

[54] RATCHET IMPLEMENT

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[51] Int. Cl. B25b 27/00

[58] Field of Search 173/47, 163, 170, 29; 145/70-77; 144/32; 81/57.11, 62, 57.14, 63, 58.1

[56] References Cited

UNITED STATES PATENTS

3,329,185	7/1967	Hettich et al.	144/32
2,544,795	3/1951	Knudsen	81/63 X
2,979,089	4/1961	Diesker	81/58.1 X
3,554,251	1/1971	McLogan	145/75
2,893,278	7/1959	Rice	81/58.1 X
1,024,151	4/1912	Smith	173/163 X

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[57] ABSTRACT

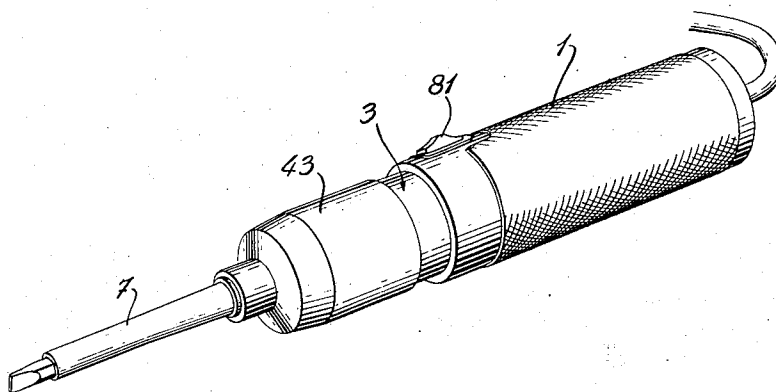
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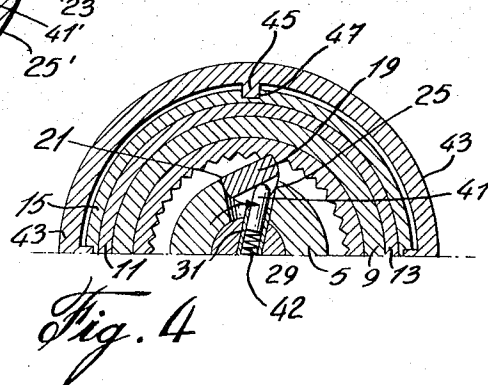
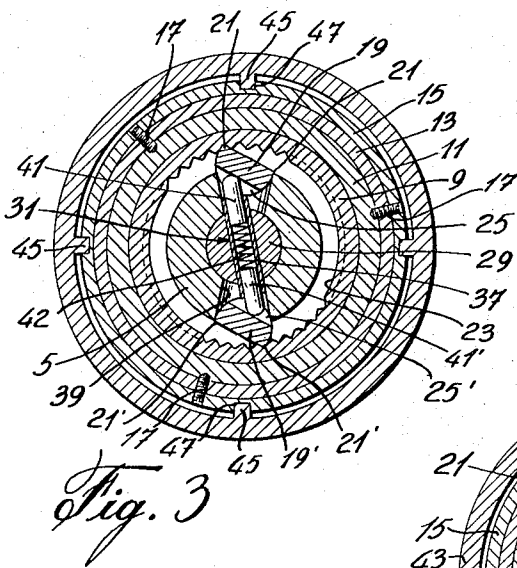
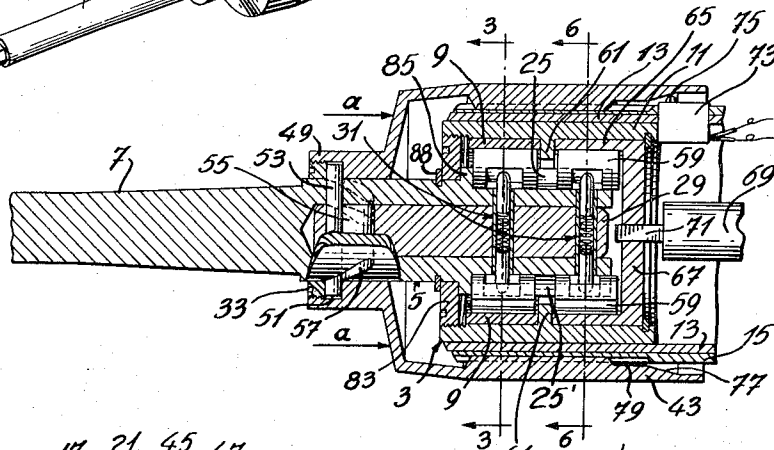
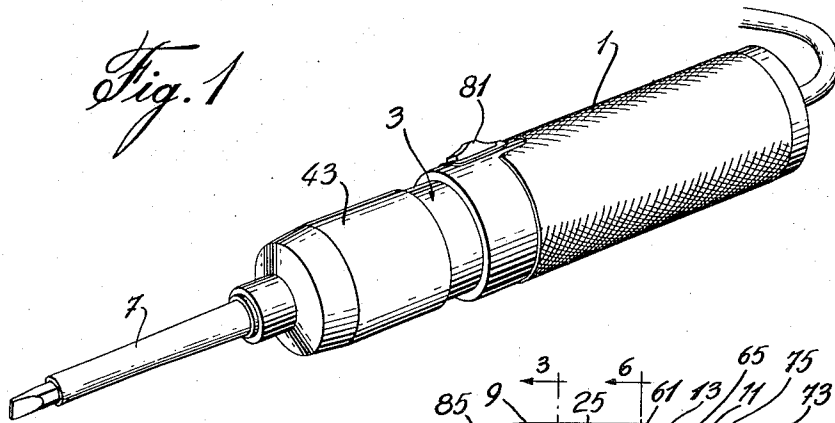
ing a housing at one end into which one end of a tool, such as a screwdriver, is inserted for rotation. The bore of the housing is formed as a ratchet wheel and the tool driven end has a pair of diametrically opposed arcuate grooves running longitudinally of the tool driven end. A pair of rocking pawls having opposed driving edges are mounted, each in one groove, for operative engagement of the driving edges with the ratchet wheel and with one groove, respectively. Spring-pressed slugs hold the pawls in driving engagement and these slugs can be shifted to cause the pawls to rock and engage the driving edges inversely with respect to the ratchet wheel and grooves.

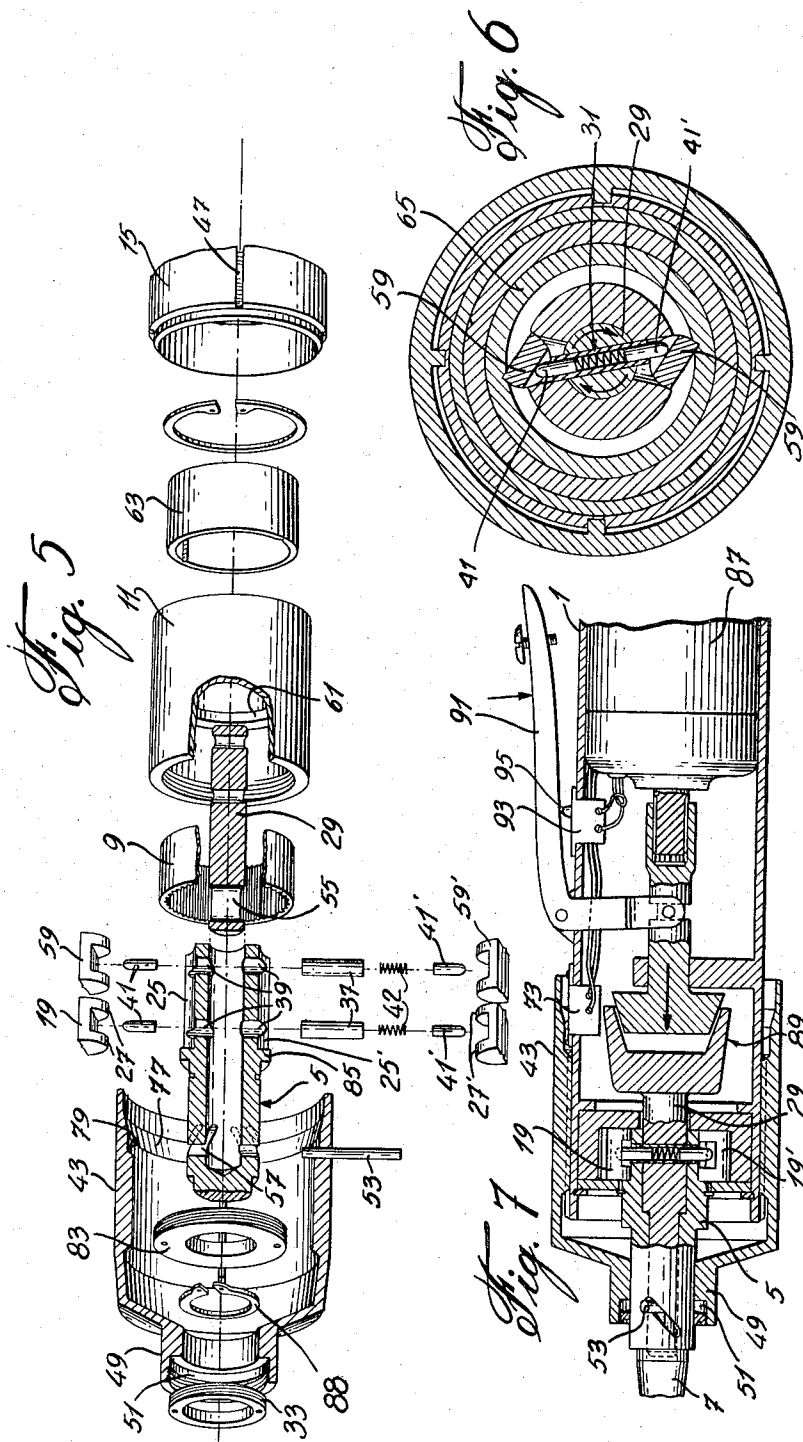
In one embodiment, two further such pawls are mounted in the arcuate groove for operative engagement with a second ratchet wheel formed in the bore of a driving member freely mounted in the housing. This driving member is, in turn, connected to a motor for rotation. The second pawls, like the first ones, are pressed into engaging position by other spring-pressed slugs that can be shifted, along with the first ones, to cause rocking of the second pawls and inverse engagement thereof with the second ratchet wheel and grooves resulting in rotation of the tool in reversed direction.

In a second embodiment, the tool is connected directly, at the driven end thereof, with a motor assembly.

6 Claims, 6 Drawing Figures







RATCHET IMPLEMENT

The present invention generally relates to a ratchet implement, particularly a ratchet screwdriver.

Manually operated ratchet implements, such as ratchet screwdrivers, are already known. It is however an object of the present invention to provide a ratchet implement that can be operated both mechanically, the tool being power driven, and manually. For this purpose, the present invention proposes a power transfer assembly between the motor or handle which is very compact thus resulting in an implement that is hardly larger than the conventional ratchet implement, such as the known ratchet screwdriver.

It is a further object of the invention to provide such an implement as mentioned above wherein the power transfer assembly used for mechanical or manual driving is of the same nature.

Still another object of the invention resides in the provision of a ratchet implement of the above-mentioned type that will allow first to drive a screw mechanically to a certain extent and then finish driving it by hand without involving, for this latter operation, the power means itself.

The above-mentioned objects may be obtained with a ratchet implement according to the present invention comprising a hollow handle defining a housing at one end within which the driven end of a tool is inserted and in which a ratchet mechanism is provided which includes at least one pawl in operative engagement with the housing and with the driven end to drive the tool in rotation in a predetermined direction when the handle is rotated in a corresponding direction and also comprising means to cause rocking of the pawl for reverse engagement thereof with the said housing and the tool driven end whereby to rotate the tool in a direction reverse the said predetermined direction when the handle is rotated in a direction reverse the said corresponding direction.

In a first preferred embodiment of the invention, two first pawls are provided for manual driving of the tool and two further second pawls are provided for mechanically rotating the tool independently of the first pawls.

In a further preferred embodiment, the tool to be rotated can be connected directly or released from a mechanical source of power to be rotated thereby either manually or by the power source, independently of one another.

It is believed that a better understanding of the invention will be afforded by the description that follows having reference to the appended drawings wherein:

FIG. 1 is a perspective view of a ratchet screwdriver made according to the invention;

FIG. 2 is an axial cross-sectional view taken along the forward portion of the screwdriver of FIG. 1;

FIG. 3 is a transverse cross-sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a transverse cross-sectional view similar to that of FIG. 3 showing the driving pawls in reverse driving position;

FIG. 5 is an exploded view, partially shown in cross-section, of the ratchet screwdriver;

FIG. 6 is a transverse cross-sectional view taken along line 6—6 of FIG. 2, and

FIG. 7 is a longitudinal cross-sectional view of the forward part of a ratchet implement made according to a second embodiment of the invention.

The implement according to the invention comprises a hollow handle 1 terminating, at the forward end thereof, into a housing 3 into which the driven end 5 of a screwdriver 7, or other similar tool, is received. The driven end 5 is disposed in coaxial space relationship with the housing 3.

The latter is formed of an inner ring 9, the bore of which is intended to act as a ratchet wheel as will hereinafter be determined. This inner ring is press-fitted into the bore of an intermediate ring 11 fitting inside a further ring 13 engaging into the bore of an outer ring 15. Rings 11, 13 and 15 are secured together by means of a series of screws 17 (FIG. 3). Since inner ring 9 is press-fitted into position and rings 11, 13 and 15 are held together by means of screws 17, it may be considered that rings 9, 11, 13 and 15 react as a unit hereinafter called housing 3, the outermost rings 13 and 15 constituting the forward end of the handle 1.

A ratchet mechanism is mounted in the housing 3 and includes gripping surfaces on the housing and on the driven end 5 of the tool 7 and at least one rocking pawl having opposed driving edges.

More specifically, the ratchet mechanism for manual operation of screwdriver 7 comprises a pair of pawls 19 and 19' having opposed lateral driving edges 21—21' adapted to engage with the gripping surfaces of housing 3 and the screwdriver 7.

The gripping surface of the housing 3 is formed by notches in the bore 23 (FIG. 3) of inner ring 9, the housing thus acting as a ratchet wheel. On the other hand, the gripping surface of the tool driven end 5 is formed by a pair of arcuate grooves 25—25', perhaps best illustrated in FIG. 5. Grooves 25—25' run longitudinally on opposite sides of the tool driven end 5 and are arcuate in cross-section. Pawls 19—19' are rockably mounted each in one of these grooves. As best shown in FIG. 5, the pawls 19—19' are U-shaped in cross-section with two half-circular sidewalls 27—27' fitting in grooves 25—25'.

As best illustrated in FIGS. 2 and 3, whenever handle 1 and its forward end, housing 3, are driven into clockwise rotation, the ratchet wheel 23 defined by the inner ring 9 will drive the screwdriver 5 into clockwise rotation through the action of pawls 19—19' bearing against one edge of the arcuate grooves 25—25'.

If pawls 19—19' are rocked in the position shown in FIG. 4, it will be understood that positive counterclockwise rotation of the driven end 5 of the screwdriver 7 will be possible whenever housing 3 is likewise rotated counterclockwise.

Pawls 19—19' are brought into rocking motion by an insert 29 freely mounted in an axial bore of the tool driven end 5, a resilient assembly 31 provided on the insert which biases the pawls 19—19' into engagement of the driving edges 21—21' with the ratchet wheel 9 and the pawl grooves 25—25', respectively, and a rotation producing assembly 33 on the insert 29, the tool driving end 5 and the housing 3 which causes partial relative rotation of the insert 29 and the tool driving end 5 to shift the resilient assembly 31 and rock the pawls 19—19' from the first position shown in FIG. 3 to the second position shown in FIG. 4, and vice versa.

More specifically, the resilient assembly 31 comprises a tube 37 secured in a through hole across the in-

sert 29, with the ends of the said tube 37 projecting beyond insert 29 freely into through apertures 39 opening into grooves 25-25'; the tubes containing oppositely directed slugs 41, 41' outwardly pressed against corresponding pawls 19-19' to force the latter into engagement with the ratchet wheel 9 and one edge of the arcuate grooves 25-25'.

The rotation producing assembly 33, on the other hand, comprises a sleeve 43 mounted over the housing 3 for rotation therewith and relative sliding displacement axially of housing 3. This is obtained by means of inwardly directed shoulders 45 (FIG. 3) slidably received into guideways 47 formed on the outer periphery of the outer ring 15. Sleeve 5 has a tool inlet end 49 with a corresponding bore intended to guide screwdriver 7. The inner end of insert 29 is formed with a pin slot 55 extending axially of the insert, the inlet end bore being located over the insert axial slot 55 and being formed with a circular pin groove 51 for the reception of the ends of a pin 53 also extending into the insert slot 55. The ends of pin 53 are further guided into a pair of spiral pin slots 57 provided through the wall defining the bore receiving the insert 29. The width of axial slot 55 across insert 29 is substantially the same as the diameter of pin 53 so that whenever the latter is driven into rotation, it likewise drives insert 29 into rotation.

With the various assemblies described above, it will be appreciated that whenever sleeve 43 is slid backward in the direction of arrow *a* of FIG. 2, pin 53 will ride in the circular pin groove 51 and along the spiral pin slots 57 to bring insert 29 into rotation through the presence of axial slot 55, shifting of the resilient assembly 31 in apertures 29 and, finally, rocking of the pawls 19-19' to thus cause the driving edges 21-21' thereof to shift from one to the other of the driving positions shown in FIGS. 3 and 4.

With the above-described mechanism, the screwdriver can manually be brought into rotation.

A similar ratchet power transfer mechanism is resorted to to power drive screwdriver 7 into rotation.

In this case, a pair of second pawls 59-59' (FIG. 6) identical to the first pawls 19-19' are rockably mounted in the grooves 25-25' adjacent thereto and separated by an inwardly directed flange 61 of the intermediate ring 11. Pawls 59-59' are driven into rotation by a cup-shaped member 63 which has a cylindrical skirt 65 overlying the second pawls 59-59' and a web 67 closing off the skirt 65 at the outer end of insert 29; skirt 65 being freely mounted in the housing 3, more specifically the bore of intermediate ring 11. As illustrated in FIG. 6, skirt 65 has a notched bore acting as a ratchet wheel for the second pawls 59-59' but in this instance, only two notches need be provided in view of the substantial speed of member 63. Indeed, the latter is driven into rotation by a motor 69 through a clutch arrangement (not shown) and any connecting means such as power take off square pin 71 (FIG. 2) engageable in a like aperture through web 67.

A resilient assembly, identical to assembly 31 previously described, biases pawls 59-59' into operative engagement with the ratchet wheel formed by skirt 55.

From the above description, it will be appreciated that whenever motor 69 is energized, ratchet wheel or skirt 65 will cause rotation of the driven end 5 of the screwdriver 7 through the action of pawls 59-59'. Ob-

viously, this will also cause pawls 19-19' to freely ride over the ratchet wheel formed by inner ring 9 under the resilient action of assembly 31. As soon as screwdriver 7 has driven the screw through the full extent of the power of motor 69, the latter is deenergized and the screw can then be driven more tightly by manual rotation of the handle 1.

Control of motor 69 for reverse rotation is obtained as follows.

The motor circuit has a reversing switch 73 with an operating button 75 projecting upwardly from outside the housing 3. On the other hand, sleeve 43 is formed inwardly with shoulder means in the form of an outwardly inclined ramp 77 terminating into a horizontal land 79. Whenever sleeve 43 is shifted backward in direction of arrows *a* to rock pawls 19-19' into the reverse position of FIG. 4, the ramp 77 will depress button 75 which will be held in depressed position under the horizontal land 79. Reversing switch 75 will then be energized and cause reverse rotation of motor 69 whenever the motor actuating switch (not shown) is turned on by shifting the knob 81 (FIG. 1).

Finally, the driven end 5 of the screwdriver 7 is held against axial displacement inside housing 3 by means of an annular cap 83 screwed into housing 3 against an abutting shoulder 85 of the driven end 5 of the screwdriver 7, the other side of cap 83 being held against a snap ring 87 mounted in a suitable groove on the surface of the driven end 5.

In the embodiment illustrated in FIG. 7, manual rotation of the screwdriver 7 is obtained in the same manner as described with the embodiment of FIG. 2 involving pawls 19-19'. This embodiment however differs from that of FIG. 2 in that the screwdriver 7 is directly connectable with the motor 87 with the insert 29 being connected to a slip-clutch 89. Whenever the motor 87 is rotated clockwise, the situation of the driving pawls 19-19', which are then inactive, is the same as that shown in FIG. 3. In such a case, pin 53 interconnecting the insert 29 and the screwdriver 7 rides loose in the circular groove 51.

In this embodiment, slip-clutch 89 is engaged or released by the conventional action of a pivotable lever 91 operable from outside the handle 1. A motor actuating switch 93 is provided below lever 91 to be operated thereby by depression of a button 95 thereof, causing energization of motor 87.

Reversing action of the pawl mechanism as well as the motor 87 is obtained in a manner identical with that described with relation to the embodiment of FIG. 2, that is by pulling sleeve 43 rearwardly thus causing rocking of pawls 19-19' and energization of the reversing switch 73 bringing motor 87 into reverse rotation whenever lever 91 is depressed sufficiently to energize actuating switch 93.

Obviously, the electric motor could be replaced by a compressed air motor in the above two embodiments without departing from the spirit of the invention.

I claim:

1. A ratchet implement comprising:

- a. a tool to be driven into rotation and having a driven end;
- b. a hollow handle defining a housing at one end; said tool driven end being inserted into said housing in coaxial spaced relationship therewith;
- c. a ratchet mechanism, in said housing, including one gripping surface in the form of a notched bore

on said housing and another gripping surface on said driven end in the form of a pair of grooves running longitudinally thereof and arcuate in transverse cross-section and a pair of rocking pawls having opposed driving edges rockably mounted in said grooves;

d. said pawls, in a first position, having one driving edge in engagement with one of said gripping surfaces and the other driving edge in engagement with the other gripping surface to drive said driving end and tool in a predetermined direction of rotation when said handle is rotated in a corresponding direction,

e. means for rocking said pawls into a second position for reverse engagement of said driving edges with said gripping surfaces, said rocking means comprises:

1. an insert freely mounted in an axial bore of said tool driven end;
2. resilient means on said insert biasing said pawls into engagement of the driving edges thereof with said notched bore and with said pawl grooves,
3. said insert bore having an inner and an outer end and defining a wall of said tool driving end;
4. said resilient means comprises: means defining a hole through said insert at said outer end; means defining registering apertures through said wall opening into said pawl-receiving grooves and registering with said insert through-hole; and outwardly biased slugs mounted in said insert hole and extending across said registering apertures to press said pawl-driving edges into engagement with said arcuate grooves and notched bore respectively, and

5. rotating means on said insert, on said driving end and on said housing to cause partial relative rotation of said insert and said tool driving end to shift said resilient means and rock said pawls from first to said second driving edge engaging positions, and vice versa, wherein said rotating means comprises: a sleeve mounted over said housing for rotation therewith and relative sliding displacement axially of said housing; said sleeve having a tool-inlet end with a bore to guide said tool; means defining a through pin slot at said inner end extending axially of said insert; said inlet-end bore being located over said insert axial slot and being formed with a circular pin groove; said tool driven end having a pair of spiral pin slots through said wall defining said insert bore, and a pin extending across said spiral pin slots and across said insert axial pin slot with the ends thereof riding in said circular pin groove of said inlet end bore, whereby sliding of said sleeve relative to said housing causes riding of said pin in said circular pin groove and along said spiral pin slots, rotation of said insert, shifting of said resilient means and rocking of said pawls to cause the driving edges thereof to shift from one to the other of said first and second positions.

2. An implement as claimed in claim 1 including a pair of second pawls rockably mounted each in one of said grooves adjacent said first pawls; a cup-shaped member for driving said second pawls, said member having a cylindrical skirt overlying said second pawls and a web closing off said skirt

at the outer end of said insert; said skirt being freely mounted in said housing and having a notched bore acting as a ratchet wheel for said second pawls;

said second pawls, in a first position, having one driving edge in engagement with said second ratchet wheel and another driving edge in engagement with said arcuate grooves to drive said driven end into rotation;

second resilient means to rock said second pawls into a second position, integral with said means to rock said first pawls, for reverse engagement of said driving edges to cause reverse rotation of said driven end and tool;

motor means in said hollow handle connected to said web of said cup-shaped member to drive said tool into rotation through said second pawls independently of said first pawls;

a manually operable motor actuating switch on said handle;

a motor reversing switch having an operating button projecting from said handle in the area of said sleeve;

said sleeve formed inwardly with shoulder means intended to engage and press on said button when displaced on said housing in a predetermined direction.

3. An implement as claimed in claim 1 including motor means in said hollow handle connected to said insert to drive said tool into rotation through said pin means; said motor means including a clutch; a depressible lever, outwardly of said handle, operatively connected to said clutch;

a motor actuating switch below said lever to be operated thereby when depressed for energization of said motor;

a motor reversing switch having an operating button projecting from said handle in the area of said sleeve;

said sleeve formed inwardly with shoulder means intended to engage and press on said button when displaced on said housing in a predetermined direction.

4. An implement as defined in claim 1 including motor means in said hollow handle operatively connected to said tool for driving said tool into rotation,

a motor actuating switch and a motor reversing switch connected to said motor means, and

said sleeve mounted over said housing including means for actuating said reversing switch during axial displacement.

5. A ratchet implement comprising:

a. a tool to be driven into rotation and having a driven end;

b. a hollow handle defining a housing at one end; said tool driven end being inserted into said housing in coaxial spaced relationship therewith;

c. a ratchet mechanism, in said housing, including one gripping surface in the form of a notched bore on said housing and another gripping surface on said driven end in the form of a pair of grooves running longitudinally thereof and arcuate in transverse cross-section and a pair of rocking pawls having opposed driving edges rockably mounted in said grooves;

- d. said pawls, in a first position, having one driving edge in engagement with one of said gripping surfaces and the other driving edge in engagement with the other gripping surface to drive said driving end and tool in a predetermined direction of rotation when said handle is rotated in a corresponding direction.
- e. means for rocking said pawl into a second position for reverse engagement of said driving edges with said gripping surfaces, said rocking means comprises:
 - 1. an insert freely mounted in an axial bore of said tool driven end;
 - 2. resilient means on said insert biasing said pawls into engagement of the driving edges thereof with said notched bore and with said pawl grooves,
 - 3. said insert bore having an inner and an outer end and defining a wall of said tool driving end;
 - 4. said resilient means comprises: means defining a hole through said insert at said outer end; means defining registered apertures through said wall opening into said pawl-receiving grooves and registering with said insert through-hole; and outwardly biased slugs mounted in said insert hole and extending across said registering apertures to press said pawl-driving edges into engagement with said arcuate grooves and notched bore respectively, and
 - 5. rotating means on said insert, on said driving end and on said housing to cause partial relative rotation of said insert and said tool driving end to shift said resilient means and rock said pawls from first to said second driving edge engaging positions, and vice versa, said rotating means including a sleeve mounted over said housing for sliding displacement axially of said handle and means interconnecting said insert and said tool driven end,
- f. a pair of second pawls rockably mounted each in one of said grooves adjacent said first pawls;
- g. a cup-shaped member for driving said second pawls, said member having a cylindrical skirt overlying said second pawls and a web closing off said skirt at the outer end of said insert; said skirt being freely mounted in said housing and having a notched bore acting as a ratchet wheel for said second pawls;
- h. said second pawls, in a first position, having one driving edge in engagement with said second ratchet wheel and another driving edge in engagement with said arcuate grooves to drive said driven end into rotation;
- i. second resilient means to rock said second pawls into a second position, integral with said means to rock said first pawls, for reverse engagement of said driving edges to cause reverse rotation of said driven end and tool;
- j. motor means in said hollow handle connected to said web of said cup-shaped member to drive said tool into rotation through said second pawls independently of said first pawls;
- k. a manually operable motor actuating switch on said handle;
- l. a motor reversing switch having an operating button projecting from said handle in the area of said sleeve;

- m. said sleeve formed inwardly with shoulder means intended to engage and press on said button when displaced on said housing in a predetermined direction.
- 6. A ratchet implement comprising:
 - a. a tool to be driven into rotation and having a driven end;
 - b. a hollow handle defining a housing at one end; said tool driven end being inserted into said housing in coaxial spaced relationship therewith;
 - c. a ratchet mechanism, in said housing, including one gripping surface in the form of a notched bore on said housing and another gripping surface on said driven end in the form of a pair of grooves running longitudinally thereof and arcuate in transverse cross-section and a pair of rocking pawls having opposed driving edges rockably mounted in said grooves;
- d. said pawls, in a first position, having one driving edge in engagement with one of said gripping surfaces and the other driving edge in engagement with the other gripping surface to drive said driving end and tool in a predetermined direction of rotation when said handle is rotated in a corresponding direction,
- e. means for rocking said pawl into a second position for reverse engagement of said driving edges with said gripping surfaces, said rocking means comprises:
 - 1. an insert freely mounted in an axial bore of said tool driven end;
 - 2. resilient means on said insert biasing said pawls into engagement of the driving edges thereof with said notched bore and with said pawl grooves,
 - 3. said insert bore having an inner and an outer end and defining a wall of said tool driving end;
 - 4. said resilient means comprises: means defining a hole through said insert at said outer end; means defining registered apertures through said wall opening into said pawl-receiving grooves and registering with said insert through-hole; and outwardly biased slugs mounted in said insert hole and extending across said registering apertures to press said pawl-driving edges into engagement with said arcuate grooves and notched bore respectively, and
 - 5. rotating means on said insert, on said driving end and on said housing to cause partial relative rotation of said insert and said tool driving end to shift said resilient means and rock said pawls from first to said second driving edge engaging positions, and vice versa, said rotating means including a sleeve mounted over said housing for sliding displacement axially of said handle and means interconnecting said insert and said tool driven end,
- f. motor means in said hollow handle connected to said insert to drive said tool into rotation through said pin means; said motor means including a clutch;
- g. a depressible lever, outwardly of said handle, operatively connected to said clutch;
- h. a motor actuating switch below said lever to be operated thereby when depressed for energization of said motor;

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- i. a motor reversing switch having an operating button projecting from said handle in the area of said sleeve;
- j. said sleeve formed inwardly with shoulder means

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intended to engage and press on said button when displaced on said housing in a predetermined direction.

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