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Coss

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[54] WIRE WRAPPING TOOL

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[58] **Field of Search** 140/115, 122, 124; 242/7.06, 242/7.17; 192/148

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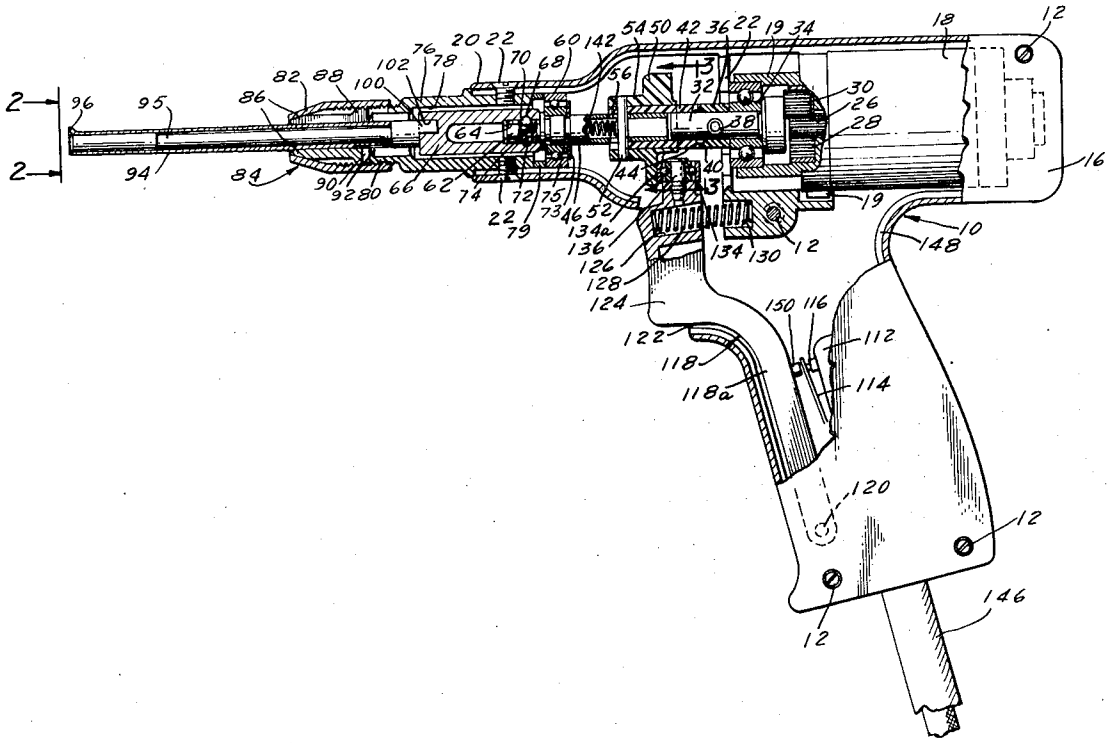
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[57] **ABSTRACT**

An electric power driven tool for making a solderless connection between a wire and an electrical terminal by wrapping the wire in successive convolutions about and in intimate engagement with the terminal. A wrapping bit is indexed to the proper point for quick, easy insertion of the wire and operates positively and quickly to reduce the time required for the complete wrapping cycle.

12 Claims, 4 Drawing Figures



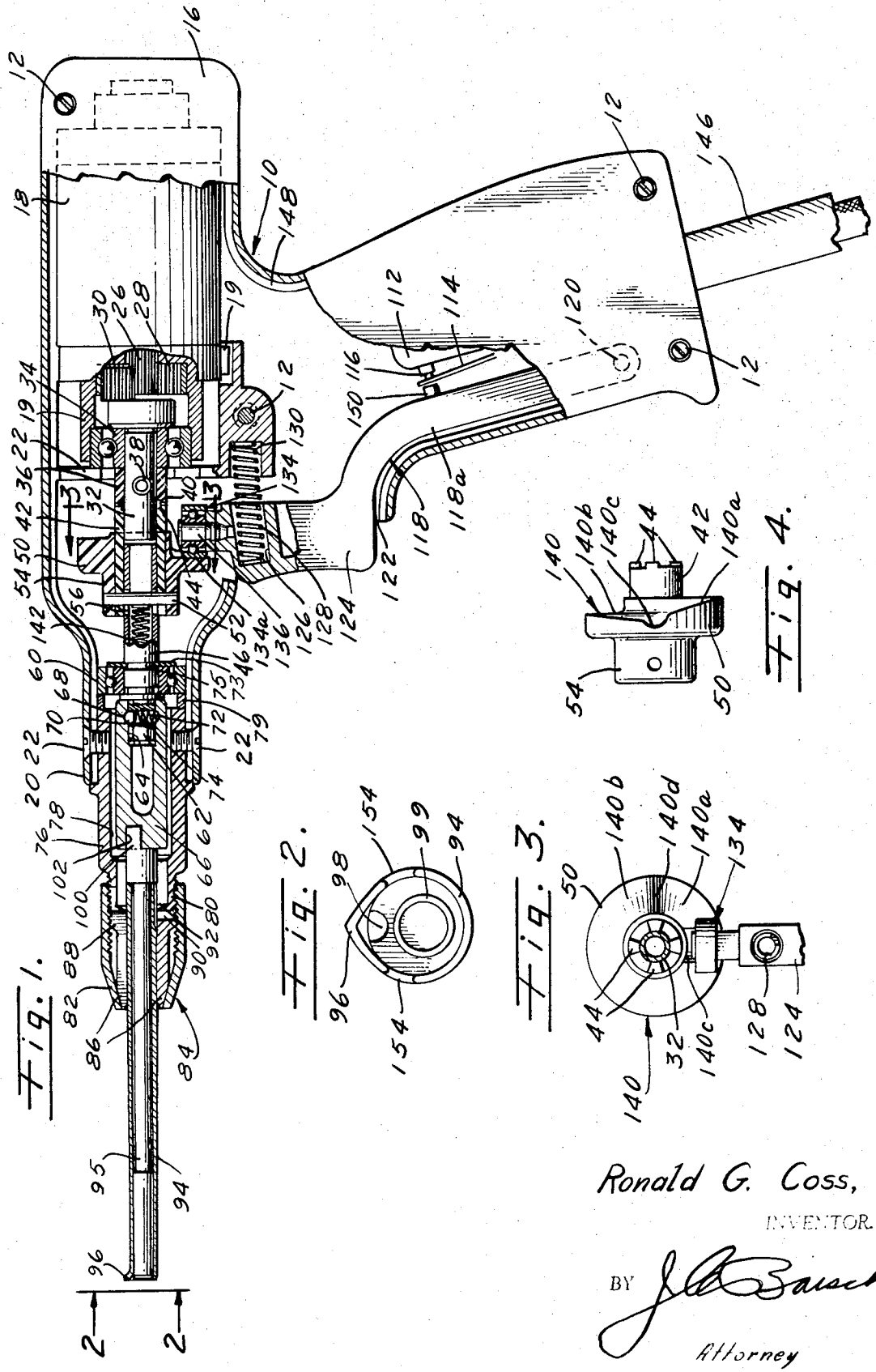


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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WIRE WRAPPING TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to power operated wire wrap tools for making a connection between a wire and an electrical terminal by wrapping the wire in successive turns about and in intimate engagement with the terminal.

2. Description of the Prior Art

There are various tools for wrapping wire onto electric terminals and these tools conventionally include a rotary driver for rotating a bit which is disposed within a sleeve member, the bit being provided at its forward end with a longitudinal recess for reception of the terminal upon which the wire is to be wrapped and with a radially offset longitudinal groove for the reception of the wire. In operation of the tool, the bit is rotated and the wire is withdrawn from the groove as it is wrapped onto the terminal.

However, there are certain problems in indexing the bit so that the groove for the free end portion of the wire to be wrapped on the terminal will always be in the same position when the bit comes to rest, so that time is lost in locatint the groove to insert said end portion of the wire thereinto.

SUMMARY OF THE INVENTION

The present invention comprises a housing with a pistol grip handle. There is a rotatable bit disposed in a tubular sleeve, said bit having a longitudinally extending bore in its forward end for reception of a terminal on which wire is wrapped, and there is a radially offset longitudinal groove for the reception of the wire.

An electric motor is disposed in the housing for driving the bit, there being a clutch between the motor and the bit. A trigger operated switch controls the motor. The motor and the bit are completely disengaged when the motor is shut off.

The bit is rotatably disposed in a bit sleeve which has a portion of the forward free end flared to serve as a guide to aid the operator in inserting the wire into the longitudinal groove in the forward end of the bit. The bit is provided with a cam which is operably engaged by a ball bearing assembly mounted on the switch actuating trigger and when the bit is disengaged from the motor the roller acts on the cam to always index or position the groove of the bit in a predetermined normal, inoperative position, whereat it is registered with the flared portion of the bit sleeve. Thus, the operator will know exactly where the groove is located for reception of the end portion of the wire to be wrapped about the terminal.

Thus, the invention indexes the wrapping bit to the proper point for quick, easy insertion of the wire and operates positively and quickly to reduce the time required for the complete wrapping cycle.

Other advantages of the invention are the elimination of impact when the motor is started and there is the proper torque for wrapping the wire onto the terminal. Further, there is no harsh action and less maintenance.

BRIEF DESCRIPTION OF THE DRAWING

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a side view of the wire wrapping tool embodying the invention, portions being broken away and in longitudinal section to show the interior construction of the mechanism;

FIG. 2 is a front end view of the mechanism as seen from line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1; and

FIG. 4 is a side elevational view of the cam.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, the tool comprises an outer housing, indicated generally at **10**. The housing comprises two halves which are secured together by a suitable number of screws, some of which are shown and indicated by the reference numeral **12**.

In the upper part **16** of the housing **10** an electric motor **18** is operably mounted. The upper part **16** of the housing extends forwardly and terminates in a reduced diameter part **20**. A key **19** keeps the motor from rotating.

Within the housing and forming a part thereof is a flange **22** and a lug **24** at the front end of the motor **18**, there being a gear case **19** in which are operably disposed a plurality of gears **26**, **28** and **30**, of well known character, gear **30** being an idler gear. These gears operably connect the drive shaft (not shown) of the motor **18** with a drive spindle **32** carried by a ball bearing assembly **34** mounted in the gear case and against the flange **22**.

On the drive spindle **32** is a driver **36** secured to said spindle by means of a roller pin **38**, or by any other suitable means. At its front end the driver **36** has a plurality of annularly spaced teeth **40** which extend longitudinally forwardly. Drive spindle **32** extends forwardly of the driver **36** on which a tubular bushing **42** is disposed, the rear end of said bushing being provided with annularly spaced, longitudinally and rearwardly extending complimentary teeth **44** adapted to be engageable with the teeth **40** of the driver **36**. Normally, the teeth **40** and **44** are out of engagement with each other but are adapted to be brought into engagement, as will be described hereinafter.

A rear portion of a tubular output spindle **46** is disposed within a forward end portion of the bushing **42**, said rear portion of the output spindle **46** being slidable longitudinally within the bushing **42**. On a rear portion of the bushing **42** is secured an index cam **50** which is secured to the bushing by means of a dowel pin **52**, or the like, said pin extending through aligned openings provided therefor in a forwardly extending hub **54** of the index cam and the bushing. The pin **52** also extends through diametrically positioned slots **56** provided therefor in the output spindle, said slots permitting the cam **50** and the bushing **42** to be moved longitudinally or axially on the driver and the output spindle, the latter being held against longitudinal or axial movement but being rotatable with said cam **50** and bushing **42**, as described hereinafter.

Disposed in the reduced diameter part **20** of the housing is a ball bearing assembly **60** in which the forward end of the output spindle **46** is operably disposed, said ball bearing assembly being secured in the reduced diameter part **20** by press fitting, or other suitable means. A forward end portion **62** of the output spindle

is octagonal in cross section and is received in a correspondingly shaped recess **64** in the rear end of a driver **66**, there being an annular groove **68** in the recess **64** for reception of a ball **70** urged into said groove by a spring **72** provided therefor in a cross bore **74** in the octagonal part of the output spindle to releasably retain the output spindle and the driver together. A retaining ring **73** in an annular groove **75** in the output spindle holds the latter against forward displacement. Screws **22** in the reduced diameter part **20** of the housing secure a sleeve holder **76** in the reduced diameter part **20** of the housing, said sleeve holder having a longitudinal bore **78** into which the driver **66** extends. A spacer **79** is disposed between the outer race of the ball bearing assembly and the adjacent ends of the sleeve holder.

An outer end portion **80** of the sleeve holder is of reduced diameter and externally threaded for reception of a sleeve nut **82** of a chuck, indicated generally at **84**, which includes the usual jaws **86** actuated in the usual manner by the sleeve nut to tighten or loosen the jaws. The jaws **86** extend forwardly from a common annular base **88** and are resilient. The base **88** has a key **90** adapted to extend into a longitudinally extending exterior slot **92** in the inner end of a bit sleeve **94** in which a bit **95** is rotatably disposed. Thus, the bit sleeve is adapted to be inserted into the chuck with proper orientation of the expanded or flaring end portion **96** thereof, said flaring portion preferably being at the top and provides guide means for a bare end portion of a wire to be inserted into a groove **98** which extends longitudinally from the forward end of the bit. The flared portion **96** extends from the free end of the bit sleeve but a short distance rearwardly so that the major portion of groove **98** is within the cylindrical part of the bit sleeve. The forward end of the bit also has an axial bore **99** therein for reception of an electrical terminal.

The rear end of the bit has a part **100** semi-circular in cross section that is received in a bore **102** in the adjacent end of the driver. A corresponding recess is provided at the inner end of the bore for reception of said part **100** to provide a positive driving connection between the driver and the bit.

Housing **10** has a depending pistol grip handle **110** which is hollow and in which is secured a micro switch **112**.

The switch is secured by any suitable means such as screws, not shown, and includes a movable switch lever **114** adapted to actuate a movable switch member **116**. At the front of the handle **110** is a trigger lever **118** having a part **118***a* which extends downwardly in the handle and which is pivoted on a pin **120** adjacent its lower end.

Handle **110** has an opening **122** at its upper, forward end through which extends the trigger portion **124** engageable by the operator's finger. This portion of the trigger lever has a bore **126** at its inner side for reception of one end portion of a spring **128**, the opposite end of said spring being disposed in a bore **130** provided therefor in the lug **24**, it being noted that the lug and adjacent part of the trigger are normally spaced apart and the lug serves as a stop means for the trigger when actuated by the operator.

At its upper end the trigger lever has a ball bearing assembly **134** mounted to said trigger by a bearing pin **136**, the axis of said ball bearing assembly being substantially vertical and the outer race **134***a* of the ball bearing assembly **134** is yieldingly urged by spring **128** into engagement with the cam surface **140** of the index cam **50**. The movement of the index cam by the spring **128** is limited by engagement of the dowel pin **52** with the forward ends of the slots **56** which is the normal position for the index cam.

There is a spring **142** disposed in the bore **144** of the output spindle forwardly of the dowel pin **52** and acts on said pin to urge the bushing and the index cam rearwardly. The forward end of said spring **142** engages a wall, not shown, at the inner end of said bore **144**. Spring **128** is stronger than spring **142** and when the trigger is released spring **128** moves the bushing **42** and index cam forwardly into its normal position whereat the teeth **44** of the bushing are out of engagement with the teeth **40** of the driver **36** so that the bit is not rotated by the motor, said teeth comprising clutch means.

There is a power cord **146** adapted to be connected to a source of electric power, said cord entering the handle **110** through an opening, not shown, provided therefor at the free end of said handle. The power cord is connected to the switch **112** which in turn is connected by a cord **148** with the motor **18**. Trigger lever **118** has a set screw **150**, or the like, at its inner edge for operable engagement with the lever **114**.

The cam face or surface **140** of the index cam **50** has inclined parts **140***a* and **140***b* which incline from a radial ridge **140***d* in opposite directions to a radial groove **140***c*.

When the cam **50** is in its normal rest position whereat the teeth **44** of the bushing **42** are disengaged from the teeth **40** of the driver **36**, the outer race **134***a* is in the groove **140***c*. The index cam is at its normal or forwardmost position, being moved and held there by the spring **128** against the force of spring **142**. The grove **98** is then aligned with the flaring part **96** of the bit sleeve and the bare end portion of a wire to be wrapped about a terminal is inserted into said groove **98** and the adjacent insulated part is turned into one of the notches **154** to thereby anchor the wire.

The terminal is inserted into the axial bore **99** in the free end of the bit, whereupon the trigger is actuated clockwise to thereby move the ball bearing assembly **134***a* rearwardly and away from the cam face of the index cam. Spring **142** then moves the index cam **50** and the bushing **42** rearwardly so that the teeth **44** of said bushing move into the spaces between the teeth **40** of the driver **36** and engage said teeth. Clockwise movement of the trigger also effects closing of the switch **112** to thereby supply electric power to the motor **18** and energize same to effect rotation of the bit and wrapping of the bare wire portion onto the terminal.

When wrapping of the wire has been completed the trigger is released so that the spring **128** forces the trigger lever counter-clockwise to deenergize the motor and force the index cam forwardly against the force of spring **142** and thereby disengage the teeth **44** of the bushing **42** from the teeth **40** of the driver **36**. Should the ball bearing assembly **134** be positioned against the cam face of the index cam annularly from the radial groove **140***c*, the pressure or force provided

by the spring 128 will cause the ball bearing assembly 134 to exert pressure on on the particular inclined part of the index cam against which it is positioned and effect rotation of the index cam until the outer race of said ball bearing assembly enters the groove 140c. Rotation of the index cam will stop at this point whereat the groove 98 of the bit 95 is in register with the flaring part 96 of the bit sleeve and permit easy insertion of the next bare part of wire to be wrapped about a terminal. The above-described procedure is followed to wrap the wire onto another terminal.

The invention and its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example, and I do not wish to be restricted to the specific form shown or uses mentioned, except as defined in the accompanying claims.

I claim:

1. A wire wrapping tool, comprising:
   A. a rotary bit
   B. indexing means operably connected with said bit, said indexing means having an angular index position related to an angular position of the bit;
   C. a motor having an energized condition and a deenergized condition;
   D. a clutch means having an engaged position and a disengaged position;
   E. motor and clutch control means for controlling the motor and the clutch, said control means having a pair of positions, and when at one position the clutch is disengaged and the motor deenergized and when at the other position the clutch is engaged and the motor energized;
   F. a part on said motor and clutch control means engageable with said indexing means and, when said control means is at said one position, said indexing means is at said angular index position;
   G. means yieldingly urging the clutch to the engaged position;
   H. and yielding means urging said control means to said one position.

2. The invention defined by claim 1, wherein the motor and clutch control means, when moved to said other position, first effects engagement of the clutch and then effects energization of the motor.

3. The invention defined by claim 1, including a cylindrical bit sleeve in which said bit is rotatably mounted, said bit sleeve having an arcuate portion at the free end flared radially outwardly, the bit's angular indexed position being related to said flared portion of the bit sleeve.

4. The invention defined by claim 1, wherein the indexing means comprises a bit sleeve having a flared portion at the free end, and the free end of the bit has a peripheral groove extending longitudinally rearwardly, said groove being at the bit's angular index position with the flared portion of the bit sleeve, said flared portion of the bit sleeve serving as a guide for the insertion of a wire into said groove, an inner end portion of said groove being in a cylindrical part of the bit sleeve, there being notches in the free end of the bit sleeve at the annular ends of said flared portion.

5. The invention defined by claim 1, wherein the means yieldingly urging the clutch to the engaged position is weaker than the yielding means urging said control means to said one position.

6. The invention defined by claim 5, wherein the clutch has a pair of parts, one of said parts being held against longitudinal movement while the other of said parts being movable longitudinally into and out of engagement with the one of said parts; and the indexing means is connected with said movable part for rotation therewith and has limited longitudinal movement relative to said other clutch part; said means yieldingly urging the other of said clutch parts to the engaged position acting through said indexing means for effecting longitudinal movement of said movable clutch part into engagement with the one clutch part.

7. The invention defined by claim 5, wherein the indexing means comprises an indexing cam with a cam face which has a radial groove therein and a ridge annularly spaced from said groove, the cam face having annular parts inclined from the ridge to the groove, the part on the motor and clutch control means engaging said cam face for exerting pressure thereon for effecting rotation of said cam to the angular index position whereat said part rests in said radial groove.

8. The invention defined by claim 7, wherein the motor is an electric motor adapted to be connected to a source of electric current, and there is a normally open electric switch for controlling electric current to said motor, said control means closing said switch when said control means is in its other position.

9. The invention defined by claim 8, wherein the clutch means comprises a part connected to the motor and having a plurality of forwardly projecting annularly spaced teeth and a part connected with the bit and having complementary annularly spaced teeth projecting rearwardly toward the first mentioned teeth and adapted to be received in the spaces between the first mentioned teeth, said clutch being disengaged when the first and second mentioned teeth are disengaged from each other, and said clutch being engaged when the teeth are positioned for engagement with each other.

10. The invention defined by claim 7, wherein the part on the motor and clutch control means for engaging the cam face of the indexing cam comprises a ball bearing assembly, the outer race of said ball bearing assembly engaging said cam face.

11. A wire wrapping tool, comprising:
   A. a hollow housing;
   B. an electric motor disposed in said housing;
   C. a rotatable, tubular driver operably connected to said motor and rotated thereby, said driver comprising a clutch part held against longitudinal movement and having a plurality of annularly spaced forwardly extending teeth;
   D. a tubular bit sleeve secured to the forward end of said housing, said bit sleeve having a circumferential part of its outer end flared outwardly;
   E. a bit rotatably disposed in said bit sleeve, said bit having a peripheral groove extending from the forward end longitudinally rearwardly and an axial bore in the free end of said bit extending longitudinally rearwardly;
   F. a drive spindle within the tubular driver and extending forwardly thereof;

G. a tubular bushing having a rear portion mounted on a forward end portion of the drive spindle and normally rotatable thereon, said bushing having a plurality of rearwardly extending annularly spaced teeth adapted to be moved into the spaces between the teeth of the driver;

H. an output spindle connected with said bit, said spindle being axially aligned with said drive spindle and having a bore extending longitudinally from the rear end, said output spindle having a pair of diametrically arranged longitudinally extending slots;

I. an index cam secured to said bushing, said cam and bushing being secured together by a pin which extends through the slots in said output spindle for limited longitudinal movement of said bushing and index cam rearwardly for engagement of the teeth of said bushing with the teeth of said driver, said index cam being circular with a rear side defining a cam face having a radial groove and a radial ridge annularly spaced from said groove, parts of said face being inclined from said ridge to said groove;

J. yielding means urging said index cam and bushing toward said driver;

K. a trigger lever in the housing pivoted at its lower end and having a ball bearing assembly at its free end, the outer race of said ball bearing assembly being engageable with the cam face of said index cam;

L. yielding means urging the trigger lever in a direction to effect operable engagement of said ball bearing assembly with said cam face and normally hold the index cam and bushing in a position whereat the teeth of said bushing and the driver are disengaged;

M. a normally open electric switch for the motor, said switch being in said housing and positioned for actuation by said trigger lever for closing said switch upon actuation of said trigger lever to relieve pressure on the ball bearing assembly on the cam face of the index cam.

12. The invention defined by claim **11**, wherein actuation of the trigger lever by an operator relieves the pressure of the ball bearing assembly on the cam face to permit the first mentioned yielding means to move the bushing teeth into engagement with the driver teeth before closing the switch.

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