Abstract: This invention relates to a tool for stripping a surrounding layer from a sheathed cable comprising a tool body having a cable-receiving channel configured to accommodate the end portion of a cable to be stripped; a cutting blade mounted in the tool body and having a cutting edge positioned in the channel to penetrate the surrounding layer to a pre-set depth; and a cable end stop arrangement provided within the tool body comprising a first abutment and a second abutment, each of the abutments being positioned at a different pre-set distance from the cutting blade when aligned with the channel, wherein, in use, an end of said cable inserted into the channel contacts one of the first and second abutments to limit the length of the surrounding layer stripped from the cable, and the second abutment is moveable between a first position in which said abutment is not aligned with the channel and a second position in which said abutment is aligned with the channel.
Cable Stripping Tool

BACKGROUND

This invention relates to a tool for stripping a surrounding layer from a sheathed cable. In particular, though not exclusively, this invention relates to a tool for stripping a layer of insulation surrounding a conducting core of a round electrical cable, or for stripping an outer sheath surrounding such a layer of insulation, in either case from an end portion of the cable. Such tools are conventionally known as wire stripping tools.

Wire stripping tools are well known and used throughout the electrical industries, for stripping insulation from a very wide variety of cable and wire types. Wire stripping tools have been developed to strip a fixed or chosen length of insulation or outer sheath from such cables and, though some of these are more effective than others, they are known to suffer from certain disadvantages. Some of the tools have a large number of different parts which can lead to difficulties in the manufacture and assembly. In order not to damage the cable, the insulation or the conductors, the cutting edge of a blade must be accurately positioned and aligned relative to the cable to be stripped when received in the tool. The requirement to accurately position and align the blade leads to manufacturing complexity. Further, some tools may have exposed sharp blades and these can represent a significant health and safety risk, whereas other tools may be difficult or inconvenient to use.

The invention is primarily (but not solely) concerned with the stripping of a surrounding layer from an electrical cable having a single conducting core which itself may be of one or several conductors. The surrounding layer could comprise a single layer of insulation around the conducting core, or could comprise a layer of insulation around the conducting core and an outer sheath around the layer of insulation, for added protection against damage or for identification purposes.

When stripping a cable having a single layer, removal of a length of that layer from the free end of the cable exposes the conductors to allow the cable to be
electrically connected to some other component. Such a strip is usually referred to as a "one-level strip". When stripping a cable having a layer of insulation and an outer sheath around the insulation, a one-level strip may be performed by removing the same lengths of outer sheath and insulation. Alternatively, a greater length of outer sheath may be removed than the length of insulation, giving rise to a so-called "two-level strip" where a short length of insulation is exposed between the exposed conductors and the outer sheath.

A particular problem arises in domestic electrical installations where heavy duty cables having a defined conductor core area (usually of 16mm$^2$ or 25mm$^2$) connect an electricity supply meter to a component such as an isolator switch, a connector block or a consumer unit (any one of which is hereinafter referred to simply as a "component"). With a national programme in the UK for the roll-out of so-called smart meters there is a requirement for very large numbers of cable stripping operations to be performed on the in-coming cables to the smart meter and between the smart meter and a component. Further, safety requirements demand that each stripping operation is conducted to a defined specification with tight tolerances appropriate for the connection to be made. If the exposed length of the conductors is too long, there is the possibility of the conductors being exposed at a connection, and also a consumer might be able to gain access to the conductors of the in-coming cables, up-stream of the meter. Conversely, if the exposed length of the conductors is too short, then an inadequate connection might result.

Typically, the stripping operations must be performed to two different strip specifications: a first for a cable end portion to be connected to a smart meter and a second for a cable end portion to be connected to a component. An electrician must therefore carry sufficient tooling to allow two-level strips to be performed to two different specifications, on two different cable sizes, usually 16mm$^2$ or 25mm$^2$ for the domestic environment, and possibly further tooling if cables having only an insulation layer (i.e. no outer sheath) are also to be stripped. An electrician must select the appropriate tool for the connection to be made but in view of the number of stripping tools that must be carried it is relatively easy for an electrician to
perform at least a first strip with the wrong tool.

In its broadest aspects, it is a principal aim of this invention to provide a wire stripping tool which a user may selectively set to perform either one of two different strip specifications, so reducing the number of tools that must be carried by an electrician and also reducing the risk of an incorrect strip being performed on a cable end portion. Further, for a preferred form of the tool, a user may selectively set the tool to perform any one of four different strip specifications, so reducing yet further the number of tools that must be carried by an electrician.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a tool for stripping a surrounding layer from an elongate electrical cable of substantially circular cross-sectional shape, comprising:
- a tool body having a cable-receiving channel configured to accommodate the end portion of a cable to be stripped;
- a cutting blade mounted in the tool body and having a cutting edge positioned in the channel to penetrate the surrounding layer to a pre-set depth; and
- a cable end stop arrangement provided within the tool body comprising a first abutment and a second abutment, each of the abutments being positioned at a different pre-set distance from the cutting blade when aligned with the channel,

wherein, in use, an end of said cable inserted into the channel contacts one of the first and second abutments to limit the length of the surrounding layer stripped from the cable, and the second abutment is moveable between a first position in which said abutment is not aligned with the channel and a second position in which said abutment is aligned with the channel.

A tool as claimed in Claim 1, in which the cutting edge of the cutting blade is defined by facets of the blade disposed at an angle to an axis of the channel, and wherein on rotation of the tool around the end portion of a cable received in
the channel the cutting blade creates a helical cut along the cable and severs a helical strip of the surrounding layer from the cable.

Preferably the channel terminates at a first end in an opening in an end face of the tool body and, when aligned with the channel, the first and second abutments are located proximate a second end of the channel.

Each of the abutments may comprise an abutment plate having an abutment surface, the abutment surface extending substantially perpendicularly to an axis of the channel when the abutment is aligned with the channel.

In preferred embodiments the tool further comprises a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the second abutment. Typically the second abutment surface will not be aligned with the channel when the carrier is in the first position and the second abutment surface will be aligned with the channel when the carrier is in the second position.

In some embodiments the first abutment is mounted within the tool body in a fixed position with respect to the channel, such that the first abutment is aligned with the channel. The second abutment may be disposed between the first abutment and the cutting blade when the carrier is in the second position.

In other embodiments the first abutment is moveable between a first position in which said abutment is not aligned with the channel and a second position in which said abutment is aligned with the channel. The tool may further comprise a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the first abutment and second abutment, and wherein when the carrier is in the first position the first abutment surface is aligned with the channel and when the carrier is in the second position the second abutment surface is aligned with the channel.

Preferably the carrier comprises an actuating member that extends through a slot.
in the tool body, the actuating member being movable to cause the carrier to move between the first and second positions.

The carrier may be mounted for rotational movement within the tool body. Alternatively the carrier may be mounted for sliding movement within the tool body.

The tool preferably further comprises a second cable-receiving channel configured to accommodate the end portion of a cable to be stripped and a second cutting blade mounted in the tool body and having a cutting edge positioned in the second channel to penetrate the surrounding layer to a pre-set depth, and wherein the cable end stop arrangement comprises a first set of first and second abutments associated with the first channel and disposed at different pre-set distances from the first cutting blade and a second set of first and second abutments associated with the second channel and disposed at different pre-set distances from the second cutting blade.

Each channel preferably terminates at a first end in an opening in an opposite end face of the tool body and, when aligned with the channel, the first and second abutments of each of the first and second sets are located proximate a second end of a respective one of the channels. Preferably the first and second channels are axially aligned.

In these embodiments the tool preferably comprises a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the second abutment associated with the first channel and the second abutment associated with the second channel. When the carrier is in the first position neither of the second abutments are aligned with the respective channel and when the carrier is in the second position both of the second abutments are aligned with the respective channel.

In some embodiments the pair of first abutments are mounted within the tool body in a fixed position with respect to the channels, such that each of the first abutments is aligned with a respective one of the channels. Preferably each of the
second abutments is disposed between one of the first abutments and a respective one of the cutting blades when the carrier is in the second position.

In other embodiments each of the first abutments is moveable between a first position in which said abutment is not aligned with the respective channel and a second position in which said abutment is aligned with the respective channel. In these embodiments the tool preferably further comprises a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the pair of first abutments and the pair of second abutments. When the carrier is in the first position each of the first abutments is aligned with a respective one of the channels and when the carrier is in the second position each of the second abutments is aligned with a respective one of the channels. Preferably the carrier comprises an actuating member that extends through a slot in the tool body, the actuating member being movable to cause the carrier to move between the first and second positions.

The carrier may be mounted for rotational movement within the tool body. Alternatively the carrier may be mounted for sliding movement within the tool body.

In preferred embodiments the tool body has opposed jaws, the jaws being moveable relative to each other from an initial position. The or each cable-receiving channel is defined by formations in the jaws, and the jaws are resiliently separable and move away from each other from the initial position to allow the cable-receiving channel to accommodate the end portion of a cable of a diameter greater than the size of the channel when the jaws are in the initial position, to ensure the formations fit closely against the surrounding layer to ensure the preset depth of cut is delivered into the layer.

In some embodiments the tool body and the opposed jaws comprises a plastics material moulding with a slot between the jaws, whereby resilient deformation of the plastics material allows the jaws to move away from each other.

In other embodiments the tool body is formed in two parts each having one of the
opposed jaws, the two parts being connected together by means allowing separation of the jaws to be resiliently increased.

Preferably the cable receiving channel or one of the cable receiving channels has an outer part which fits closely to the sheath of a cable being stripped and an inner part deeper in the channel which fits closely to the insulating layer of a cable being stripped. The channel or one of the channels may comprise a first section proximate the opening having a first radial dimension and a second section furthest from the opening having a second radial dimension, the second radial dimension being less than the first radial dimension.

Preferably an aperture is formed through a side face of the tool to communicate with the cutting end of the cutting blade whereby a severed surrounding layer cut from a cable may leave the cable-receiving channel through the aperture.

In preferred embodiments the tool body has first pair of opposed jaws and a second pair of opposed jaws, each pair of jaws having a respective cable receiving channel defined by formations in the jaws, the jaws being arranged such that the cable-receiving channels are axially-aligned, and each channel having a respective cutting blade positioned therein. Preferably a first channel formed by the first pair of opposed jaws terminates in a first opening in a first end face of the tool body and a second channel formed by the second pair of opposed jaws terminates in a second opening in a second end face of the tool body, the second end face being opposite to the first end face. The formations defining the channels of the two sets of jaws may have different configurations, whereby a cable having two layers surrounding inner conductors may be stripped to expose the conductors and the inner layer, by selection of the opening.

Preferably the first channel is substantially cylindrical and has a first radial dimension and the second channel is substantially cylindrical and comprises a first section having a radial dimension equal to the first radial dimension and a second section having a second radial dimension, the first radial dimension being greater than the second radial dimension. The second section of the second channel will
typically be further from the second opening than the first section of the second
channel.

In some embodiments the tool body has first pair of opposed jaws and a second
pair of opposed jaws, each pair of jaws having a respective cable receiving
channel defined by formations in the jaws, and the jaws being arranged such that
the cable-receiving channels thereof are axially-aligned. Further, the tool body is
preferably formed in two parts, a first part comprising a first one of each of the
opposed jaws and a second part comprising a second one of each of the opposed
jaws, the two parts being connected together in a central region of the tool body by
means allowing separation of the jaws to be resiliently increased. The carrier is
preferably mounted for rotational movement about said means connecting the two
parts of the tool body.

It will be appreciated that the tool is preferably a hand tool.

In some embodiments the tool preferably comprises: a tool body defining a cable-
receiving opening configured to accommodate the end portion of a cable to be
stripped, the opening being configured to fit closely against the surrounding layer
of the cable end portion; a cutting blade mounted in the tool body and having a
cutting edge positioned in the opening to penetrate the surrounding layer of a
cable entered therein to a pre-set depth, the cutting edge of the cutting blade
being defined by facets of the blade disposed at an angle to the axis of the
opening thereby to create a helical cut along the end portion of a cable received in
the opening on rotation of the tool around the cable and sever a helical strip of the
surrounding layer from the cable; and a cable end stop arrangement provided
within the tool body for engagement by the end of the cable being stripped thereby
to limit the length of the helical cut along the cable from the end thereof, the end
stop arrangement having first and second abutments disposed at different pre-set
distances from the cutting blade; and a manually-operable control to allow
selection of either the first abutment or the second abutment for engagement by
the cable end.
It will be appreciated that, in these embodiments, the tool has a single blade set to perform a one-level strip on a cable end portion but the tool may be set to strip one of two pre-defined lengths of a surrounding layer from a cable end portion, by using the control to select the appropriate abutment for the required strip specification.

In other embodiments the tool may comprise: a tool body defining first and second cable-receiving openings each configured to accommodate the end portion of a cable to be stripped and being configured to fit closely against the surrounding layer of the cable end portion; a first cutting blade mounted in the tool body and having a cutting edge positioned in the first opening to penetrate the surrounding layer of a cable entered therein to a first pre-set depth; a second cutting blade mounted in the tool body and having a cutting edge positioned in the second opening to penetrate the surrounding layer of a cable entered therein to a second pre-set depth; the cutting edges of the first and second cutting blades being defined by facets of the respective blade disposed at an angle to the axis of the respective opening thereby to create a helical cut along the end portion of a cable received in the opening on rotation of the tool around the cable and sever a helical strip of the surrounding layer from the cable; a cable end stop arrangement provided within the tool body for engagement by the end of the cable being stripped thereby to limit the length of the helical cut along the cable from the end thereof, the end stop arrangement having first and second abutments associated with the first opening and disposed at different pre-set distances from the first cutting blade and further first and second abutments associated with the second opening and disposed at different pre-set distances from the second cutting blade; and a manually-operable control to allow selection, for each opening, of either the first abutment or the second abutment for engagement by the cable end.

With a tool according to these embodiments of this invention, the tool has two cable-receiving openings each having an associated blade to penetrate a cable surrounding layer to a pre-set depth. The two blades could be pre-set to penetrate the surrounding layer to the same depth, and in this case the tool could be arranged to perform one-level strips to four different strip specifications or perhaps
on two different cable sizes. Preferably, the blades are pre-set to penetrate the
surrounding layer to different depths, whereby the tool can be arranged to perform
two-level strips to two different strip specifications or perhaps on two different
cable sizes.

In a preferred form of the just-described tool, the two openings are axially aligned
in the tool body from opposite ends thereof. There is a cable end stop arrangement for each opening for engagement by the end of the cable being
stripped, each end stop arrangement having first and second abutments disposed
at different pre-set distances from the respective cutting blade, thereby to limit the
length of the helical cut depending upon the selected abutment. The manually-
operable control may simultaneously select for each opening either the first
abutment or the second abutment.

In a preferred embodiment, the end stop arrangement includes a carrier providing
the first and second abutments in a spaced-apart disposition, the carrier being
mounted within the tool body for movement between two positions at which either
the first abutment or the second abutment is aligned with the opening to provide
an end stop for the cable end portion being stripped. Alternatively, the end stop
arrangement may comprise a fixed first abutment provided by the tool body and
aligned with the opening to provide an end stop for the cable end portion being
stripped and a second abutment provided on a carrier mounted within the tool
body for movement between two positions at one of which the second abutment is
aligned with the opening and is disposed in front of the first abutment thereby to
provide an end stop for the cable end portion being stripped.

In either of the above arrangements, the carrier may mounted for rotational
movement within the tool body between said positions, the carrier having a lever
or tab projecting through a slot in the body to allow manual access thereto,
whereby operation of the lever selects the abutment to provide the end stop for the
cable end portion being stripped. Alternatively, the carrier may have a recess or
other surface engageable by a tool such as a screwdriver inserted through the slot
to effect rotation of the carrier. Instead of being rotatable, the carrier may be
slidably mounted within the tool body for movement between said limiting positions. For example, the carrier may be mounted within a slot in the tool body so as to project from one side or the other side of the tool body depending upon the selected limiting position.

Each of the first abutment and the second abutment may comprise a wall extending transversely to the axis of the opening when in the active setting, for engagement by the end of a cable being stripped. The abutments may comprise a part of the carrier formed integrally therewith. In the alternative, the abutments may be formed separately of a relatively harder or tougher material than the carrier, to minimise wear by the cut ends of a cable being stripped as the tool is rotated therearound. The abutments may therefore comprise inserts of a metal, a ceramic or other hard material fitted to the carrier.

To allow for variations in cable sizes for example due to manufacturing tolerances or from different manufacturers the tool body may define a pair of opposed jaws which are moveable relative to each other from an initial position, the cable-receiving opening being defined by formations in each of the jaws. With this arrangement, the jaws are resiliently separable and move away from each other from the initial position to allow the cable-receiving opening to accommodate the end portion of a cable of a diameter greater than the size of the opening when the jaws are in the initial position. This ensures the formations fit closely against the surrounding layer to deliver into the layer the pre-set depth of cut.

BRIEF DESCRIPTION OF THE DRAWINGS

By way of example only, two embodiments of wire stripping tool of this invention will now be described in detail, reference being made to the accompany drawings, in which:

Figure 1 is an isometric view of the first embodiment of wire stripping tool, configured for performing a two-level strip on an end portion of an electrical cable
having an inner insulation layer around a conducting core and an outer sheath around the insulation layer;

Figure 2 is an exploded view of the tool of Figure 1, showing the arrangement of a carrier including an abutment housed within a body of the tool;

Figure 3 shows a cutting blade of the tool, separated from the tool body;

Figure 4 shows the blade of Figure 3 installed in an upper part of the tool body but with the body partly cut away for clarity;

Figure 5 is a plan view of the part of the tool of Figure 4;

Figure 6 shows the tool being rotated to strip an outer sheath from the cable;

Figure 7 is a partly cut away view of the tool showing a cable located therein at the completion of the removal of an inner insulation layer from the cable;

Figure 8 is an exploded view of the tool of Figure 1, in a first setting;

Figure 9 is an exploded view of the tool of Figure 1, in a second setting;

Figure 10 shows a part of the tool of Figure 1 with a cable inserted into the tool and an end of the cable in contact with an abutment, so limiting the length of layer stripped from the cable end portion;

Figures 11 and 12 are axial sections through the tool of Figure 1, respectively in the first and second settings;

Figure 13 is an axial section through a second embodiment of a wire stripping tool, in a first setting; and
Figure 14 is an axial section through the tool of Figure 13, in a second setting.

DETAILED DESCRIPTION

The first embodiment of the wire stripping tool of this invention is shown in Figures 1 to 7 and comprises a hand tool 10 configured to perform a two-level strip on a cable 2 having an inner conducting core 3, a layer of insulation 4 around the core 3 and an outer sheath 5 surrounding the insulation 4. The tool 10 comprises a body 11 having two body parts 12 and 13. The tool body 11 is preferably made from a moulded plastics material. The tool body 11 is elongate having opposite first and second end faces 14, 15. Each body part 12, 13 is also elongate and includes a part of each of the end faces 14, 15 of the tool. Each body part 12, 13 further includes a confronting face 16 (which may be substantially planar or curved), and the two parts 12, 13 are connected together such that the two confronting faces 16 oppose each other. Each body part 12, 13 further includes a side face 17 opposite to the confronting face 16. The side faces 17 and confronting faces 16 therefore extend along the length of the tool 10 between the first and second ends 14, 15.

Preferably the body parts 12, 13 are connected or clamped together in a central region 18 of the body 11. Typically the body parts 12, 13 are clamped together by means of a rivet (not shown). Aligned first and second pairs of opposed jaws 20, 21 project in opposite directions from the central region 18. In this way, each of the body parts 12, 13 includes a first jaw 20a, 20b extending from the central region 18 to the first end face 14 and a second jaw 21a, 21b extending from the central region 18 to the second end face 15. The regions of the confronting faces 16 corresponding to each pair of opposed jaws 20, 21 each have formations therein which define a cable receiving channel 22, 23. The cable receiving channel 22, 23 in each of the first and second pairs of jaws 20, 21 terminates in a generally circular opening 24, 25 in a respective one of the first and second end faces 14, 15. Each of the formations preferably comprises a semi-cylindrical surface. Each of the semi-cylindrical surfaces of a first pair of formations in the first pair of jaws...
20 has a substantially uniform cross-sectional shape along an axial length of a first channel 22. In this way, each of the semi cylindrical surfaces in the first pair of jaws 20 has a first radius. A second channel 23 formed in the second pair of jaws 21 has an outer part or section 26, proximate the opening 25, of substantially the same cross-section as the first channel 22 and an inner part or section 27, further from the opening 25, of a smaller cross-section (shown most clearly in Figure 12).

In this way, each of the semi cylindrical surfaces in the second pair of jaws 21 includes a first section having a radius equal to the first radius, and a second section having a second radius that is smaller than the first radius. It is to be noted that the radial dimensions of each of the openings 24, 25 is substantially the same.

An axis of each of the channels 22, 23 extends from the opening 24, 25 in the respective end face 14, 15 towards the central region 18. The two channels 22, 23 in the tool body 11 are preferably axially aligned.

A respective cutting blade 28 is mounted in one jaw 20a, 21a of each pair. In this embodiment each upper jaw is provided with a cutting blade 28 (Figures 10 to 12) arranged to sever a layer (either the outer sheath 5 or the insulation layer 4, depending on which channel 22, 24 is being used) from a cable 2 inserted into the channel 22, 23, when the tool 10 is rotated about that cable 2, as will be described below.

Each cutting blade 28 has a cutting edge 29 defined by facets of the blade at the cutting end thereof. The cutting end projects into the respective channel 22, 23 with the cutting edge 29 accurately positioned within the respective jaw 20a, 21a, such that the cutting edge 29 cuts into the adjacent cable layer to a precise and accurately pre-defined depth, defined by the formation of the jaw from which the blade projects.

The facets of the cutting blade 28 defining the cutting edge 29 lie at an angle to the axis of the respective channel 22, 23 so that on pushing the cable end into the opening 24, 25 and rotating the tool 10 around the cable 2 in the correct sense,
the blade 28 performs a helical cutting action. By rotating the tool 10 and urging it along the cable 2, the tool 10 in effect is threaded along the cable 2 while cutting and possibly partly shearing a strip 30 of the adjacent layer of the cable 2. The severed helical strip 30 is lifted by a ramp surface of the cutting blade 28 to exit the tool 10 through an aperture 31 formed in the jaw 20a, 21a of the tool 10 holding the cutting blade 28. The aperture 31 is preferably formed in the side face 17 of the body part 12, 13 and extends through the body part 12, 13 from the side face 17 to the channel 22, 23. Both the first pair of jaws 20 and the second pair of jaws 21 are similarly configured and each has an aperture 31 through which a severed helical strip 30 exits the respective channel 22, 23 provided in those jaws 20, 21.

The tool body 11 is formed internally to provide an enlarged space 32 compared to the sizes or radii of the channels 22, 23 within the jaws 20, 21, to allow for some splaying of the conductors in a case where a previously connected cable is to be dressed to a new strip specification. Each of the channels 22, 23 is preferably elongate with the openings 24, 25 being at a first end of the channel 22, 23. The enlarged space 32 is, therefore, formed between a second end of each channel 22, 23 in the central region 18 of the tool body 11. Within that enlarged space 32 there is provided an end stop arrangement arranged to limit the extent to which the tool 10 may be advanced along the cable 2, or in other word to limit the extent to which the cable 23 may be inserted into one of the channels 22, 23, by virtue of an end face of the cable 2 contacting a selected abutment forming a part of the end stop arrangement.

The end stop arrangement comprises a carrier 33 mounted within the enlarged space 32 of the tool body 11 for rotation about an axis perpendicular to the axes of the channels 22, 23. A post or axle about which the carrier 33 rotates may be provided by the rivet connecting the two body parts 12, 13 together. The configuration of the carrier 33 is best appreciated from Figure 2 and Figures 8 to 12 and as shown, the carrier 33 comprises a pair of spaced apart support plates or cheeks 34, 35 extending substantially perpendicularly to the rotational axis of the carrier 33. Two pairs of end stops are provided between those support plates 34,
35. Each pair of end stops comprises angularly-spaced abutment plates or walls 36, 37 disposed at different radii with respect to the rotational axis of the carrier 33. Each of the abutment plates includes a radially outward facing abutment surface 38, 39. Accordingly, a first pair of end stops comprises a first abutment plate 36a having an abutment surface 38a and a second abutment plate 37a having an abutment surface 39a. A second pair of end stops comprises a first abutment plate 36b having an abutment surface 38b and a second abutment plate 37b having an abutment surface 39b. The first abutment plate 36b of the second pair of end stops is disposed diametrically opposite the first abutment plate 36a of the first pair of end stops. Similarly, the second abutment plate 37b of the second pair of end stops is disposed diametrically opposite the second abutment plate 37a of the first pair of end stops. The abutment plates 36, 37 may be formed integrally with the support plates 34, 35 or they may be separate components or inserts made of a harder or tougher material, perhaps of metal or a ceramic, which are attached to the support plates 34, 35.

Rotation of the carrier 33 brings either the first abutment plate 36 or the second abutment plate 37 into alignment with each of the channels 22, 23 defined in the tool body 11 for receiving a cable end portion. The abutment plates 36, 37 limit the length of the end portion of the cable which may be inserted into the channel. As shown in Figures 8 and 11, with the carrier in a first position, the two first abutment plates 36 are aligned with the channels 22, 23 respectively. By rotating or turning the carrier 33 to a second position shown in Figures 9 and 12, the second abutment plates 37 move into alignment with the channels 22, 23. Because the second abutment plates 37 are disposed at a greater radial distance from the rotational axis of the carrier 33 than the first abutment plates 36, the second abutment surfaces 39 are disposed closer to the second end of each of the channels 22, 23 when the carrier 33 is in the second position than the first abutment surfaces 38 when the carrier 33 is in the first position. Positioning the carrier 33 in the second position, therefore, reduces the length of cable 2 that can be inserted into the respective channel 22, 23 before the end face of the cable 2 engages or contacts the abutment surface 39.
The carrier 33 has a tab or actuating member 40 which projects through a slot 41 in a side wall of the tool body 11. The tab 40 permits the carrier 33 to be rotated by finger pressure on the tab 40. In particular, a user of the tool 10 can move the tab 40 between a first position at a first end of the slot 41 and a second position at a second end of the slot 41 to rotate the carrier 33 between the first position and the second position. Movement of the tab 40 between the first and second positions, which causes rotation of the carrier 33, therefore switches the tool 10 between two pre-set strip lengths for each channel, by bringing either the two first abutment plates 36 into alignment with the channels 22, 23 (Figures 8 and 11) or the two second abutment plates 37 into alignment with those channels 22, 23 (Figures 9 and 12).

As can be seen from the drawings showing the first, upper part 12 of the tool body 11, there is a window 42 in that upper part 12 through which an upper surface 43 of a first one of the support plates 34 of the carrier 33 can be viewed. The upper surface 43 of the first support plate 34 of the carrier has an indicator 44 which may be aligned with and exposed through the window 42 depending on the rotational setting of the carrier 33. That indicator 44 may have brown and blue coloured panels which will be exposed or viewable through the window 42 when the carrier 33 is in the first position shown in Figures 8 and 11 thus indicating to a user that the tool 10 is in the correct setting for performing a first pre-set strip specification. When the carrier 33 is turned counter-clockwise to the second position shown in Figures 9 and 12, the indicator 44 is no longer exposed or viewable, thus indicating to a user that the tool 10 is in the correct setting for performing a second pre-set strip specification.

Returning to Figures 3 to 5, there is shown the cutting blade 28 of the tool 10, for severing a helical strip 30 of surrounding layer from a cable end portion. As mentioned above, that surrounding layer may be an insulation layer 4 immediately overlying the conductors of the cable 2 or it may be an outer sheath 5 overlying an insulation layer 4. The preferred embodiment of the tool 10 described above is intended for use with a cable 2 having both an insulation layer 4 and an outer sheath 5 surrounding the insulation layer 4, the tool 10 being configured to perform
a two-level strip on the cable end portion, to two different strip specifications. After that strip has been performed, the conductors at the end of the cable 2 are exposed for a pre-set distance back from the cable end face, and also a short length of the insulation layer 4 is exposed along the cable back from the exposed conductors. The tool 10 could however be configured to perform one-level strips to four different strip specifications.

For each upper jaw 20a, 21a, the cutting blade 28 is installed in a socket 45 provided in the upper jaw 20a, 21a so as to lie in part within the adjacent channel 22, 23. The cutting blade 28 is formed in two linked parts; a base part 46 having a ramp surface 47 and a knife part 48 having the cutting edge 29, the two parts 46, 48 being interlinked to define the relationship between the ramp surface 47 and the cutting edge 29. The cutting edge 29 is defined by facets of the knife part 48 lying at an acute angle to each other. As defined, the cutting edge 29 is linear and when the cutting blade 28 is installed in the socket 45 of the tool body 11 the cutting edge 29 extends along a chord of the respective channel 22, 23, at a shallow angle to a true radial plane of the channel 22, 23.

The base part 46 of the cutting blade 28 has a planar under-surface 49 which, when installed in the socket 45, lies in a plane substantially parallel to a tangent of the channel 22, 23, the ramp surface 47 and under-surface 49 together forming an edge 50 which lies at an obtuse angle to the cutting edge 29.

Unless the outer sheath 5 of a cable 2 is bonded to the insulation layer 4 or the insulation layer 4 is bonded to the conductors, the edge 50 does not need to be especially sharp as it does not perform a cutting action; rather it merely lifts the layer severed by the knife part 48, away from the underlying layer or conductors so that the severed strip may leave the tool body 11 through the aperture 31.

Though the cutting blade 28 is shown as having two linked parts 46, 48, it could be made in one piece. Also, the edge 50 could be sharp, to allow a cutting action for stripping a cable 2 where the layers are bonded to each other or to the conductors.
Use of the hand tool 10 will now be described to perform a two-level strip on a cable 2. Figure 1 shows the initial state of the first embodiment of the hand tool 10, with the confronting faces 16 of each pair of opposed jaws 20, 21 in contact with each other, and with the carrier 33 in the first position. Though not shown, it would be possible to have a small clearance gap between the jaws 20, 21 when the jaws are in their initial position. On pushing a cable end portion 2 into the channel 22 defined by the first pair of jaws 20 through the opening 24, the jaws 20 are sprung apart to a small extent by resilient deformation of the plastics material of the body 11, sufficient to allow the cable 2 to be inserted into the channel 22 until the knife part 48 engages the end of the cable 2. The tool 10 is then rotated in the correct sense about the cable 2, as shown in Figure 7, such that the knife part 48 of the cutting blade 28 cuts a helical strip 30 of outer sheath 5 from the end of the cable 2, the severed sheath being lifted by the ramp surface 47 of the base part 46 to leave the tool 10 through the aperture 31. At the same time as the tool 10 is rotated, pressure is applied to the tool 10 in the direction along the length of the cable 2 away from the free end thereof. In view of the facets of the cutting blade 28 defining the cutting edge 29 being disposed at an angle to a true radial plane of the channel 22, the tool 10 moves along the cable 2 creating a helical cut in the sheath 5 until the free end of the cable 2 comes into engagement with the abutment surface 38a of the first abutment plate 36a of the carrier 33. The tool 10 can then no longer move along the cable 2 and so, on continued rotation, the tool 10 causes the cutting blade 28 to make a circumferential cut, completely severing the strip of outer sheath from the cable 2.

Following completion of the strip of the outer sheath 5, the end portion of the cable 2 is withdrawn from the first opening 24 and the carrier 33 is moved or turned from the first position shown in Figures 8 and 11 to the second position shown in Figures 9 and 12. The cable end portion is then inserted through the opening 25 into the second channel 23 defined by the second pair of jaws 21 of the tool 10. In a similar manner to that described above, the confronting faces 16 (shown as curved) of the second pair of jaws 21 defining the second channel 23 are initially in contact (though perhaps with a small clearance therebetween, as mentioned above) but on pushing the cable end into the opening 25, the jaws 21 are sprung
apart to a small extent by resilient deformation of the plastics material of the jaws.
The outer part 26 of the channel 23 fits closely against the outer sheath 5 of the
cable 2 and the inner part 27 of the channel 23 fits closely against the layer of
insulation 4 around the core 3 of conductors of the cable 2, exposed in the first
strip.

As with the first strip, the tool 10 is rotated about the cable 2 so as to cut a helical
strip 30 of insulation from the cable 2, that strip exiting the tool 10 through the
aperture 31 adjacent the cutting blade 28 of the second pair of jaws 21. Rotation is
continued until the free end of the conducting core 3 comes into engagement or
contact with the abutment surface 39 of the second abutment plate 37. The tool 10
can then no longer be moved along the cable 2 so that continued rotation of the
tool 10 performs a circumferential cut in a radial plane thereby completely severing
the strip of insulation 4 from the cable end.

Figure 10 shows an example in which a cable end portion 2 has been inserted into
channel 22 in order to carry out a one-level strip to remove a layer of insulation 4
surrounding a core 3. The helical strip 30 of insulation 4 has been removed from
cable end and the end face of the cable 2 is engaging or in contact with the
abutment surface 39 of the abutment plate 37. The tool 10 cannot be moved
further along the cable 2 in view of the engagement between the end face of the
cable 2 and the abutment plate 37 and the location of the abutment plate 37
relative to the channel 22 and the cutting blade 28, therefore, defines and limits
the length of insulation 4 stripped from the cable 2.

As shown in the drawings, the confronting faces 16 of the second pair of opposed
jaws 21 define essentially cylindrical outer and inner bores 26, 27, there being a
step between the outer and inner bores 26, 27. The diameter of the outer bore 26
is essentially equal to the anticipated diameter of the outer sheath 5 of a cable 2
with which the tool 10 is to be used, when at the smallest end of the manufacturing
tolerances for such cables. Similarly, the diameter of the inner bore 26 is no
smaller than the anticipated diameter of the inner insulation 4 of a cable 2 with
which the tool 10 is to be used, when at the smallest end of the manufacturing
tolerances for such cables. In practice, most cables will be slightly larger than the smallest anticipated diameter and some cables might be at the largest end of the manufacturing tolerances for such cables. Further, cables from different manufacturers may have slightly different sizes for the layers of insulation and outer sheath, for the same conductor core sizes. Whichever cable is to be stripped, on pushing the cable end into one of the channels 22, 23 the respective jaws 20, 21 will be sprung apart slightly to allow accommodation of that cable end with the formations defining the channel 22, 23 fitting closely to the cable end, so ensuring an effective strip. It should be noted that the inner bore 27 serves to support the cable end being stripped to ensure the cutting action does not damage the conductors while effectively removing the insulation layer.

Though the described embodiment of the tool has, for each channel 22, 23, two abutment plates 36, 37 either of which can be selected, it would be possible to have more than two abutment plates any one of which could be selected to serve as a stop for a cable end portion being stripped.

Figures 13 and 14 show an alternative embodiment of a hand tool 110 and like parts with those of the first embodiment described above are given the same reference numerals incremented by 100. Many of the components or features of this second embodiment of the tool 110 have the same features and functions as corresponding components and features of the first embodiment and will not be described in detail again here. In this embodiment a first pair of abutment plates or walls 136 is provided on a boss 51 in the tool body 111. A moveable or rotatable carrier 133 is provided with a second pair of abutment plates or walls 137. The first pair of abutment plates 136 are attached to the tool body 111 such that they remain in a fixed position relative to the channels 122, 123. Each one of the first pair of abutment plates 136 is aligned with a respective one of the channels 122, 123, and an abutment surface 138 of each of the abutment plates 136 is substantially perpendicular to an axis of the channel 122, 123.

The rotatable carrier 133 is moveable between a first position, shown in Figure 13 and a second position, shown in Figure 14. When the carrier 133 is in the first
position the second abutment plates 137 are not aligned with the channels 122, 123. Consequently, when a cable is inserted into one of the channels 122, 123, an end of the cable will contact the abutment surface 138 of a respective one of the first abutment plates 136. Turning the carrier 133 by means of a tab 140 to the second position, shown in Figure 14, brings the second abutment plates 137 into alignment with the channels 122, 123. Consequently, with the carrier 133 in the second position, when a cable is inserted into one of the channels 122, 123, an end of the cable will contact an abutment surface 139 of a respective one of the second abutment plates 137. Because the second abutment plates 137 are disposed radially outwardly of the first abutment plates 136, about the rotational axis of the carrier 133, when the second abutment plates 137 are aligned with the channels 122, 123, the length of the cable which may be inserted into the channels 122, 123 before the end face of the cable contacts the respective abutment surface 139 is reduced, compared to when the carrier 133 is in the first position. In this embodiment, the tab 140 is formed separately from the carrier 133 but is connected to or interlocked therewith.
CLAIMS

1. A tool for stripping a surrounding layer from an elongate electrical cable of substantially circular cross-sectional shape, comprising:
   - a tool body having a cable-receiving channel configured to accommodate the end portion of a cable to be stripped;
   - a cutting blade mounted in the tool body and having a cutting edge positioned in the channel to penetrate the surrounding layer to a pre-set depth; and
   - a cable end stop arrangement provided within the tool body comprising a first abutment and a second abutment, each of the abutments being positioned at a different pre-set distance from the cutting blade when aligned with the channel, wherein, in use, an end of said cable inserted into the channel contacts one of the first and second abutments to limit the length of the surrounding layer stripped from the cable, and the second abutment is moveable between a first position in which said abutment is not aligned with the channel and a second position in which said abutment is aligned with the channel.

2. A tool as claimed in Claim 1, in which the cutting edge of the cutting blade is defined by facets of the blade disposed at an angle to an axis of the channel, and wherein on rotation of the tool around the end portion of a cable received in the channel the cutting blade creates a helical cut along the cable and severs a helical strip of the surrounding layer from the cable.

3. A tool as claimed in any preceding claim, wherein the channel terminates at a first end in an opening in an end face of the tool body and, when aligned with the channel, the first and second abutments are located proximate a second end of the channel.

4. A tool as claimed in any preceding claim, wherein each of the abutments comprises an abutment plate having an abutment surface, the abutment surface extending substantially perpendicularly to an axis of the channel when the abutment is aligned with the channel.
5. A tool as claimed in any preceding claim, further comprising a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the second abutment, and wherein the second abutment surface is not aligned with the channel when the carrier is in the first position and the second abutment surface is aligned with the channel when the carrier is in the second position.

6. A tool as claimed in any preceding claim, in which the first abutment is mounted within the tool body in a fixed position with respect to the channel, such that the first abutment is aligned with the channel.

7. A tool as claimed in Claim 6, when dependent on Claim 5, in which the second abutment is disposed between the first abutment and the cutting blade when the carrier is in the second position.

8. A tool as claimed in any one of Claims 1 to 5, in which the first abutment is moveable between a first position in which said abutment is not aligned with the channel and a second position in which said abutment is aligned with the channel.

9. A tool as claimed in Claim 8, further comprising a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the first abutment and second abutment, and wherein when the carrier is in the first position the first abutment surface is aligned with the channel and when the carrier is in the second position the second abutment surface is aligned with the channel.

10. A tool as claimed in any preceding claim, when dependent on Claim 5 or Claim 9, wherein the carrier comprises an actuating member that extends through a slot in the tool body, the actuating member being movable to cause the carrier to move between the first and second positions.

11. A tool as claimed in any preceding claim, when dependent on Claim 5 or
Claim 9, wherein the carrier is mounted for rotational movement within the tool body.

12. A tool as claimed in any one of Claims 5 to 10, when dependent on Claim 5 or Claim 9, wherein the carrier is mounted for sliding movement within the tool body.

13. A tool as claimed in any one of Claims 1 to 4, further comprising a second cable-receiving channel configured to accommodate the end portion of a cable to be stripped and a second cutting blade mounted in the tool body and having a cutting edge positioned in the second channel to penetrate the surrounding layer to a pre-set depth, and wherein the cable end stop arrangement comprises a first set of first and second abutments associated with the first channel and disposed at different pre-set distances from the first cutting blade and a second set of first and second abutments associated with the second channel and disposed at different pre-set distances from the second cutting blade.

14. A tool as claimed in Claim 13, wherein each channel terminates at a first end in an opening in an opposite end face of the tool body and, when aligned with the channel, the first and second abutments of each of the first and second sets are located proximate a second end of a respective one of the channels.

15. A tool as claimed in Claim 13 or Claim 14, wherein the first and second channels are axially aligned.

16. A tool as claimed in any one of Claims 13 to 15, comprising a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the second abutment associated with the first channel and the second abutment associated with the second channel, and wherein when the carrier is in the first position neither of the second abutments are aligned with the respective channel and when the carrier is in the second position both of the second abutments are aligned with the respective channel.
17. A tool as claimed in any one of Claims 13 to 16, in which the pair of first abutments are mounted within the tool body in a fixed position with respect to the channels, such that each of the first abutments is aligned with a respective one of the channels.

18. A tool as claimed in Claim 17, when dependent on Claim 16, in which each of the second abutments is disposed between one of the first abutments and a respective one of the cutting blades when the carrier is in the second position.

19. A tool as claimed in any one of Claims 13 to 16, in which each of the first abutments is moveable between a first position in which said abutment is not aligned with the respective channel and a second position in which said abutment is aligned with the respective channel.

20. A tool as claimed in Claim 19, further comprising a carrier mounted for movement with respect to the tool body between a first position and a second position, the carrier including the pair of first abutments and the pair of second abutments, and wherein when the carrier is in the first position each of the first abutments is aligned with a respective one of the channels and when the carrier is in the second position each of the second abutments is aligned with a respective one of the channels.

21. A tool as claimed in Claim 16 or Claim 20, wherein the carrier comprises an actuating member that extends through a slot in the tool body, the actuating member being movable to cause the carrier to move between the first and second positions.

22. A tool as claimed in Claim 16 or Claim 20, wherein the carrier is mounted for rotational movement within the tool body.

23. A tool as claimed in Claim 16 or Claim 20, wherein the carrier is mounted for sliding movement within the tool body.
24. A tool as claimed in any preceding claim, in which the tool body has opposed jaws, said jaws being moveable relative to each other from an initial position, the or each cable-receiving channel is defined by formations in the jaws, and the jaws are resiliently separable and move away from each other from the initial position to allow the cable-receiving channel to accommodate therein the end portion of a cable of a diameter greater than the size of the channel when the jaws are in the initial position, to ensure the formations fit closely against the surrounding layer to ensure the pre-set depth of cut is delivered into the layer.

25. A tool as claimed in Claim 24, wherein the tool body and the opposed jaws comprises a plastics material moulding with a slot between the jaws, whereby resilient deformation of the plastics material allows the jaws to move away from each other.

26. A tool as claimed in Claim 24, wherein the tool body is formed in two parts each having one of the opposed jaws, the two parts being connected together by means allowing separation of the jaws to be resiliently increased.

27. A tool as claimed in any of the preceding claims, wherein the cable receiving channel or one of the cable receiving channels has an outer part which fits closely to the sheath of a cable being stripped and an inner part deeper in the channel and which fits closely to the insulating layer of a cable being stripped.

28. A tool as claimed in any preceding claim when dependent on Claim 3, wherein the channel or one of the channels comprises a first section proximate the opening having a first radial dimension and a second section furthest from the opening having a second radial dimension, the second radial dimension being less than the first radial dimension.

29. A tool as claimed in any of the preceding claims, wherein an aperture is formed through a side face of the tool to communicate with the cutting end of the cutting blade whereby a severed surrounding layer cut from a cable may leave the cable-receiving channel through the aperture.
30. A tool as claimed in any one of Claims 13 to 23, wherein the tool body has first pair of opposed jaws and a second pair of opposed jaws, each pair of jaws having a respective cable receiving channel defined by formations in the jaws, the jaws being arranged such that the cable-receiving channels thereof are axially-aligned, and each channel having a respective cutting blade positioned therein.

31. A tool as claimed in Claim 30, wherein a first channel formed by the first pair of opposed jaws terminates in a first opening in a first end face of the tool body and a second channel formed by the second pair of opposed jaws terminates in a second opening in a second end face of the tool body, the second end face being opposite to the first end face.

32. A tool as claimed in Claim 30 or Claim 31, wherein the formations defining the channels of the two sets of jaws are of different configurations, whereby a cable having two layers surrounding inner conductors may be stripped to expose the conductors and the inner layer, by selection of the opening.

33. A tool as claimed in any one of Claims 30 to 32, wherein the first channel is substantially cylindrical and has a first radial dimension and the second channel is substantially cylindrical and comprises a first section having a radial dimension equal to the first radial dimension and a second section having a second radial dimension, the first radial dimension being greater than the second radial dimension.

34. A tool as claimed in Claim 33 when dependent on Claim 31, wherein the second section of the second channel is further from the second opening than the first section of the second channel.

35. A tool as claimed in Claim 20, in which the tool body has first pair of opposed jaws and a second pair of opposed jaws, each pair of jaws having a respective cable receiving channel defined by formations in the jaws, the jaws being arranged such that the cable-receiving channels thereof are axially-aligned,
the tool body being formed in two parts, a first part comprising a first one of each of the opposed jaws and a second part comprising a second one of each of the opposed jaws, the two parts being connected together in a central region of the tool body by means allowing separation of the jaws to be resiliently increased, and wherein the carrier is mounted for rotational movement about said means connecting the two parts of the tool body.

36. A tool as claimed in any preceding claim, wherein the tool is a hand tool.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**INV.** H02G1/12

According to International Patent Classification (IPC) or to both national classification and IPC

**ADD.**

According to International Patent Classification (IPC) or to both national classification and IPC

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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

H02G  B21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>US 6 530 152 BI (CHRISTENSEN BRIAN [DK] ET AL) 11 March 2003 (2003-03-11)</td>
<td>1,3,5, 10,11, 27,28,36</td>
</tr>
<tr>
<td>Y</td>
<td>figures 1, 6-8, 12 col umn 1, line 6 - line 10 col umn 1, line 66 - col umn 2, line 29 col umn 7, line 17 - line 29</td>
<td>24-26,29</td>
</tr>
<tr>
<td>Y</td>
<td>US 3 659 483 A (MATTHEWS JAMES J) 2 May 1972 (1972-05-02)</td>
<td>2,4,29</td>
</tr>
<tr>
<td>A</td>
<td>figures 1-2</td>
<td>1,6,7,36</td>
</tr>
<tr>
<td>Y</td>
<td>EP 0 146 397 A2 (KOZOTOVICH VASILIJE) 26 June 1985 (1985-06-26) figure 1</td>
<td>24-26</td>
</tr>
</tbody>
</table>

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Date of the international search: 7 December 2016

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<tr>
<th>Patent document</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
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</tr>
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<tr>
<td>US 6530152 B1</td>
<td>11-03-2003</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US 3659483 A</td>
<td>02-05-1972</td>
<td>GB 1285664 A</td>
<td>16-08-1972</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 3659483 A</td>
<td>02-05-1972</td>
</tr>
<tr>
<td>EP 0146397 A2</td>
<td>26-06-1985</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>US 7984553 B1</td>
<td>26-07-2011</td>
<td>NONE</td>
<td></td>
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</tbody>
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