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(54) **POWER TOOLS ATTACHABLE TO
REMOVABLE OR FIXED POWER CORDS**

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(57) ABSTRACT

A power tool (10) may include a motor (11) accommodated within a housing (12). An adapter (32) may be attached to the housing. A connector fitting portion or insert (34) may be defined in a projecting portion of the adapter and the projecting portion may extend from the housing. A power cord (61) may be removably connected to the connector fitting portion. The power cord may include a cord fitting portion or plug (62), which fits into the connector fitting portion. By inserting the cord fitting portion into the connector fitting portion, the power cord can be removably connected to the connector fitting portion. The motor may be electrically connected to a commercial power source by connecting one end of the power cord to the connector fitting portion and by connecting the other end of the power cord to the commercial power source.

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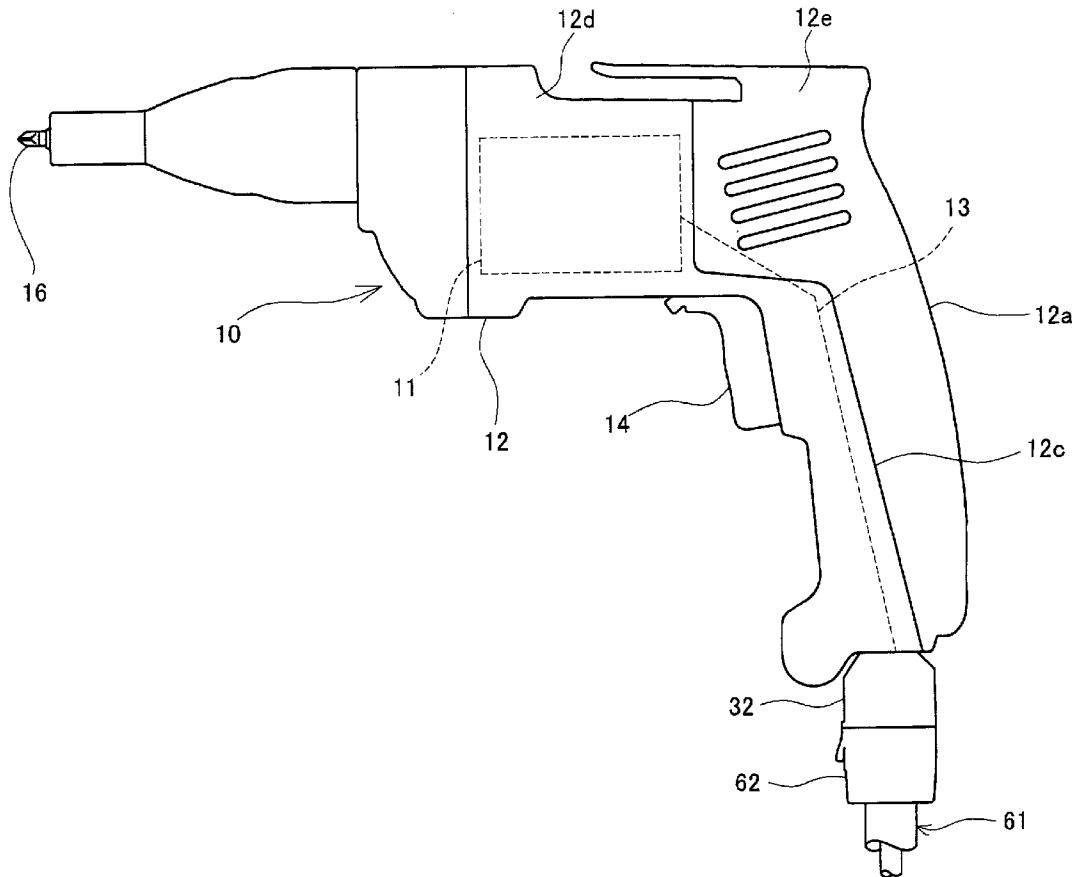
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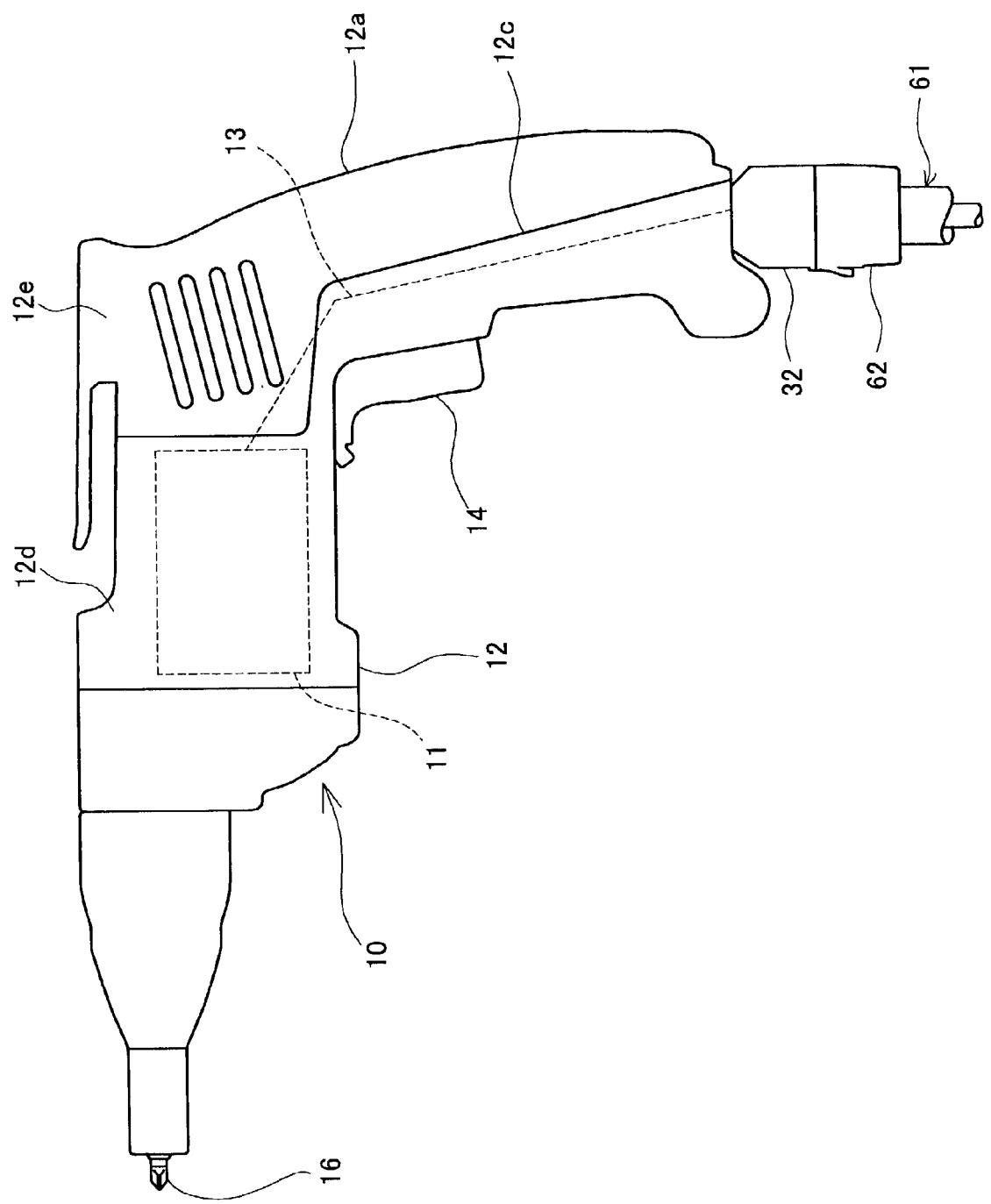


FIG. 1

FIG. 2

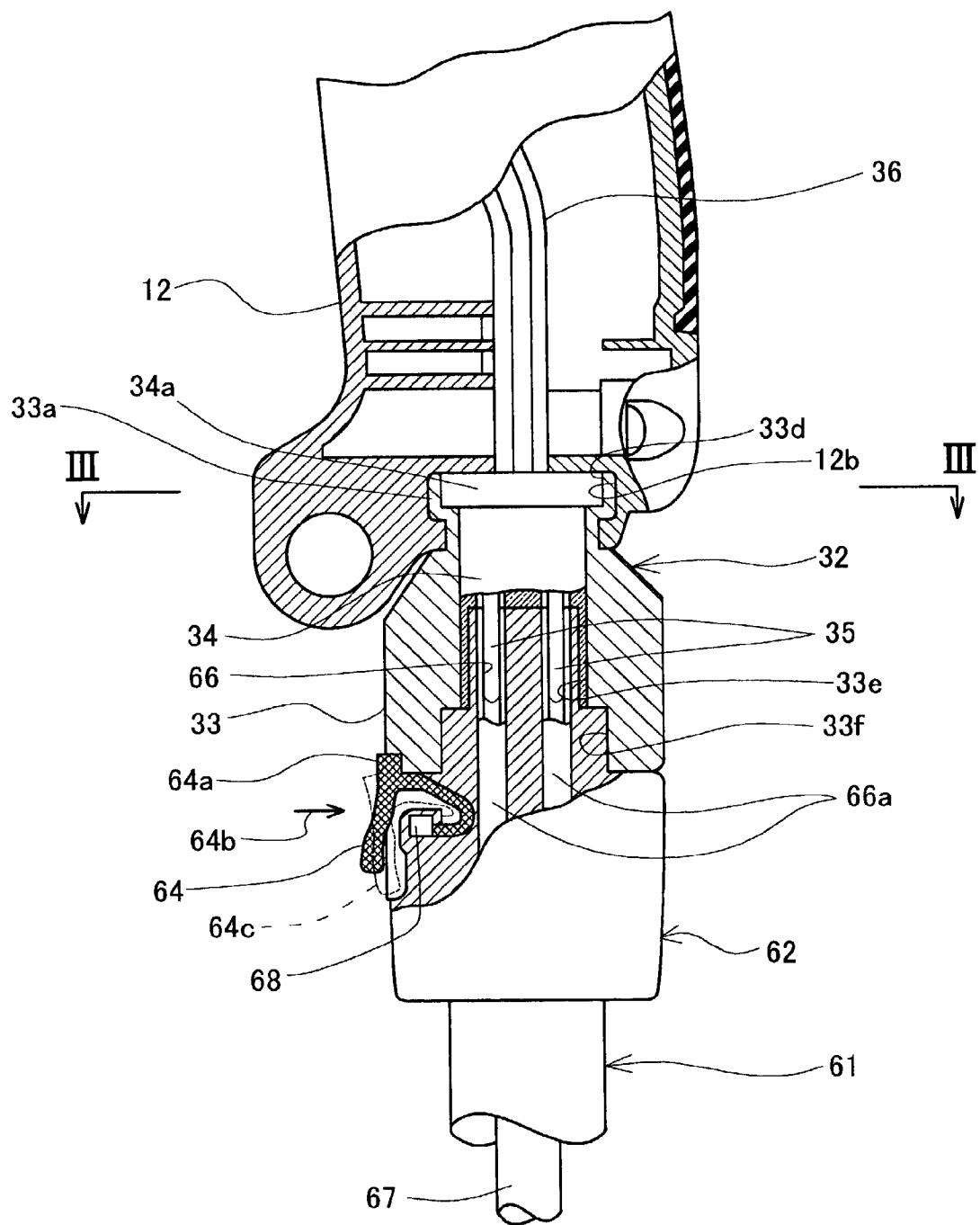


FIG. 3

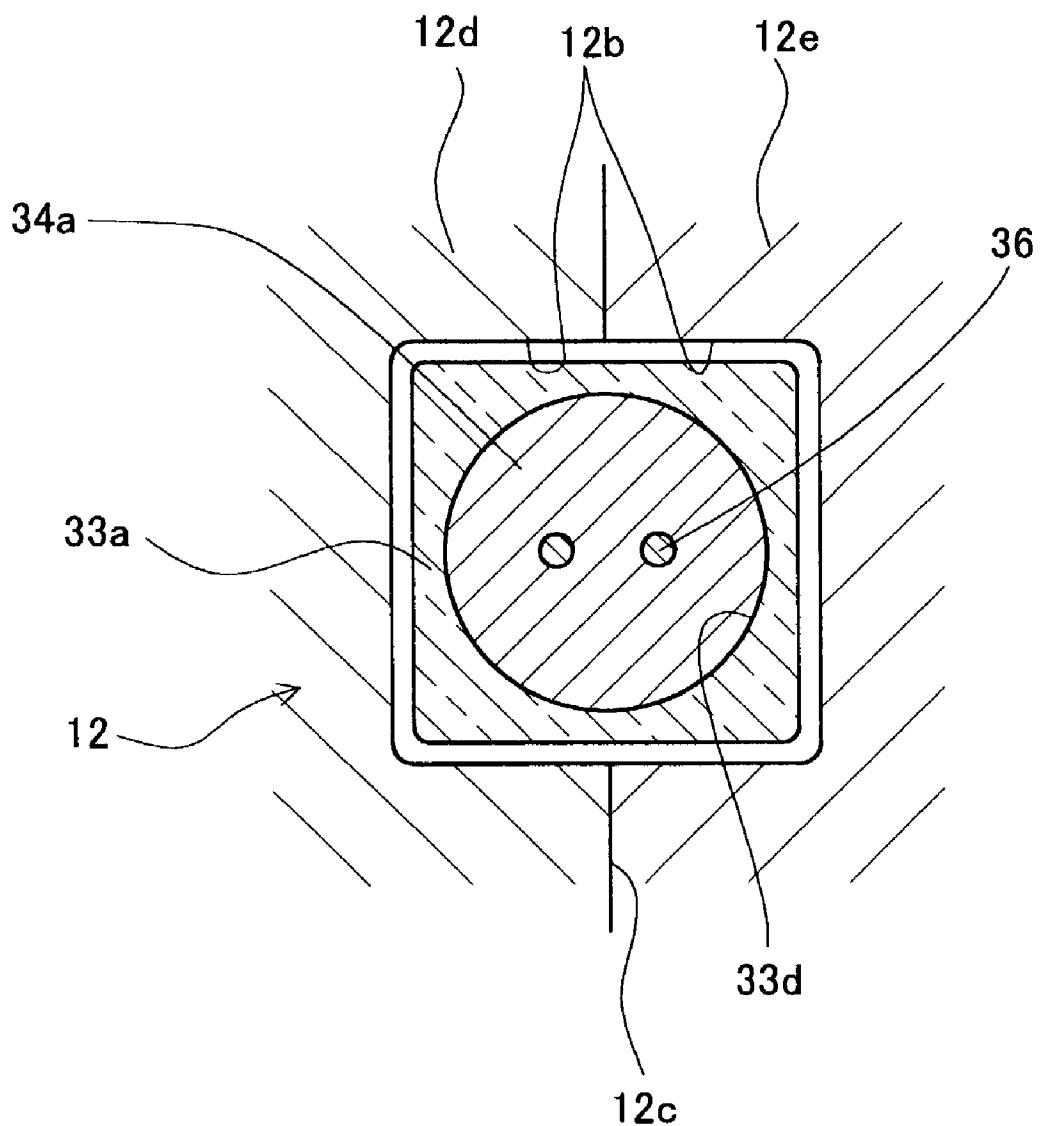


FIG. 4

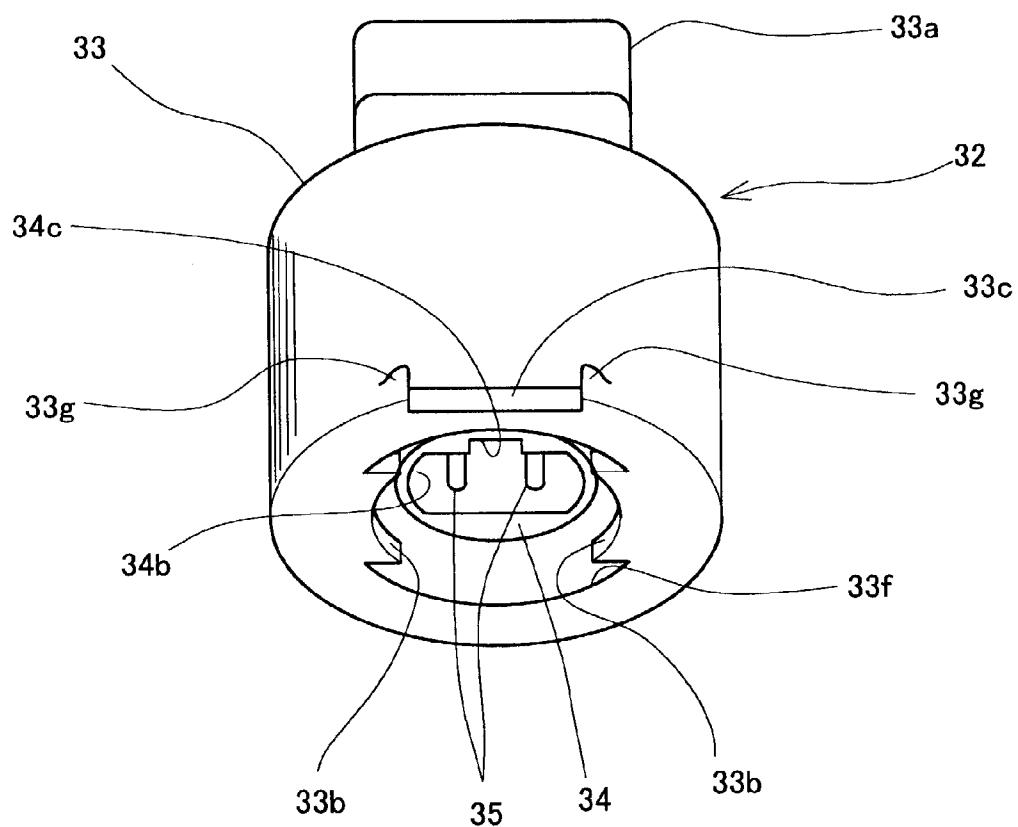


FIG. 5

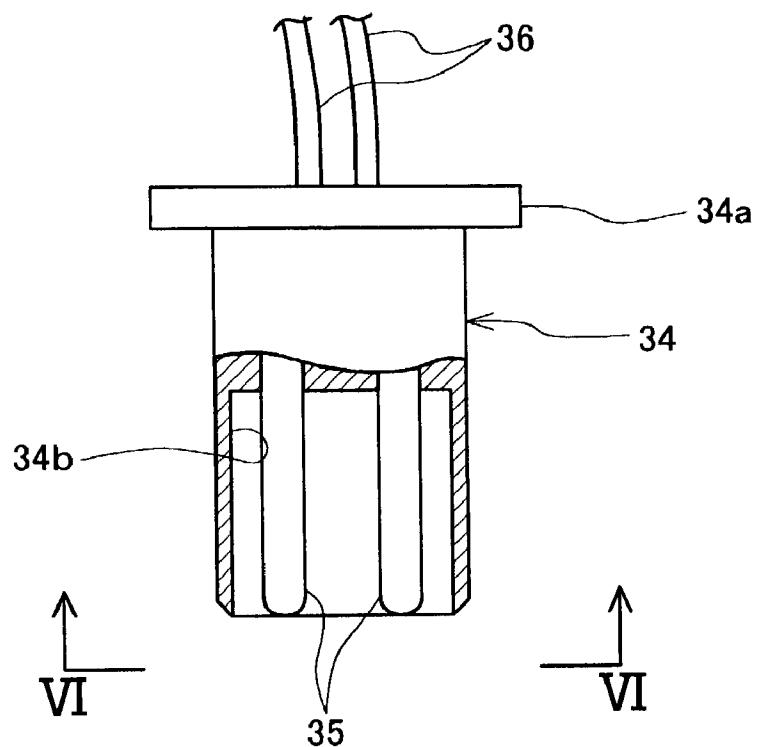


FIG. 6

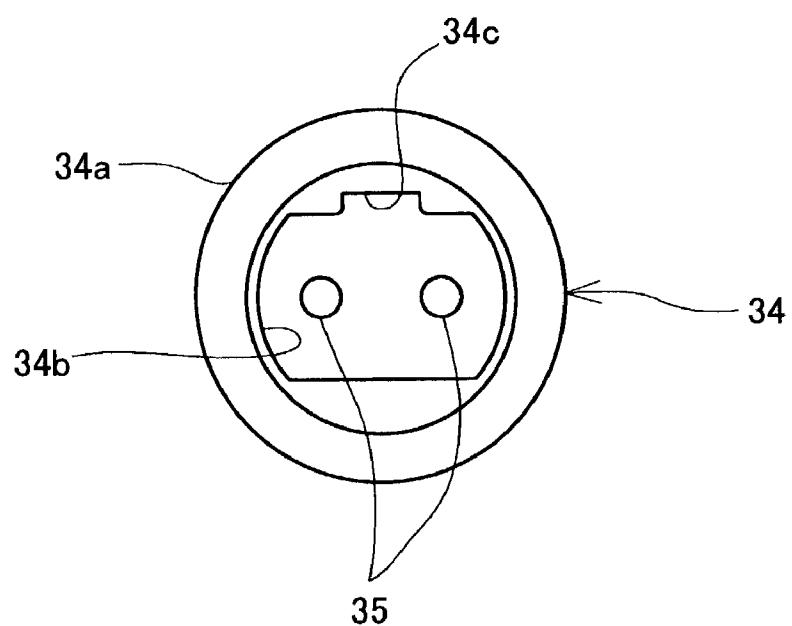
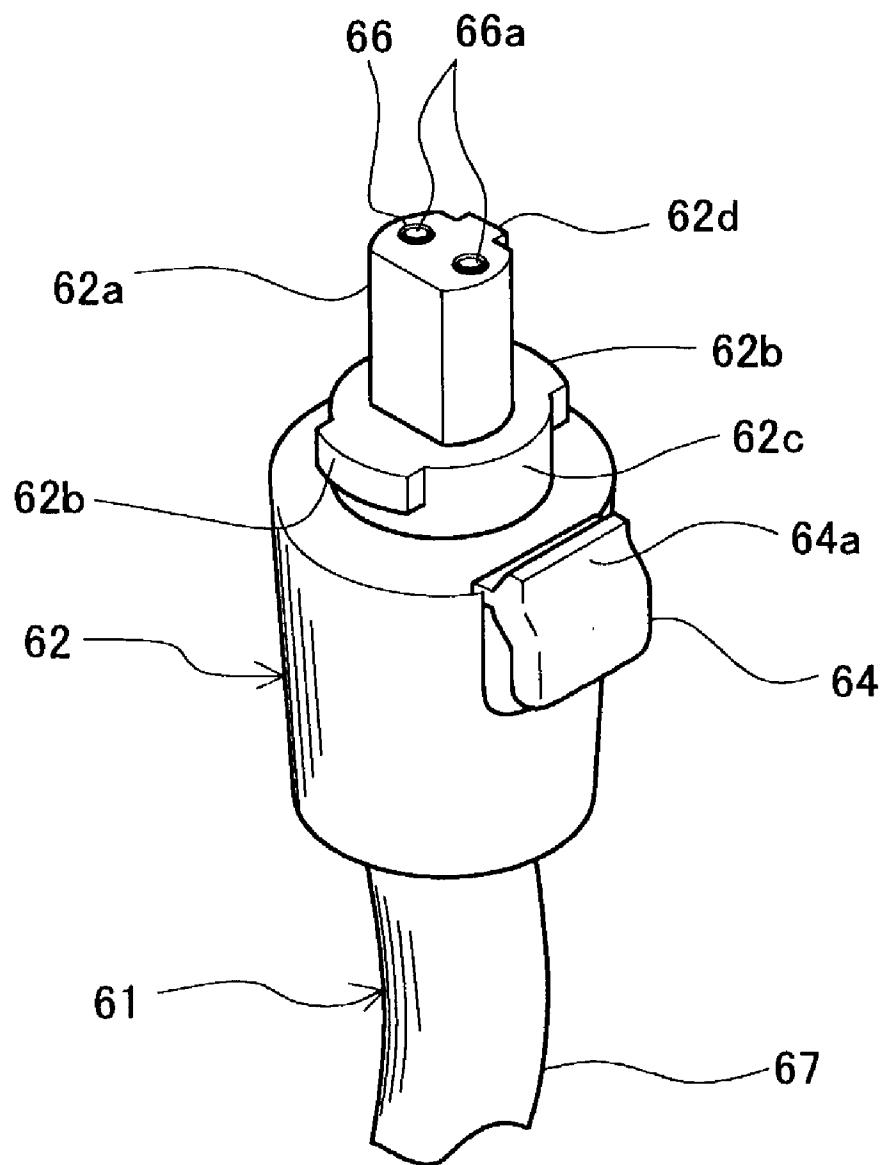
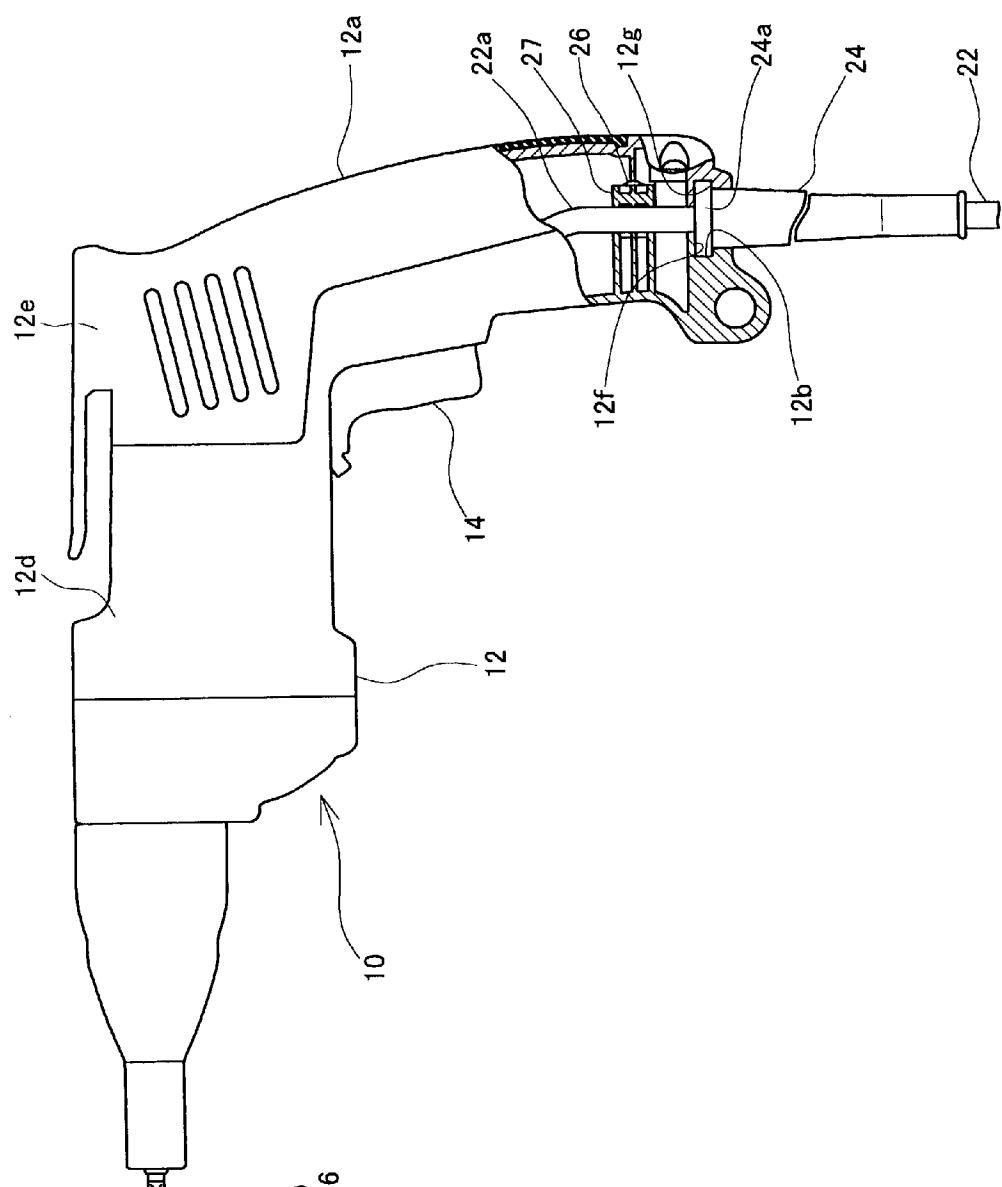


FIG. 7





POWER TOOLS ATTACHABLE TO REMOVABLE OR FIXED POWER CORDS

CROSS-REFERENCE

[0001] This application claims priority to Japanese patent application serial number 2001-319277, the contents of which are hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to power tools and, more particularly, to techniques for either fixedly or removably attaching a power cord to a common housing for a power tool.

[0004] 2. Description of the Related Art

[0005] Power tools are usually connected to an electric power source (commercial power outlet) via a power cord. The power cord may be fixedly attached to the housing of the power tool or may be removably attached to the housing of the power tool. U.S. Pat. No. 6,368,133 describes a removable power cord that is inserted into a receiving hole provided within the housing of the power tool. A connection terminal for the power tool is disposed within the receiving hole. The shape of the connection end of the power cord is complementary to the shape of the receiving hole of the housing, and a connection terminal is provided for the power cord. Thus, in order to connect the power cord to the power tool, the connection end of the power cord is inserted into the receiving hole of the housing. Upon inserting the power cord into the receiving hole, the connection terminal of the power tool is electrically connected to the connection terminal of the power cord.

[0006] However, according to U.S. Pat. No. 6,368,133, the design of the power tool housing that will be attached to a removable power cord must be different from the design of the power tool housing that will be attached to a fixedly attached power cord, because the receiving hole must be provided within the housing for the known removably attachable power cord. Consequently, two different molds are required to manufacture housings for the power tool. That is, one mold must define a first power tool housing for receiving a fixedly attached power cord and the second mold must define a second power tool housing for receiving the removably attached power cord. Thus, according to the known art, the first power tool housing can not be utilized interchangeably with the second power tool housing.

SUMMARY OF THE INVENTION

[0007] It is, accordingly one object of the present teachings to overcome such problems and to teach techniques for enabling either a removable power cord or a fixed power cord to be connected to a common power tool housing.

[0008] In one aspect of the present teachings, power tools may include a motor that is disposed within a housing. The motor may be arranged and constructed to drive a tool or a tool bit. The housing is preferably defined so as to be capable of receiving either a fixedly attached power cord or a removably attachable power cord without requiring any changes to the housing. For example, a fitting recess (e.g., a

common fitting recess) may be defined within the housing and the fitting recess is preferably designed so as to receive either an adapter (or connector) for a removable power cord or a cord guard for a fixedly secured power cord. Thus, if a fixedly secured power cord will be attached to the housing, the cord guard fitting portion may be disposed within the common fitting recess and no changes to the housing (e.g., the common housing) are necessary.

[0009] If a removable power cord will be attached to the housing (e.g., the common housing), an adapter (or connector) may be coupled to the motor and may be attached to the housing. For example, an adapter fitting portion (e.g., a flange) may be defined on the adapter and may be disposed within the fitting recess (e.g., the common fitting recess) of the housing. The adapter also may include a connector fitting portion (e.g., an insert or socket). Further, a receiving hole for the removable power cord may be defined within the connector fitting portion. The connector fitting portion is preferably disposed outside of (external to) the housing when the adapter is attached to the housing. The removable power cord may include a cord fitting portion (e.g., a plug), such as a connection end of the power cord. The cord fitting portion (e.g., plug) preferably fits into or engages with the connector fitting portion (e.g., socket). By fitting the cord fitting portion into the connector fitting portion, the power cord may be removably connected to the connector.

[0010] In such power tools, the removable power cord may be connected to the connector fitting portion, which is attached to the housing. Because the connector fitting portion may be disposed outside the housing, the housing is not required to contain a mechanism or device for connecting to the removable power cord. Therefore, if the adapter is arranged and constructed to engage a housing that is designed for a fixedly attached power cord, a common housing can accommodate both a fixedly attachable power cord and a removably attachable power cord. Therefore, a single housing can be manufactured for each of these applications of the power tool.

[0011] At least one of the connector fitting portion and the cord fitting portion preferably may include a receiving hole and the other may include an insertion projection. The insertion projection is inserted into the receiving hole. The receiving hole preferably may include one or more projecting terminals and the insertion projection preferably may also include one or more receiving terminals. The projecting terminal(s) may be inserted into the receiving terminal(s). If the projecting terminal(s) are provided within the receiving hole, the projecting terminal(s) will be protected from being deformed or damaged.

[0012] In another aspect of the present teachings, the receiving hole may be defined within the connector fitting portion. In this case, the cord fitting portion may include the insertion projection. The adapter may also include a sleeve that may be secured to the housing in order to support (e.g., rotatably support) the connector fitting portion. Further, one (terminal) end of the sleeve may be disposed beyond the corresponding end of the connector fitting portion. For example, the sleeve may project beyond the end of the connector fitting portion (i.e., the terminal end of the connector fitting portion (or insert) is preferably disposed within the interior of the sleeve). A first projection may be formed on the inner wall of the end of the sleeve. A second (locking)

projection may be formed on (or proximal to) the outer wall of the insertion projection of the power cord.

[0013] In this case, the cord fitting portion may be first aligned with the connector fitting portion, so that the insertion projection of the power cord can be inserted into the receiving hole of the connector fitting portion. For example, the connector fitting portion may be substantially in a first position relative to the sleeve, so that the first projection (of the sleeve) does not interfere with the second projection (of the cord fitting portion of the power cord). Thus, in this first position, the insertion projection of the power cord can be pulled (removed) from or inserted into the receiving hole of the connector fitting portion, because the first projection does not interfere with the second projection in the first position. After inserting the insertion projection into the receiving hole, the cord fitting portion and the connector fitting portion may be rotated together about the common rotational axis to (or is disposed in) a second position with respect to the sleeve. When the cord fitting portion is disposed in the second position with respect to the sleeve, the first projection will engage the second projection and/or the first projection (of the sleeve) will prevent the second projection (of the power cord) from passing the first projection. (For example, the first and second projections may be disposed in a substantially interlocking position.) As a result, the insertion projection of the power cord can be prevented from being pulled out of (removed from) the receiving hole of the connector fitting portion due to the engagement of the first and second projections. Thus, by engaging the first projection with the second projection, the power cord can be prevented from accidentally falling out of the connector fitting portion.

[0014] These aspects and features may be utilized singularly or in combination in order to provide improved power tools. In addition, other objects, features and advantages of the present teachings will be readily understood after reading the following detailed description together with the accompanying drawings and the claims. Of course, the additional features and aspects disclosed herein also may be utilized singularly or in combination with the above-described aspects and features.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a side view of a screwdriver according to a representative embodiment of the present teachings.

[0016] FIG. 2 is a longitudinal cross-sectional view of the bottom portion of a handle.

[0017] FIG. 3 is a cross-sectional view taken along line III-III shown in FIG. 2.

[0018] FIG. 4 is a perspective view of a representative adapter.

[0019] FIG. 5 is a longitudinal cross-sectional view of a representative connector fitting portion.

[0020] FIG. 6 is a cross-sectional view taken along line VI-VI shown in FIG. 5.

[0021] FIG. 7 is a perspective view of a representative plug.

[0022] FIG. 8 is a side view of the representative screwdriver with a power cord fixedly attached to the housing.

DETAILED DESCRIPTION OF THE INVENTION

[0023] In another embodiment of the present teachings, power tools may include a motor (e.g., an electric motor) disposed within a housing. The motor preferably may be adapted to drive the power tool or a tool bit attached to the power tool. An adapter or connector may be electrically connected to the motor and attached to the housing. The adapter may include a connector fitting portion that is disposed external to (outside of) the housing. The connector fitting portion may be defined, e.g., as a socket or insert for receiving a cord fitting portion of a removable power cord. The cord fitting portion may be defined, e.g., as a plug that is arranged and constructed to fit within (or engage with) the connector fitting portion or socket. By fitting the cord fitting portion (e.g., plug) into the connector fitting portion (e.g., socket), the power cord can be electrically and removably connected to the adapter.

[0024] In another embodiment, one of the connector fitting portion and the cord fitting portion may include a receiving hole. The other of the connector fitting portion and the cord fitting portion may include an insertion projection arranged and constructed for insertion into the receiving hole. At least one projecting terminal may be disposed within the receiving hole and at least one receiving terminal may be arranged and constructed to receive the at least one projecting terminal defined within the insertion projection. In another embodiment, the receiving hole may be defined within the connector fitting portion and the insertion projection may be defined within the cord fitting portion.

[0025] Optionally, the adapter may include a sleeve that supports the connector fitting portion and the sleeve may be attached to the housing. For example, the sleeve may be arranged and constructed to rotatably support the connector fitting portion, such that the connector fitting portion can rotate within the sleeve. One end of the sleeve may be disposed beyond a corresponding end of the connector fitting portion. First projections may be defined on an inner wall of the end of the sleeve and second projections may be defined on an outer wall of the cord fitting portion (e.g., the plug).

[0026] The cord fitting portion can be inserted into the connector fitting portion when the connector fitting portion is disposed substantially in a first position with respect to the sleeve. In this first position, the first projections do not interfere with the second projections, thereby allowing the insertion projection of the power cord to be pulled (removed) from or inserted into the receiving hole of the connector fitting portion. Then, when the cord fitting portion is rotated about a common rotational axis to a second position with respect to the sleeve, the first projections preferably engage the second projections in order to prevent the insertion projection of the power cord from being pulled (removed) from the receiving hole of the connector fitting portion. For example, the second projections may block the first projections from passing out of the sleeve.

[0027] In another embodiment, a locking mechanism may be utilized to releasably secure the removable power cord to the sleeve. For example, the locking mechanism may be operated or manipulated to release the removable power cord from the sleeve when the connector fitting portion is disposed in the second position with respect to the sleeve.

Optionally, the locking mechanism may include a groove defined in one of the sleeve or the removable power cord. A locking member may be defined on the other of the sleeve and the removable power cord. Preferably, the locking member disengages from the groove when the locking member has been operated or manipulated from its original or initial position and the locking member engages the groove when the locking member has been released and returned to its original or initial position. The locking member may be arranged and constructed such that the locking member is urged toward the locking position and away from the unlocking position. For example, the locking member may be made of an elastic resin material that urges the locking member toward the locking position and away from the unlocking position.

[0028] The locking mechanism may also include one or more stoppers arranged and constructed to prevent the locking member from dislodging from the groove. Further, the locking member may be defined on the removable power cord.

[0029] In other optional embodiments, the receiving hole may include a recess and an engaging projection may be defined on an outer wall of the cord fitting portion (e.g., the plug). The engaging projection is preferably designed to engage the groove. In addition or in the alternative, the sleeve may be attached to the housing such that the sleeve is prevented from rotating with respect to the housing. For example, the adapter fitting portion of the sleeve may be defined so that the adapter fitting portion can not rotate or pivot within the fitting recess of the housing.

[0030] Each of the additional features and method steps disclosed above and below may be utilized separately or in conjunction with other features, elements and method steps to provide improved power tools. Detailed representative examples of the present teachings, which examples will be described below, utilize many of these additional features and method steps in conjunction. However, this detailed description is merely intended to teach a person of skill in the art further details for practicing preferred aspects of the present teachings and is not intended to limit the scope of the invention. Only the claims define the scope of the claimed invention. Therefore, combinations of features and steps disclosed in the following detailed description may not be necessary to practice the present teachings in the broadest sense, and are instead taught merely to particularly describe representative and preferred embodiments of the present teachings, which will be explained below in further detail with reference to the figures. Of course, features and steps described in this specification and in the dependent claims may be combined in ways that are not specifically enumerated in order to obtain other usual and novel embodiments of the present teachings and the present inventor expressly contemplates such additional combinations.

[0031] FIG. 1 shows a representative screwdriver 10 according to the present teachings, in which housing 12 may accommodate motor 11. Tool bit 16 may be mechanically connected to motor 11 via a transmission mechanism (not shown). A removable power cord 61 may be electrically coupled to motor 11 via adapter (e.g., connector) 32 and electric circuit (wire) 13, which may be disposed within housing 12. By connecting power cord 61 to an external

power source (e.g., a commercial power outlet), current will be supplied to motor 11 in order to rotate motor 11 and drive tool bit 16.

[0032] Handle 12a may be defined on a portion of housing 12. Trigger switch 14 may be disposed on handle 12a and is preferably designed to actuate motor 11. When trigger switch 14 is actuated, current is supplied to motor 11 from the external power source. When trigger switch 14 is deactivated (released), the supply of current from the external power source will be stopped. Accordingly, pressing or actuating trigger switch 14 will cause tool bit 16 to rotate and releasing or de-activating trigger switch 14 will cause tool bit 16 to stop rotating.

[0033] Housing 12 may be divided along dividing line 12c into two housing halves 12d, 12e. By fitting together housing halves 12d, 12e, fitting recess 12b may be defined within a bottom portion of handle 12a, as shown in FIGS. 2 and 3. That is, a first portion of fitting recess 12b may be defined within housing half 12d and a second portion of fitting recess 12b may be defined within housing half 12e. Fitting recess 12b may have, e.g., a substantially square cross-section, although a variety of configurations are contemplated, as will be discussed further below. Further, fitting recess 12b is preferably designed so as to receive either adapter fitting portion 33a for removable power cord 61 or power cord fitting portion 24a of fixedly secured power cord 22, as will be further discussed below.

[0034] Adapter 32 may be mounted or disposed within fitting recess 12b. As shown in FIG. 2, adapter 32 may include sleeve 33 and insert (e.g., connector fitting portion) 34. Insert 34 also may be interchangeably referred to as socket 34. Sleeve 33 is preferably separable from insert 34, although sleeve 33 may be integrally and continuously formed with insert 34. In the present embodiment, insert 34 can rotate or pivot within sleeve 33, as will be further discussed below.

[0035] Adapter fitting portion 33a may be defined in or on a first terminal end of sleeve 33 (e.g., the top end of sleeve 33, as shown in FIG. 3). Adapter fitting portion 33a also may have, e.g., a substantially square cross-section, that is substantially complementary to fitting recess 12b. In addition, adapter fitting portion 33a is preferably arranged and constructed to fit within (or engage) fitting recess 12b, so that adapter 32 will not rotate within (or with respect to) the handle 12a when adapter 32 is engaged with fitting recess 12b. Thus, although adapter fitting portion 33a and fitting recess 12b may preferably have substantially square (complementary) configurations, any complementary shapes or configurations that will prevent adapter 32 from rotating with respect to handle 12a may be utilized with the present teachings.

[0036] An aperture may be defined within sleeve 33 from the first terminal end (e.g., the top end) of sleeve 33 to a second terminal end (e.g., the bottom end) of sleeve 33. The aperture may include a substantially circular upper opening 33d, a substantially circular middle opening 33e, which may have a slightly smaller diameter than upper circular opening 33d, and a substantially circular lower opening 33f, which may have a larger diameter than the substantially circular middle opening 33e.

[0037] Referring to FIG. 4, two projections 33b may be defined on an inner wall of substantially circular lower

opening 33f of sleeve 33. Projections 33b may be disposed opposite to each other and project inwardly from the inner wall of the substantially circular lower opening 33f. Locking groove 33c may be defined on an outer surface of the lower portion of sleeve 33. Stoppers 33g may be defined on both sides of locking groove 33c and may project from the outer surface of sleeve 33.

[0038] As shown in **FIGS. 5 and 6**, the outer shape of insert 34 may be substantially cylindrical, such that insert 34 will closely fit within substantially circular upper opening 33d and substantially circular middle opening 33e. Flange 34a may be defined on an upper (or first terminal) end of insert 34. Receiving hole 34b may be defined within the lower (or second terminal) end of insert 34. Receiving hole 34b may preferably extend perpendicularly (e.g., upwardly) from a lower end face of insert 34. The depth of receiving hole 34b may be, e.g., approximately one-half the longitudinal length of insert 34.

[0039] As shown in **FIG. 6**, the cross-sectional design of receiving hole 34b may include a combination of arcs and straight lines. Recess 34c may be defined within one of the two straight inner walls. Two pins (projecting terminals) 35 may be fixed in position so as to extend or project within receiving hole 34b. One wire 36 may be electrically coupled to each respective pin 35. The wires 36 may constitute parts of electric circuit 13 and may be fastened to the first terminal end of insert 34.

[0040] Referring back to **FIG. 2**, insert 34 may be inserted from above into apertures 33d, 33e, which are defined within sleeve 33, so as to be pivotable or rotatable with respect to sleeve 33 about the rotational (longitudinal) axis of the insert 34. After disposing insert 34 within sleeve 33, sleeve 33 may be attached to housing 12 by disposing adapter fitting portion 33a within fitting recess 12b. For example, housing halves 12d, 12e may be assembled around adapter fitting portion 33a so that the adapter fitting portion 33a is securely disposed within fitting recess 12b.

[0041] As shown in **FIG. 3**, if adapter fitting portion 33a and fitting recess 12b each have a square cross-section, sleeve 33 cannot pivot or rotate with respect to housing 12. However, as noted above, the adapter fitting portion 33a and fitting recess 12b may have different, but still complementary configurations, that enable adapter fitting portion 33a to be non-rotatably disposed within fitting recess 12b. A wide variety of complementary configurations are known in the art and thus need not be specifically described herein.

[0042] Adapter 32 is preferably designed to receive removable power cord 61. As shown in **FIG. 2**, plug (e.g., cord fitting portion) 62 may be coupled to one terminal end of power cord 61. Referring to **FIG. 7**, plug 62 may include a substantially cylindrical lower portion. Plug 62 also may include cylindrical portion 62c disposed adjacent to the substantially cylindrical lower portion. Insertion projection 62a may be disposed adjacent to cylindrical portion 62c. Insertion projection 62a preferably may have an outer shape that is complementary with receiving hole 34b of insert 34. Engaging projection 62d may be defined along one of the straight extending peripheral walls of insertion projection 62a.

[0043] Two terminal holes 66 may be defined within an upper end of insertion projection 62a. Cylindrical terminals

66a may be respectively disposed within terminal holes 66. Cylindrical terminals 66a may be electrically connected to cord 67, which extends from the substantially cylindrical lower portion of plug 62. Two locking projections 62b may project outwardly from cylindrical portion 62c of plug 62. Preferably, locking projections 62b may be symmetrically disposed about the center of cylindrical portion 62c. A power-source plug (not shown) for insertion into a commercial power outlet (or power socket) may be connected to the terminal end of cord 67.

[0044] Referring to **FIGS. 2 and 7**, plug 62 may also include locking member 64, which may be an elastic resin body. The lower (or first terminal) end of locking member 64 may be coupled to affixing portion 68. Locking portion 64a may be defined on the upper portion of locking member 64. When locking portion 64a is pressed in the direction of arrow 64b shown in **FIG. 2**, locking member 64 will deform as shown by broken lines in **FIG. 2** to an "unlocked" position. Consequently, locking member 64a will move obliquely downward. When the pressing force is removed or released from locking portion 64a, locking member 64 will return to its initial or original position, i.e., a "locked" position, due to the elastic restoring force of the elastic resin body.

[0045] A representative method for coupling plug 62 to adapter 32 will now be described. First, insertion projection 62a of plug 62 may be inserted into receiving hole 34b of insert 34 when the insert 34 is disposed substantially in a first position with respect to the sleeve 33. This insertion operation may be accomplished by moving plug 62 toward adapter 32 in a manner so that projections 33b of sleeve 33 do not interfere with locking projections 62b of plug 62. That is, in the first position, projections 33b do not interfere or engage locking projections 62b. Upon inserting plug 62 into adapter 32, pins 35 will be respectively inserted into cylindrical terminals 66a of terminal holes 66. For example, the shape of recess 34c of insert 34 is preferably complementary to the shape of engaging projection 62d so that insertion projection 62a can be inserted into receiving hole 34b. Due to the complementary shapes of engaging projection 62d and receiving hole 34b, plug 62 can be inserted into insert 34 only in one particular orientation, which will be referred to as the "first" or "insertion" orientation.

[0046] In addition, in order to prevent locking portion 64a from interfering with the bottom of sleeve 33 when plug 62 is inserted into adapter 32, locking member 64 should be pressed, e.g., manually pressed, into the unlocked position.

[0047] Next, plug 62 is rotated approximately 90 degrees from the first or insertion orientation to a second position while keeping plug 62 completely inserted within adapter 32. As a result, locking projections 62b of plug 62 will contact the rear portions of projections 33b of sleeve 33 and plug 62 will be prevented from falling out of (or being removed from) adapter 32 when plug 62 is disposed substantially in the second position with respect to sleeve 33.

[0048] Further, in this condition, locking groove 33c of sleeve 33 coincides with locking member 64 in the circumferential direction. Therefore, when the pressing force applied to locking member 64 is removed or released, locking member 64 will return to the locking position due to its elastic restoring force. Therefore, locking portion 64a fits into (engages) locking groove 33c. Because locking portion

64a is fitted into (engaged with) locking groove 33c, plug 62 is prevented from pivoting about its longitudinal axis with respect to insert 34. Further, if stoppers 33g are defined on both sides of locking groove 33c, locking portion 64a can be prevented from dislodging from locking groove 33c.

[0049] Projections 33b of adapter 32 respectively engage locking projections 62b of plug 62. Further, locking portion 64a fits within (engages) locking groove 33c. Therefore, plug 62 is prevented from moving both along and around its longitudinal axis and plug 62 is positively, but releasably, secured to adapter 32.

[0050] In order to disconnect plug 62 from adapter 32, locking member 64 may be deformed (e.g., manually pressed), thereby forcing locking portion 64a out of locking groove 33c. By rotating plug 62 around its longitudinal axis to the first or insertion orientation while continually pressing locking member 64 and then by pulling plug 62 in the axial direction, plug 62 can be disconnected (removed) from adapter 32.

[0051] The connection/disconnection of plug 62 to/from adapter 32 can be accomplished by a series of actions, such as inserting and rotating (or pivoting) plug 62 and operating locking member 64. These actions may be manually performed with one hand, thereby enabling "one-touch" operation. Therefore, by using the above-described adapter 32 and plug 62, connection and removal of the removable power cord 61 is facilitated.

[0052] Fitting recess 12b of the present embodiment also enables a power cord to be fixedly attached to housing 12. In this case, a mechanism for receiving and affixing the removable power cord 61 is not provided within housing 12 of screwdriver 10. Therefore, a common fitting portion (e.g., fitting recess 12b) can be utilized in order to affix either the adapter for a removable power cord or a fixed power cord.

[0053] FIG. 8 shows screwdriver 10, which is identical to screwdriver 10 shown in FIG. 2, but in which power cord 22 has been fixedly secured to housing 12. As shown in FIG. 8, power cord 22 may include cord guard 24, which prevents power cord 22 from being sharply bent. Fitting portion 24a may be defined on a terminal end (e.g., an upper end) of cord guard 24 and fitting portion 24a may have a substantially circular cross-section, although naturally the shape of fitting portion 24a is preferably designed to be substantially complementary to the shape of fitting recess 12b. For example, the thickness of fitting portion 24a may be substantially equal to the height of fitting recess 12b. When fitting portion 24a is disposed within fitting recess 12b, upper face 12f and lower face 12g of fitting recess 12b will restrict axial movement of power cord 22.

[0054] In addition, cord clamp 27 may be disposed proximally to fitting recess 12b and cord clamp 27 may be fastened to housing 12, e.g., by screw 26. Power cord 22a may extend within housing 12 and may be firmly and securely disposed between housing 12 and cord clamp 27. Power cord 22 can be disconnected or removed from housing 12 (i.e., from fitting recess 12b) by separating housing half 12e from housing half 12d.

[0055] The present teachings may be modified in a variety of ways without departing from the spirit of the present teachings. For example, the means for affixing the adapter or the power cord to the housing is not particularly limited. The

adapter or the power cord may be affixed to the housing by threading the adapter or the power cord into the housing, by tightly pressing (press-fitting) the adapter or the power cord into the housing, or by any other means. In addition, although adapter 32 comprises sleeve 33 and insert 34 in the representative embodiment, adapter 32 may be a single-piece (integral) device.

1. A power tool comprising:
 - a housing having a fitting recess,
 - a motor disposed within the housing, the motor being adapted to drive the power tool,
 - an adapter providing an electrical connection to the motor, the adapter including an adapter fitting portion disposed within the fitting recess and a connector fitting portion disposed external to the housing, and
 - a power cord removably connectable to the connector fitting portion, the power cord including a cord fitting portion arranged and constructed to engage the connector fitting portion, thereby electrically connecting the power cord to the adapter, wherein the fitting recess is also defined in order to be capable of receiving a power cord fitting portion of a fixedly attached power cord.
2. A power tool as in claim 1, further comprising a receiving hole defined within one of the connector fitting portion and the cord fitting portion and an insertion projection defined on the other of the connector fitting portion and the cord fitting portion, the insertion projection being arranged and constructed to be inserted into the receiving hole.
3. A power tool as in claim 2, further comprising:
 - at least one projecting terminal disposed within the receiving hole and
 - at least one receiving terminal disposed in the insertion projection and being arranged and constructed to receive the at least one projecting terminal.
4. A power tool as in claim 2, wherein the receiving hole is defined within the connector fitting portion and the insertion projection is disposed on the cord fitting portion.
5. A power tool as in claim 2, further comprising a recess defined within the receiving hole and an engaging projection defined on an outer wall of the cord fitting portion, the engaging projection being designed to engage the recess.
6. A power tool as in claim 2, wherein the receiving hole is defined within the connector fitting portion and the insertion projection is disposed on the cord fitting portion, and further comprising:
 - at least one projecting terminal disposed within the receiving hole,
 - at least one receiving terminal disposed in the insertion projection and being arranged and constructed to receive the at least one projecting terminal,
 - a recess defined within the receiving hole and
 - an engaging projection defined on an outer wall of the cord fitting portion, the engaging projection being designed to engage the recess.
7. A power tool as in claim 6, wherein the adapter further comprises a sleeve supporting the connector fitting portion, the adapter fitting portion being defined on the sleeve.

8. A power tool as in claim 7, wherein the sleeve is attached to the housing such that the sleeve is prevented from rotating with respect to the housing.

9. A power tool as in claim 8, wherein the sleeve rotatably supports the connector fitting portion, one end of the sleeve is disposed beyond a corresponding end of the connector fitting portion, at least one first projection is defined on an inner wall of a terminal end of the sleeve and at least one second projection is defined on an outer wall of the cord fitting portion,

wherein when the connector fitting portion is disposed in a first position with respect to the sleeve, the first projection does not interfere with the second projection, thereby allowing the insertion projection to be removed from and inserted into the receiving hole and

wherein when the connector fitting portion engages the cord fitting portion and is disposed in a second position with respect to the sleeve, the first projection blocks the second projection from passing out of the receiving hole, thereby preventing the insertion projection from being removed from the receiving hole.

10. A power tool as in claim 9, further comprising a lock releasably securing the power cord to the sleeve when the connector fitting portion is disposed in the second position with respect to the sleeve.

11. A power tool as in claim 10, wherein the lock comprises a groove defined within one of the sleeve and the power cord and a locking member defined on the other of the sleeve and the power cord, wherein the locking member and the groove are arranged and constructed to engage and disengage from each other by manipulating the locking member.

12. A power tool as in claim 11, wherein the lock further comprises at least one stopper arranged and constructed to prevent the locking member from dislodging from the groove.

13. A power tool as in claim 12, wherein the locking member is defined on the power cord.

14. A power tool as in claim 12, wherein the locking member is arranged and constructed so as to be urged toward engagement with the groove.

15. A power tool as in claim 11, wherein the locking member comprises an elastic resin body.

16. A power tool as in claim 2, wherein the adapter further comprises a sleeve rotatably supporting the connector fitting portion, the adapter fitting portion being defined on the sleeve and the sleeve is prevented from rotating with respect to the housing,

one end of the sleeve is disposed beyond a corresponding end of the connector fitting portion, at least one first projection is defined on an inner wall of a terminal end of the sleeve and at least one second projection is defined on an outer wall of the cord fitting portion,

wherein when the connector fitting portion is disposed in a first position with respect to the sleeve, the first projection does not interfere with the second projection, thereby allowing the insertion projection to be removed from and inserted into the receiving hole and

wherein when the connector fitting portion engages the cord fitting portion and is disposed in a second position with respect to the sleeve, the first projection blocks the second projection from passing out of the receiving

hole, thereby preventing the insertion projection from being removed from the receiving hole.

17. A power tool as in claim 16, further comprising a lock releasably securing the power cord to the sleeve when the connector fitting portion is disposed in the second position with respect to the sleeve, wherein the lock comprises:

a groove defined within one of the sleeve and the power cord,

a locking member defined on the other of the sleeve and the power cord, wherein the locking member and the groove are arranged and constructed to engage and disengage from each other by manipulating the locking member and

at least one stopper arranged and constructed to prevent the locking member from dislodging from the groove.

18. A power tool comprising:

a housing having a fitting recess,

a motor disposed within the housing, the motor being adapted to drive the power tool,

an adapter having an adapter fitting portion disposed within the fitting recess and a socket disposed external to the housing, and

a power cord having a plug that is removably engageable with the socket, whereby the adapter electrically connects the power cord to the motor, and wherein the fitting recess is also defined so as to be capable of receiving a power cord fitting portion of a fixedly attached power cord.

19. A power tool as in claim 18, further comprising:

a receiving hole defined within the socket, wherein at least one projecting terminal is disposed within the receiving hole and a recess is defined within the receiving hole,

an insertion projection defined on plug, wherein the insertion projection is arranged and constructed to be inserted into the receiving hole, at least one receiving terminal is disposed in the insertion projection and is arranged and constructed to receive the at least one projecting terminal, and

an engaging projection defined on an outer wall of the plug, the engaging projection being designed to engage the recess.

20. A power tool as in claim 19, wherein the adapter further comprises a sleeve rotatably supporting the socket, the adapter fitting portion being defined on the sleeve and the sleeve is prevented from rotating with respect to the housing,

one end of the sleeve is disposed beyond a corresponding end of the socket, at least one first projection is defined on an inner wall of a terminal end of the sleeve and at least one second projection is defined on an outer wall of the plug,

wherein when the socket is disposed in a first position with respect to the sleeve, the first projection does not interfere with the second projection, thereby allowing the insertion projection to be removed from and inserted into the receiving hole and

wherein when the socket engages the plug and is disposed in a second position with respect to the sleeve, the first projection blocks the second projection from passing

out of the receiving hole, thereby preventing the insertion projection from being removed from the receiving hole.

21. A power tool as in claim **20**, further comprising a lock releasably securing the power cord to the sleeve when the socket and plug are disposed in the second position with respect to the sleeve, wherein the lock comprises:

a groove defined within one of the sleeve and the power cord,

a locking member defined on the other of the sleeve and the power cord, wherein the locking member and the groove are arranged and constructed to engage and disengage from each other by manipulating the locking member and

at least one stopper arranged and constructed to prevent the locking member from dislodging from the groove.

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