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Jacyno et al.

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[54] SUBFRAME FOR POWER TOOL HAVING DOUBLE INSULATED BRUSH HOLDERS

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[52] **U.S. Cl.** **310/50**, 310/239, 310/242

[51] **Int. Cl.** **H02k 5/14**

[58] **Field of Search** ..... 310/47, 50, 239, 40 MM, 42, 310/242

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[57] **ABSTRACT**

A subframe for a power tool comprised of first and second frame members secured together in contiguous engagement throughout a substantial portion of their peripheries. The frame members include complementary cut outs defining a motor receiving opening. A pair of brush receiving spaces are defined by a pair of stuck out portions on opposite sides of the motor receiving opening in one of the frame members together with an opposed notch in the other of the frame members. Each of the brush receiving spaces is adapted to receive one or more insulating inserts for holding brushes.

6 Claims, 4 Drawing Figures

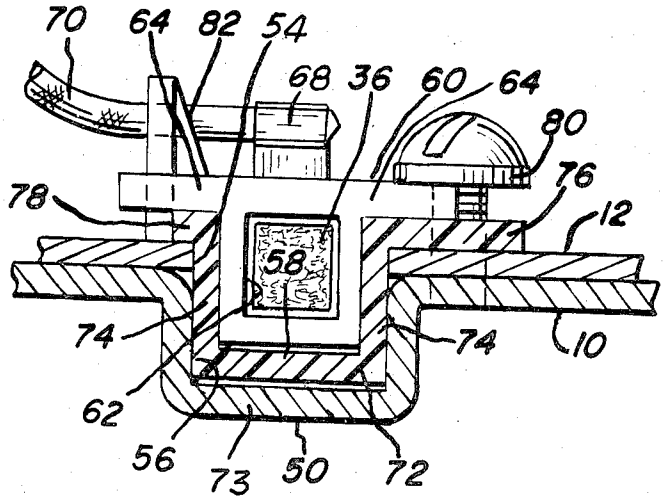
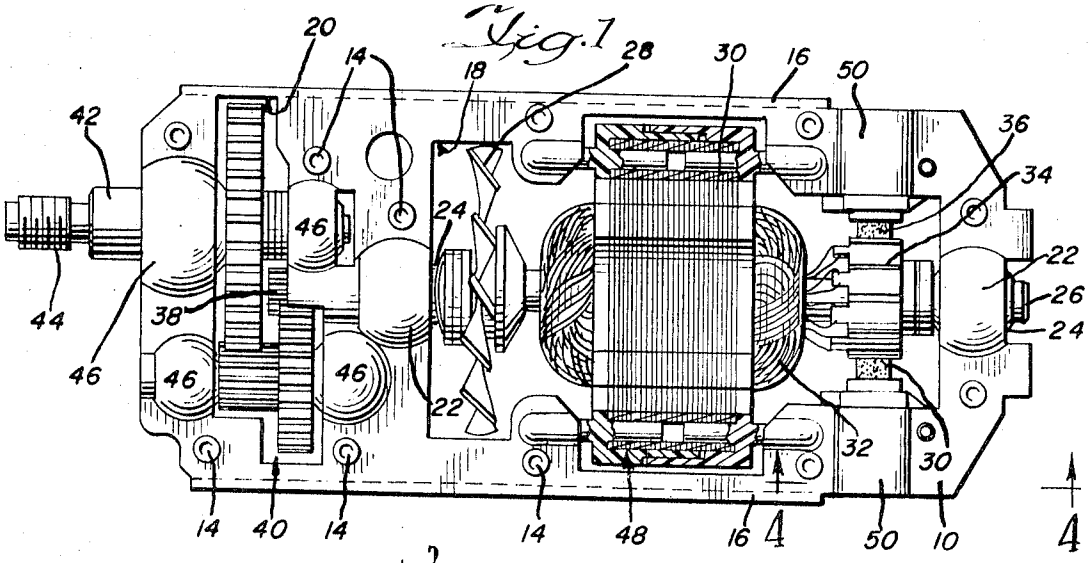


Fig. 1



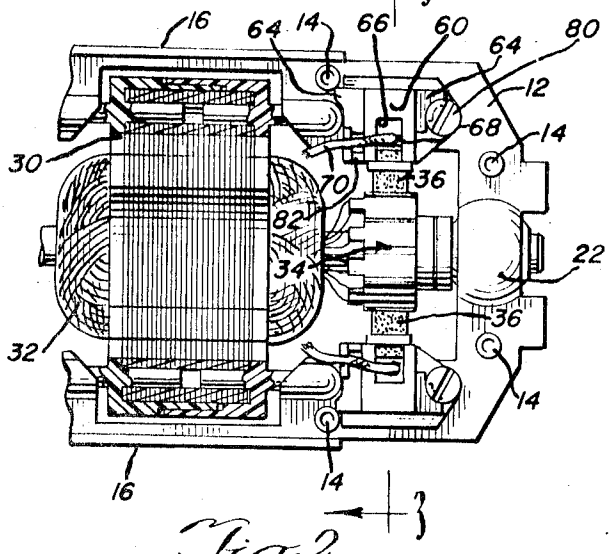


Fig. 2

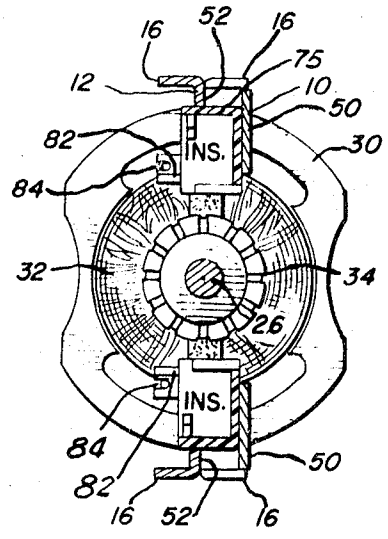


Fig. 3

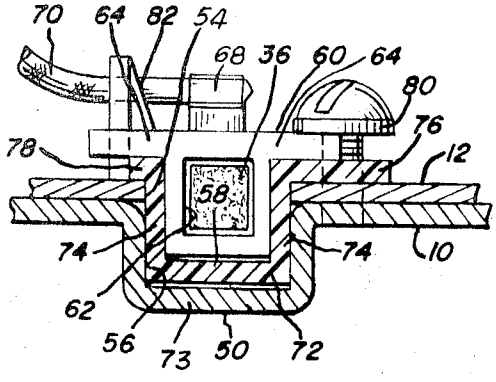


Fig. 4

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SUBFRAME FOR POWER TOOL HAVING DOUBLE INSULATED BRUSH HOLDERS

BACKGROUND OF THE INVENTION

This invention relates to portable hand tools and in particular, to subframes for holding the motor and transmission parts in a main power tool casing or housing.

Many frames are currently in use for mounting motors and gears in a housing to provide power for portable tools. In most cases, the motor and transmission are secured directly to the main tool housing. The primary disadvantage of this arrangement is that the tool housing must be cast and it is therefore necessary to disassemble not only the housing, but parts of the motor and transmission as well in order to repair or replace worn or damaged parts. Moreover, in such a construction it is necessary that the bearing bosses in the housing be machined separately in separate machining operations to assure that the bearings are accurately located.

It has therefore been proposed to provide motor and transmission frames which include cast supporting members for the motor and transmission parts and which are separate from the main tool housing. The principal disadvantage of such a construction is that the die cast parts required are difficult to manufacture with any degree of accuracy. And, in any event, such constructions require separate machining operations for their various bearing bosses.

There has recently been proposed a subframe assembly construction that eliminates the foregoing disadvantages. The same is disclosed in the copending application of Anthony Jacyno, Ser. No. 850,834, filed Aug. 18, 1969 now abandoned in favor of Ser. No. 78,434, filed Oct. 6, 1970, and assigned to the same assignee as the instant application. The subframe therein disclosed is formed of a pair of stamped metal plates that are mirror images of one another. Semispherical struck out portions define spherical bearing receiving recesses while semi-cylindrical struck out portions define cylindrical brush receiving spaces, all due to the fact that both plates are mirror images of one another.

Such a construction has proved entirely successful for its intended purpose and has significantly reduced the expense of manufacture as well as the ease of maintenance of power tools. However, the construction disclosed therein has one drawback relating to the mounting of brushes. Recent concern about safety of the operator of a portable power tool has suggested that good practice in the construction of power tools requires the use of so-called "double insulation" between electrical conductors and frame members. Furthermore, it is desirable that such double insulation be of the so-called "reinforced" type rather than merely "secondary" insulation.

SUMMARY OF THE INVENTION

It is the principal object of the invention to provide a new and improved subframe assembly for use in power tools and, in particular, one that is suitable for so-called "double insulation" of brush assemblies of the reinforced variety.

The foregoing object is achieved in the exemplary embodiment of the invention through a subframe construction generally following the teachings set forth in the above-identified Jacyno application, but which differs therefrom in the construction of brush receiving spaces and brush holding means employed therein. In particular, brush receiving spaces are defined by struck out portions in one of the frame members and which are bounded by substantially planar portions in the other frame member. According to the exemplary embodiment, the brush receiving spaces have a generally uniform rectangular cross section and the frame member opposite the struck out portion further includes a notch for receipt of brush holding means.

The brush receiving spaces are located on opposite sides of a motor receiving space in the frame members defined by complementary cut outs therein.

According to the invention, the brush holding means are comprised of two elements, the first including a hollow insert

received snugly within a brush receiving space and including a flange or lip which is adapted to be secured to one or both of the frame members. The insert is formed of any suitable type of electrical insulating material. The second insert is received within the hollow of the first insert and is secured to one or both of the frame members by any suitable means. According to one embodiment of the invention, a single screw may be employed to secure both inserts together and to the subframe. The innermost one of the inserts in turn mounts an electrical brush forming part of the motor used in the portable power tool. An electrical connector may extend from the innermost insert for connection to an electrical lead in the electrical circuitry and for safety purposes, the outermost insert is provided with a projection extending away from the subframe and having a key-shaped notch in which an electrical lead may be received and gripped.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of a subframe for an electrical power tool made according to the invention;

FIG. **2** is a fragmentary side elevation of the subframe taken at an angle of approximately 180° from the position of the view shown in FIG. **1**;

FIG. **3** is a vertical section taken approximately along the line 3—3 of FIG. 2; and

FIG. **4** is a horizontal section taken approximately along the line 4—4 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An exemplary embodiment of a subframe for a power tool is best seen in FIGS. 1–3, inclusive, and comprises a pair of stamped metal plates **10** and **12** located together in contiguous relation about a substantial portion of their periphery. Means, in the form of rivets **14**, secure the plates **10** and **12** together to form the subframe.

As best seen in FIG. **3**, the assemblage is strengthened by means of outturned flanges **16** extending from both sides of the frame members **10** and **12**.

The subframe includes a motor receiving opening, generally designated **18**, defined by a pair of complementary cut outs, one in each of the frame members **10** and **12**. Also included is a transmission receiving opening, generally designated **20**, which is similarly formed.

Opposite sides of the motor receiving opening **18** include semi-spherical struck out portions **22** in both of the plates **10** and **12** to define spherical bearing recesses which may receive spherical bearings **24** for purposes of mounting opposite ends of a motor shaft **26**. One end of the motor shaft **26** mounts an impeller **28** for rotation therewith for the purpose of drawing cooling air through suitable vents in the tool housing (not shown) and for directing the same toward a motor stator **30** as well as a rotor **32**.

The other end of the shaft **26** mounts a commutator **34** which cooperates with brushes **36** to provide electrical power to rotor windings (not shown).

Returning to the end of the shaft **26** opposite the commutator **34**, the same includes gearing **38** in engagement with a gear transmission, generally designated **40**, to ultimately drive an output shaft **42**. The end of the output shaft **42** may bear threads **44** for connection to a chuck or the like. Alternatively, the output shaft **42** could be connected to a motion converting mechanism such as a rotary to reciprocating motion converting mechanism if the subframe is to be employed in a power tool such as a saber saw or a hedge trimmer.

The varus gearing comprising the transmission **40** may be mounted on suitable shafts received in spherical bearings mounted in spherical bearing receiving recesses defined by semi-spherical struck out portions **46** similar to the struck out portions **22**. Alternately, other types of bearing receiving

recesses or bearing mounts may be employed and it is to be understood that the particular transmission **40** and the means of mounting bearings form no part of the invention.

The motor-stator **30** is secured to the subframe by insulating mounting means, generally designated **48**. The mounting means **48** form no part of the instant invention but preferably are of the form disclosed in the copending application of Anthony Jacyno entitled "Modular Design — Double Insulated Field," Ser. No. 37,810, filed May 15, 1970, and assigned to the same assignee as the instant application; the details of which are herein incorporated by reference.

The subframe is completed by brush holding spaces for the brushes **36** and brush holders received therein. As best seen in FIG. **1**, the brush holding spaces are defined by struck out portions in the frame member **10** and are located on opposite sides of the motor receiving opening **18** about the commutator **34**. The brush receiving spaces are further defined by a substantially planar portion **52** on the plate **12** including a cooperating notch **54**, best seen in FIG. **4**. As a result, a rectangular brush receiving space of generally uniform cross section is defined with the same including a notched out portion in the one wall defined by the frame member **12**.

Received within the brush receiving opening is an outer insert **56** formed of an insulating material and having a rectangular hollow **58** for receiving an inner brush holding insert **60** also formed of a insulating material, but preferably of an insulating material different from the insulating material of which the insert **56** is formed. As best viewed in FIG. **4**, the inner insert **60** includes a central hollow **62** which receives one of the brushes **36**.

With reference to FIGS. **2** and **4**, the inner insert **60** includes a pair of wings **64** of symmetrical configuration so that the same insert may be located either above or below the commutator **34** thereby eliminating the necessity of forming two different inserts. The insert **60** further includes a rectangular opening **66** through which an electrical connector **68** may extend to make electrical contact with the associated brush **36**. The electrical connector receives one end of an electrical lead **70** forming part of the electrical circuit of the motor. Additionally, the insert **60** may contain suitable spring biasing means (not shown) for biasing the associated brush **36** into contact with the commutator **34**.

With reference to FIGS. **3** and **4**, the outer insert **56** includes a rear wall **72** which rests in spaced relationship to the outermost portion **73** of the struck out portion **50**, a pair of opposed side walls **74** which abut the side walls of the struck out portion **50**, a base **75** which bridges the side walls **74** across the opening of the notch **54**, a securing ear **76** (FIG. **4**) and a lead gripping ear **78**. Due to the nature of the construction, outer insert **56** is made in rights and lefts for use on the opposite sides of the tool.

The securing ear **76** includes a bore (not shown) for receiving a screw **80** which may extend therethrough into a corresponding bore (not shown) in either one or both of the frame members **10** and **12**. In this respect, the wings **64** of the inner insert **60** are configured so that they will underlie the head of the screw **80** so that a single screw will suffice to secure both of the inserts **56** and **60** to the subframe. The distance between the undersurface of each wing **64** and the plane of the outer bottom surface of the insert **60** is sufficient to provide a small clearance between the insert **60** and the rear wall **72** of the outer insert **56** so that tightening the screw **80** will not snap off the wing **64**.

The wire gripping ear **78** terminates in an outturned projection **82** (FIGS. **2–4**) which extends away from the subframe and includes a keyway shaped notch **84** for receiving and gripping the lead **70** as it extends from the electrical connector **68** to outer electrical conductors associated with the motor. In particular, the narrow opening of the keyway shaped notch **84** permits insertion of a lead **80** thereinto through a slight flexing of the insulation on the same, and when the lead is fully within the enlarged portion of the keyway shaped notch **84**, the elasticity of the insulation will tend to cause the lead to fill the enlarged portion and be retained by the narrow neck thereof.

It will be appreciated that the just-described construction provides a simple and inexpensive "double insulation" mounting for the brushes **36**; and one that is "reinforced." That is, because the brush holding means in the form of the inserts **56** and **60** are essentially sandwiched between the two frame members **10** and **12**, and extremely durable construction results. Furthermore, the construction provides for ease of assembly insofar as it may be formed using stamped sheet metal frame members or, in the alternative, heat pressed or vacuum processed plastic sheets if desired. Finally, the use of but a single securing element to secure each multipart brush holding means in place provides a significant advantage in terms of maintenance and the presence of the lead gripping ear provides a further safety factor against shorting which could be caused by one of the electrical leads vibrating loose from the electrical connector during operation of the tool.

I claim:

1. A subframe for a power tool comprising: first and second plate-like frame members, in contiguous engagement throughout a substantial portion of their peripheries; means securing said frame members together; means in said frame members receiving a motor and including complementary cut outs in each of said frame members defining a motor receiving opening; and means defining a pair of brush receiving spaces located on opposite sides of said opening, each said space being defined by a struck out portion in one of said frame members and bounded by a substantially planar portion of the other of the frame members.

2. The subframe of claim **1** wherein said struck out portions and said planar portions define brush receiving spaces having a uniform, rectangular cross section.

3. The subframe of claim **2** further including a pair of brush holding means, one in each of said spaces, and each comprised of an outer, insulating insert received in one of said spaces, and an inner brush holder formed of insulating material received in said outer insert, and lead gripping means on said outer insert.

4. A subframe for a power tool comprising: first and second stamped metal plate-like frame members in contiguous engagement throughout a substantial portion of their peripheries; means securing said frame members together; means in said frame members for receiving a motor and including complementary cut outs in each of said frame members defining a motor receiving opening; complementary struck out portions in said frame members adjacent opposite sides of said opening for receiving bearings adapted to rotatably mount in a motor shaft; and means defining a pair of brush receiving spaces located on opposite sides of said opening different from said first mentioned sides, each said space being defined by struck out portion in one of said frame members and a notch in the other frame member opposite the struck out portion.

5. The subframe of claim **4** further including a pair of brush holding means, one for each of said brush receiving spaces; each of said brush holding means comprising a first hollow insert adapted to snugly fit in a respective one of said spaces, said insert further including a securing portion adapted to overlap the frame member having the notch therein, and fastening means associated with said securing portion for securing the insert to said notched frame member, and a brush holding insert receiving within the hollow of said first mentioned insert for holding a motor brush, fastening means for securing said inner insert to said subframe, and means on one of said inserts defining a projection away from said subframe, said projection including a notch therein adapted to receive an electrical lead extending to the brush in said inner insert; said inserts being formed of insulating material.

6. The subframe of claim **5** wherein both of said fastening means comprise a single element.

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