end. The circular knife blade comprises a segmented, two piece blade having a plurality of mounting holes transversely therethrough which are adapted to closely receive the peg-like members when the segments are properly positioned on the retainer. Magnetic elements disposed in the first engaging surface magnetically attract the knife segments for temporarily holding them in position against the first engaging surface in order that the final blade locking steps may be easily completed. To finalize blade locking, a locking member having a second blade engaging surface thereon is threadedly advanced along the threaded area of the body portion from a first position adjacent the outermost end of the threads to a second knife engaging position with a portion of the side faces of the blade being tightly engaged between the two blade engaging surfaces.

19 Claims, 6 Drawing Figures

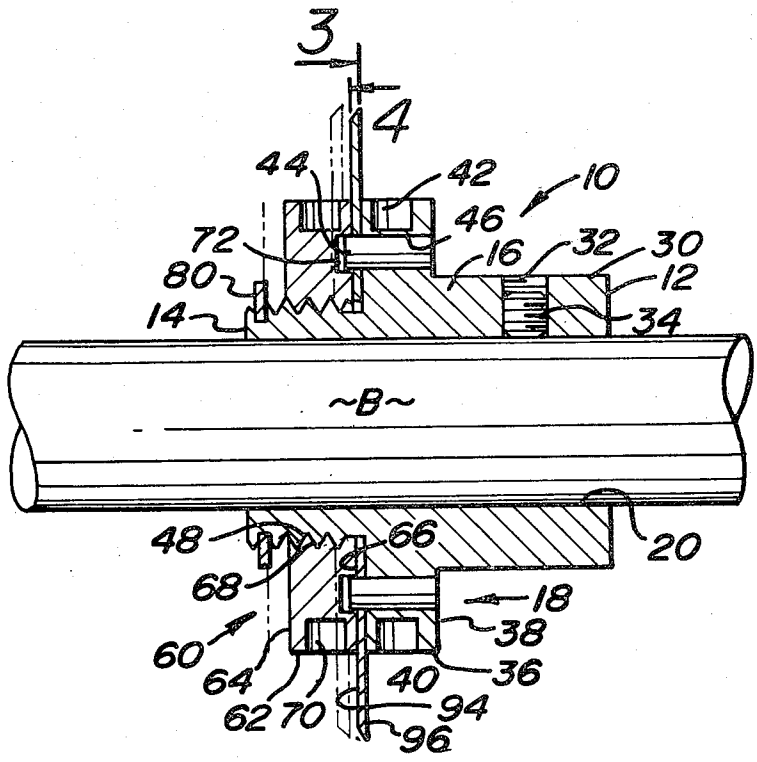


FIG. 1

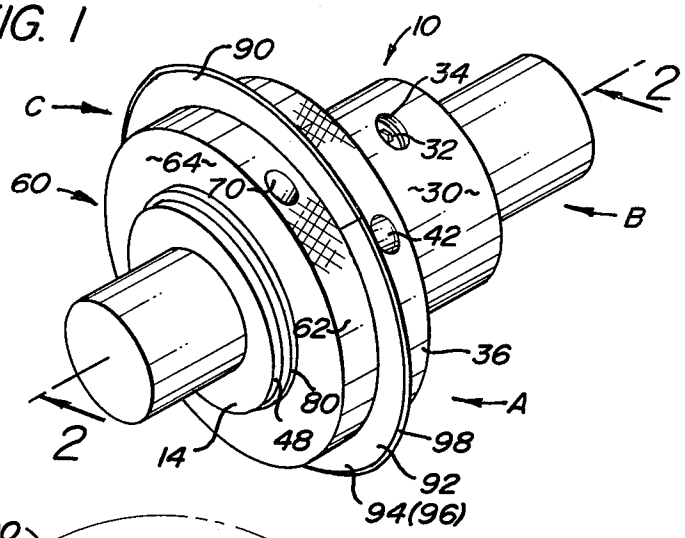
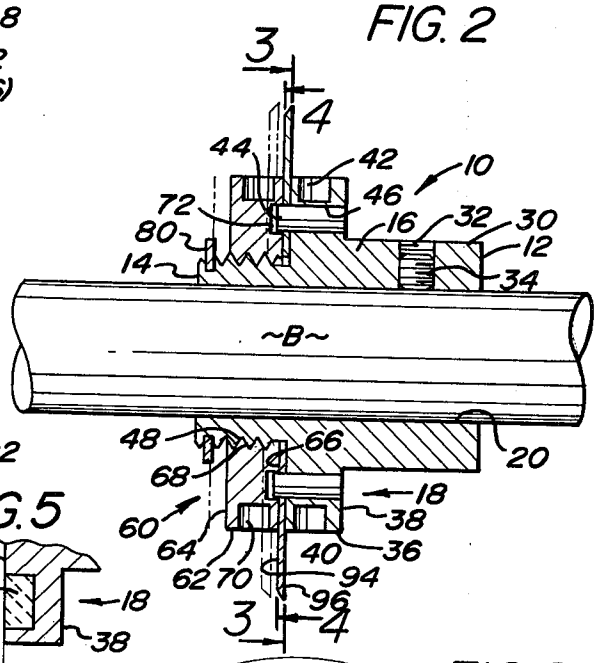


FIG. 2



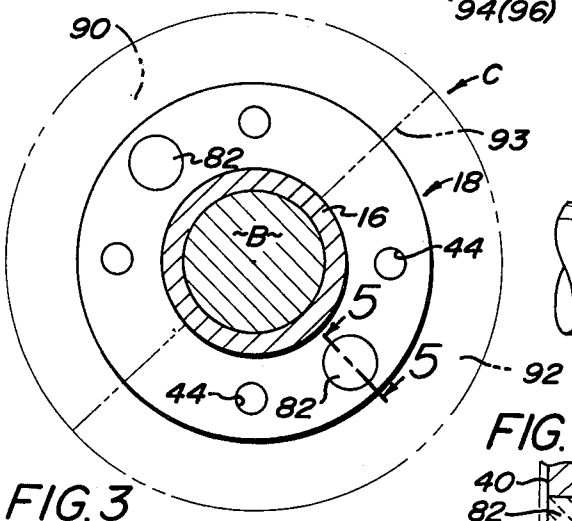


FIG. 3

FIG. 5

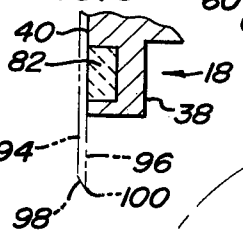


FIG. 4

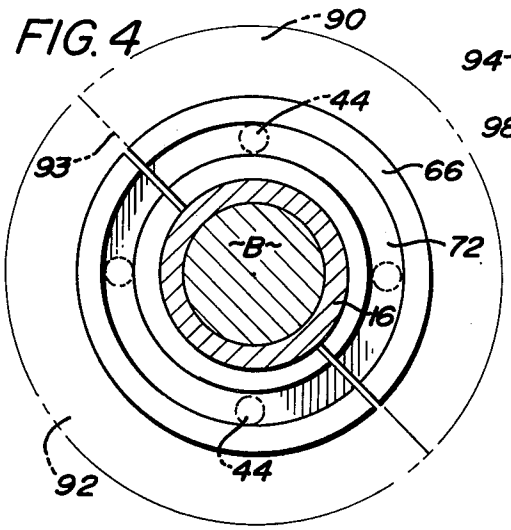
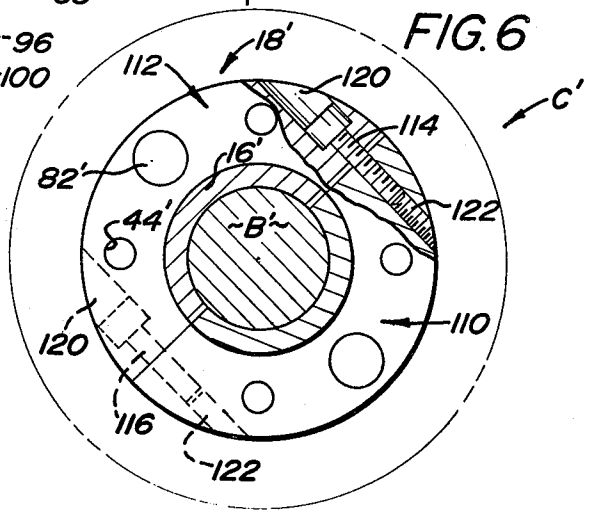


FIG. 6



KNIFE RETAINER

BACKGROUND OF THE INVENTION

This application pertains to the art of cutting apparatus and more particularly to cutting apparatus which employ thin, rotary cutting or slitting knives to effect desired cutting of workpiece material.

The invention is particularly applicable to paper cutting or slitting apparatus of the type substantially employed in the newspaper printing industry and will be described with specific reference thereto. It will be appreciated by those skilled in the art, however, that the invention has broader applications and may be employed in other cutting environments. For example, it may be used to cut or slit cardboard, various metals and other materials in situations where it is feasible to employ rotary cutting or slitting knives.

In the newspaper industry, it is quite common to employ a plurality of thin, circular slitting knives which are mounted on elongated arbors which, in turn, are rotatably driven about their longitudinal axes in order to effect desired slitting or cutting of paper passed in contact therewith. Generally, a number of such knives are mounted at spaced intervals along a single arbor with a plurality of such arbors being variously located throughout the paper processing machinery to effect the final desired results. Such processing equipment is deemed well known in the art.

Due to the high speed at which such processing equipment is operated, frequent failure and wearing of the blades occurs which necessitates some type of maintenance. Normally this maintenance takes the form of a "blade change", that is, replacement of the failed or worn blade with a new one. In sophisticated and interconnected processing equipment such as that used in the newspaper industry, knife blade maintenance or breakdown periods idle a considerable number of employees and machines. Because of the financial losses involved during production idle time, it is extremely desirable to design means whereby the knife blades may be quickly mounted and unmounted on the arbors so that they can not only properly perform their slitting or cutting function, but also to permit them to be easily removed for maintenance and changes. Such installations make it possible to reduce idle time and wasted man hours with resulting increases in productivity. Although several attempts have thus far been made to yield means for accomplishing these desires, none of these means has yet achieved the degree of flexibility required.

More specifically, circular knife blades have heretofore been mounted to the arbors in a rigid manner by means of knife retainers. An early improvement to the overall design technology was to the effect of dividing the circular blades into a plurality, normally two, of interfitting segments to permit the blade to be assembled and disassembled over the arbor and eliminate the need for slipping the blades off the ends of the arbors. The key to solving the problem, however, lay in the retainer design and typical of such arrangements are shown in U.S. Pat. Nos. 2,598,649 and 3,440,915. Although the earlier, improved retainers found some success, they presented extreme difficulty to maintenance personnel when the arbors were located on the processing equipment in fairly inaccessible areas. That is, prior knife retainers of this type have been designed in a manner which require workmen to simultaneously employ both

hands during knife changes and where also a number of "loose" component parts were necessarily involved during such knife blade changes. Thus, in the hard to reach limited access and limited sight areas. maintenance personnel have consistently had extreme difficulty in efficiently and timely effecting knife changes when needed. For example, in some instances using prior retainer designs, it takes approximately 20 minutes for a single knife change which, although not seemingly great when taken in and of itself, amounts to a great deal when considering total man hours and production time lost as a result thereof.

The present invention contemplates a new and improved device which overcomes the above noted problems and provides a new knife retainer which is simple, economical, easy to use and readily adaptable to a number of different slitting or cutting environments.

BRIEF DESCRIPTION OF THE INVENTION

A new knife retainer is mounted on an elongated arbor for conveniently rigidly holding a rotary knife blade having a cutting surface along its outermost edge. The knife retainer comprises an elongated retainer body portion which is adapted to be generally axially received over a portion of the arbor at a desired spaced position. This body portion includes means for selectively affixing the body portion to the arbor and a first knife engaging surface. The end of the body portion adjacent the first knife engaging surface has means thereon for releasably receiving a knife locking member. Knife locating means are disposed in the first knife engaging surface which are adapted to engage the knife blade itself for properly locating it on the body portion and for preventing relative rotation between the blade and the retainer. A knife locating member having a second knife engaging surface is selectively movable on the receiving means between a first non-locking position with the first and second knife engaging surfaces spaced apart from each other and a second knife locking position with the first and second knife engaging surfaces being closely spaced to each other in a clamping relationship with a portion of the side faces of the knife blade.

Magnetic elements are disposed in the first knife engaging surface adapted to magnetically attract the blade for retaining it in a desired position against the first knife engaging surface when the locking member is in the first position.

The body portion may alternatively be comprised of two substantially identical axial halves including means for selectively rigidly affixing the two halves together to closely surround the arbor.

The locking member may also be alternatively comprised of two interfitting halves including means for selectively interconnecting the locking member halves.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in the specification and illustrated in the accompanying drawings which form a part hereof and wherein:

FIG. 1 is a perspective view of the subject new knife retainer when mounted on a section of an elongated arbor;

FIG. 2 is a longitudinal cross-sectional view of the new knife retainer taken along lines 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view of the new knife retainer taken along lines 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view of the new knife retainer taken along lines 4—4 of FIG. 2 in an optional two-piece configuration;

FIG. 5 is a partial cross-sectional view taken along lines 5—5 of FIG. 3; and,

FIG. 6 is a cross-sectional view similar to FIG. 3 showing an alternative embodiment of a retainer incorporating the concepts of the subject invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein the showings are for purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting same, the FIGURES show a knife retainer A affixed to a portion of a conventional elongated arbor B. Retainer A is shown as rigidly retaining a thin, generally circular knife blade C in a desired cutting position generally transverse to the longitudinal axis of the arbor.

More specifically, and with particular reference to FIGS. **1** and **2**, knife retainer A is comprised of an elongated body portion generally designated **10** having a first end and end face **12** and a second, spaced apart end and end face **14** with an intermediate area **16** disposed between ends **12, 14.** Included along intermediate portion **16** toward second end **14** is a radial outwardly extending flange generally designated **18.** A bore **20** extends axially through the body portion between the end faces of ends **12, 14** and is dimensioned to be closely slidably received on arbor B. Of course, the size of bore **20** may vary depending upon the specific processing apparatus arbor size requirements. Inasmuch as these dimensional characteristics are deemed conventional, further elaboration thereon is not considered necessary.

Intermediate area **16** has an outer peripheral surface **30** extending between first end **12** and flange **18** and includes a threaded hole **32** extending generally transversely therethrough into bore **20.** A conventional threaded member **34** is threadably received in hole **32** for selective threaded movement into and out of clamping engagement with arbor B to affix the knife retainer in a desired position longitudinally along the arbor. Although the threaded member comprises a set screw in the preferred embodiment, it will be appreciated that other, convenient means may be employed for affixing the retainer to the arbor without departing from the intent and scope of the present invention.

Outwardly extending flange **18** includes an outer peripheral surface **36** and a pair of opposed side faces **38,** 40. At least side face **40** extends in a plane transverse to the axis of arbor B and defines a first knife engaging surface, the use of which will be described and become fully apparent hereinafter. A plurality of wrench receiving recesses **42** are disposed about peripheral surface **36** and adapted to receive a spanner type wrench for assembling and disassembling the retainer. Extending through flange **18** from side face **38** and outwardly of side face **40** are a plurality of pins or peg-like members **44** which comprise blade locating means to assist in properly locating the blade. Preferably, peg-like members **44** comprise hardened dowel pins and are located in flange **18** by a force fit arrangement in holes **46.** The outermost ends of members **44** protrude outwardly from side face **40** a short distance in a direction generally axially of the body portion itself. Although four such peg-like members equally spaced around the flange are preferred, it will be appreciated that other numbers of the members could be employed if so desired. Disposed adjacent side face **40** along intermediate area **16** toward and including second end **14** is a threaded area **48.** This threaded area is adapted for receiving a knife locking member to be described in detail hereinafter. It will be appreciated that area **48** could have other configurations for receiving a knife locking member such as, for example, a bayonet type connection, etc. without departing from the scope and intent of the present invention.

The knife locking member employed in the preferred embodiment is generally designated **60.** Basically, the member is annular shaped having an outer peripheral surface **62** and opposed spaced apart side faces **64, 66.** In the preferred arrangement, at least side face **66** is disposed so that when the knife locking member is associated with the body portion on threaded area **48,** the plane defined by that side face is generally transverse to the axis of the arbor and parallel to side face **40.** Side face **66** defines a second knife engaging surface for selective blade clamping cooperation with the first knife engaging surface. The inner peripheral surface of annular locking member **60** includes a threaded area **68** extending axially therethrough which threadedly engages with threaded area **48** of body portion **10.** A plurality of wrench recess areas **70** are also disposed around outer peripheral surface **62** to receive spanner type wrenches for convenient assembly and disassembly of the locking member. Side face **64** includes a circular peg receiving groove **72** (FIGS. **2** and **4**) which receives the outwardly extending portions of peg-like member **44** as second blade engaging surface **66** on the locking member is brought into close spaced association with first blade flange **18** by threadedly advancing locking member **60** on threaded portion **48.** A stop or ring member **80** closely received over second end **14** adjacent the end face establishes a positive first position for the locking member to provide means for maintaining the locking member in a threaded relationship with the body portion.

As best shown in FIGS. **3** and **5,** a plurality of magnetic elements **82** are also disposed in first blade engaging surface **40.** In the preferred embodiment of the present invention, there are shown two such magnetic elements oppositely disposed from each other although it will be appreciated that other numbers could be variously employed without departing from the intent and scope of the present invention. Also, these magnetic elements preferably comprise generally cylindrical ceramic magnets which are press fit into corresponding receiving holes (not shown) so that the outermost surfaces thereof are flush with the surface of first blade engaging surface **40** itself (FIG. **5**). These magnetic elements are employed to temporarily maintain knife blade C in position during blade changes as will hereinafter be more fully described.

As used in the environment here under discussion, knife blade C is a thin, generally circular blade comprised of a pair of interfitting arcuate or semi-circular blade segments generally designated **90, 92** which mate with each other in an abutting relationship so as to form a joint **93.** The broad concept of such blade designs per se are deemed to be known and include spaced apart

side faces **94, 96,** continuous outer peripheral surface **98** and a cutting edge **100.** However, when employed with the subject new retainer, side faces **92, 94** of each segment have a plurality of locating and mounting holes **102** therein which are spaced apart and dimensioned to correspond to the dimensioning and spacing of peg-like members **44.** This structure facilitates proper mounting and locating of segments **90, 92** by mounting cooperation between peg-lime members **44** and locating and mounting holes **102.** Again, the blades themselves are deemed to be substantially conventionally known except for the locating and mounting hole arrangements so that further elaboration thereon is not deemed necessary. It should be noted, however, that the diameter of the assembled blade is greater than the cross-sectional dimension of the two blade engaging surfaces so as not to interfere with the actual cutting or slitting operation.

In using the above described knife retainer, and assuming that the retainer has already been desirably located and rigidly affixed to the arbor, description will hereinafter be made with reference to removing and installing a knife blade C in retainer A. In this regard, a spanner type wrench is used in association with recesses **70** on locking member **60** and recesses **42** in flange **18** to back the locking member off from its closely engaging, locking position with the knife blade positioned as shown in the solid lines of FIG. **2** to a first position as generally shown in the phantom lines of FIG. **2.** The first position is normally a positive position established by stop or ring member **80.** In this position, segments **90, 92** may be freely withdrawn from their association with the retainer, particularly, as between locating and mounting holes **102** and outwardly extending peg-like members **44.** This position of the segments is also shown in phantom in FIG. **2.**

Next, two new segments **90, 92** are located on the retainer by means of the cooperating peg-like members and locating and mounting holes to mate at joint **93** and form the generally circular knife blade C. Since the arbors are often disposed in areas which are not readily accessible and since the knife blades are normally constructed from steel, magnetic elements **82** disposed in first knife engaging surface **40** magnetically attract the segments to magnetically retain them in position against surface **40** until the locking member can again be threadedly moved into the second blade engaging position with the segments. Thus, following proper location of the new segments, it is then merely necessary to advance locking member **60** from its first position to the second knife engaging position until blade segments **90, 92** are closely, tightly embraced between first and second knife engaging surfaces **40, 66.** As will be particularly seen from FIG. **2,** groove **72** facilitates this operation by receiving peg-like members **44** therein so as to eliminate any interference problems between the retainer components. Once tightening is completed by means of, for example, spanner type wrenches, the new blade is ready for production use.

The above described new knife retainer device facilitates ease of blade removal and installation for blade maintenance or change purposes. In using the subject new retainer, the changing work may be substantially effected by maintenance personnel using only one hand without the necessity for removing any of the retainer components from association therewith. This provides a substantial advantage when an arbor is located in an area which is not readily accessible so that replacement of, for example, screws, retainer rings, etc. would be extremely difficult and time consuming where maintenance personnel could not have full view and access to the entire retainer assembly. It has been found that with prior knife retainers, a single knife changing time of approximately 20 minutes is not at all uncommon and that when using the concepts of the subject invention for the same knife change, only a 5 minute changing time is required. This time reduction represents a significant savings as to undesired processing equipment downtime and production personnel idle time. These savings are particularly significant when considering the number of individual blade installations and the frequency of blade changes for a single piece of typical processing equipment.

Although body portion **10,** including flange **18,** and locking member **60** have been shown as preferably being generally cylindrical in configuration, it will be appreciated that other configurations could be employed without departing from the intent and scope of the present invention. The embodiment shown is deemed to more equally distribute operating stresses throughout the entire retainer device than would other possible configurations. Also, the retainer components are desirably constructed from steel.

Referring now to FIG. **6** of the drawings, there is shown an alternative arrangement for body portion **10** in which body portion is of a two piece construction with the pieces selectively fastened together so as to embrace arbor B. Accordingly, for ease of illustration of the arrangement, new components are designated by new numerals and like components include like, primed (′) numerals. The view of FIG. **6** is substantially identical to the view of FIG. **3** and shows the body portion as being comprised of two body portion halves **110, 112.** Basically, the entire body portion has been axially cut in half with the halves then being selectively held together to surround the arbor by means of mechanical fasteners. Accordingly, FIG. **6** shows halves **110, 112** closely received over arbor B′ and closely affixed to each other by means of standard threaded mechanical fasteners **114, 116** with each fastener being received in a standard countersunk hole **120** for threaded engagement with an aligned threaded hole **122.** Holes **120, 122** are preferably disposed in flange **18′** to pass substantially coplanar therethrough. Once this retainer embodiment has been installed over and located on an arbor use of the retainer itself is the same as that hereinabove described with reference to FIGS. **1–5.** It is also possible to similarly fabricate annular locking member **60** from two pieces as shown in FIG. **4** and interconnect the pieces by standard mechanical fastening means of the type shown in FIG. **6.**

The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon the reading and understanding of this specification. It is my intention to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

Having thus described my invention, I now claim:

1. A knife blade retainer device for conveniently mounting a rotary cutting knife blade having a cutting surface disposed adjacent the outermost edge thereof on an elongated arbor, said retainer comprising:

an elongated body portion adapted to be generally axially received over a portion of said arbor, said body portion including a first knife engaging surface and means for selectively affixing said body portion to said arbor;

means on said body portion for releasably receiving a knife locking member;

knife blade locating means adapted to engage said knife and prevent relative rotation between said knife and said retainer; and

a knife blade locking member including a second knife blade engaging surface thereon, said locking member being selectively receivable on said receiving means and movable thereon between a first non-locking position with said second engaging surface axially spaced from said first engaging surface and a second knife locking position with said first and second engaging surfaces closely spaced from each other with said knife blade clamped therebetween, the knife blade locking member further including means in said knife blade locking member for providing room for said knife blade locating means to allow said second knife blade engaging surface to engage said knife blade.

2. The retainer as defined in claim **1** further including magnetic elements received in one of said first and second engaging surfaces adapted to magnetically attract said knife blade to retain said blade in position relative to said one engaging surface when said knife locking member is in said first position.

3. The retainer as defined in claim **1** wherein said knife blade has a central opening dimensioned to be received over said body portion and is segmented into at least two substantially identical pieces, each said piece including mounting holes spaced therearound adjacent said central opening for receiving said knife locating means, said knife locating means comprising a plurality of peg-like members extending outwardly from said one engaging surface generally axial of said body portion adapted to be received in said mounting holes when said segments are properly positioned relative to said retainer.

4. The retainer as defined in claim **3** wherein said releasable receiving means comprises a threaded area adjacent said first engaging surface and extending axially along a portion of said body portion from one end thereof, said knife locking member being threadedly received on said threaded portion and threadedly movable between said first and second positions.

5. The retainer as defined in claim **4** wherein the means for providing room for said knife blade includes a groove extending circularly therearound, said groove receiving the outwardly extending ends of said peg-like members as said locking member is threadedly moved from said first toward said second position.

6. The retainer as defined in claim **5** wherein said peg-like members are disposed in said first engaging surface.

7. The retainer as defined in claim **4** wherein said threaded portion includes means disposed adjacent said one end for retaining said locking member on said threaded portion.

8. The retainer as defined in claim **7** wherein said affixing means comprises a threaded mechanical fastener extending generally transversely through said body portion for selective clamping engagement with said arbor.

9. The retainer as defined in claim **8** further including spaced apart wrench receiving recesses in the outer peripheral surfaces of said locking member and said body portion adapted for use in moving said locking member between said first and second positions.

10. The retainer as defined in claim **1** wherein said body portion comprises two substantially identical axial body portion halves and further includes means for selectively rigidly interconnecting said halves.

11. The retainer as defined in claim **1** wherein said locking member comprises two interfitting locking member halves and further includes means for selectively rigidly interconnecting said halves.

12. A knife blade retainer device for mounting a cutting knife blade on an elongated arbor, said retainer device comprising in combination:

an elongated body portion having first and second ends and an intermediate area, a bore extending axially through said body portion between said first and second ends adapted to permit said body portion to be closely received over said arbor, a first knife blade engaging surface adjacent said second end disposed generally transverse of said body portion, said second end including means for receiving a locking member thereon;

means for rigidly affixing said body portion to said arbor to prevent relative rotation therebetween;

a knife locking member having a second knife engaging surface thereon, said locking member being received on said receiving means and movable thereon between a first non-locking position with said first and second engaging surfaces spaced apart from each other and a second knife locking position with said engaging surfaces in a closely spaced knife engaging relationship;

knife locating means disposed about one of said first and second engaging surfaces extending outwardly thereof toward the other of said engaging surfaces;

means on the other of said engaging means for providing room for said knife locating means; and

a rotary knife blade having opposed side faces and a cutting edge adjacent the outer peripheral surface thereof, said blade including a central opening for permitting said blade to be received over said body portion and means for blade mounting association with said locating means, whereby when said engaging surfaces are in said second position they engage portions of said opposed side faces adjacent said central opening.

13. The retainer as defined in claim **12** wherein said receiving means comprise a threaded area extending inwardly along said body portion from said second end toward said first engaging surface and including means disposed adjacent said second end for retaining said locking member on said threaded portion.

14. The retainer as defined in claim **13** wherein said one of said engaging surfaces includes magnetic members disposed therein for attracting said knife blade and retaining it is position against said first engaging surface when said locking member is in said first position.

15. The retainer as defined in claim **13** wherein said one of said engaging surfaces comprises said first engaging surface, said locating means comprising a plurality of peg-like members spaced around said first engaging surface and extending outwardly thereof toward said second engaging surface generally axial of said body portion, said blade mounting means comprising a

plurality of spaced holes extending transversely through said blade between said opposed side faces with said plurality of holes being spaced and dimensioned to receive said peg-like members and properly locate said blade relative to said retainer adjacent said first engaging surface.

16. The retainer as defined in claim **15** wherein said second engaging surface includes a circular groove disposed therein for receiving the outwardly extending ends of said peg-like members as said locking member is moved from said first toward said second position.

17. The retainer as defined in claim **16** wherein said knife blade is comprised of a plurality of knife blade segments, said segments each being individually locatable relative to said body portion to cooperate in forming said blade.

18. The retainer as defined in claim **12** wherein said body portion comprises two substantially identical axial body portion halves and further includes means for selectively rigidly interconnecting said halves.

19. A retainer as defined in claim **12** wherein said locking member comprises two interfitting locking member halves and further includes means for selectively rigidly interconnecting said halves.

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