

3,254,353

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June 7, 1966

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3,254,353

YIELDABLE DRIVING DEVICES FOR THREAD CUTTING TAPS

Filed Jan. 21, 1964

7 Sheets-Sheet 2

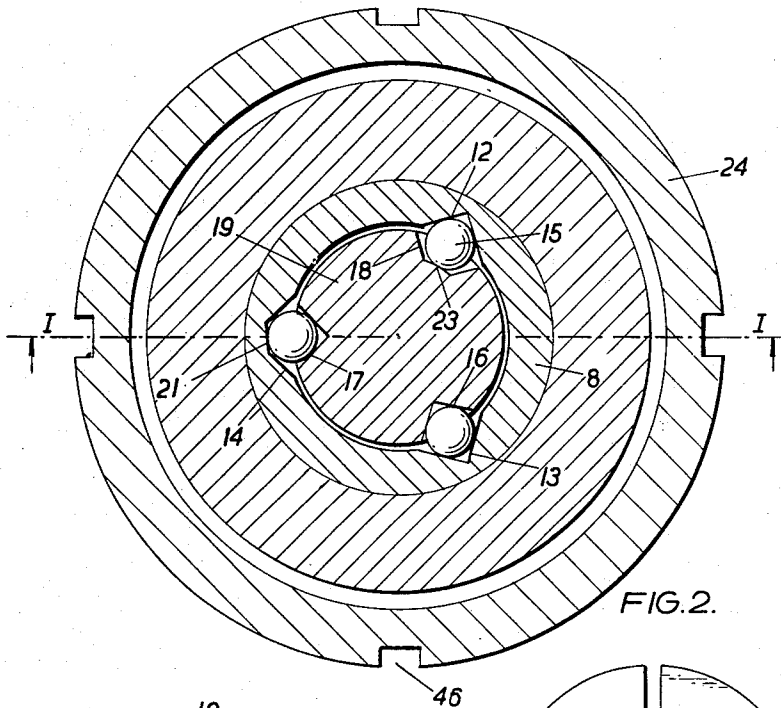


FIG. 2.

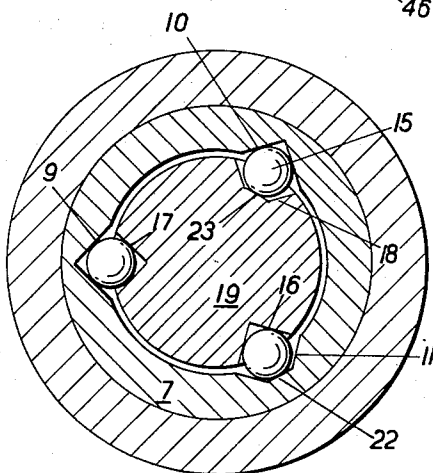


FIG. 3.

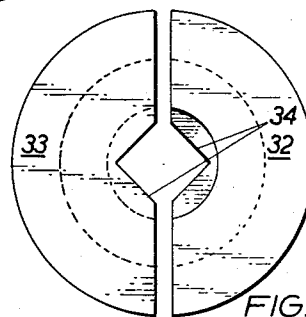


FIG. 5.

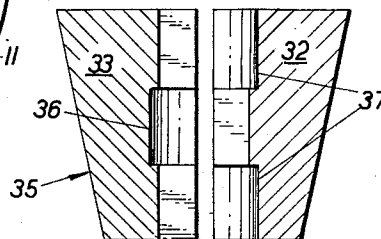


FIG. 4.

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3,254,353

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Filed Jan. 21, 1964

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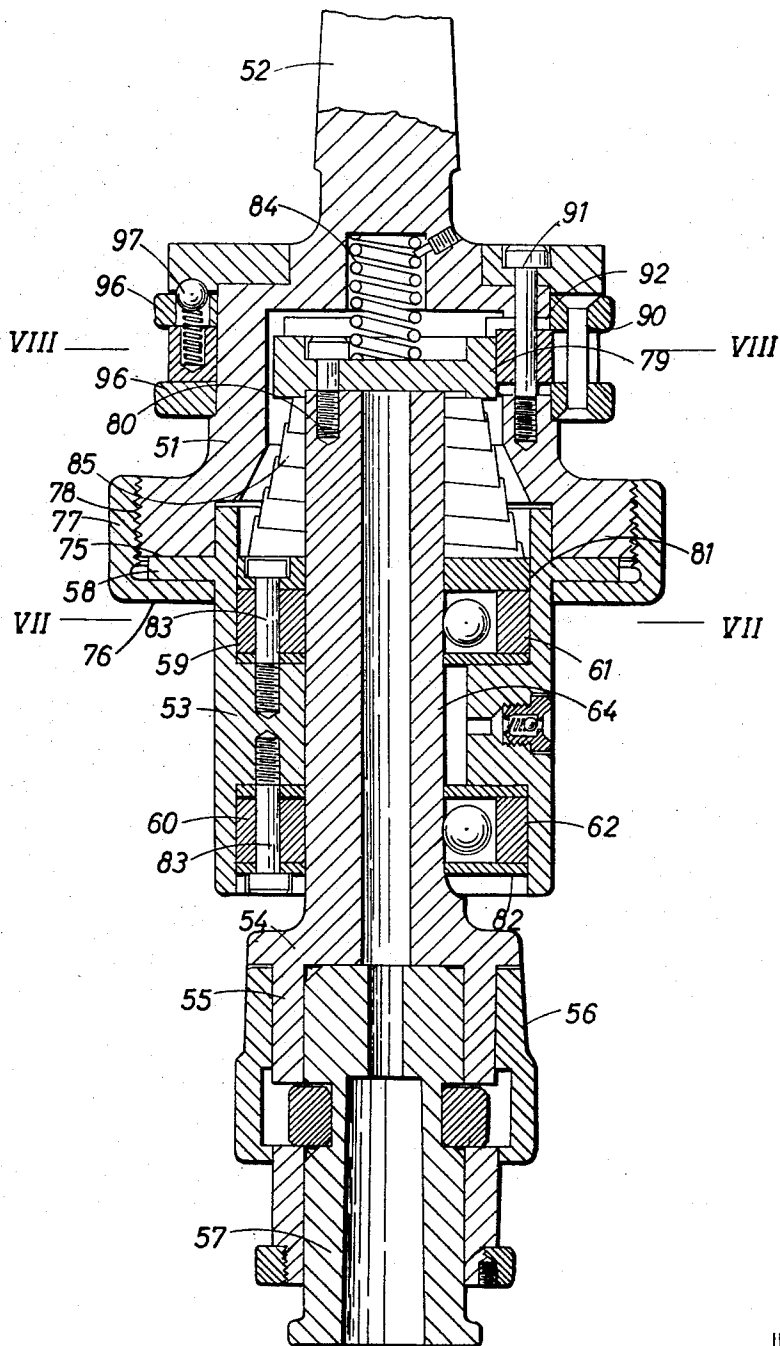


FIG. 6

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Filed Jan. 21, 1964

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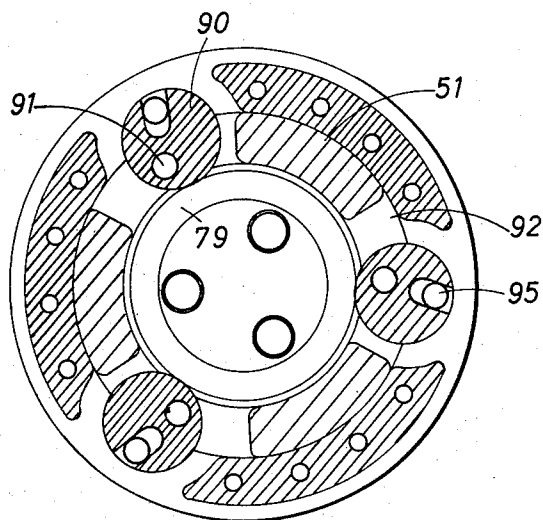


FIG. 8

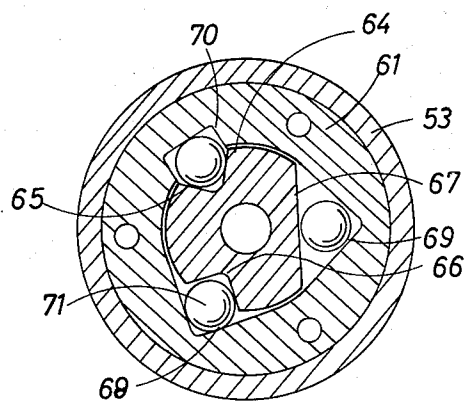


FIG. 7

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YIELDABLE DRIVING DEVICES FOR THREAD CUTTING TAPS

Filed Jan. 21, 1964

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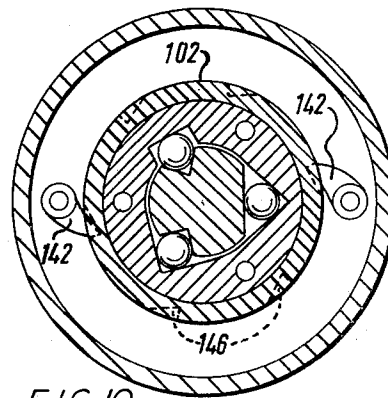
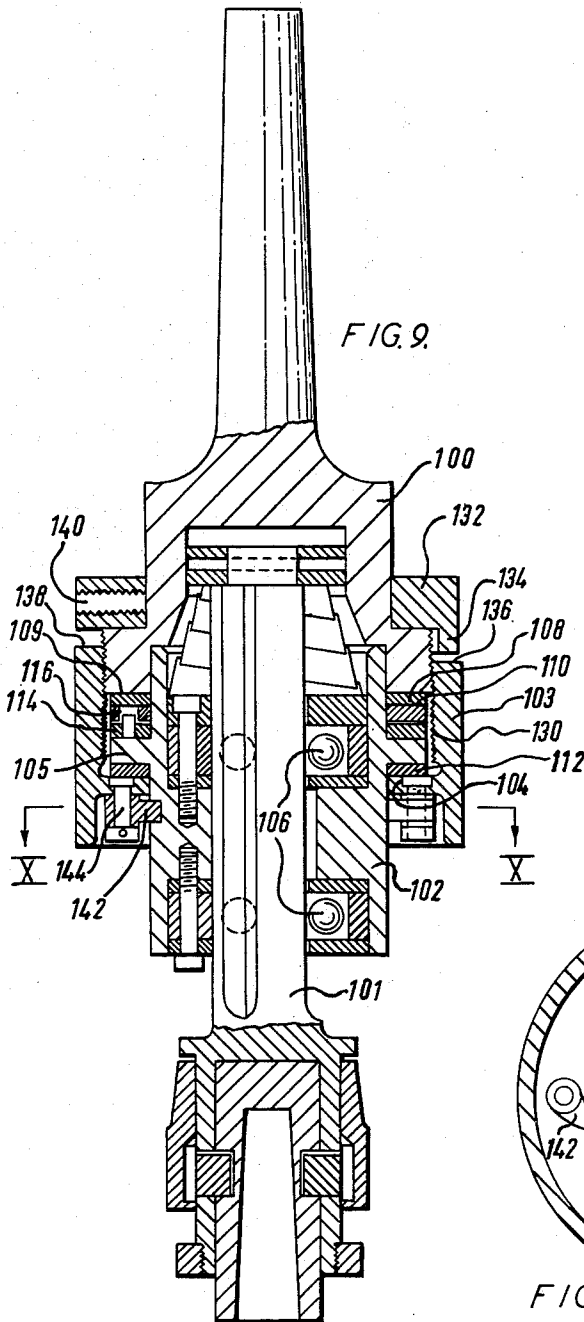


FIG. 10.

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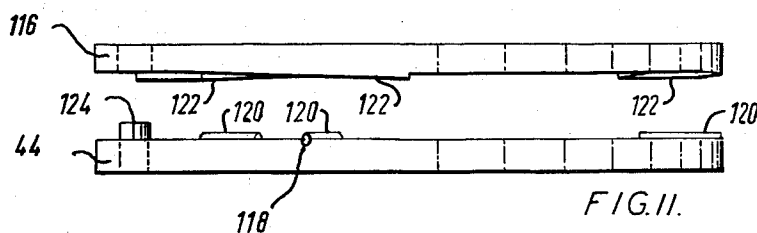
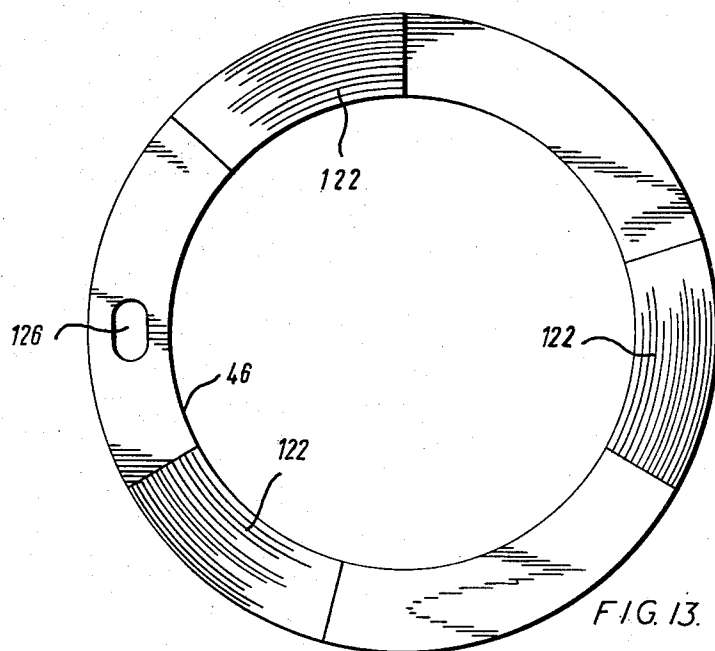
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YIELDABLE DRIVING DEVICES FOR THREAD CUTTING TAPS

Filed Jan. 21, 1964

7 Sheets-Sheet 6



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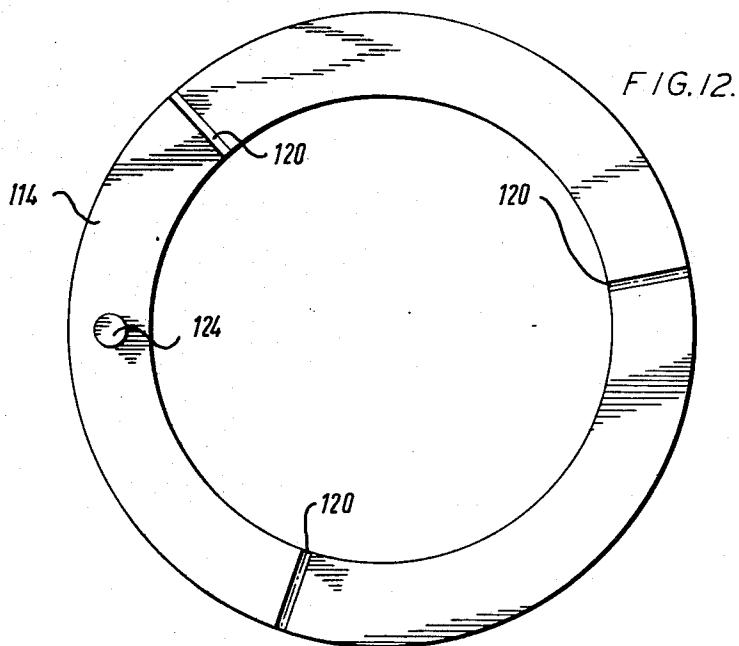
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YIELDABLE DRIVING DEVICES FOR THREAD CUTTING TAPS

Filed Jan. 21, 1964

7 Sheets-Sheet 7



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3,254,353

YIELDABLE DRIVING DEVICES FOR THREAD CUTTING TAPS

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Filed Jan. 21, 1964, Ser. No. 339,260

Claims priority, application Great Britain, June 6, 1959, 19,410/59

21 Claims. (Cl. 10—135)

The present invention relates to yieldable driving devices for the driving of thread cutting tools such as taps and thread chasers in drilling, tapping and like machines and this patent application is a continuation-in-part application of patent application Serial No. 33,298 which was filed on June 1, 1960.

The present invention provides a driving device for thread cutting tools in which a driven member through which the drive may be transmitted to the cutting tool or on which the cutting tool may be mounted is capable of axial displacement relatively to a driving member whilst being rotationally driven thereby the torque from said driving member being transmitted to the driven member through self-releasing friction clutch means adapted automatically to disengage itself when the torque substantially exceeds the normal cutting torque and automatically to re-engage itself when the direction of rotation of the driving member is reversed.

The invention is applicable for example to the cutting of male threads on studs and to the tapping of female threads in holes and more particularly in blind holes. The invention will as a rule be hereinafter described with reference to the tapping of female threads.

In the conventional method of tapping threads in drilling machines the tap and drilling head are axially fixed relatively to one another and the operator feeds the drill head axially as the cutting of the thread proceeds. The operator is seldom able to apply axial feed at precisely the appropriate rate so that there is usually either over-feed or under-feed which applies axial compression or axial tension to the tap which causes distortion of the profile of the cut thread and often results in breakage of the tap. There is some ground for believing that this axial loading of the tap is responsible in a greater degree than torsional loading for tap breakage. The relative axial displaceability of the driving and driven members relieves the tap of the above mentioned axial loading and thus enhances the truth of the thread profile, minimises tap breakage and enables the thread cutting to be performed at higher speeds.

The possibility of thread cutting at higher speeds is further enhanced by the use of a friction clutch which is able not only to slip but also to release itself when the torque substantially exceeds the normal cutting torque and which can automatically re-engage itself on reversal of the driving member to withdraw the tap. This avoids the need when tapping blind holes for accurate deceleration of the tap towards the end of each tapping operation and eliminates the danger of tap breakage through over-feeding. By means of the present invention the thread cutting can proceed at full speed until the thread has been completely cut whereupon the clutch will automatically release itself and disconnect the drive from the tap; thereafter the machine can be reversed to withdraw the tap and to enable the clutch automatically to re-engage itself ready for the next tapping operation.

Driving devices according to the present invention embody an intermediate member which is axially fixed relatively to one of said driving or driven members and relatively to the other of which it is axially displaceable, the drive between said one member and said intermediate member being transmitted through self-releasing friction

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clutch means as above referred to. The friction clutch means is engaged by a threaded nut which is automatically tightened to apply clutching pressure on reversal of rotation of the driving member, that is to say on rotation of the driving member in the direction opposite to that for thread cutting, and which is automatically slackened on slipping of the clutch. The intermediate member may be axially fixed to the driving member and the driven member may be axially displaceable relatively thereto with said self-releasing clutch means between the driving member and the intermediate member.

A further feature of the invention resides in the provision of wedging means between axially opposed faces of interclutchable members of said friction clutch means, such wedging means having a circumferential inclination in the same direction as that of the thread of said nut.

The driven member may be held in concentric juxtaposition with the intermediate member by axially spaced sets of circumferentially spaced balls only one of which in each set serves to transmit torque from the intermediate member to the driven member. The torque transmitting ball of one set is preferably circumferentially spaced from that of another or the other set.

The invention is further described by way of example with reference to the accompanying drawings in which:

FIG. 1 is an axial sectional view of a driving device taken on the line I—I of FIG. 2;

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a cross-sectional view taken on the line III—III of FIG. 1;

FIG. 4 is a detail of the chucking arrangement;

FIG. 5 is a plan view of FIG. 4;

FIG. 6 is an axial sectional view of an alternative form of driving device as compared with that of FIG. 1;

FIG. 7 is a sectional view taken on the line VII—VII of FIG. 6;

FIG. 8 is a cross-sectional view taken on the line VIII—VIII of FIG. 6;

FIG. 9 is an axial sectional view of a further form of driving device;

FIG. 10 is a section taken on the line X—X of FIG. 9;

FIG. 11 is a side view illustrating two of the elements shown in FIG. 9 to a larger scale and somewhat spaced apart;

FIG. 12 is a plan view of the lower of the elements illustrated in FIG. 11; and

FIG. 13 is an inverted plan view of the upper of the elements illustrated in FIG. 11.

In FIG. 1 the driving member comprises a hollow annular body 1 having a morse taper or other shank 2 to suit the head of a drilling or tapping machine. Rotation of the driving member 1 is transmitted to an intermediate member 3 in the form of a sleeve by means of a friction clutch 4 which comprises an annular friction clutch element disposed beneath the lower face 5 of the driving member 1 and the flanged upper face 6 of the intermediate member 3.

The intermediate member 3 is provided with two annular rings 7 and 8, ring 7 having axial flutings 9, 10 and 11 therein and the ring 8 having axial flutings 12, 13 and 14 therein, and aligned respectively with the flutings 10, 11 and 9 of the ring 7, in which flutings are located balls 15. The balls 15 engage within axial flutings 16, 17, 18 formed in the shaft 19 of the driven member of tap holder 20 so that on rotation of the intermediate member 3, the balls 15 act in the appropriate flutings of the shaft 19 to cause the tap holder to rotate.

The flutings 16, 17, 18 extend nearly the whole length of shaft 19 and allow the shaft 19 of tap holder 20 to move axially relatively to the driving member 1 and intermediate member 3.

The flutings 9, 10, 11 of annular ring 7 and the flutings 12, 13, 14 of annular ring 8 are spaced apart by 120°. As shown in FIG. 2 the flutings 12 and 13 are formed as right angle grooves whereas the fluting 14 has a flat surface 21. As seen in FIG. 3 the flutings 9, 10 in annular ring 7 are formed as right angle grooves whilst the fluting 11 has a flat surface 22. The flutings 16, 17 upon the shaft 19 are formed as right angle grooves whilst the groove 18 has a flat surface 23. The form and position of the flutings 9, 10, 11 in ring 7 and flutings 12, 13, 14 in ring 8 and of the flutings 16, 17, 18 in the shaft 19 are thus in accordance with the principles of Kinematic design, in that of the three balls in each set which serve to maintain the concentric juxtaposition of the shaft 19 and intermediate member 3, only one in each set serves to transmit the torque, namely the ball in groove 9 and that in groove 13.

The friction clutch 4 is engaged by means of a flanged nut 24 which is in threaded engagement with the driving member 1 by means of threads 25 of hand opposite to the thread to be cut. As threads to be cut are usually righthanded the threads 25 will usually be lefthanded. The nut 24 is provided with knurling or slots or both 46 to aid in the screwing and unscrewing thereof. A second friction clutch 26 comprises an annular friction clutch element disposed between the lower face 27 of the flange on the intermediate member and the face 28 of the flange of the nut 24.

The arrangement is such that if the nut 24 is slack and the clutch 4 disengaged, rotation of the driving member 1 in the reverse direction with the flange of the intermediate member 3 supported by the flange of the nut 24 will cause the driving member 1 to screw itself into the nut 24 and thereby to engage the clutch 4 ready for a subsequent tapping operation. The clutch 4 is designed so that with such tightening of the nut 24 as above referred to it will be capable of transmitting a normal cutting torque. When the tap reaches the bottom of a blind hole the torque requirement will sharply increase and the clutch 4 will thereby slip and the driving member 1 will to some extent screw itself out of the nut 24 which will to some extent be restrained against rotation by its engagement through the friction element 26 with the flange of the intermediate member 3.

Blind holes may thus be tapped at high speed right up to the end of a tapping operation since the drive to the tap will automatically be disengaged as it reaches the bottom of the hole. Reversal of the rotation member 1 however will re-engage the clutch ready for the next tapping operation and to enable the tap to be withdrawn from the tapped hole.

The lower portion of shaft 19 of the tap holder 20 has an internal recess 29 therein to accommodate the tap shaft. An external thread 30 is provided which may engage with the internal thread of a casing portion of a conventional adjustable chucking device for the tap.

A chunking arrangement which may also be used in the present invention is shown in greater detail in FIG. 4 and comprises two movable parts 32 and 33 each tapered as at 35 and having an axial right angle fluting 34 therein. The flutings 34 are suitably recessed to provide a six surface grip of the tap shaft in accordance with the principles of Kinematic design. Thus, there are provided the recess 36 in the part 33, and the recesses 37 in the part 32, which leaves two projections in part 33 and one intermediate V-shaped fluting in the part 32.

The intermediate member 3 has a flat annular retaining plate 38 secured thereto by screws 39, and which acts to retain the ring 7 in the transmission member 3. The upper end of shaft 19 also has a flat annular ring 40 secured by screws 41. The ring 40 at 42 is of larger diameter than the shaft 19, which is retained within the driving member 1 and intermediate member 3 by abutment of the part 42 with the shoulder 43 of ring 8.

In operation the driving device, with a suitable tap held in the tap holder 20 and with the spindle 2 positioned

in a drilling or tapping machine, is lowered until the tap is directly above the hole in which an internal screw-thread is to be made. The shaft 19 is then in its uppermost position as shown in FIG. 1. The drilling or tapping machine is then started in order to rotate the driving member 1, which in turn causes rotation of the intermediate member 3 through clutch 4. The intermediate member 3 rotates the driven member or tap holder by means of the balls 15.

As the tap rotates a screw thread is formed in the hole and the revolving tap pulls itself into the work piece, the fluting 16, 17, 18 in the shaft 19 allowing the tap holder to move with minimum frictional resistance axially relatively to the driving member 1 and intermediate member 3 as the threads are formed without the application of external axial pressure to the tap holder and without requiring the tap to tow the drill head downwardly as the tapping proceeds.

The driving device illustrated in FIGS. 6, 7 and 8 comprises a hollow driving element 51 formed integral with a morse taper shank 52, an intermediate member 53 and a driven member 54 formed with a socket 55 and provided with a chuck nut 56 for a collet 57.

The intermediate member 53 is formed as a sleeve with a flange 58 near one end and with opposed recesses 59, 60 to receive annular rings 61, 62 of which the upper ring 61 is illustrated in FIG. 7, the lower ring 62 being similar thereto but turned through 120°.

The shaft 64 of the driven member 54 is formed with flutings 65, 66 (FIG. 7) of roughly triangular cross-section and with a flat 67. Each of the rings 61, 62 is formed with flutings 68, 69 of roughly triangular cross-section and with a fluting 70 of rectangular cross-section. The concentric juxtaposition between the shaft 64 and the intermediate member 53 is maintained by balls located in the grooves of the rings 61, 62 and engaging the flutings and flat of the shaft 64. Of the three balls engaging in the ring 61 only the ball 71 is employed to transmit torque from the intermediate member 53 to the shaft 64. Likewise only a single ball of those engaging in the ring 62 is employed for transmitting the torque, the two torque transmitting balls being angularly spaced by 120°.

The flange 58 on the intermediate member frictionally engages with face 75 at the lower end of the driving member 51 and with flange 76 of clutch nut 77. The threaded engagement 78 between the clutch nut 77 and the driving member 51 is lefthanded so that when the tap encounters an obstruction giving rise to an increased torque requirement, slipping will occur between the driving member 51 and the flange 58 whereby to cause the nut 77 to unscrew itself to some extent from the driving member 51 or in other words to cause the driving member 51 to screw itself to some extent out of the nut 77 whereby to release the clutching engagement between the driving member 51 and flange 58 and thus to disengage the drive from the tap. On reversal of rotation of the driving member 51 the engagement of the flange 76 with the flange 58 tending to keep the nut 77 stationary will enable the driving member 51 to screw itself into the nut 77 to re-engage the clutch.

A circular cap 79 is secured to the upper end of the shaft 64 by three screws 80. The rings 61, 62 are held in position by caps 81, 82 and screws 83. Buffer means in the form of a spring 84 is interposed between the driving member 51 and the driven member 54 and buffer means in the form of a spring 85 is interposed between the driven member 54 and the intermediate member 53.

To enable the driving device to be used also for drilling it may often be desirable to eliminate the torque limitation which arises from the friction clutch means and to that end mechanical means is provided for rotationally locking the driven member to the driving member comprising three equi-angularly spaced cams 90 eccentrically mounted on pins 91 which pass downwardly across slots 92 in the wall of the hollow driving member

51. Each cam 90 is formed with a jaw to receive a pin 95. The pins 95 are fixed to a composite ring 96 which can be locked by means of a detent device 97 in an angular position at which the cams 90 are held out of engagement with the disc member 79 which is secured to the driven member 54. Alternatively the detent 97 can be released and the composite ring 96 moved rotationally to rotate the cams 90 into engagement with the disc member 79 whereupon the application of increasing torque to the driving member 51 will increasingly lock the cams 90 in engagement with the disc member 79 to rotationally lock the driven member 54 to the driving member 51. This mechanical locking device would of course only be employed when a positive drive is required as for example when drilling.

The driving device illustrated in FIG. 9 comprises a driving member 100, a driven member 101, an intermediate member 102 and nut 103 with an inwardly directed flange 104 which embraces a flange 105 on the intermediate member 102. The mode of driving of the driven member 101 by the intermediate member 102 through balls 106 is substantially the same as in FIGS. 1 and 6 and does not require further description.

A friction ring 108 is bonded to the lower end face 109 of the driving member 100 and provides a bearing face 110 for the driving member; a friction ring 112 is bonded to the lower face of flange 105 of the intermediate member 102.

A washer 114 is bonded to the upwardly directed face of flange 105 of the intermediate member 102. A second washer 116 is disposed between washer 114 and friction ring 108 and frictionally engages ring 108. Washer 114 has three radially directed grooves 118 in its upper face in which are received rollers 120 which respectively engage circumferentially inclined wedge-like surfaces 122 on the lower face of washer 116. A pin 124 extends upwardly from washer 114 and enters into a slot 126 in washer 116 whereby to limit relative angular displacement of the washers 114, 116. The slope of the surfaces 122 is in the same direction as that of the thread 130 of the nut 103.

The device illustrated in FIG. 9 is suitable for tapping righthand threads and the thread 130 of nut 103 is therefore lefthanded. When the driven member 101 is restrained as the tap reaches the bottom of a hole there is angular displacement of the driving member 100 relatively to the intermediate member 102 and nut 103 to release the clutch between driving member 100 and intermediate member 102. When rotation of the driving member 100 is reversed to withdraw the tap there is angular displacement in the opposite direction of the driving member 100 relatively to the driven member 101 and nut 103 so as to screw the driving member 100 into the nut 103 to re-engage the clutch.

When the driving member 100 is again rotated in the tapping direction any circumferential slip between the driving member 100 and the driven member 101 will cause the inclined faces 122 of washer 116 to ride upwardly on the rollers 120 whereby to tighten the clutch and thus to prevent further slipping of the clutch until rotation of the driven member 101 is again restrained. The abutment of pin 124 of washer 114 with one end of the slot 126 prevents undue tightening of the clutch through riding of the inclined surfaces 122 of ring 116 on rollers 120.

In an alternative form of construction the rollers 120 are received in slots 118 formed in the upper face of flange 105 of the intermediate member 102 and pin 124 extends upwardly from flange 105 and the washer 114 is eliminated. However the cost of forming slots 118 in flange 105 is likely to be greater than the cost of washer 116.

In another alternative form of construction the ring 116 is inverted and bonded to the upper face of flange 105 of the intermediate member 102, and ring 114 is in-

verted and disposed above the ring 116 and beneath friction ring 108. In a further modification inclined wedge-like surfaces 122 are formed on the upper face of flange 105 with ring 114 located thereabove and inverted beneath friction ring 108.

Referring again to FIG. 9, a ring 132 has a downwardly extending abutment 134 which engages in a recess 136 in the upper edge 138 of the nut 103. The circumferential extent of the recess 136 is greater than the circumferential extent of the abutment 134 thus permitting a limited degree of rotational movement of the nut 103 relatively to the ring 132 and thus relatively to the driving member 100 to which the ring 132 is locked by means of a locking screw 140 which permits of angular adjustment of the ring 132 relatively to the driving member 100. The ring 132 and the recess 136 serve to limit the extent to which the driving member 100 can unscrew itself from the nut 103. The length of the recess 136 is of course sufficient to allow the clutch to disengage.

Two pawls 142 are mounted respectively on diametrically opposed pivot pins 144 which extend downwardly from the flange 104 of nut 103. The pawls 142 are adapted to engage in recesses 146 in the cylindrical outer surface of the intermediate member 102. The pawls 142 serve to enable the nut 103 positively to drive the driven member 101 in the reverse direction for withdrawal of the tap after the end of a tapping operation. Any resistance to rotation of the driven member 101 in the reverse direction is thus positively applied to the nut 103. This tends to facilitate or enhance the screwing of the driving member 100 into the nut 103 for the purpose of re-engaging the clutch on reversal of the driving member.

I claim:

1. A driving device for thread cutting tools comprising a driving member, a driven member coaxial with the driving member and a hollow intermediate member, one of said driving and driven members being substantially axially fixed relatively to the intermediate member and the other passing through the intermediate member and being axially displaceable relatively thereto and in positive torque transmitting relationship therewith, said one member and said intermediate member having opposed axially directed faces to render said one member and said intermediate member interclutchable, a nut in threaded engagement with one of said interclutchable members and having a flange embracing and frictionally engageable with the other of said interclutchable members, said threaded engagement being of opposite hand to the cutting direction whereby to provide a self-releasing clutch means between the driving member and the driven member adapted automatically to disengage itself when the torque substantially exceeds the normal cutting torque and automatically to re-engage itself when the direction of rotation of the driving member is reversed.

2. A driving device according to claim 1 comprising axially spaced sets of circumferentially spaced balls holding said other member in concentric juxtaposition with the intermediate member, of which only one ball of each set serves to transmit torque.

3. A driving device according to claim 1 comprising mechanical means for rotationally locking the driven member to the driving member.

4. A driving device according to claim 1 comprising axially directed buffer means between the driving and driven members.

5. A driving device according to claim 1 comprising wedging means between said axially directed faces of said interclutchable members, said wedging means having a circumferential inclination in the same direction as that of the thread of said nut.

6. A driving device according to claim 5 comprising means for limiting the effectiveness of said wedging means.

7. A driving device according to claim 1 comprising two washers between said axially directed faces and within said nut, said washers being capable of limited relative circumferential displacement, one of said washers having at least three radially directed grooves in its face adjacent to the other washer, a roller in each of said grooves, the other washer having on its face adjacent to said one washer circumferentially inclined wedge-like surfaces equal in number to the number of grooves in said one washer, each of said inclined surfaces being engaged by one of said rollers and the inclination of said surfaces being in the same direction as that of the thread of the said nut.

8. A driving device according to claim 7 in which one of said washers is bonded to the axially directed face adjacent thereto.

9. A driving device according to claim 7 comprising a pin extending axially from one of said washers and engaging in a slot in the other of said washers in order to limit relative angular displacement of the washers.

10. A driving device according to claim 1 comprising a ring surrounding the interclutchable member with which the nut is in threaded engagement, means for securing the ring to said interclutchable member, an abutment on the ring extending towards and into a recess in the nut, the circumferential extent of the recess in the nut being greater than that of said abutment thereby permitting limited angular displacement of said interclutchable member relatively to the nut.

11. A driving device according to claim 1 comprising a uni-directional driving means between the nut and the intermediate member to enable the nut to drive the intermediate member in the direction of rotation opposite to the cutting direction.

12. A driving device according to claim 11 comprising at least one pawl on the nut engageable in a recess in the surface of the intermediate member.

13. A driving device for thread cutting tools comprising a driving member, a driven member having a tool holder at one end thereof, said driven member being coaxial with the driving member, and a hollow intermediate member, one of said driving and driven members being substantially axially fixed relatively to the intermediate member and the other passing through the intermediate member and being axially displaceable relatively thereto and in positive torque transmitting relationship therewith, said one member and said intermediate member having opposed axially directed faces to render said one member and said intermediate member interclutchable, a nut in threaded engagement with one of said interclutchable members and having a flange embracing and frictionally engageable with a flange on the other of said interclutchable members, said threaded engagement being of opposite hand to the cutting direction whereby to provide a self-releasing clutch means between the driving member and the driven member adapted automatically to disengage itself when the torque substantially exceeds the normal cutting torque and automatically to re-engage itself when the direction of rotation of the driving member is reversed.

14. A driving device according to claim 13 comprising axially spaced sets of circumferentially spaced balls holding said other member in concentric juxtaposition with the intermediate member, of which only one ball of each set serves to transmit torque, the torque transmitting ball of one set being circumferentially spaced from that of another set.

15. A driving device according to claim 13 comprising eccentric cams rotationally mounted in equi-angularly spaced disposition on the driving member adapted to be released from disengaged positions and to rotate into engagement with the driven member and by virtue of relative rotation between the driving member and the driven member in the drilling or tapping direction to lock the driving member to the driven member.

16. A driving device according to claim 13 comprising axially directed spring buffer means between the driving and driven members.

17. A driving device according to claim 13 comprising axially directed spring buffer means between the driving member and driven member and between the intermediate member and the driven member.

18. A driving device for thread cutting tools comprising a driving member and a driven member with a tool holder at one end thereof, said driving and driven members being coaxial, one of said members having at one end an annulus formed with an axially directed bearing face, and the other member comprising a shaft having a ball receiving recess thereon, a hollow intermediate member positioned on said shaft adjacent to said bearing face and having a ball receiving recess on the internal bore, one of said ball receiving recesses being elongate and in the form of a fluting, a ball engaging in the ball receiving recesses of the intermediate member and said other member to enable one to drive the other rotationally while permitting relative axial displacement thereof, said intermediate member incorporating an annulus formed with an axially directed bearing face adjacent to the bearing face of said one member, said bearing faces being in frictional inter-relationship, a nut in threaded engagement with one of said annuli, said threaded engagement being of opposite hand to that of the thread to be cut, and a flange on said nut embracing and in frictional relationship with a flange on the member which includes the other of said annuli, said bearing faces and said nut forming a self-releasing friction clutch means between said one member and said intermediate member which is adapted automatically to release itself when the torque substantially exceeds the normal cutting torque by relatively rotating the nut and the annulus in threaded engagement therewith in the direction to release said bearing faces from one another and automatically to re-engage itself on reversal of rotation of the driving member.

19. A driving device for thread cutting tools comprising a driving member and a driven member with a tool holder at one end thereof, said driving and driven members being coaxial, one of said members having at one end an axially extending cavity terminating in an annulus formed with an axially directed bearing face, and the other member comprising a shaft having at least one axially directed fluting thereon, a portion of said shaft positioned in said cavity, a hollow intermediate member positioned on said shaft adjacent to said bearing face and having at least one ball receiving recess on the internal bore, a ball engaging in the recess of the intermediate member and in the fluting of said other member to enable one to drive the other rotationally whilst permitting relative axial displacement thereof, said intermediate member incorporating an annulus formed with an axially directed bearing face adjacent to the bearing face of said one member, said bearing faces being in frictional inter-relationship, a nut in threaded engagement with one of said annuli, said threaded engagement being of opposite hand to that of the thread to be cut, and a flange on said nut embracing and in frictional relationship with a flange on the member which includes the other of said annuli, said bearing faces and said nut forming a self-releasing friction clutch means between said one member and said intermediate member which is adapted automatically to release itself when the torque substantially exceeds the normal cutting torque by relatively rotating the nut and the annulus in threaded engagement therewith in the direction to release said bearing faces from one another and automatically to re-engage itself on reversal of rotation of the driving member.

20. A driving device for thread cutting tools comprising a driving member and a driven member with a tool holder at one end thereof, said driving and driven members being coaxial, one of said members having at one

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end an axially extending cavity and a bearing flange formed with an axially directed bearing face, and the other member comprising a shaft having at least one axially directed fluting thereon, a portion of said shaft positioned in said cavity, a hollow intermediate member positioned on said shaft adjacent to said bearing flange and having at least one ball receiving recess on the internal bore, a ball engaging in the recess of the intermediate member and in the fluting of said other member to enable one to drive the other rotationally while permitting relative axial displacement thereof, said intermediate member having a bearing flange with an axially directed bearing face adjacent to the bearing face of said one member, said bearing faces being in frictional interrelationship, a nut in threaded engagement with one of said bearing flanges, said threaded engagement being of opposite hand to that of the thread to be cut, and a flange on said nut embracing and in frictional relationship with the other of said bearing flanges, said bearing flanges and said nut forming a self-releasing friction clutch means between said one member and said intermediate member which is adapted automatically to release itself when the torque substantially exceeds the normal cutting torque by relatively rotating the nut in the direction to move the nut away from the flange which it embraces and automatically to re-engage itself on reversal of rotation of the driving member.

21. A driving device for thread cutting tools comprising a driving member having an axially extending cavity and bearing face at one end, a driven member coaxial with the driving member and comprising a shaft with a tool-holder at one end and having at least one axially directed fluting on said shaft, a portion of said shaft positioned in said cavity, a hollow intermediate member positioned on said shaft between said tool-holder and

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said bearing face and having at least one axially directed fluting on the internal bore, a ball engaging in the flutings of the intermediate and driven members to enable one to drive the other rotationally whilst permitting relative axial displacement thereof, said intermediate member having a flange at the end adjacent said bearing face, a nut in threaded engagement with the driving member, said threaded engagement being of opposite hand to that of the thread to be cut, and a flange on said nut in frictional engagement with the lower surface of the flange on the intermediate member, the upper surface of said latter flange being in frictional engagement with said bearing face to form a self-releasing friction clutch means between the driving member and said intermediate member which is adapted automatically to release itself when the torque substantially exceeds the normal cutting torque by relatively rotating the nut and driving member in the direction for moving the nut away from the lower surface of the flange on the intermediate member and automatically to re-engage itself on reversal of rotation of the driving member.

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