Jan. 23, 1940. G. L. ROCK 2,188,158

SCREW DRIVER

Filed March 3, 1937 3 Sheets-Sheet 1

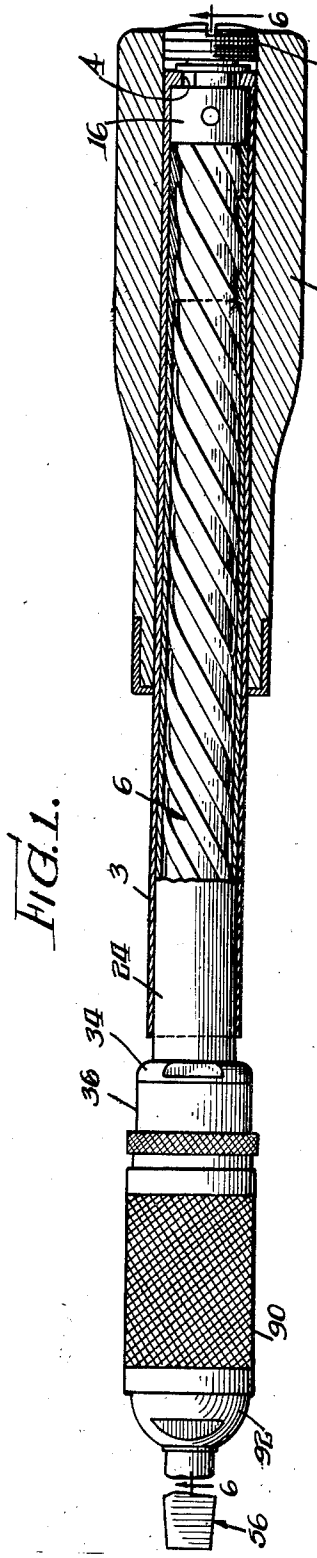


FIG. 1.

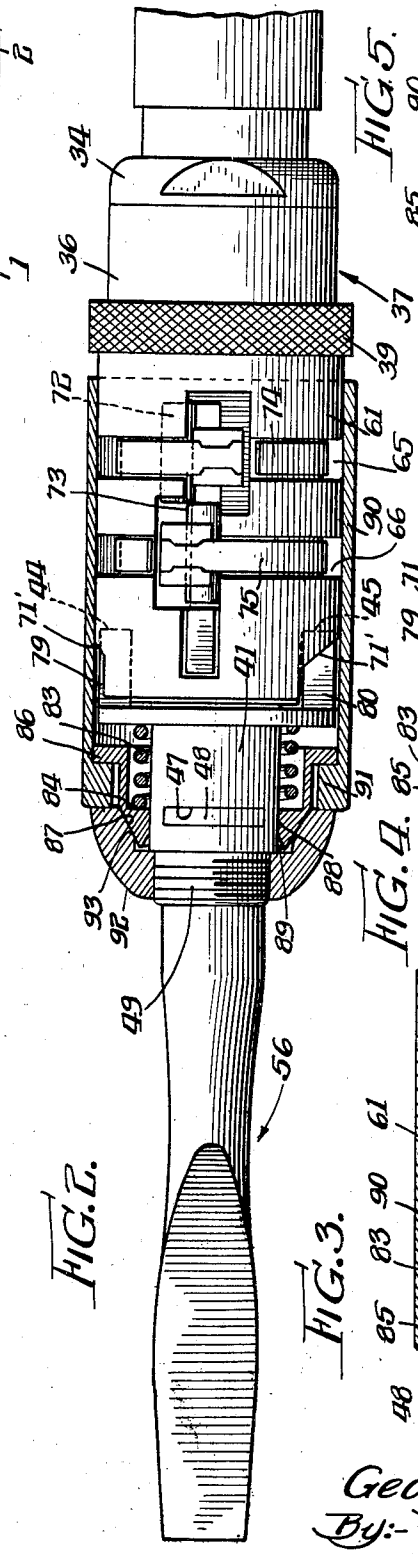


FIG. 2.

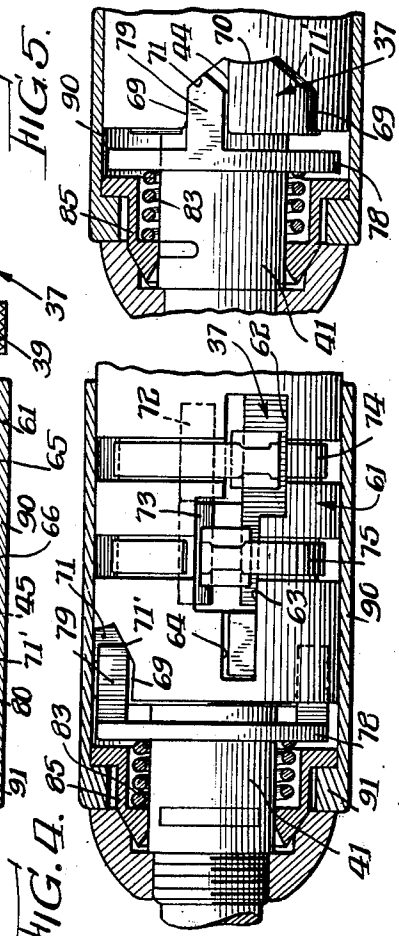


FIG. 5.

FIG. 4.

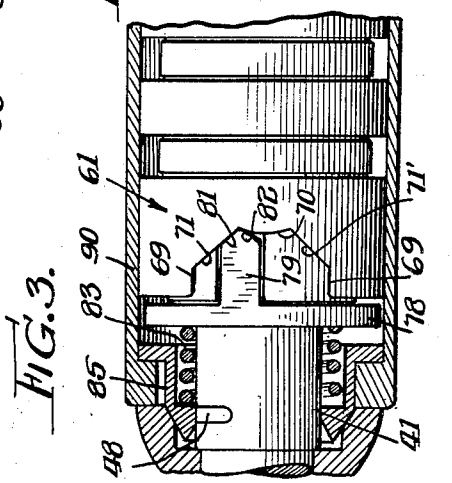


FIG. 3.

Inventor
George L. Rock
By:- Cox & Moore attys.

Jan. 23, 1940. G. L. ROCK 2,188,158

SCREW DRIVER

Filed March 3, 1937 3 Sheets-Sheet 2

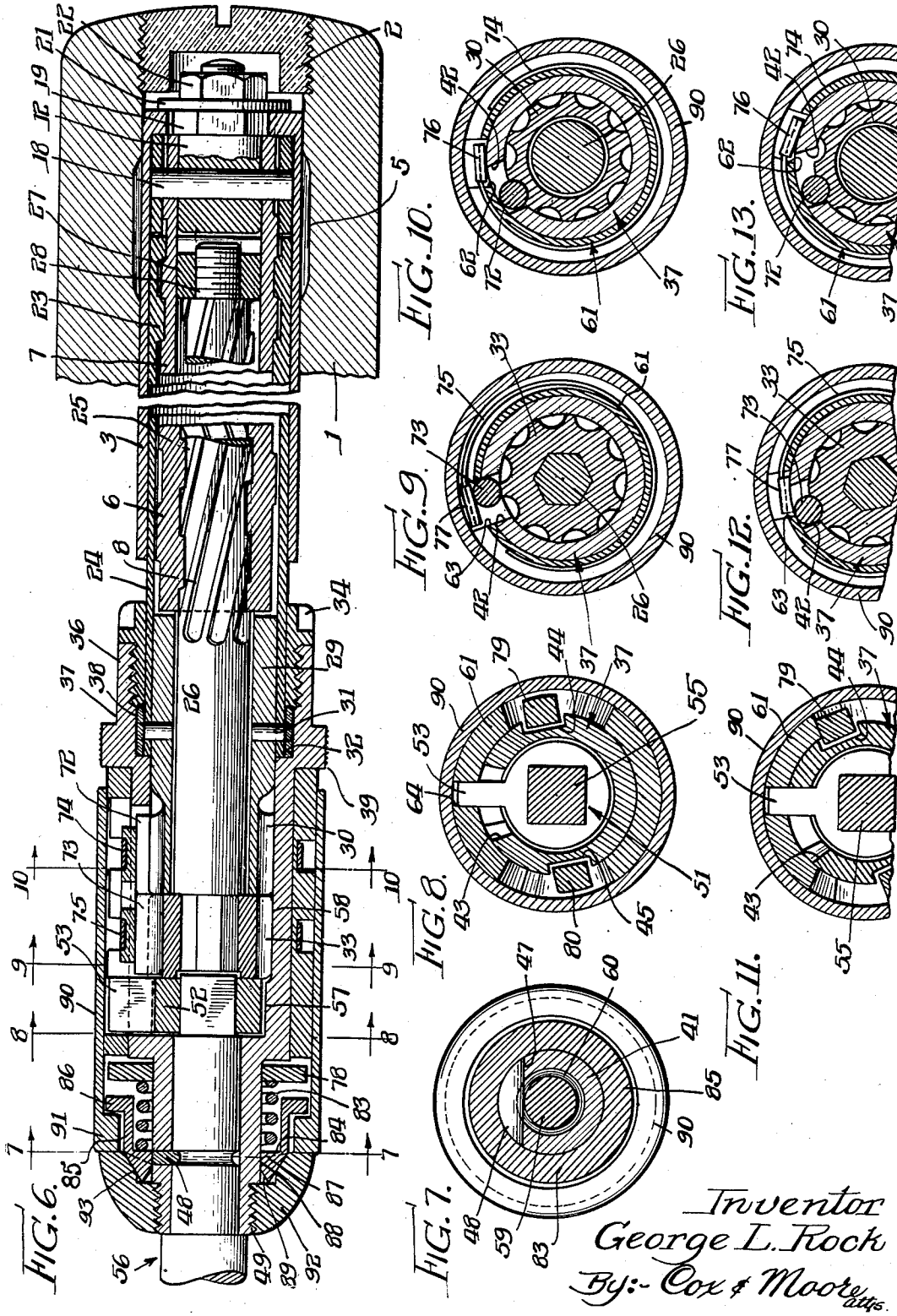


FIG. 6.

FIG. 10.

FIG. 13.

FIG. 9.

FIG. 12.

FIG. 8.

FIG. 11.

FIG. 7.

Inventor
George L. Rock
By:- Cox & Moore Attys.

Jan. 23, 1940. G. L. ROCK 2,188,158

SCREW DRIVER

Filed March 3, 1937 3 Sheets-Sheet 3

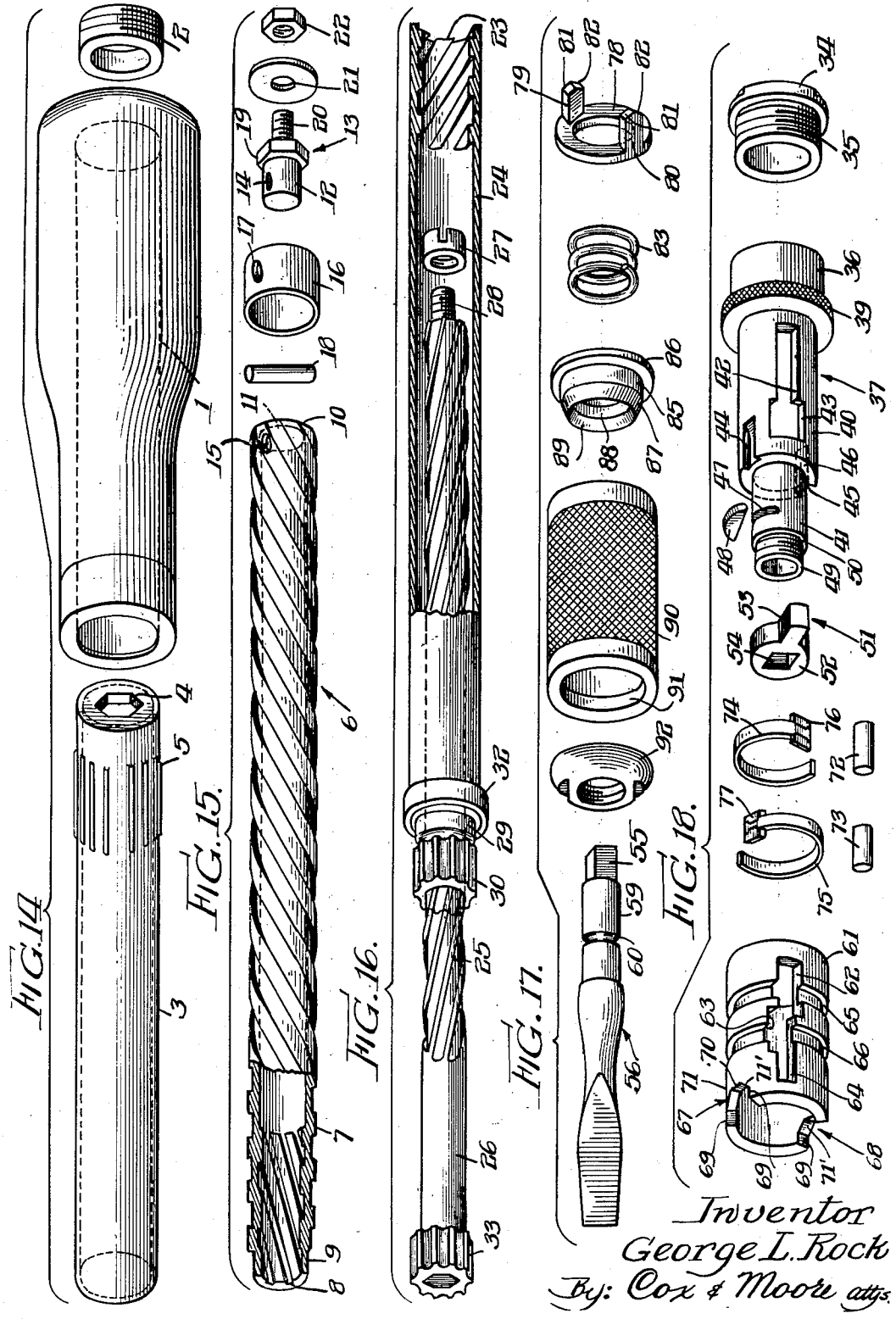


FIG. 14

FIG. 15.

FIG. 16.

FIG. 17.

FIG. 18.

Inventor
George L. Rock
By: Cox & Moore attys.

Patented Jan. 23, 1940 2,188,158

UNITED STATES PATENT OFFICE

2,188,158

SCREW DRIVER

George L. Rock, North Adams, Mich.

Application March 3, 1937, Serial No. 128,830

18 Claims. (Cl. 145—54)

This invention relates to spiral screw drivers.

Spiral screw drivers in use today each embody an exposed longitudinally movable spiral shaft secured to an operating handle and a nut or follower secured through suitable instrumentalities to the screw driver blade or bit. For the purpose of providing movement in opposite directions, reversely directed spirals are cut into the shaft and mechanism is provided for shifting the follower from one groove to the reverse groove or to a locking position between the starting ends of the two intersecting grooves.

The use of such screw drivers has been limited, and when used in high speed or quality work found unsatisfactory, because of certain inherent defects. As the force required to move the screw increases there is an increased tendency of the handle to back-spiral, that is, to turn backwardly upon downward push of the handle, the screw driver blade consequently being rotated less and less. In order to prevent this, a force must be applied circumferentially of the handle sufficient to overcome the backward tortional thrust of the spiral. These forces, when not in exact balance, produce with the force exerted longitudinally of the handle, a resultant force which increases to such a magnitude as to cause the screw driver blade suddenly to slide laterally of, and out of engagement with, the screw head. This, besides being a constant annoyance and causing a loss of time in all cases, prohibits its use in house finishing or other work of a decorative character. The necessary film of lubricant on the exposed spiral keeps the tool dirty and results in the spoilation of fine work, such as room trim and the like. Also, this film rapidly picks up and retains dirt, gravel, saw dust and the like, requiring relatively frequent disassembling of the tool for cleaning purposes. Another inherent defect is the rapid deterioration and destruction of the spiral mechanism caused by the relatively small wearing surface between operating parts. Objection has also been validly made to the means provided for controlling the spiraling action. In order to rotate the screw driver blade directly when the force required exceeds that which can be transmitted through the spiral, it is necessary to remove the tool from the screw, push the spiral to the complete forward position and manually make a precise adjustment of the small locking pin that prevents movement of the follower along either of the two spiral grooves. This is an operation which often results in the annoyance of pinched and lacerated hands and consumes sufficient time to constitute a matter of considerable importance in high speed or mass production assembly work.

It is the object of applicant's invention to provide a spiral screw driver free from the above generally stated inherent defects.

Specifically, it is an object of this invention to provide, in a spiral screw driver or the like, means to automatically lock the driver bit or work tool to the handle whenever the force required to move the screw exceeds a predetermined value, said means being operative in all positions of the handle and spiral and being effective to prevent "back-spiraling."

A further object is to provide tortionally actuated means for automatically locking the handle to the driver bit or work tool for rotation as a unit.

Another object is to provide tortionally actuated means between the driver bit and the spiral actuating means for automatically locking the handle to the driver blade for rotation as a unit.

A further object of applicant's invention is the provision of a spiral screw driver employing separate and independent spiral members for forward and reverse rotation of the driver bit, thereby elminating cross-overs between the spirals, and the excessive wear caused thereby.

A further object is the provision of a spiral screw driver having inter-engaging wearing surfaces between a spiral member and a follower increased to an extent impossible in previous spiral screw drivers.

A further object is to provide spiral screw drivers in which the spiral members and followers are each provided with an increased number of inter-engaging spiral teeth or threads for properly distributing the forces between said members and said followers.

Another object of the invention is the provision of more efficient and durable means for connecting a spiral member to a driver bit for transmitting force in one direction and for permitting full ratcheting in the reverse direction.

A further object is to provide a spiral screw driver with more precise and yet sturdier means for controlling the forward and reverse movements of the driver bit.

A still further object of applicant's invention is to provide a spiral screw driver by which the speed of tightening and loosening screws may be different to the end that the initial tightening of the screws may be accomplished at a higher speed than the loosening of the screws for the purpose of shortening the time of placing screws

while at the same time preventing removal of screws at too rapid a rate for safety.

Another object of the invention is to provide a spiral screw driver in which no lubricating surface is exposed; in which the conditions of lubrication are ideal from the standpoint of efficiency and cleanliness, and in which no spiral surface is exposed to pinch or lacerate the operator's hands.

Other and further objects are to provide a spiral screw driver which, as compared to present day spiral screw drivers, shall be lighter in weight, sturdier and more durable in construction; shorter in length for the same handle travel; cleaner to handle, and of an increased range of usefulness.

Other and further objects and advantages will be apparent from the following detailed description of one illustrative embodiment of the invention, when considered with the accompanying drawings wherein:

Fig. 1 is an elevational view partly in section of a screw driver embodying the invention;

Fig. 2 is a view partly in elevation and partly in section of the driven end of the screw driver;

Figs. 3, 4 and 5 are views similar to Fig. 2 showing a portion of the mechanism in different positions of operation;

Fig. 6 is a longitudinal section taken along the lines 6—6 of Fig. 1;

Fig. 7 is a lateral cross section taken along the lines 7—7 of Fig. 6;

Fig. 8 is a transverse cross section taken along the line 8—8 of Fig. 6;

Fig. 9 is a transverse section taken along the line 9—9 of Fig. 6;

Fig. 10 is a transverse section taken along the line 10—10 of Fig. 6;

Figs. 11, 12 and 13 are sections similar to Figs. 8, 9 and 10 but showing the positions of the parts under a different condition of operation, and

Figs. 14, 15, 16, 17 and 18 are exploded views in perspective of the different parts of the screw driver.

As shown in the drawings, the screw driver embodies a handle 1 threaded at one end to receive a cap screw 2 and centrally bored to receive a shield 3 therein, the shield 3 comprising a cylindrical tube open at one end and having a hexagonal aperture 4 (Fig. 14) in its other end for a purpose later to be described. The shield 3 is provided with teeth or projections 5 (Fig. 14) for engaging the material of the handle 1 when driven thereinto for retaining the shield against movement relative to the handle 1. The shield 3 receives a spiral member 6 which is secured thereto against relative rotation. The spiral member 6 comprises a tube having spiral teeth or threads 7 on its outer periphery and internal spiral teeth or threads 8 extending a short distance inwardly from the end 9 of the tube. The internal diameter of the tube from the opposite end 10 to the internal spiral teeth 8 is equal to the base or root diameter of said teeth as clearly shown in Fig. 15. The end 10 of the spiral member 6 is provided with an opening 11 to receive the cylindrical end 12 of a stud 13. The cylindrical portion 12 of the stud 13 is provided with a transverse aperture 14 of the same size and adapted to register with a transverse aperture 15 in the end 10 of member 6. A collar 16 is adapted to snugly fit over the end 10 of the member 6 and the collar is provided with a transverse aperture 17 of the same size, and adapted to register with, the aperture 14 of the stud 13 and the aperture 15 of the member 6. A pin 18 is provided, and this pin passes through the apertures 14, 15 and 17 and secures these parts in assembled relation.

The stud 13 is provided with a hexagonal nut portion 19 of the same size and adapted to register with the hexagonal aperture 4 in the end of the shield 3 for the purpose of securing the stud and the attached member 6 to the shield 3. The stud 13 is provided with a threaded portion 20, which is adapted to receive a washer 21 and a nut 22 for securing the stud and member 6 to the shield 3 against longitudinal movement. The external teeth 7 of the spiral member 6 are adapted to mate with spiral teeth or threads 23 formed internally of the tube 24 and the internal teeth 8 of the spiral member 6 are adapted to mate with the external teeth or threads 25 of a spiral member 26. The spiral member 26 passes loosely through the tube 24 into mating engagement with the spiral member 6. A nut 27 threaded on the reduced end 28 of the member 26 slidingly engages the inner portion of the tube 6 between the threaded end 9 and the opposite end 10 and the movement of the member 26 outwardly of the tube 6 is limited by the engagement of the nut with the inner end of the spiral teeth or threads 8.

The tube 24 at its end opposite the spiral 23 is pinned to the hub portion 29 of a ratchet 30 by a pin 31 which passes through the tube and the hub 29. A pressed-fit collar 32 surrounds the end of the tube 24 and the pin 31. At its outer end, the spiral member 26 carries a similar ratchet 33 and the portion of the member 26 which passes through the central bore of the ratchet 30 is smooth and of slightly smaller diameter than the internal diameter of said ratchet, thereby permitting the member 26 to freely rotate in the opposite direction relative to the ratchet 30. On the tube 24 there is mounted a sleeve 34 having a reduced and externally threaded portion 35. The sleeve 34 abuts the collar 32 and threadedly engages the internally threaded shank 36 of a driven member or sleeve 37. Inwardly of the internal threads the member 37 is provided with a smooth bore 38 which co-operates with the collar 32 to form a bearing for the member 37. Inwardly of the shank 36 the member 37 is provided with a knurled annular flange 39 to permit manual manipulation of the member 37 for purposes later to be described. The member 37 is provided with a reduced portion 40 inwardly of the collar 39 and the portion 40 connects with a still further reduced portion 41.

The portion 40 is provided with a longitudinal slot 42 and an aperture 43 somewhat greater in width than the width of the slot 42 and registering with said slot. Longitudinal slots or grooves 44 and 45 are cut into the surface of the portion 40 at right angles to the slot 42 and aperture 43, the grooves 44 and 45 extending to the shoulder 46 formed by the reduced portions 41 and 40. The portion 41 is provided with an arcuate slot or key-way 47 adapted to receive a substantially semi-circular key 48 and at the outer end of the portion 41 is formed a threaded portion 49 of slightly smaller diameter than the portion 41, and therefore forming with the portion 41 a shoulder 50.

A drive pin or clutch member 51 has a hub portion 52 and an upstanding tooth or lug 53. The hub 52 is provided with a square or rectangular aperture 54 for receiving the squared or rec-

tangular end 55 of a screw driver bit 56. The member or key 51 is adapted to be received in the driven member or sleeve 37, the hub portion 52 mating with a bored portion 57 of the member 37 (Fig. 6), and the tooth or lug 53 passing through the aperture 43 in the member or sleeve 37. It should be noted that the portion 57 of the member 37 is of a slightly reduced internal diameter relative to the portion 58 which receives the ratchets 30 and 33, and that the tooth or lug 53 is substantially less in width than the width of the aperture 43. In assembling the screw driver, this facilitates the insertion of the member 51 into the sleeve 37.

The portions 41 and 49 of the sleeve 37 are centrally bored to receive the circular shank 59 of the bit 56 and the circular shank 59 is grooved as at 60 to engage the key 48 and be releasably held thereby against longitudinal movement relative to the sleeve or member 37.

A second sleeve 61 is adapted to slidably fit over and rotate on the member or sleeve 37. This sleeve 61 is provided with a plurality of longitudinal slots 62, 63 and 64, the slots 62 and 63 being each of a width equal to the width of the slot 42 in the sleeve 37, but being off-set circumferentially relative to each other a distance equal to substantially half the width of the slot 42. The slot 64 registers with the aperture 43 in the sleeve 37 but is substantially narrower than said aperture, and is of a width slightly greater than the thickness of the tooth or lug 53 of the member 51, which tooth is adapted to pass through the slot 64 and at its outer end be flush with the surface of the sleeve 61. The member 61 is provided with a plurality of circumferential slots or grooves 65 and 66 intersecting the slots 62 and 63 respectively at their midpoints. Inwardly from one edge there are cut, in the member 61, diametrically opposed cam grooves 67 and 68. Each of these cam grooves comprises a plurality of opposed surfaces 69 extending longitudinally of the sleeve 61, a curved surface 70 centrally of the groove and oppositely inclined surfaces 71 and 71' connecting the surfaces 69 to the curved surface 70.

Pins 72 and 73, which together are of a length slightly less than the combined length of the slots 62 and 63, are adapted to set in grooves between the teeth of the ratchets 30 and 33 and to co-operate with the sides of the slot 42, in a manner later to be described, to rotate the bit 56. The pins 72 and 73 are retained in ratchets 30 and 33 by spring straps 74 and 75 which seat in the grooves 65 and 66 of the sleeve 61, and these spring straps 74 and 75 are provided with enlarged heads 76 and 77, which extend into the slots 62 and 63 in positions overlying the pins 72 and 73, as best shown in Fig. 2.

A ring 78 slidably fits over the reduced portion 41 of the sleeve 37 and carries integral cam fingers or lugs 79 and 80, which are slidably received in the slots or key ways 44 and 45 and the cam grooves 67 and 68. The cam fingers 79 and 80 are each provided with oppositely tapering or beveled surfaces 81 and 82 for engaging the surfaces 70 and 71 of the cam grooves 67 and 68. For normally retaining the ring 78 and the sleeve 61 in the position shown in Fig. 3, wherein the surface 81 of each cam finger is in engagement with the surface 71 and the surface 82 is in engagement with the surface 70, there is provided a spiral spring 83. This spiral spring bears at one end against member 78 and at its other end against an internal shoulder 84 (Figs. 2 and 6) of a cap member 85. Cap member 85 is provided with an upstanding circular flange 86 and a beveled nose 87. The nose 87 is provided internally with a cylindrical portion 88 normally overlying the key 48 and an outwardly tapering or conical portion 89 for a purpose later to be described.

The cap member 85 is adapted to be moved rearwardly against action of the spring 83 by a cylindrical member or sleeve 90 which fits loosely over the sleeve 61 and is provided at one end with down-turned or inwardly extending flange 91 engaging the front surface of the flange 86 of the cap 85. The outward movement of the cap 85 is limited by a nut 92 fitted on the portion 49 of the sleeve 37, and this nut is provided with a beveled portion 93 co-operating with the beveled portion 87 of the cap 85.

The screw driver is assembled in the following manner:

The threaded sleeve 34 is slid over the tube 24 and the spiral member 6 is threaded into the tube 24 and over the spiral member 26. By means of a special tool passing into the tube 6 from the end 10, the nut 27 is threaded on the threaded portion 28 of the tube 26, thus locking the spiral members 6 and 26 together against excessive longitudinal movement. The stud 13 and collar 16 are then assembled on the end 10 of the tube 6 and secured thereto by the pin 18 which passes through the transverse openings 14, 15 and 17. The shield 3 having been pressed into the handle 1 until its upper end is adjacent the upper end of the handle 1, the stud 13, which is now attached to the spiral member 6 and parts assembled thereto, is inserted through the opening 4 of the shield 3 with the hexagonal nut 19 seated in the hexagonal opening 4. The washer 21 and nut 22 are then fastened on the threaded end 20 of the stud 13 and the cap screw 2 threaded into the upper end of the handle 1. The sleeve 61 is now slid onto the sleeve 37 with the slot 64 of the sleeve 61 in alignment with the slot 42 of the sleeve 37. The driving pin 51 is then inserted into the bore of the sleeve 37 through the end 36 and the pin 51 having reached the reduced bore 57 of the sleeve 37 is now tilted by an instrument, or by the tilting of the sleeves 37 and 61, until the tooth or lug 53 passes outwardly through the slot 42 and the pin 51 then moves down the slot 42 into its proper position wherein the lug 53 passes through the aperture 43 of the sleeve 37 and the slot 64 of the sleeve 61, as best shown in Figs. 6 and 8. The sleeve 37 to which has been assembled the sleeve 61 and pin 51, is now passed over the ratchets 30 and 33 and threaded onto the sleeve 34 by which it is secured to the tube 24. The pins 72 and 73 are now dropped through the slots 62 and 63 and the slot 42 into the grooves formed by the teeth of the ratchets 30 and 33, and the spring straps 74 and 75 are placed in the circumferential grooves 65 and 66 in the sleeve 61 with the enlarged heads 76 and 77 in the slots 62 and 63 and resiliently engaging the pins or pawls 72 and 73. The ring 78 is slid on the portion 41 of the sleeve 37 with its fingers 79 and 80 in the grooves 44 and 45 and engaging the surfaces of the cam grooves 67 and 68. The key 48 is next inserted into the key-way 47 and the spring 83 and cap 85 are placed in position on the portion 41 of the sleeve 37. The sleeve 90 is then slid over the sleeve 61 with its depending flange 91 in engagement with the upstanding flange 86 of the cap 85 and the nut 92 is then threaded on the reduced portion 49 of the sleeve

37 to retain the parts in assembled relation on said sleeve.

In order to insert the bit 56 into the screw driver, the sleeve 90 is slid axially to the right (Fig. 6) to move the cap 85 axially to the right against the action of the spring 83. Inserting the bit in the end of the sleeve 37 the key 48 will be moved into the recess formed by the outwardly tapering portion 89 in the nose 87 of the cap 85 to permit the squared end 55 of the bit to be inserted into the complementary opening 54 in the driving pin 51, the key 48 dropping into the groove 60 in the bit to secure the bit against longitudinal movement. Upon release of the sleeve 90 the key 48 is locked in position by the cap 85.

The operation of the screw driver is as follows:

Upon longitudinal movement of the handle 1, the spiral member 6 will be moved therewith and the external teeth 7 engaging tooth 23 of the tube 24 will cause the tube 24 to rotate in one direction, while the internal teeth 8 of the spiral 6 engaging the external teeth of the spiral 26 will cause this member 26 to be rotated in a direction opposite to the tube 24. The ratchet 30 being connected to the tube 24, and the ratchet 33 being connected to the member 26, these ratchets will be rotated in opposite directions. The sleeve 37 is rotated by manual manipulation of the knurled flange 39 to place the cam fingers 79 and 80 of the ring 78 in the position shown in Fig. 3, wherein the surfaces 81 of the fingers 79 and 80 are in engagement with the surfaces 71 of the cam grooves 67 and 68. The pins or pawls 72 and 73 will assume the position shown in Figs. 9 and 10, wherein the pin 72, associated with the forward driving ratchet 30, is held by the sleeve 61 in the groove in said ratchet. The pin or pawl 73, associated with the reverse driving ratchet 33, will be free to move outwardly to permit the ratchet to move reversely relative to the sleeve 37, to which motion is imparted in a forward driving direction by the pin or pawl 72. As shown in Figs. 2, 9 and 10, with the cam fingers 79 and 80 in the forward driving position in the cam grooves 67 and 68, the slot 63 of the sleeve 61 will be in alignment with the slot 42 of the sleeve 37 to permit the pin or pawl 73 to move outwardly or "ratchet" relative to the ratchet 33, but the slot 62 of the sleeve 61 will uncover only half of the slot 42. Since the ratchet 30 rotates in a clockwise direction, as viewed in Fig. 10, the pin 72 will be carried under the sleeve 61 and locked against outward movement, as before described. Driving motion in a forward direction is transmitted from the ratchet 30 through the pin 72, the sleeve 37, the cam fingers 79 and 80, the sleeve 61 to the driving pin 51 and the screw driver bit 56.

Whenever the force required to rotate the bit exceeds a certain predetermined value, the screw driver will be locked against spiraling action in the driving direction in the following manner:

The bit 56 will be momentarily held stationary but the sleeve 37 will continue to rotate causing the cam fingers 79 and 80 to be moved longitudinally of the sleeve 37 by the cam surface 71 of the sleeve 61, which sleeve is momentarily held stationary with the bit 56 by the driving pin 51. The sleeve 37 will move relatively to the sleeve 61 the angular distance permitted by the aperture 43 of the sleeve 37, it being noted that in the normal spiraling position the lug 53 is disposed centrally of the aperture 43, as shown in Fig. 8, but in the locking position one edge of the aperture 43 engages the tooth or lug 53 of the driving pin 51, as shown in Fig. 11. The sleeve 37, in moving relatively to the sleeve 61, causes both pins or pawls 72 and 73 to be locked against outward movement by the sleeve 61. These positions of the pins are shown in Figs. 4, 12 and 13 wherein the slots 62 and 63 of the sleeve 61 are both out of alignment with the slot 42, the inner half of the slot 42 being substantially closed by the sleeve 61 and the outer half of the slot 42 being closed by the sleeve 61 to an extent sufficient to prevent outward movement of the pin 73. Both ratchets 30 and 33, now being locked against movement relative to the sleeve 37, the spiral members 6, 26 and 24 are locked against longitudinal movement, and further rotation of the driving bit 56 in the driving direction may only be accomplished by rotating the handle 1, the rotational force being transmitted by rotation of the members 6, 24, 26 and the ratchets 30 and 33 as a unit. From the ratchets 30 and 33 the motion is transmitted by both pins 72 and 73 to the sleeve 37 and from the sleeve 37 directly through the driving pin 51 to the bit 56.

It will be evident that upon movement of the handle in the opposite direction, that is in the non-driving direction, the spring 83 and the cam 78 will cause the sleeve 61 to rotate relative to the sleeve 37 from the position shown in Fig. 5 to the original position shown in Fig. 3. The rotation of the sleeve 37 in the non-driving direction will aline the slot 42 in said sleeve with the slots 62 and 63 of the sleeve 61 in such manner that both pawls will be free to move outwardly of the slots 62 and 63 to permit free ratcheting of the ratchets 30 and 33.

For the reverse operation of the driver bit, that is, in a direction to remove a screw, the sleeve 37 will be rotated by operation of the knurled portion 39 while retaining the bit against movement to cause the cam fingers 79 and 80 to engage the cam surfaces 71' of the cam grooves 67 and 68. The slot 62 of the sleeve 61 will then be in alignment with the slot 42, but the slot 63 will be out of alignment with said slot 42. The pin 73 will then be moved by its ratchet 33 under the overhanging portion of the sleeve 61, which will prevent outward movement of the pin 73, but the pin 72 will be free to "ratchet" outwardly, relative to its ratchet 30. Reverse rotation of the driver bit will therefore be imparted through the ratchet 33, the pin 73 and sleeve 37 to the ring 78, cam fingers 79 and 80 to the sleeve 61, and the driving pin 51 to the driver bit 56.

If, during the reverse rotation of the bit, the force required exceeds the predetermined value, the screw driver will be locked against spiraling action in the driving direction in the same manner as previously described but the ratchets 30 and 33 will have free movement upon operation of the handle in the non-driving direction.

It will be seen from the above description, that applicant has provided a screw driver having tortionally actuated means which automatically locks the handle to the driver bit whenever the force required exceeds any desired predetermined value. In thus automatically locking, it will be apparent that back-spiraling of the handle is prevented. By providing separate and independent spiral members 24 and 26 for forward and reverse rotation respectively, it is possible to pro-

vide a higher driving speed for the initial tightening of screws than is safe for the removal of screws. The use of separate spirals also makes it possible to provide a large number of parallel spirals peripherally or internally of each spiral member, thereby increasing the wearing surfaces between the spiral members to a degree impossible in prior spiral screw drivers in which the number of threads or parallel spirals is limited to two by reason of the fact that both the forward and reverse spirals are cut in the external surface of the same tube or shaft.

It will also be apparent that applicant's construction, as hereinbefore described, eliminates the usual cross-overs between the forward and reverse spirals and therefore eliminates the excessive wear between the follower and the spirals which was caused by those cross-overs. Further, it will be evident that by reason of the increased number of parallel spirals which may be formed on the spiral member, the forces will be distributed equally upon each of the spirals, thereby increasing the life of the spiral members.

It will be further observed that there are no exposed spiral members and hence no exposed lubricated surfaces, or surfaces adapted to pinch the user's fingers, as the handle is moved longitudinally to place or remove a screw or to adjust the screw driver. In view of the fact that the screw driver is automatically locked against spiraling action both forwardly and backwardly whenever the force required to turn the screw exceeds a predetermined value, the work of placing and removing screws in mass production is considerably speeded because it then becomes unnecessary to remove the screw driver, operate a locking pin and replace the screw driver in order to complete the tightening of the screw beyond the initial tightening movement.

Other and further advantages of applicant's invention will be apparent, and it will be evident that changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention or sacrificing any of its attendant advantages, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. A spiral work tool comprising a tool receiving member, a tubular actuating member, said tubular member having spirals internally and externally thereof, separate spiral members engaging said internal and external spirals and rotating in opposite directions upon longitudinal movement of said actuating member, and means for selectively connecting said rotatable spiral members to said tool receiving member to cause said last mentioned member to be rotated selectively in a clockwise or a counterclockwise direction upon longitudinal movement of said tubular actuating member.

2. A spiral screw driver comprising a bit receiving member, a tubular actuating member, said tubular member having spirals internally and externally thereof, separate spiral members engaging said internal and external spirals and rotating in opposite directions upon longitudinal movement of said actuating member, manually operable means for selectively connecting said rotatable spiral members to said bit receiving member to cause said last mentioned member to be rotated selectively in either direction upon longitudinal movement of said tubular actuating member, and automatically operable means for simultaneously connecting both said spiral members to said bit receiving member thereby automatically to lock said spiral members against relative movement whenever the force required exceeds a predetermined value.

3. A spiral screw driver comprising a tubular actuating member, said member having spirals internally and externally thereof, separate spiral members engaging said internal and external spirals to be rotated in opposite directions upon longitudinal movement of said actuating member, a driving sleeve selectively connectable to said spiral members for selective rotation in either direction, means detachably connecting a driver bit to said driving sleeve for rotation therewith, and a second sleeve mounted on said first sleeve for controlling the selective connection of said spiral members to said driving sleeve.

4. A spiral screw driver comprising an actuating member, a pair of separate spiral members rotated by said actuating member in opposite directions, a driving sleeve, means for selectively connecting either one or both of said spiral members to said driving sleeve, a second sleeve shiftably mounted on said first sleeve for movement relative thereto to control said connecting means, a bit receiving member connected to said second sleeve, and overload release means connecting said driving sleeve to said second sleeve for moving said sleeves relatively to cause said connecting means to simultaneously connect both said spiral members to said driving sleeve and thereby lock said sleeves and said members against relative rotation whenever the force required exceeds a predetermined value.

5. A spiral screw driver comprising a handle, a tubular actuating member having internal and external spirals, a tubular actuated member having an internal spiral engaging the external spiral of the actuating member, a second actuated member passing through said first tubular actuated member and having an external spiral engaging the internal spiral of the actuating member, a pair of ratchets having longitudinal grooves, one of said ratchets being secured to each of said actuated members, a rotatable member for receiving a driver bit, a driving sleeve connected to said bit receiving member and rotatably journalled on said tubular actuated member, said driving sleeve enclosing said ratchets and having a longitudinal slot therein, a plurality of rollers in said slot and engaging in the longitudinal grooves of said ratchets, and means for selectively preventing the movement of said rollers outwardly of said grooves, thereby selectively to connect said ratchets to said driving sleeve for selective rotation of said bit receiving member in either direction upon longitudinal movement of said handle.

6. A spiral screw driver comprising a handle, a plurality of spiral members rotatable in opposite directions, a pair of ratchets having longitudinal grooves, one of said ratchets being secured to each of said spiral members, a driving sleeve loosely journalled on one of said spiral members and enclosing said ratchets, said sleeve having a longitudinal slot in alignment with said ratchets, a plurality of rollers in said slot and seated in the grooves of said ratchets for connecting said ratchets to said driving sleeve, a second sleeve loosely journalled on said driving sleeve and adapted to overlie said rollers to prevent movement of said rollers outwardly relative to said ratchets thereby to connect said ratchets to said driving sleeve, said second sleeve having a

plurality of laterally offset longitudinal slots adapted to be selectively aligned with the longitudinal slot in the driving sleeve to permit outward movement of a selected roller relative to said ratchets, a driving pin having an aperture for receiving a driver bit connected to said second sleeve and having a lost motion connection to said driving sleeve, and a spring-pressed cam member slidably mounted on said driving sleeve, said second sleeve having a cam groove engaging said cam member whereby said cam causes movement of said driving sleeve relative to said second sleeve whenever the force transmitted to the driving pin exceeds a predetermined value to connect the driving sleeve directly to the driving pin and simultaneously connect both said ratchets to said driving sleeve thereby automatically to lock said spiral members and said driving sleeve against relative movement.

7. A work tool comprising a handle, a rotatable member for receiving a work bit, a pair of rotary actuating members, means connecting said actuating members to said handle for rotating said actuating members in opposite directions upon reciprocation of said handle, manually operable means for selectively connecting one of said rotary actuating members to said bit receiving member and simultaneously disconnecting the other of said rotary actuating members from said bit receiving member, and means for automatically connecting both of said rotary actuating members to said bit receiving member whenever the force required exceeds a predetermined value to cause said bit receiving member to rotate with said handle.

8. A spiral screw driver comprising a handle, a rotatable member adapted to receive a driver bit, a plurality of separate spiral members selectively connectible to the bit receiving member for selectively rotating said bit receiving member in either direction, a common spiral member secured to said handle and operatively connected to both of said separate spiral members for rotating said separate spiral members relatively in opposite directions upon longitudinal movement of the handle, and torsion responsive means for automatically locking said separate spiral members against relative movement to cause said bit, said spiral members and said handle to rotate as a unit whenever the torsion required of the screw driver receives a predetermined value.

9. A spiral screw driver comprising a handle, a rotatable member adapted to receive a driver bit, a plurality of separate spiral members for selectively rotating said rotatable member, means for rotating said separate spiral members relatively in opposite directions upon reciprocation of the handle, ratchet means for controlling the relative movement of said spiral members whereby selectively to connect one of said spiral members to said driver bit, and means for automatically operating said ratchet means whenever the force required exceeds a predetermined value to lock said spiral members against relative movement.

10. A spiral screw driver comprising a handle, a tubular actuating member secured to said handle and having internal and external spirals, a tubular actuated member having an internal spiral engaging the external spiral of the actuating member, a second actuated member passing through said first tubular actuated member and having an external spiral engaging the internal spiral of the actuating member, a pair of ratchets, one of said ratchets being connected to each of said actuated members, a chuck for receiving a driver bit, a driving sleeve connected to said chuck, said driving sleeve enclosing said ratchets, a plurality of ratchet pawls movable relative to said sleeve for connecting and disconnecting said ratchets to and from said sleeve, and means selectively operable to prevent the movement of said pawls relative to said sleeve, thereby selectively to connect said ratchets to said driving sleeve for rotation of said bit receiving member in either direction upon longitudinal movement of said handle.

11. A spiral screw driver comprising a handle, a tubular actuating member secured to said handle and having internal and external spirals, a tubular actuated member having an internal spiral engaging the external spiral of the actuating member, a second actuated member passing through said first tubular actuated member and having an external spiral engaging the internal spiral of the actuating member, a pair of ratchets, one of said ratchets being connected to each of said actuated members, a chuck for receiving a driver bit, a driving sleeve connected to said chuck, said driving sleeve enclosing said ratchets, a plurality of ratchet pawls movable relative to said sleeve for connecting and disconnecting said ratchets to and from said sleeve, a second sleeve for controlling the movement of said pawls relative to said driving sleeve, said second sleeve being rotatable relative to the driving sleeve into three positions, in one of which one pawl is locked against movement relative to the driving sleeve, in a second of which the other pawl is locked against movement relative to the driving sleeve and in the third of which both of said pawls are locked against movement relative to said driving sleeve, manually operable means for moving said second sleeve relative to said driving sleeve into the first and second of said positions, and automatically operable means for moving said second sleeve relative to the driving sleeve to the third of said positions whenever the force required of the tool exceeds a predetermined value.

12. A spiral screw driver comprising a handle, a tubular actuating member having internal and external spirals, a tubular actuated member having an internal spiral engaging the external spiral of the actuating member, a second actuated member passing through said first tubular actuated member and having an external spiral engaging the internal spiral of the actuating member, a pair of ratchets, one of said ratchets being secured to each of said actuated members, a driving sleeve enclosing said ratchets and having a longitudinal slot therein, a pair of ratchet pawls in said slot and engageable with said ratchets, means selectively adjustable to one of two positions to prevent the movement of a selected one of said two pawls outwardly of said slot thereby selectively to connect said ratchets to said driving sleeve for rotation in either direction, and selectively adjustable to a third position to prevent movement of both of said pawls out of said slot, means adapted to detachably connect a driver bit to said driving sleeve, said means comprising a cap member slidably mounted on one end of said driving sleeve, said driving sleeve having a slotted keyway, a key in said keyway, a spring member normally retaining said cap member in locking engagement with said key and manually operable means carried by said driving sleeve and movable relative thereto for moving the cap member relative to the driving

sleeve against the action of said spring to release said key and permit insertion and removal of the driver bit into and from the driving sleeve and a cam controlled by said spring member for automatically shifting said selectively adjustable means into its third position of adjustment whenever the force applied by the screw driver exceeds a predetermined value.

13. A spiral screw driver comprising a handle, a rotatable member adapted to receive a driving bit, a plurality of separate spiral members selectively connected to said rotatable member for selectively rotating said member in either direction, and a common spiral member secured to said handle for operating both said first mentioned spiral members.

14. A spiral screw driver comprising a handle, a rotatable member adapted to receive a driver bit, a plurality of separate spiral members connected to said handle for simultaneous rotation in opposite directions upon reciprocation of the handle, ratchet and pawl means for selectively connecting one of the spiral members to the bit receiving member to rotate the bit receiving member selectively in either direction, means for locking said ratchet and pawl means to cause said bit receiving member to rotate only upon rotation of the handle and force responsive means for automatically actuating said locking means whenever the force applied exceeds a predetermined value.

15. A spiral work tool comprising a driving member, a rotatable tool receiving member, a pair of oppositely rotatable separate spiral members selectively connectible to said tool receiving member for rotating said tool receiving member in either direction, a common spiral member connecting the driving member to both said first mentioned spiral members, means for locking the oppositely rotatable spiral members against relative movement to cause the bit receiving member and the spiral members to rotate as a unit, and torsionally actuated means for operating said locking means automatically whenever the torque applied by the tool exceeds a predetermined value.

16. A spiral work tool comprising a driving member, a rotatable tool receiving member, a pair of separate spiral members for selectively rotating said rotatable tool receiving member in either direction, and a common actuating means connecting said driving member to both of said spiral members for causing simultaneous rotation of said spiral members in opposite directions upon reciprocation of the driving member.

17. A spiral screw driver comprising a handle, a rotatable member adapted to receive a driver bit, a pair of spiral members, common actuating means connecting the handle to both spiral members for rotating the spiral members in opposite directions upon longitudinal movement of the handle, means for selectively connecting one of said spiral members to said bit receiving member selectively to rotate said bit receiving member in either direction, means for locking said spiral member against relative movement to cause the bit receiving member to rotate only upon rotation of the handle and means responsive to the force exerted by the bit receiving member for automatically actuating said locking means whenever said force exceeds a predetermined value.

18. A spiral work tool comprising a driving member, a rotatable tool receiving member, a pair of separate spiral members, common actuating means connected to said handle and to both of said separate spiral members for causing simultaneous rotation of said spiral members relatively in opposite directions upon reciprocation of the driving member, means selectively adjustable to one of two positions for selectively connecting one of said spiral members to said tool receiving member and selectively adjustable to a third position for locking said spiral members against relative rotation to cause said tool receiving member to rotate only upon rotation of the driving member, and torsion responsive means for automatically actuating said selectively adjustable means to said third position whenever the torque applied by the tool exceeds a predetermined value.

GEORGE L. ROCK.