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Brush gear

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H2A

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FIG. 1

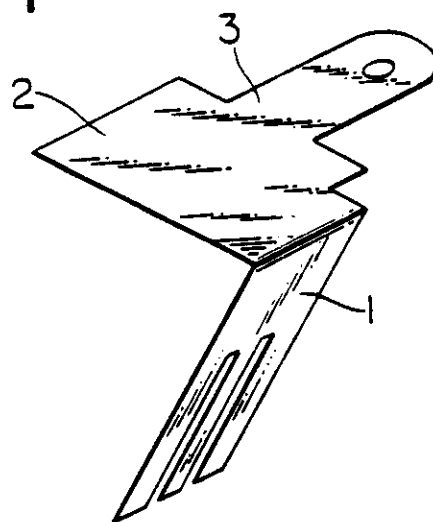


FIG. 2

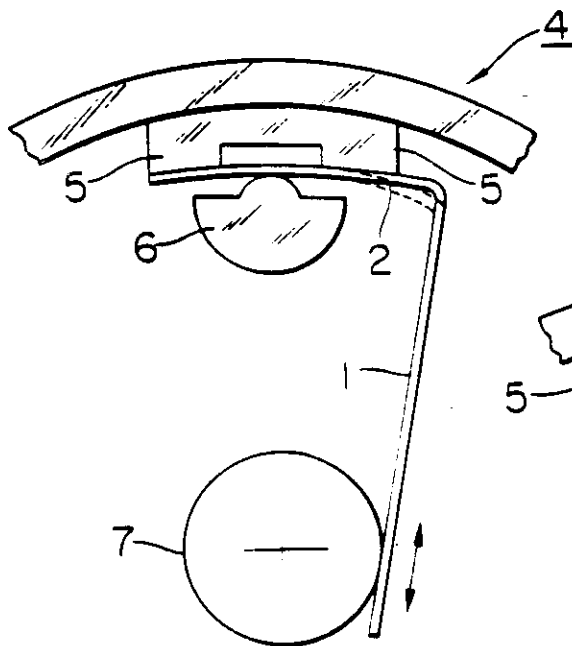


FIG. 3

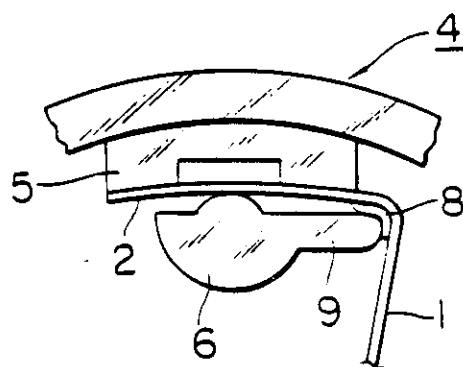


FIG. 4

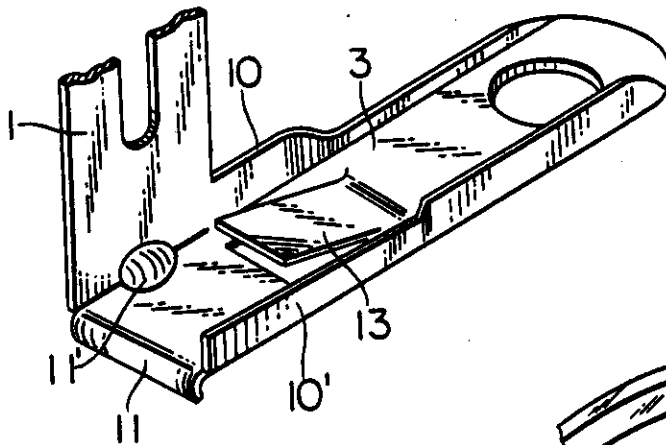


FIG. 5

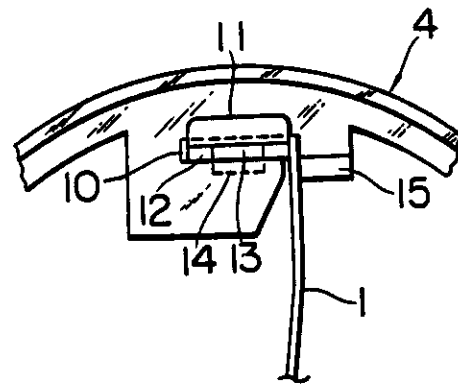


FIG. 6

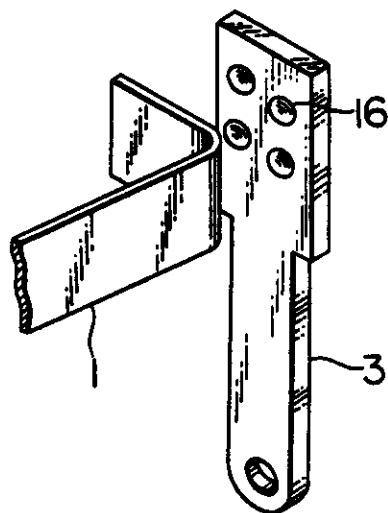
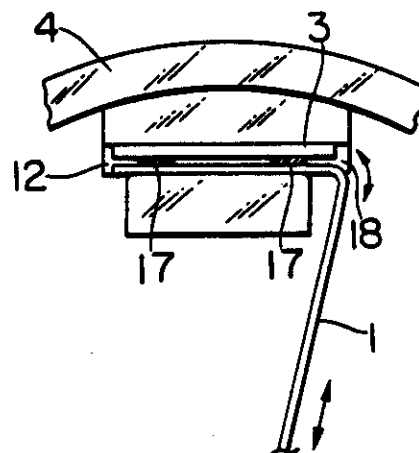
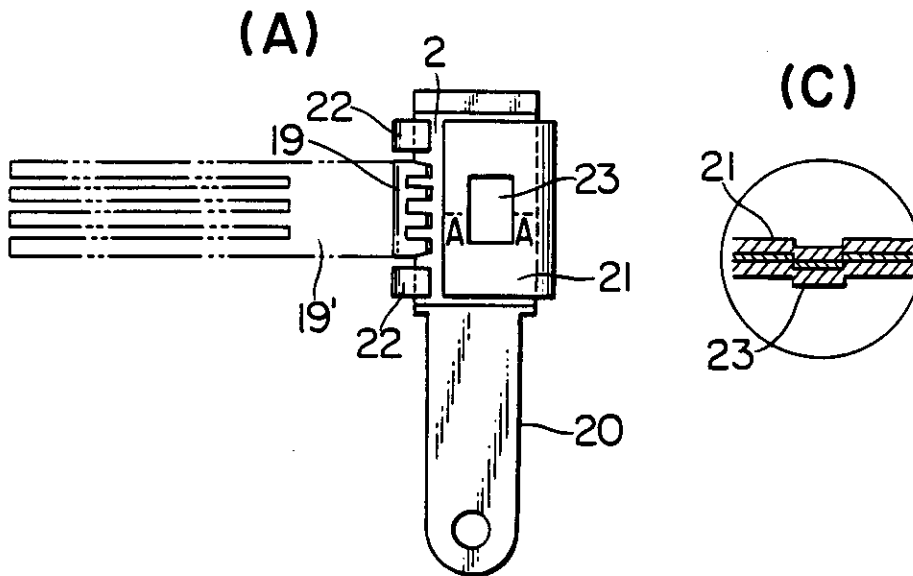


FIG. 7



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FIG. 8



(B)

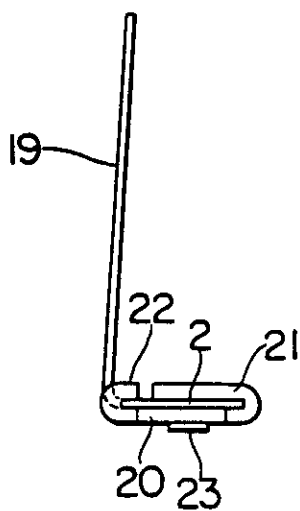


FIG. 9

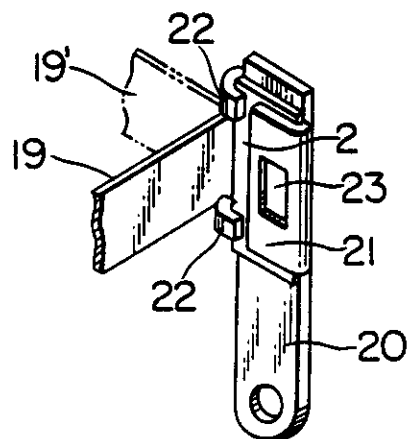


FIG. 10

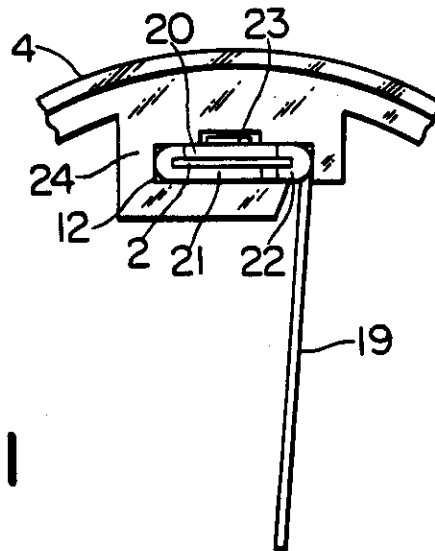
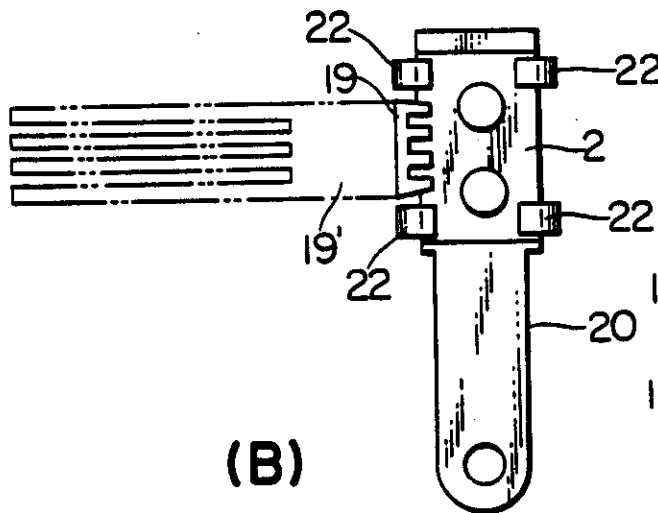


FIG. 11

(A)



(B)

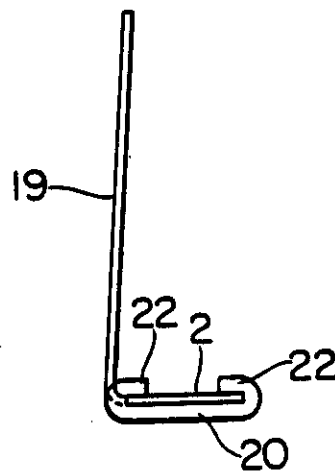
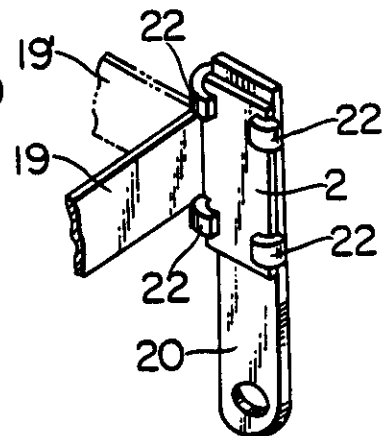


FIG. 12



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BRUSH GEAR

This invention relates to brush gear and to brushes therefor.

As we shall explain in more detail below with reference to Fig. 1 to 7, there have been numerous
5 prior proposals for brushes for electric motors and particularly for small electric motors, of the kind in which previously proposed brushes exhibit a number of problems which we have sought to overcome.

In accordance with the present invention, we
10 provide a brush for an electric motor, comprising a terminal strip, providing a terminal, and a brush strip; the terminal strip and brush strip being formed of separate electrically conductive metal strips and being joined together into one piece by joining members integral
15 with the terminal strip and bent to wrap around at least one edge of said brush strip; the brush strip comprising a brush base in facial contact with said terminal strip, and a brush base in facial contact with said terminal strip, and a brush arm extending from said brush base at
20 one side edge of said terminal strip.

The invention also provides brush gear comprising a plurality of the said brushes and a brush holder therefor made of a synthetic resin and having terminal holes into which the terminals are inserted. The terminal holes are
25 preferably configured so as to receive with a force fit the joined portion where the joining means are wrapped around the brush base.

The invention is hereinafter more particularly described by way of example only with reference to the
30 accompanying drawings, in which:-

Fig. 1 is a perspective view of a previously proposed embodiment of brush;

Fig. 2 is a front elevational view showing the brush of Fig. 1 in use;

Fig. 3 is a scrap view similar to Fig. 2 showing a modified arrangement of brush and holder;

Fig. 4 is a perspective view of part of a second previously proposed embodiment of brush;

5 Fig. 5 is a front elevational view showing the brush of Fig. 4 received in a brush holder;

Fig. 6 illustrates one way in which a brush could be formed as two elements and joined together;

10 Fig. 7 is an explanatory view for the purpose of explaining the shortcomings of an embodiment of brush joined as shown in Fig. 6;

Fig. 8 shows in plan (A), side elevation (B) and scrap section (C) an embodiment of brush constructed in accordance with the present invention;

15 Fig. 9 is a perspective view of the brush of Fig. 8;

Fig. 10 is a side elevational view showing how a brush in accordance with the present invention may be held in a brush holder;

20 Fig. 11 shows in plan (A) and in side elevation (B) a second embodiment of brush constructed in accordance with the present invention; and

Fig. 12 is a perspective view of the brush of Fig. 11.

25 In order that the present invention can be seen properly in its context, it is deemed helpful to review its antecedents.

Figs. 1 and 2 illustrate a simple embodiment of conventional brush gear. The brush shown in Fig. 1
30 comprises a brush arm 1, a brush base 2 and a terminal 3, all integrally formed of a thin electrically conductive metal strip. The brush is three-point supported at the brush base 2 on a motor case side plate 4 made of a synthetic resin by means of first support means 5, 5 and
35 by second support means 6. The brush arm 1 is adapted to make elastic contact with the commutator 7, as shown in Fig. 2. Though not shown in the figure, the terminal

3 is passed through the motor case side plate 4 and led out for external connection.

The brush gear should keep the brush arm 1 in good contact with a commutator, such as 7, at all times. How the brushes are supported, how vibrations due to the rotation of the commutator may arise, and how the pushing force applied on to the commutator 7 is selected may all affect performance. In small motors where marked improvements have recently been made to ensure the roundness of the commutator, brushes have been increasingly constructed of thin resilient electrically conductive metal strips to improve the contact properties thereof to ensure positive contact with unwanted grooves on the commutator while minimizing the pushing force of the brush arm 1 on to the commutator 7. The thinner the brushes, the lower becomes the strength of each portion of the brushes. We have found that this may result in unstable support of the brush, or unwanted vibrations due to the revolution of the commutator 7. The unwanted vibrations are caused by a pulling or pushing force exerted in the direction shown by arrows in Fig. 2 by the frictional resistance of the brush arm 1 with the revolving commutator 7. That is, when the commutator 7 revolves clockwise, the brush arm 1 is pulled downward, causing the brush base 2 to warp into a shape shown by dotted lines in the figure (the reverse is the case with counter-clockwise revolution of the commutator). And, as the warpage of the brush base 2 exceeds a given limit, the brush arm 1 is rapidly returned to its original state. As the abovementioned warpage and restoration is repeated in this way during the revolution of the commutator 7 vertical movements in the brush arm 1 result: that is, unwanted vibrations.

To overcome this problem, various improvements have been proposed for brushgear, including proposals of the present applicants. For example, the present applicants have proposed an improvement wherein a rein-

forcement 8 is provided by embossing at the bent portion of the brush arm 1 and the brush base 2 and an auxiliary support means 9 is provided to support the reinforcement 8, as illustrated in Fig. 3, so as to prevent the vibrations of the brush arm 1 in the direction shown by arrows in Fig. 2. Other improvements have also been proposed, as shown in Figs. 4 and 5. Bent portions 10 and 10' and reinforcing portions 11 and 11' are provided on the brush not only to reinforce the terminal 3 but also to reinforce the rigidity of the whole brush. Fig. 5 shows a brush so reinforced held in position in a support means provided on a motor case side plate 4. A shouldered portion 14 is provided on the internal wall of the terminal hole 12 and caused to engage with the tip of a cut and raised portion 13 formed in terminal 3 as shown in Fig. 4 to prevent the brush from becoming detached. Furthermore, the side edge at the foot of the brush arm 1 is supported by the seat 15 to prevent the brush arm 1 from loosening and twisting (as described in Japanese Patent Unexamined Publication No. 71253-82).

We have described above with reference to Figs. 1 to 5 a number of conventional forms of brush gear which have been proposed by the present applicants. In these arrangements, the brush is integrally formed from a metal strip formed of a material having good electrical conductivity and high resiliency. The most suitable materials have been found to be phosphor bronze or beryllium bronze. Though these materials are very suitable for the brush arm where substantial resiliency is required, we have found that such materials are less suitable when formed into terminals as we have found that there is a tendency for these materials to be somewhat brittle or to be relatively difficult to solder when making external connections to an electrical circuit.

This consideration has led us, notwithstanding the

weight of prior art directed towards one piece metal strip brushes, to consider whether as a satisfactory alternative a brush formed of two metal strips would provide a satisfactory alternative. Materials such as copper or brass which are electrically conductive and relatively easy to solder and flexible enough to withstand repeated bending are, we find, much more suitable for use as terminals than the materials mentioned hereinabove. We have considered the possibility of riveting two strips of dissimilar material together or of spot welding strips of dissimilar material together.

We have found that both these arrangements have disadvantages. In riveting additional parts and manufacturing steps are involved. There is a difficulty in spot welding phosphor bronze or beryllium bronze with copper or brass. Moreover, our experiments suggest that when brushes are formed in this way, the configuration which results may produce an arrangement in which unwanted vibrations still occur.

This is illustrated by reference to Figs. 6 and 7 in which Fig. 6 shows a plurality of spot welding locations 16 and Fig. 7 shows the resultant brush held in a terminal hole 12 of a brush holder. The spot welded portions are shown at 17 in Fig. 7. It will be noted that a gap 18 results between the two strips at their edge in the join. A similar gap tends also to arise if the strips are joined by rivets. Because of the production of this gap 18, unwanted vibrations in the brush arm may result in the same manner as described above with reference to the arrangement of Figs. 1 and 2.

Reference will now be made to Figs. 8 to 12 which show a plurality of embodiments constructed in accordance with the present invention. Where appropriate, like reference numerals to those used in Figs. 1 to 7 are employed for the parts of the embodiments shown in Figs. 8 to 12.

The brush shown in Fig. 8 is formed of a first brush strip comprising a brush base 2 and a brush arm 19 bent from the position shown at 19' in phantom lines at an angle to the brush base, and a second terminal strip 20. The brush strip is formed of a highly resilient, relatively thin and electrically conductive metal strip material, as for example of beryllium bronze having a thickness of 0.07 mm. The terminal strip is formed of a relatively thicker and electrically conductive metal strip material which is easy to solder and sufficiently flexible to withstand repeated bending. A suitable material is brass having a thickness of 0.3 mm. Both strips are suitably formed by stamping from a sheet of the appropriate material. Terminal strip 20 is formed with integral joining means to be described below. In order to join the two strips together the brush base 2 is placed upon the terminal strip and joining members such as large joining member 21 and two smaller joining members 22 shown in Fig. 8 are bent about the adjacent edges of the brush base 2 so as to be wrapped therearound to form the two strips into one piece. To ensure a tight join, a portion 23 of the large joining member 21 may be deformed inwardly into the material of the brush strip as best shown in the scrap sectional view of Fig. 8(C).

Fig. 10 shows how a brush as constructed in Figs. 8 and 9 may be mounted in a brush holder. A motor case side plate 4 provides a brush holder 24 including a terminal hole 12 into which the terminal strip is inserted so as to extend to the exterior of the motor case. Terminal hole 12 is configured so that its width is slightly less than the width of the brush at the portion where the terminal strip and brush base are joined. In other words, the width of the terminal hole 12 is slightly less than the combined thickness of the terminal strip 20, the brush base 2 and the joining

members. Thus, the portion at which the two strips are joined may be received as a force fit in the terminal hole providing for positive securement without any special engaging means. It will be apparent from Fig. 10
5 that unwanted vibration of the brush arm as described hereinabove with reference to Fig. 2 cannot arise.

A second embodiment of brush constructed in accordance with the present invention is illustrated in Figs. 11 and 12. As will be seen, the terminal strip
10 20 is provided with four small joining members 22 integrally therewith. These joining members are bent and wrapped around the edges of the brush base 2 as shown. The brush base 2 and terminal strip 20 may additionally be spot welded to ensure a firm join or may
15 be deformed in a manner similar to the deformation 23 in the embodiment of Figs. 8 and 9 where the two strips overlap.

CLAIMS

1. A brush for an electric motor, comprising a terminal strip, providing a terminal, and a brush strip; the terminal strip and brush strip being formed of separate electrically conductive metal strips and being
5 joined together into one piece by joining members integral with the terminal strip and bent to wrap around at least one edge of said brush strip; the brush strip comprising a brush base in facial contact with said terminal strip, and a brush arm extending from said brush base at one side
10 edge of said terminal strip.
2. A brush according to Claim 1, wherein said terminal strip is formed of a relatively thick, electrically conductive metal strip of a material which is easy to solder and sufficiently flexible to withstand bending.
- 15 3. A brush according to Claim 1 or Claim 2, wherein said brush strip is made of a highly resilient, relatively thin and electrically conductive metal strip.
4. A brush according to any preceding claim, wherein said joining members comprise a large joining member bent
20 around one edge of said brush base and a plurality of small joining members bent about one or more other edges of said brush base.
5. A brush according to Claim 4, wherein, following bending of said large joining member to wrap around said
25 brush base, a portion of the material of said large joining member is deformed into the material of said brush base to enhance the join between said terminal strip and said brush strip.
6. A brush according to any of Claim 1 to 3, wherein
30 said joining members comprise a plurality of similar joining members adapted to be bent about a plurality of edges of said brush base.

7. A brush according to any preceding claim, wherein said terminal strip and said brush strip are additionally spot welded to enhance said join.
 8. Brush gear comprising a brush holder made of synthetic resin, and a plurality of brushes according to any preceding claim held therein by insertion of the said terminal into a respective terminal hole.
 9. Brush gear according to Claim 8, wherein said terminal hole is configured to receive said terminal so as to extend therethrough, and the joined portion where said joining members are wrapped around said brush base in a force fit, whereby firmly to support said brushes.
 10. A brush for an electric motor substantially as hereinbefore described with reference to Figs. 8 to 12 of the accompanying drawings.
 11. Brush gear substantially as hereinbefore described with reference to and as shown in Figs. 8 to 12 of the accompanying drawings.
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REGISTER ENTRY FOR GB2127233

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Priority claimed:

30.08.1982 in Japan - doc: 57130936U

Title BRUSH GEAR

Applicant/Proprietor

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Classified to

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H01R

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Patent Granted with effect from 25.06.1986 (Section 25(1)) with title BRUSH
GEAR

**** END OF REGISTER ENTRY ****