

Feb. 21, 1967

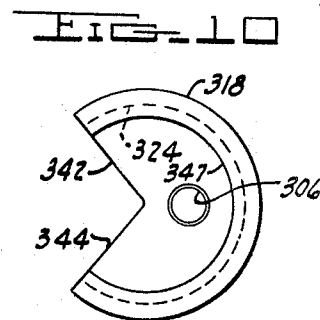
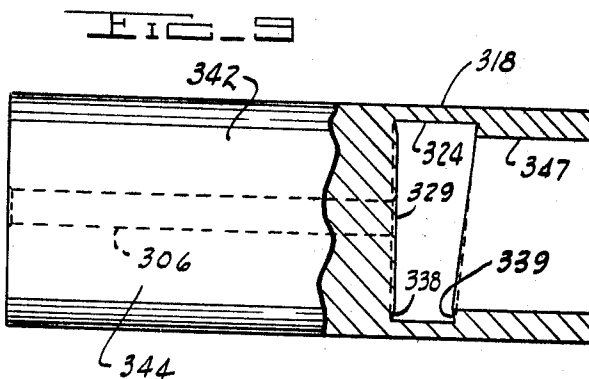
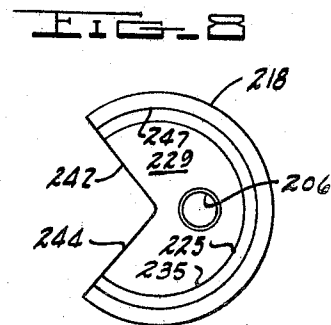
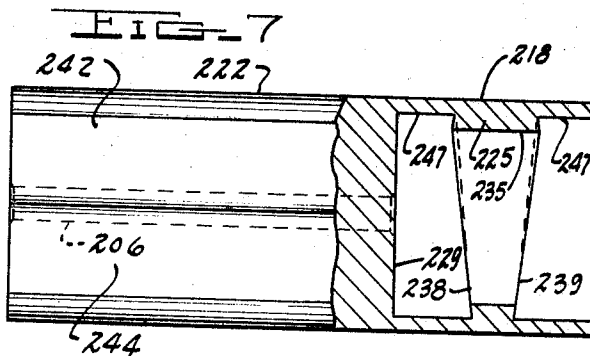
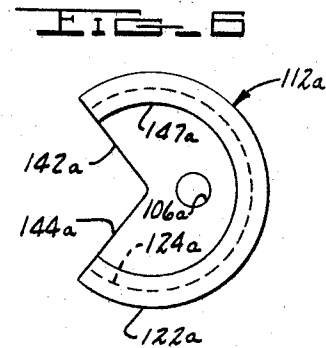
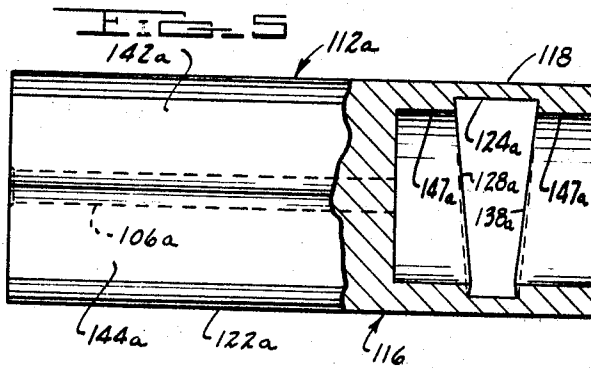
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3,304,816

DETACHABLE DRILL TIP AND COUPLING MEANS

Original Filed Feb. 10, 1964

3 Sheets-Sheet 2



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3 Sheets-Sheet 3

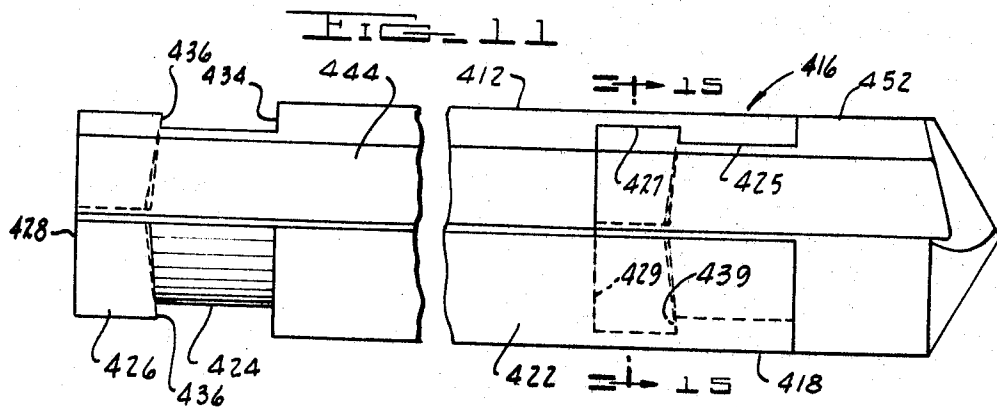


FIG. 13

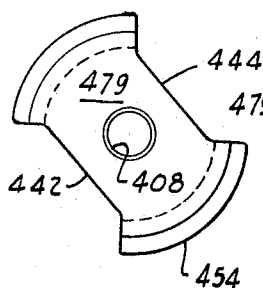


FIG. 12

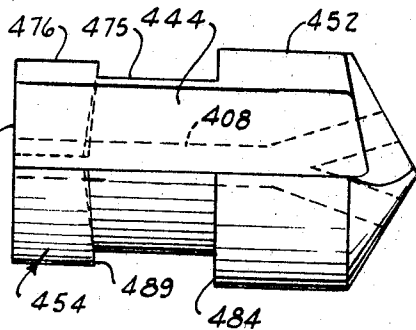


FIG. 14

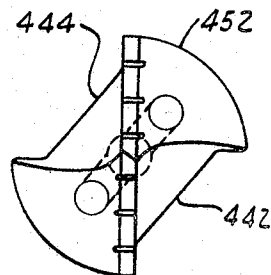
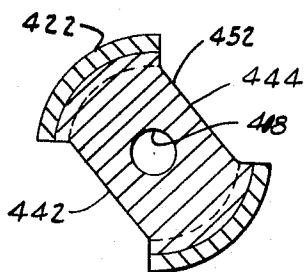


FIG. 15



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3,304,816

DETACHABLE DRILL TIP AND COUPLING MEANS

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Continuation of application Ser. No. 343,529, Feb. 10, 1964. This application Apr. 7, 1965, Ser. No. 453,534
8 Claims. (Cl. 77-68)

The present invention is a continuation of application Serial Number 343,529, filed February 10, 1964, now abandoned, and relates to new and useful improvements in machine tools and more particularly to machine tools which are perishable. In the present instance, the tool is a gun drill with a quick detachable coupling device. When the tool of the present invention is in use, the coupling means will become more tightly engaged, and thus will in effect have the same characteristics as though it were a solid tool bit.

It will be understood that the cutting end of the tool bit will be coupled and uncoupled many times for sharpening during its life and when it is completely worn out, it will be replaced with another tool bit of similar configuration. The driver portion of the coupling will not be changed and of course will last the life of many tool bits.

It is therefore a primary object of the present invention to provide a simple, durable and relatively inexpensive machine tool which embodies the present invention, while providing in addition, a more efficient structure at a lower cost.

Another object of the invention is the provision of a multi-section machine tool, wherein a plurality of driving members are coupled together to extend the length of the tool, with the driving members piloted in the opening made by the tool bit coupled to the forward end of the complete assembly.

Still another object of the present invention is the provision of a driving member which is made from a more ductile and less costly material than the cutting tool which is coupled to the outer end thereof.

Another object of the invention is the provision of a quick detachable cutting tool, wherein the cutting tool may have one or more cutting edges thereon and of single or multi-flute configuration.

Still another object of the instant invention is the provision of a self-aligning machine tool which is not only rigid, but will provide an accuracy equivalent to that of a machine tool manufactured from a solid bar, at but a fraction of the cost.

Another object of the invention is the provision of a machine tool wherein the machine set-up need not be disturbed when the tool bit needs to be sharpened. The tool bit is merely uncoupled from the assembly, sharpened and then recoupled.

Still another object of the instant invention is the provision of a multi-section machine tool, wherein the coupling means are drawn tighter during usage, although any section of the tool can be readily uncoupled to facilitate rapid change of the tool bit when it becomes dull, or a cut of different configuration is required.

Another object of the present invention is the provision of a machine tool of multi-section, wherein the tool bit will not become uncoupled within the opening being drilled when a reverse rotation of the tool occurs, nor will any of the drivers.

Still another object of the invention is the provision of a machine tool wherein a coolant passage may be provided to permit lubrication and coolant to pass over, around and about the cutting surface or surfaces thereof.

These and other objects can be accomplished by the provision of a machine tool wherein said machine tool is of multi-section construction and the tool bit is readily

separable from the driving means and the driving means are extensible, said extensible driving means and said separable tool bit having these characteristics, a hollow cylindrical sleeve on the end of each of said drivers; an undercut in said sleeve in co-axial relationship therewith; two non-parallel edge surfaces on said undercut, one edge surface having a helix thereon, while the other surface is flat throughout its full length and perpendicular to the rotational axis of the tool; a back taper on said helix; a detachable cutting tool; a cutting edge on said detachable cutting tool; a single flute disposed substantially throughout the full length of said cutting tool and each of said drivers; an undercut on the cutting tool body forming a cylindrical section thereon; an enlarged co-axial flange on said cylindrical section of said cutting tool; two non-parallel edge surfaces on said enlarged flange, one edge having a helix thereon, while the other edge surface is flat throughout its full length and perpendicular to the rotational axis of the tool; a back taper on said helix; cooperation of said flange portion of said cutting tool and the undercut in said driver forming a compound locking and driving means, maintaining said respective parts in co-axial relationship; each of said parts being provided with aligned passages therethrough for lubricant as well as coolant during usage; rotational displacement of said tool bit and driver in opposite directions and less than 180°, to permit engagement of two opposite surfaces of said flutes to prevent uncoupling of said tool bit from said drivers during retraction of said machine tool since the rotational displacement is less than the total engagement of the respective parts.

Now, while the above describes a preferred embodiment of the present invention, it will be understood that the structure of the tool could be reversed without departing from the spirit of the invention. Thus, the enlarged flange could be on the driver and the undercut sleeve on the cutting tool.

Other objects of the invention will appear in the following description and appended claims, reference being had to the accompanying drawings which form a part of this specification, wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is an elevational view of a single fluted cutting tool and driver member which embodies the present invention.

FIGURE 2 is a cross section taken along lines 2-2 of FIGURE 1 and illustrates the flange portion of the driver.

FIGURE 3 is a cross section taken along lines 3-3 of FIGURE 1 and illustrates the cutter member and driver.

FIGURE 4 is an elevational view of another single fluted cutting tool which embodies a modified form of the present invention.

FIGURE 5 is an elevational view of a driver member partially broken away to illustrate the undercut in the hollow cylindrical portion thereof, this driver being operable with the cutting tool shown in FIGURE 4.

FIGURE 6 is an end view of the one flute driver shown in FIGURE 5.

FIGURE 7 is an end view broken away to illustrate another driver coupling, a portion of which is shown in elevation for clarity.

FIGURE 8 is an elevation of the end of the driver coupling shown in FIGURE 7.

FIGURE 9 is an elevational view of another modified drive coupling.

FIGURE 10 is an end view of the drive coupling shown in FIGURE 9.

FIGURE 11 is an elevational view of a two fluted

machine tool which embodies the principals of the present invention.

FIGURE 12 is an elevational view of the cutting tool shown assembled in FIGURE 11.

FIGURE 13 is an end view of the tool shown in FIGURE 12.

FIGURE 14 shows the cutting end of the machine tool illustrated in FIGURE 12.

FIGURE 15 is a cross section taken along lines 15—15 of FIGURE 11.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated, since the invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not limitation.

With reference to the drawings, FIGURE 1 illustrates an elevational view of a single fluted cutting tool and driver assembly, constructed in accordance with the teachings of the present invention. The teachings of the present invention permits the manufacture of high quality cutting tools at but a fraction of the cost previously encountered, with replacement of the cutting portion of the tool at a still further reduction in cost. This cost reduction is not possible to obtain with any cutting tools which are currently being manufactured. In addition, the time and material required to manufacture the second and all subsequent cutting portions of the tool has been reduced also. This is true because only the cutting portion of the tool need be replaced, since the driver is adaptable for use with other tools such as reamers, counterbores and the like. In addition, the time required to complete a given task necessitating deep hole drilling has also been reduced, in view of the fact that the machine set up need not be destroyed in the event that the tool needs to be sharpened or replaced. With the above in mind, the advantages of the present invention will be readily apparent.

FIGURE 1 of the drawings represents an elevational view of a single fluted cutting tool and driver assembly 10. The tool when assembled is generally the same in appearance as any other single fluted cutting tool, with the exception that in the present invention, the driver 12 and the cutting tool 52 are detachable.

The driver 12 may be of any configuration and in the present instance is generally cylindrical and of slightly less outside diameter than the outside diameter of the cutting tool 52. Longitudinal pilots (not shown) are provided as required to maintain the concentricity of the respective parts.

The driver 12 illustrated in FIGURE 1 is generally cylindrical in cross section and of any desired length. A coupling member 14 is provided on the left end of the driver shown, which is of the same configuration as coupling 54 on the cutting tool 52. The right end 16 of the driver 12 is provided with a female coupling 18 which is cooperable with coupling 54 on the cutting tool 52, or another coupling end 14 as provided on another driver member. This permits the coupling of a plurality of driver members to form a single assembly and thereby increase the length of the overall tool.

It will be noted that the driver body 22 is undercut as shown at 24, with a flange 26 extending upwardly therefrom. The end 28 of the driver body 22 is flat throughout as shown at 32 and is in generally parallel relationship to the forward edge 34 of the undercut 24. The edge 36 of flange 26, which is intermediate the end 28 and the forward edge 34 has a helix thereon. The helix 38 is back tapered and extends upwardly and outwardly from the undercut 24 to the outside diameter 46 of the flange 26. The helix 38 has its widest portion at the intersection of the upper surface 42 of the flute and

terminates at the lower surface of the flute 44 with the narrow portion.

The female coupling 18 is located on the right end 16 of the driver 12. The driver body 22 on the right end is hollow and generally cylindrical as indicated by numeral 25. An undercut 27 is provided adjacent the bottom 29 thereof. The bottom portion 29 is flat and square with the cylindrical surface 47 of the undercut 27, while surface 47 is generally parallel to the cylindrical surface 25 and the outside diameter of the driver body. The bottom portion 29 thereof also forms one edge 33 of the undercut 27, while the forward edge surface of the undercut 27 is in the form of a helix 39. The helix 39 is back tapered, the narrow portion being on the cylindrical surface 25, the wide portion being on surface 47 at the intersection point.

The cutting tool 52 shown in FIGURE 1, like the driver 12, is generally cylindrical and the left end thereof is provided with a coupling 54. The cutting tool 52 is undercut as shown at 74, with flange 76 extending upwardly therefrom. The end 78 of the cutting tool 52 is flat and in generally parallel relationship to surface 84 of the undercut 74. Surface 86, which is intermediate flat surface 78 and surface 84 has a helix thereon. The helix is identified by numeral 88. The helix 88 is back tapered and extends upwardly and outwardly from the undercut 74 to the outside diameter 96 of the flange 76. The helix 88 has its widest portion at the intersection of the upper surface 92 of the flute and terminates at the lower section of the flute 94 with the narrow portion.

From the foregoing description and observation of the geometry of the tool as shown in FIGURE 16, it is readily apparent that when the tool is assembled as illustrated in FIGURE 3 of the drawings, a reverse rotation of the respective parts is less than 180° and therefore will not permit the tool to become uncoupled from the driver. This is true because of the differential area of the respective flute surfaces formed by the surface of rotation of the helices 39 and 88, with respect to flat surfaces 29 and 78. Reverse rotation of the two coupled sections will cause the widest portion of the helix 88, located at the intersection of flute surface 92 to engage flute surface 44 of the coupled member located at the narrow portion of the helix. Since the length of the helix is greater than 180° and the rotational displacement which can be obtained is less than 180°, a portion of the helical flange will remain in the undercut 27. Thus, the tool remains coupled at all times the tool is in an opening and can become uncoupled only when lateral movement of the respective parts in opposite directions occurs. This lateral movement of course cannot occur during the time the tool is in use.

It will be understood that the left end of the driver 12 and the right end 16 thereof are similar, but duplicated in reverse. The cylindrical shank 24 on the left end of the driver 12 is of the same general dimension as the inside diameter 25 of coupling 18 on the right end 16. The outside diameter of the flange 26 is generally the same as the inside diameter 47 of the undercut 27, with the flange and undercut being positioned so as to cooperate with another driver or cutting tool. The left end of the cutting tool 52 is of the same general character and dimension as the left end of the driver 12. When said driver and cutting tool 52 are joined by engagement of the flange portion 76 with the undercut 27, through partial rotation of each member, the cylindrical surface 74 is piloted in the hollow sleeve of the driver 12, while end 78 of the cutting tool 52 engages the flat bottom 29 of the driver. Flange 76 is then firmly engaged between the two non-parallel surfaces of the said flange to form a unitary structure. Each of the flute surfaces 42, 44, 92 and 94 being positioned in alignment, along with the coolant passages 6 and 8 respectively. While the coolant passages are shown symmetrical, they may of course be positioned anywhere in the body, dependent on the terminus thereof in respect to the cutting edge of the cutting tool.

FIGURE 4 of the drawings illustrates another form of

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the present invention, wherein flange 176 on the cutting tool 152 is located intermediate the ends of the undercut portion 174. In addition, a helix 186 is formed on both opposed edges of the flange 176. Both of the helical portions are back tapered and depend in opposite directions. The helical portions could of course depend in the same direction, which would render the inner and outer edges thereof in generally parallel relationship, with the back tapered portions being divergent in direction.

Coupling end 114 is of the same configuration as the cutting tool 152, flange 126 is located on the driver 112 and positioned intermediate the ends of the undercut portion 124, while a helix 136 is formed on each of the edges of the flange. The coupling 118 on the right end 116 of the driver 112 is shown in FIGURE 5 of the drawings.

In FIGURE 5 of the drawings, the driver 112a is shown. In this driver, the left end of same is flat and square with the outside diameter of the body 122a, while the right end has a coupling 118a thereon. The central portion of the right end 116a is hollow and generally cylindrical as defined by surface 147a. Intermediate the ends of surface 147a is an undercut 124a, which surface is generally parallel with surface 147a. The surfaces 128a and 138a between surfaces 124a and 147a have a back taper thereon in addition to a helix on each of the respective surfaces. The helical portions thereon depend in opposite directions, with the widest portion intersecting the flute 142a and the narrowest portion intersecting flute 144a. It is therefore readily apparent that as the cutting tool 152 is caused to engage the driver, a compound locking engagement of the respective parts will occur and the parts will be joined as a single assembly.

In FIGURE 7 of the drawings, another modified form of the invention is shown, as in the case of FIGURE 9. Both of the figures illustrate drivers, which are without benefit of a cutting tool. It will be understood that the driven cutting tool coupling is cooperable with the driver coupling and is of the same general configuration as the driver coupling in reverse. In FIGURE 7, the coupling 218 is adapted for counter-clockwise rotation, as opposed to clockwise rotation in each of the couplings previously described. The central portion of the driver body 222 is hollow with a flat bottom 229. Extending longitudinally from the bottom surface 229 is a cylindrical surface 247, which surface is divided by a flange 225. The inside surface of flange 225 is identified by numeral 235. The sides of flange 225 each have helical portions thereon which are numbered 238 and 239 respectively. Each of said helical portions 238 and 239 are back tapered and depend in opposite directions, so that when the driver and cutting tool are coupled together, they form an integral, aligned assembly. The surfaces of the flutes are identified by numerals 242 and 244, with the wide portions of the helical sections intersecting the flute 242 and the narrow section of the helical portion intersects flute 244.

FIGURE 9 shows a coupling end 318, wherein the bottom 329 of the cylindrical portion 347 is undercut as indicated at 324. The edges of the undercut portion are identified by numerals 338 and 339 and each have a back taper thereon. However, only the forward edge 339 is provided with a helical portion. The coolant passage is identified by numeral 306 in this figure, by 206 in FIGURE 7 and by 106a in FIGURE 5.

In FIGURE 11 of the drawings, an elevational view of a two fluted cutting tool and driver assembly is illustrated. This tool is generally the same in appearance as any other two fluted cutting tool, except that the cutting tool 452 is detachable from the driver 412.

The driver 412 is generally cylindrical, except for the portion which is cut away so as to form the flutes 442 and 444. The coupling provided on the left end 414 of the driver 412 is the same as the coupling 454 on the left end of the cutting tool 452. The right end of the driver 416 has a female coupling 418 which is cooperable with the male coupling 454 on the cutting tool 452 or a

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male coupling 414 on a driver 412. This construction permits the length of the cutting tool to be extended, should the need arise.

The driver body 422 which is generally cylindrical, is undercut at 424 to form a second generally cylindrical surface in parallel relationship to the outside diameter of the driver body 422. The left end 428 of the driver body 422 is flat and is generally parallel to the step 434 of the undercut 424. The left end of the undercut 424 has a flange 426 thereon, the outside diameter of which is parallel to the outside diameter of the undercut 424 and the outside diameter of the driver body 422. One edge of the flange 426 is defined by the end 428 of the driver while the forward edge of the flange is identified by numeral 436. Since the flange 426 is divided by the flutes 442 and 444, we have in effect two flanges. Each of said flanges 426 has a helix on the forward edge thereof, which surfaces are back tapered. As shown, the helical portions are similar and extend in the same direction.

The female coupling 418 is located on the right end 416 of the driver 412. The right end 416 of the driver body 416 is hollow, with the inside surface thereof being generally cylindrical in configuration and identified by numeral 425. An undercut 427 of similar configuration to the flanges, but of opposite hand is formed adjacent to the bottom 429 of the cylindrical portion 425. The bottom portion 429 is flat and square with the cylindrical surface 447 of the undercut 427, while surface 447 is also generally parallel to surface 425 as well as the outside diameter of the driver body 422.

The bottom portion 429 forms one edge of the undercut 427, while the forward edge thereof is identified by numeral 439 and has a helix thereon. With the undercut being divided, in effect there are two undercuts, each of which has a helix thereon, which helical portions are co-operable with the helical portions of the flange on the cutting tool 452 or the flange 426 on the driver 412.

From the foregoing description, it will be apparent that the present invention is simple, durable and less expensive than its counterpart, the one piece construction which is now available. In addition, the tool of the present invention may be extended in length, which is not now possible. Since the tool is formed from a minimum of two parts having a coupling means disposed therebetween, the respective parts can be coupled and uncoupled when sharpening is required and replaced when the tool or cutting portion is worn out, without replacement of the driver. Because of the nature of the construction, the cutting tool will not be released during retraction of the tool because of the engagement of the enlarged flange with the undercut when the opposed flutes are in abutment with each other.

Having thus described my invention, I claim:

1. In a cutting tool for use in the machine tool industry, the combination of,
 - a driver member;
 - a detachable cutting tool;
 - at least one cutting edge on said detachable cutting tool;
 - a single undercut in the cutting tool body forming a cylindrical section thereon;
 - an enlarged flange portion on said cylindrical section;
 - two opposed non-parallel surfaces on said enlarged flange portion, one edge surface having a helix thereon, while the other edge of said enlarged flange is flat throughout its full length and perpendicular to the rotational axis of said tool;
 - a back taper on the helical edge of said flange;
 - a hollow, generally flat bottom sleeve portion on one end of said driver member;
 - a single cylindrical undercut in said sleeve;
 - two opposed non-parallel edge surfaces on said undercut, one edge surface thereof having a helix thereon, while the other surface is flat throughout its full

- length and perpendicular to the rotational axis of the tool;
- rotational engagement of said driver and said detachable cutting tool between said non-parallel edges of said enlarged flange and said undercut joining said members as a single unit assembly. 5
2. In a two part tool for use in the metal cutting industry, the combination of,
- a driver member;
 - a detachable cutting tool; 10
 - a cutting edge on said tool;
 - an undercut in the cutting tool body forming a cylindrical section thereon;
 - an enlarged flange portion on said cylindrical section;
 - two non-parallel edges on said enlarged flange portion, 15
 - each having a helix thereon;
 - a back taper on each helix throughout its full length;
 - a hollow, generally flat bottom sleeve portion on one end of said driver member;
 - a cylindrical undercut in said sleeve; 20
 - two non-parallel edge surfaces on said undercut, each surface having a helix thereon;
 - a back taper on each helix throughout its full length;
 - engagement of said driver and cutting tool between said non-parallel edges of said enlarged flange and said undercut joining said members as a single unit. 25
3. In a cutting tool for use in the machine tool industry, the combination of,
- at least one driver member;
 - a detachable cutting tool; 30
 - a cutting edge on said tool;
 - a single flute disposed throughout the full length of said cutting tool and substantially throughout the full length of said driver;
 - an undercut in the cutting tool body forming a cylindrical section thereon having an arc in excess of 180°;
 - an enlarged coaxial flange on said cylindrical section having an equivalent arc;
 - two opposed non-parallel edge surfaces on said enlarged flange extending throughout the full length thereof; 40
 - a generally cylindrical sleeve on one end of said driver;
 - a coaxial undercut on the inside diameter of said sleeve;
 - two opposed non-parallel edge surfaces on said undercut extending throughout the full length thereof; 45
 - engagement of said flange with said undercut joining said driver and cutting tool as a unitary assembly when said members are rotated, rotation less than 180° in the opposite direction permits engagement of the differential areas of the flutes created by the non-parallel edge surfaces of the flange and undercut without disengagement of the respective parts, thus the driver and cutting tool cannot become uncoupled as a result of reverse rotation of the tool during retraction of the tool after a work cycle. 50
4. In a multi-section cutting tool, the combination of,
- a driver member and cutting tool, said driver member and cutting tool having a coupling means therebetween; 55
 - a flute disposed throughout the length of said driver and cutting tool;
 - an undercut on the end of said cutting tool forming a cylindrical section in coaxial relationship with the

- body portion thereof and having an arc in excess of 180°;
- an enlarged flange on the end of said cylindrical section and coaxial with said cylindrical section and said body portion of the tool and having an arc in excess of 180°;
- two opposed non-parallel edge surfaces extending throughout the full arc on said enlarged flange, one edge surface having a helix thereon;
- a hollow, generally cylindrical sleeve on one end of said driver, said sleeve being generally coaxial with the body portion of said driver;
- an undercut on the inside diameter of said sleeve in generally coaxial relationship to said sleeve and the body portion of said driver;
- two opposed non-parallel edges on said undercut extending throughout the full arc, one edge surface having a helix thereon;
- lateral displacement of the respective parts toward each other followed by rotation of the respective parts joins said parts between the non-parallel edge surfaces as a unitary assembly, while rotation of said parts in the opposite direction less than 180° engages the opposed flute surfaces of differential area to abut each other without release of the respective parts unless lateral displacement occurs.
- 5. A tool as in claim 4, wherein a back taper is provided on said flange helix and said undercut helix edge surface.
- 6. A tool as in claim 4, wherein a back taper is provided on each of the non-parallel edges of said enlarged flange and on each of the non-parallel edges of said undercut.
- 7. A tool as in claim 4, wherein a coolant passage extends throughout the full length of each member, with said passage in each respective member being in alignment when said members are engaged.
- 8. In a multi-section tool adapted for lateral and rotational engagement, the combination of,
- a male and female coupling member;
- said male and female coupling members having cut away portions throughout their lengths respectively, the included angle of said cut away portions being less than 180°;
- a flange portion on said male coupling and an undercut on said female coupling;
- two opposed non-parallel edges extending throughout the full length of each edge of said flange and of said undercut;
- said non-parallel edges starting at the intersection of one surface of said cut away portion in spaced relationship and terminating at the intersection of the adjacent surface of said cut away portion in greater spaced relationship so as to form two surfaces of differential area to prevent uncoupling of the respective parts.

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