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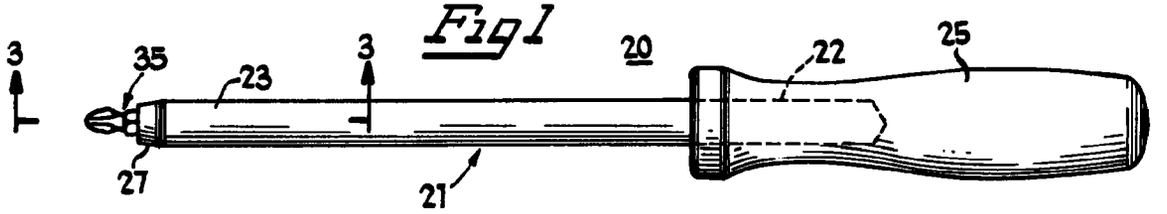
(54) Composite screwdriver with bit holder

(57) An insulating hand tool has an elongated composite shank, to the working end of which is fixed a bit holder defining a polygonal socket in which is press-fitted a bit having a press-fit projection. In one embodiment the working end of the shank is hollow and receives the bit holder therein and in another embodiment the working end of the shank has a reduced diameter which is received in an axial bore in the bit holder, the combination being encased in a composite sleeve. The bit holder bore may be a through bore or may stop short of the socket. The handle end of the shank may have a reduced diameter.

In another embodiment an elongated bit holder is fixed to the working end of the shank and projects axially therefrom, the combination being encompassed in a composite sleeve. The bit holder has an axial bore in its distal end, the inner end of the bore receiving a permanent magnet and a keeper, and the outer end being enlarged to define a polygonal socket to mateably receive a bit which is magnetically retained in the socket. The bit holder is crimped against the magnet to hold the magnet in place.

Fig1



EP 0 747 178 A1

Description

Background of the Invention

Field of the Invention

The present invention relates to hand tools of the type which are relatively non-conducting electrically so that they can be safely used in applications where they may come into contact with sources of electrical power.

Description of the Prior Art

The present invention is an improvement of the electrically insulating composite hand tool disclosed in U.S. patent no. 5,259,277, the disclosure of which is incorporated herein by reference.

That prior art tool utilizes a composite shank and a composite sleeve which receives in the rear end thereof the forward end of the shank and receives in the forward end thereof a metal bit holder carrying a permanent magnet which magnetically retains an associated bit in the bit holder. The sleeve is adhesively secured to the shank and to the bit holder. This arrangement is useful for removably retaining a bit. Indeed the handle of this prior art tool is hollow for retaining therein replacement bits.

This prior art arrangement does an effective job of electrical insulation and also effectively removably retains bits in the bit holder. However, since it is magnetic it is limited to use with bits formed of magnetizable material.

Another disadvantage of this prior art arrangement is that it has been found to provide inadequate torque strength in certain applications. More specifically, the bit holder is secured to the shank only through the sleeve, which is a rather thin-walled hollow tubular member. It has been found that, in high-torque applications, the sleeve itself may fail or the adhesive bond between the sleeve and either the bit holder or the shank may fail.

Also, in this prior art construction, the magnet is adhesively bonded in a bore which is formed axially in the end of the bit holder opposite the bit-receiving socket and communicating therewith. Thus, the bit may contact the magnet and it is possible for the magnet to be knocked loose and moved away from the inner end of the socket.

It is also known to provide a dimpled bit for frictional retention in a socket or bit holder, such an arrangement being disclosed in U.S. patent no. 5,295,423.

Summary of the Invention

It is a general object of the invention to provide an improved electrically insulating hand tool of the type which retains a bit on a shank, which avoids the disadvantages of prior such tools while affording additional structural and operating advantages.

An important feature of the invention is the provision of an electrically insulating hand tool of the type set forth, which joins a bit holder to a shank with a joint of improved torsional strength.

A further feature of the invention is the provision of a hand tool of the type set forth which is adapted for use with non-magnetic bits.

Still another feature of the invention is the provision of a hand tool of the type set forth which is adapted for permanent or semi-permanent mounting of bits thereon.

A still further feature of the invention is the provision of a hand tool of the type set forth which utilizes a magnetic bit retention and effectively prevents separation of the magnet from the bit-receiving socket.

In connection with the foregoing features, a further feature of the invention is the provision of a hand tool of the type set forth which is of simple and economical construction.

Certain ones of these and other features of the invention are attained by providing an insulating hand tool comprising: an elongated shank formed of electrically insulating material and having a longitudinal axis with a handle at one end thereof and with the other end thereof defining a working end, an elongated bit holder fixedly secured to the working end coaxially with the shank and having an axial socket polygonal in transverse cross section formed in an outer end thereof, and a bit mateably receivable in the socket and provided with a lateral projection to afford a press fit in the socket.

Still further features of the invention are attained by providing an insulating hand tool comprising: an elongated shank formed of electrically insulating material and having a longitudinal axis with a handle at one end thereof and with the other end thereof defining a working end, an elongated bit holder secured to the working end of the shank and extending coaxially therefrom, the bit holder having an axial bore formed in an outer end thereof, the bore having a cylindrical inner portion and an enlarged outer portion of polygonal transverse cross section, and a permanent magnet received in the inner portion of the bore, the bit holder being crimped against the permanent magnet for fixing the magnet in the bore.

The invention consists of certain novel features and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the details may be made without departing from the spirit, or sacrificing any of the advantages of the present invention.

Brief Description of the Drawings

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, the invention, its construction and operation, and many of its advantages should be readily understood and appreciated.

FIG. 1 is a side elevational view of a hand tool constructed in accordance with and embodying the features of a first embodiment of the present invention;

FIG. 2 is a side elevational view of a hand tool in accordance with a second embodiment of the invention;

FIG. 3 is an enlarged, fragmentary, sectional view taken along the line 3-3 in FIG. 1;

FIG. 4 is an enlarged, fragmentary, sectional view taken along the line 4-4 in FIG. 2;

FIG. 5 is a reduced sectional view of the bit holder of the tool of FIG. 3;

FIG. 6 is an enlarged end elevational view of the left-hand end of the bit holder of FIG. 5;

FIG. 7 is an enlarged end elevational view of the right-hand end of the bit holder of FIG. 5;

FIG. 8 is a reduced sectional view of the bit holder of tool of FIG. 4;

FIG. 9 is an enlarged end elevational view of the left-hand end of the bit holder of FIG. 8;

FIG. 10 is an enlarged end elevational view of the right-hand end of the bit holder of FIG. 8;

FIG. 11 is an enlarged, fragmentary, exploded, perspective view of a tool in accordance with another embodiment of the invention;

FIG. 12 is a side elevational view in partial section of the tool of FIG. 11;

FIG. 13 is a view similar to FIG. 11 of a tool in accordance with still another embodiment of the invention;

FIG. 14 is a sectional view of the bit holder subassembly of the tool of FIG. 13; and

FIG. 15 is a fragmentary side elevational view in partial section of the tool of FIG. 13.

Description of the Preferred Embodiments

Referring to FIGS. 1, 3 and 5-7, there is illustrated an electrically insulating hand tool 20 in the form of a screwdriver. The tool 20 has an elongated shank 21 of a composite construction which may be of the type disclosed in the aforementioned U.S. patent no. 5,259,277. The shank 21 has a handle end 22 and a working end 23. A handle 25, which is formed of a electrically insulating material, such as a suitable plastic, is fixedly secured to the handle end 22 of the shank 21 by any suitable means, such as the means disclosed in the aforementioned U.S. patent no. 5,259,277. The working end 23 of the shank 21 has a cylindrical axial bore 26 formed therein and has the outer surface thereof tapered or chamfered at its distal end, as at 27.

The hand tool 20 also includes an elongated, cylindrical bit holder 30 which may be formed of a suitable material, such as steel, and which is telescopically received in the bore 26 of the shank 21, the length of the bit holder 30 being substantially the same as the depth of the bore 26 so that the bit holder 30 does not project axially outwardly beyond the working end 23 of the shank 21. The bit holder 30 has an axial through bore 31 which is enlarged adjacent to its outer end to define a hexagonal bit socket 32. The bit holder 30 is fixedly secured in the bore 26 by a suitable adhesive 34.

The bit socket 32 is adapted to matably receive therein an associated bit 35. More specifically, the bit 35 has a hexagonal shank 36 which is dimensioned to mate with the bit socket 32, the shank 36 being provided with a laterally outwardly extending projection 37, which may be in the nature of an upset dimple or bead. The shank 36 is dimensioned so that the projection 37 affords a press fit in the bit socket 32, thereby affording a permanent or semi-permanent mounting of the bit 35 on the hand tool 20. In this regard, the inner end of the bit socket 32 defines a peripheral shoulder 38 which serves to limit the depth of insertion of the bit 35 in the socket 32.

Because the bit holder 30 is directly adhesively secured along its entire length to the shank 21, it affords a greater torsional strength than the hand tool disclosed in the aforementioned U.S. patent no. 5,259,277.

Referring to FIGS. 2, 4 and 8-10, there is illustrated another hand tool 40, which is also in the nature of a screwdriver and is constructed in accordance with another embodiment of the invention. The hand tool 40 has an elongated shank 41, which may be formed of the same material as the shank 21 of the tool 20, except that it has a reduced-diameter handle end 42 which is joined to the working end 23 by a tapered portion 44. The tool 40 includes an elongated cylindrical bit holder 45 which is similar to the bit holder 30, except that it does not have a through bore. Rather, the bit holder 45 has a cylindrical axial bore 46 formed in its rear end and has a hexagonal bit socket 47 formed axially in its forward end which stops short of the bore 46 to leave an intervening inner wall 48. The outer surface of the bit holder 45 is chamfered at its outer end, as at 49.

The bit holder 35 is adhesively secured in the axial bore 26 of the shank 41 in the same manner as was described above in connection with the tool 20. The chamfer at 49 on the end of the bit holder 45 defines an annular recess into which excess adhesive may be wiped. The hand tool 40 operates and receives the associated bit 35 in the same manner as was described above in connection with the hand tool 20. It will be appreciated that, if desired, the bit holder 45 could be provided with a counterbore at the outer end of the bit socket 47 in the same manner as was described in connection with bit holder 30, and the forward end of the bit holder 30 could have a chamfered outer surface, in the same manner as the bit holder 45.

Referring now to FIGS. 11 and 12, there is illustrated a tool shank 50 which has an outer cylindrical surface 51 and may be substantially the same as the shank 21 described above in connection with the tool 20, except that the shank 50, instead of being bored at its working end, has a reduced-diameter working end 52 which defines an annular shoulder 53.

The shank 50 is adapted for use with an associated elongated tubular sleeve 55, which is similar to the cor-

responding sleeve disclosed in the aforementioned U.S. patent no. 5,529,277, and may be formed of the same material. However, the sleeve 55 has an outer surface which may be tapered or chamfered at its opposite ends, as at 56 and 57. The shank 50 is adapted for use with the bit holder 45, described above. More particularly, the reduced-diameter working end 52 of the shank 50 is telescopically received in the cylindrical bore 46 of the bit holder 45 and is bonded thereto by an adhesive 54. Preferably, the parts are dimensioned so that the bit holder 45 has an outer diameter which is substantially the same as the diameter of the outer surface 51 of the shank 50.

The sleeve 55 is telescopically received over the bit holder 45 until its forward tapered end 57 is substantially flush with the forward end of the bit holder 45. The sleeve 55 has a length such that, when thus assembled, it overlaps the outer surface 51 of the shank 50 a substantial distance, which may be approximately the same as the length of the bit holder 45. The sleeve 55 is preferably adhesively secured to the shank surface 51 and to the bit holder 45.

A tool incorporating the shank 50 operates in substantially the same manner as the tool 40, described above. This arrangement provides a torsional strength which is substantially greater than the prior art tool disclosed in the aforementioned U.S. patent no. 5,259,277, since the bit holder 45 is adhesively bonded along both its inner and outer diameters, and is directly bonded to the shank 50 along the entire length of its working end 52.

Referring now to FIGS. 13-15, there is illustrated a shank 60, which could be substituted for any of the shanks 21, 42 and 50, described above, and is substantially the same as the shank 50, described in connection with FIG. 11, except that it does not have a reduced-diameter working end. Rather, it terminates in a flat, circular working end surface 61, which has the same diameter as the rest of the shank 60. The shank 60 is adapted for use with the same sleeve 55 described above in connection with FIG. 11. It is also adapted for use with a bit holder 62 which may be formed of a suitable metal, such as non-magnetic stainless steel. The bit holder 62 has formed in its forward end an axial cylindrical bore 63, which has a depth less than the length of the bit holder 62. Formed in the forward end of the bore 63 is a hexagonal bit socket 64.

A cylindrical magnetic keeper 65, formed of a suitable magnetizable material, is received in the bore 63 and seated at the inner end thereof. Also received in the bore 63 and seated against the keeper 65 is an elongated, cylindrical, permanent magnet 66 which has a length such that, when fully seated in the bore 63, it has its outer end disposed substantially at the inner end of the hexagonal bit socket 64. When the parts are thus assembled, the wall of the bit holder 62 is crimped, as at 67, at diametrically opposed locations to produce radially inwardly extending projections 68 which firmly clamp the magnet 66 in place. If desired, the outer surface of the bit holder 62 may be machined to return it to round. In this regard, the bit holder 62 is preferably dimensioned so that it has an outer diameter substantially the same as that of the shank 60.

The assembled bit holder 62 has its closed end adhesively secured to the working end surface 61 of the shank 60. The sleeve 55 is then telescopically received over the bit holder 62 until its tapered forward end 57 is substantially flush with the outer end of the bit holder 62. Preferably the sleeve 55 has a length such that it overlaps the end of the shank 60 a distance substantially the same as the length of the bit holder 62. The sleeve 55 is adhesively secured along its entire length to the shank 60 and the bit holder 62.

In use, a bit (not shown) formed of a magnetizable metal is removably mateably received in the bit socket 64 and is magnetically retained therein by the magnet 66. The magnetic keeper 65 serves to control the direction of the magnetic flux lines to achieve optimum magnetic holding power. It will be appreciated that, in this embodiment of the invention, since the magnet 66 is bottomed in the bit holder 62, it cannot be moved inwardly away from the bit socket 64 by engagement with associated bits.

From the foregoing, it can be seen that the present invention affords all of the electrical insulating advantages of the hand tool disclosed in the aforementioned U.S. patent no. 5,259,277, while at the same time affording improved torsional strength, adaptation to permanent or semi-permanent bit mountings, and/or improved magnetic retention. Another important aspect of the invention is that it utilizes parts, such as the bit holders 30 and 45 and the sleeve 55, which can be interchangeably used in different embodiments of the invention. While the preferred embodiments of the invention have been described as embodied in screwdrivers, it will be appreciated that the principles of the invention could be used in nut drivers or other types of hand tool.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects. Therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only and not as a limitation. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective based on the prior art.

Claims

1. An insulating hand tool comprising: an elongated shank formed of electrically insulating material and having a longitudinal axis with a handle at one end thereof and with the other end thereof defining a

working end, an elongated bit holder fixedly secured to said working end coaxially with said shank and having an axial socket polygonal in transverse cross section formed in an outer end thereof, and a bit mateably receivable in said socket and provided with a lateral projection to afford a press fit in said socket.

2. The hand tool of claim 1, wherein said working end of said shank has an axial bore formed therein, said bit holder being received telescopically in said bore.

3. The hand tool of claim 2, wherein said working end of said shank has a chamfered outer surface.

4. The hand tool of claim 2, wherein said bit holder is adhesively secured in said shank bore.

5. The hand tool of claim 1, wherein said working end of said shank has a reduced diameter relative to the remainder of said shank.

6. The hand tool of claim 5, wherein said bit holder has an axial bore formed in an inner end thereof receiving therein said reduced-diameter working end of said shank.

7. The hand tool of claim 6, and further comprising a tubular sleeve encompassing said bit holder and an adjacent portion of said shank.

8. The hand tool of claim 7, wherein said working end of said shank is adhesively secured to said bit holder and to said sleeve.

9. The hand tool of claim 7, wherein said sleeve has an outer surface which is chamfered at the opposite ends thereof.

10. The hand tool of claim 6, wherein an axial bore terminates short of said socket and has a diameter less than the width of said socket.

11. The hand tool of claim 6, wherein said axial bore communicates with said socket.

12. The hand tool of claim 1, wherein said one end of said shank has a reduced diameter.

13. The hand tool of claim 1, wherein said shank is formed of a composite epoxy/glass material.

14. An insulating hand tool comprising: an elongated shank formed of electrically insulating material and having a longitudinal axis with a handle at one end thereof and with the other end thereof defining a working end, an elongated bit holder secured to said working end of said shank and extending coaxially therefrom, said bit holder having an axial bore formed in an outer end thereof, said bore having a cylindrical inner portion and an enlarged outer portion of polygonal transverse cross section, and a permanent magnet received in said inner portion of said bore, said bit holder being crimped against said permanent magnet for fixing said magnet in said bore.

15. The hand tool of claim 14, and further comprising a tubular coupling sleeve formed of electrically insulating material and telescopically receiving therein the working end of said shank and said bit holder.

16. The hand tool of claim 15, wherein said sleeve is adhesively secured to said working end of said shank and to said bit holder.

17. The hand tool of claim 15, wherein said sleeve has an outer surface which is chamfered at its opposite ends.

18. The hand tool of claim 15, wherein said sleeve is formed of a composite material.

19. The hand tool of claim 14, and further comprising a keeper disposed in said bore inboard of said magnet for controlling the direction of the magnetic flux lines.

20. The hand tool of claim 14, wherein said shank is formed of a composite material.

Fig 1

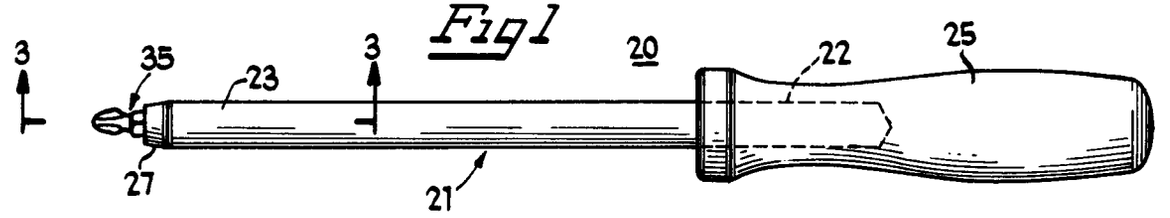


Fig 2

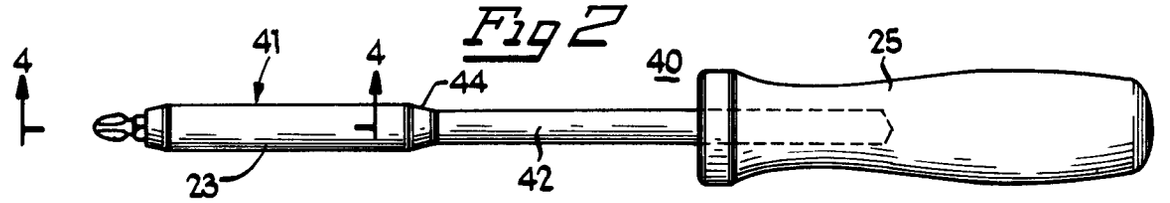


Fig 3

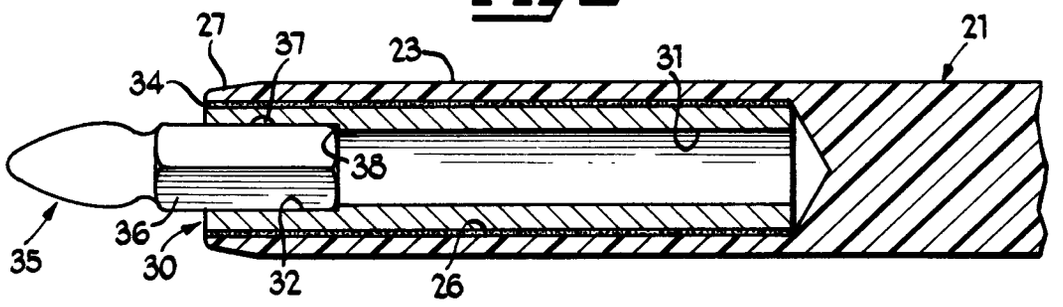


Fig 4

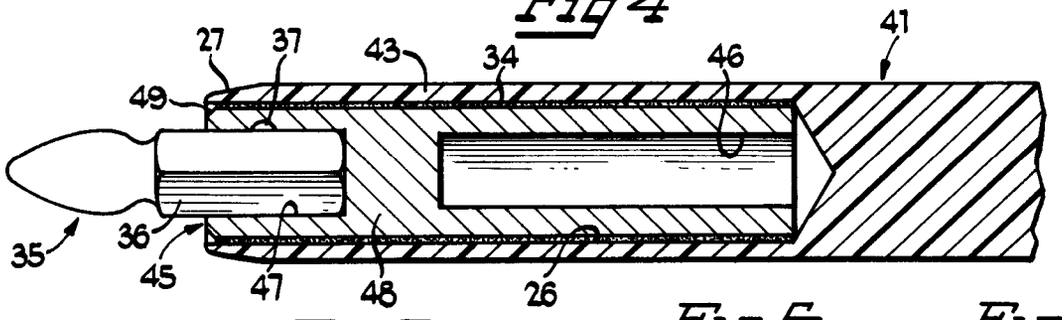


Fig 5

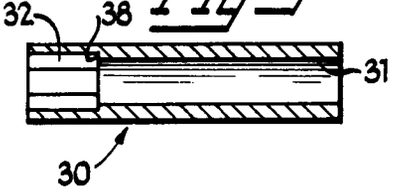


Fig 6

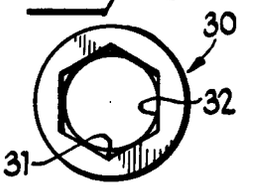


Fig 7

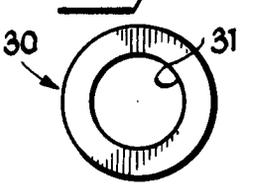


Fig 8

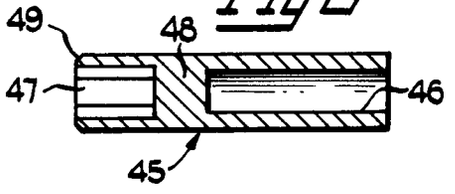


Fig 9

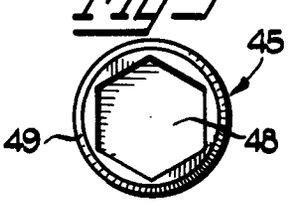
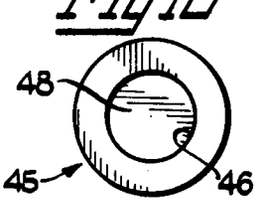


Fig 10



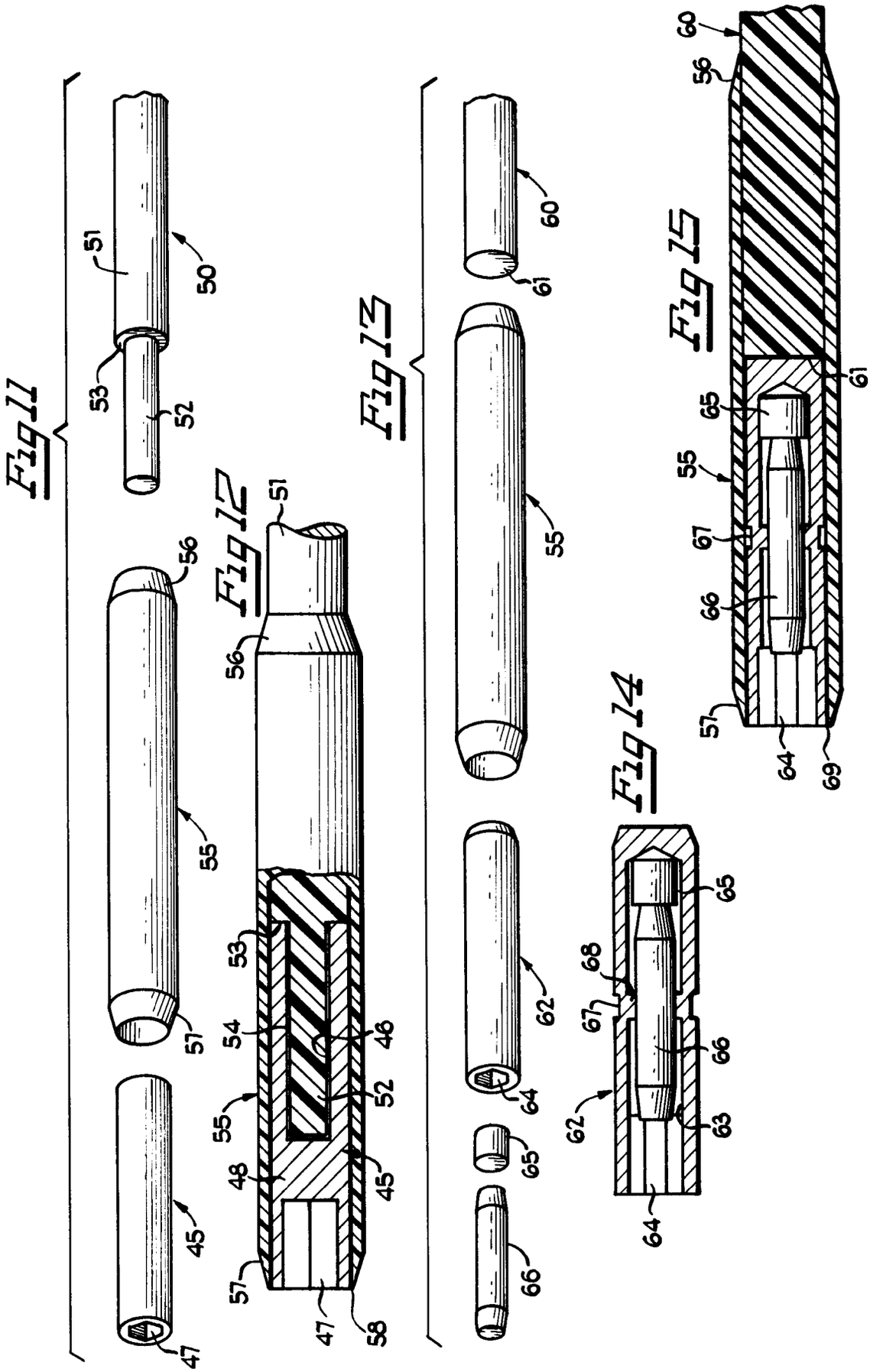


Fig 11
Fig 12
Fig 13
Fig 14
Fig 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 8511

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,Y A	US-A-5 259 277 (G.A.ZURBUCHEN) * abstract; figures * ---	1,13,14 2,4,7,8	B25G1/12
D,Y	US-A-5 295 423 (F.MIKIC) * abstract; figures * ---	1,13	
Y	DE-U-94 03 652 (FA. ROBERT SCHRÖDER) * page 4, line 24 - line 31; claim 5; figure 4 * ---	14	
A	DE-U-92 02 275 (WERA-WERK HERMANN WERNER GMBH & CO) * page 6, line 6 - line 27; figures 6,7 * ---	1,3	
A	EP-A-0 478 782 (Y.AOYAMA) * column 5, line 54 - column 6, line 2; figures 6,7 * -----	19	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B25G B25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 October 1996	Majerus, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,

namely claims:

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.

namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.

namely claims:

☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims.

namely claims:

European Patent Office

EP 96 10 8511 -B-

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-13 : Insulated hand tool with a handle, a shank of electrically insulating material and a bit holder fixedly connected to said shank and means for holding a bit in said bit holder, said means being a lateral projection to afford a press fit between said bit and said bit holder.
2. Claims 14-20 : Insulated hand tool with a handle, a shank of electrically insulating material and a bit holder fixedly connected to said shank and means for holding a bit in said bit holder, said means being a permanent magnet placed in an inner bore in the bit holder, the bit holder being crimped against the permanent magnet.

Document US5259277 shows an insulated hand tool with a handle, a shank of electrically insulating material and a bit holder fixedly connected to said shank, the bit holder having a polygonal opening for receiving a bit and means for holding the bit in said polygonal opening.

The tools claimed in the two independent claims 1 and 14 of the present application differ from the tool shown in the document US5259277 only by the means by which the bit is held in the bit holder.

In the tool of claim 1 the bit is held in position by a lateral projection to afford a press fit of said bit in said polygonal opening of the bit holder.

In the tool of claim 14 the bit is held in position by a permanent magnet placed in an inner bore in the bit holder, the bit holder being crimped against the permanent magnet. (The feature of holding the bit in position in the bit holder by means of a permanent magnet being known per se from US529277)

The subject matter of the independent claims 1 and 14 of the present application therefore differ from the subject matter disclosed in US529277 only by the special technical feature of the execution of the holding means for holding the bit in the bit holder; claim 1 including a first variation of said holding means and claim 2 including a second variation of said holding means.

Seen that means for holding the bit in the bit holder are per se known from US529277 this leads to lack of unity a priori between the independent claims 1 and 14.

According to EPC rules only the first subject matter described in claim 1 and the claims depending therefrom has been searched.

The subject matter described in claim 14 and the claims depending therefrom have not been searched.