COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952–1973

APPLICATION FOR A PATENT

I/We JOHNSON ELECTRIC INDUSTRIAL MANUFACTORY, LIMITED

of Johnson Building, 14–16 Lee Chung Street, Chaiwan, HONG KONG

hereby apply for the grant of a Patent for an invention entitled:

A METHOD OF CONNECTING AN ARMATURE WINDING TO A COMMUTATOR SEGMENT

which is described in the accompanying complete specification. This Application is a Convention Application and is based on the Application(s) numbered: 8706166 for a Patent or similar protection made in Great Britain on 16 March 1987.

My/Our address for service is:

GRIFFITH HASSEL & FRAZER
71 YORK STREET
SYDNEY N.S.W. 2000
AUSTRALIA

DATED this 27th day of August, 1987.

JOHNSON ELECTRIC INDUSTRIAL MANUFACTORY, LIMITED

By his/their Patent Attorneys

GRIFFITH HASSEL & FRAZER

TO: THE COMMISSIONER OF PATENTS
COMMONWEALTH OF AUSTRALIA
COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT

(Name of applicant)

In support of an application made by: Johnson Electric Industrial...Manufactury, Limited...for a patent for an invention entitled: A Method of Connecting an Armature Winding to a Commutator Segment...

(Title)

1. Patrick Shui-Chung Wang, Officer of care of and on behalf of Johnson Electric Industrial Manufactury, Limited of Johnson Building, 14-16 Lee Chung Street, Chaivan, Hong Kong...

do solemnly and sincerely declare as follows:

1. I am authorised by the above mentioned applicant for the patent to make this declaration on its behalf.

2. The name and address of each actual inventor of the invention is as follows: Patrick Shui-Chung Wang, 22 Belleview Drive, 10/F., Repulse Bay Garden, Repulse Bay, Hong Kong, and the facts upon which the applicant is entitled to make this application are as follows: The Applicants are the assignees of the inventor in respect of the invention.

3. The basic application(s) as defined by Section 141 of the Act was (were) made as follows:
Country: Great Britain on 16 March, 1987, in the name(s) Johnson Electric Industrial Manufactury, Limited and in the name(s)...

4. The basic application(s) referred to in the preceding paragraph was(were) the first application(s) made in a Convention country in respect of the invention the subject of this application.

(Place and date of signing)

Declared at Hong Kong this 11th day of June, 1987.

Signed: [Signature]

Position: [Position]

GRIFFITH HASSEL & FRAZER
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The present invention seeks to provide a method of connecting an armature to a commutator segment without the need to provide the terminals with cutters.

1. A method of connecting an armature winding to a commutator segment, the commutator segment being provided with an integral terminal having a slot which is open at one end for receiving a portion of the armature winding and which is arranged so as in use to straddle and grip said winding portion to establish and maintain electrical contact between the terminal and the winding portion, the method comprising the steps of:-

(a) removing insulation from at least part of said winding portion, and
(b) subsequent to step (a), moving the terminal and the winding portion relative to one another so that a bared part of the winding portion enters the slot and the slot straddles and grips the bared part of said winding portion to establish and maintain electrical contact between the terminal and the winding portion.

8. An armature made according to the method set forth in any one of the preceding claims.
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PATENTS ACT 1952

COMPLETE SPECIFICATION

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
   Lodged:

Complete Specification—Lodged:
   Accepted:
   Lapsed:
   Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: JOHNSON ELECTRIC INDUSTRIAL MANUFACTORY, LIMITED

Address of Applicant: Johnson Building, 14-16 Lee Chung Street, Chaiwan, HONG KONG

Actual Inventor: Patrick Shui-Chung Wang

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Complete Specification for the invention entitled:

A METHOD OF CONNECTING AN ARMATURE WINDING TO A COMMUTATOR SEGMENT

The following statement is a full description of this invention, including the best method of performing it known to me/us:—
A method of connecting an armature winding to a commutator segment

This invention relates to a method of connecting an armature winding to a commutator segment.

In our British Patent No.2128818B we describe a connection between the armature winding and a commutator segment which avoids the application of heat to effect the connection and which utilises the principle of insulation displacement in which a wire having an insulating cover is forced into a slot narrower than the wire diameter to form a clean metal to metal contact between the wire and a terminal integral with the commutator segment.

The terminals described in the aforesaid patent are provided with cutters to sever the insulation on the wire as the wire is moved into the slot.

The present invention seeks to provide a method of connecting an armature to a commutator segment without the need to provide the terminals with cutters.
According to the present invention, there is provided a method of connecting an armature winding to a commutator segment, the commutator segment being provided with an integral terminal having a slot which is open at one end for receiving a portion of the armature winding and which is arranged so as in use to straddle and grip said winding portion to establish and maintain electrical contact between the terminal and the winding portion, the method comprising the steps of:

(a) removing insulation from at least part of said winding portion, and

(b) subsequent to step (a), moving the terminal and the winding portion relative to one another so that a bared part of the winding portion enters the slot and the slot straddles and grips the bared part of said winding portion to establish and maintain electrical contact between the terminal and the winding portion.

Preferably, the armature comprises a housing for said terminal. In this case, said winding portion may be located in said housing prior to step (b) and in performing step (b) the terminal is inserted into
said housing such that the slot straddles and grips said bared part of said winding portion.

Conveniently, step (a) is performed after the winding portion is located in said housing.

5 Preferably, the armature has a plurality of housings and insulation is removed from winding portions in each of said housings simultaneously.

The invention also resides in an armature made according to the aforesaid method.

The invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows in plan view a body forming part of the armature and is partially sectioned to illustrate the configuration of one of the connection housings with a wire laid therein,

Figure 2 is a plan view of a commutator segment and terminal in blank form,
Figure 3 is an elevation of the commutator segment terminal of Figure 2 showing the operational configuration of the commutator segment and terminal, and

Figure 4 is a vertical sectional view of the body of figure 1 showing the commutator segment and terminal of Figures 2, 3 and 4, when attached to the body.

Figures 1 to 4 illustrate one embodiment of the invention in which the commutator has five segments. Five connections to the armature winding are required.

Figure 1 shows a moulded plastics body 10. The body 10 has three sections, 12, 14 and 16, and is essentially a hollow cylinder with additional structures provided on its external surface, in its middle section 14. The shaft of an armature (not shown) passes through the body 10 and the portion 16 is a spacer which spaces the middle section 14 of the body 10 from the base of the armature stacks (not shown).

The middle portion 14 of the body 10 has five housings 18 equally spaced around the circumference of the body 10. Each of the housings 18 is used in
effecting connection between a respective portion of the armature winding and one of the commutator segments.

Section 12 of the body 10 provides support for the commutator segments.

One of the housings 18 is shown in section in Figure 1. The housing 18 has side walls 20, an end wall 22 and a cover 24. The end wall 22 is adjacent the spacer 16 and an opening 26 which faces the commutator support 12 is provided by the walls 20, 22 and cover 24. The side walls are parallel with the longitudinal axis of the body 10.

A boss 28 projects centrally from the internal surface of the end wall 22 and extends within the housing 18 for approximately half the length of the side walls 20. The boss 28 extends parallel with the longitudinal axis of the body 10 and is only connected to the body 10 by the end wall 22. Each side wall 20 of the housing 18 has a slot 30 which extends parallel to the longitudinal axis of the body 10, from the commutator end of the housing 18 for a length which terminates at the level of the free end of the boss 28. A portion 32 of the armature winding
is passed through the slots 30 of one of the housings 18 and the winding portion 32 rests on the end of the boss 28. The external surfaces of the side walls 20 are bevelled so as to facilitate entry of the winding portion 32 into the slots 30.

The combined commutator segment 34 and terminal 36 are illustrated in Figures 2 and 3. Figure 2 shows the combination in the form of a blank and Figure 3 is an end elevation of the combination when formed into its operational configuration. The commutator segment 34 has a base 38 which carries a copper overlay 40. The base 38 can be of spring quality brass or steel providing the terminal with some degree of give should it be necessary to make the body 10 of a thermosetting plastics. A lug 42 of reduced width is provided at the front end of the base 38 and the lug 42 has a central struck-up tag 44.

At its rear end, the base 38 of the commutator segment 34 is connected to the terminal 36. The terminal 36 is rectangular with its minor axis coincident with the longitudinal axis of the commutator segment 34. The terminal 36 has a central cut out portion 46 which is symmetrical with respect to both the major and minor axis of the terminal 36.
The cut out 46 reduces from its largest width at the centre of the terminal to two key hole shaped portions 48 which terminate either end of the cut out 46. A triangular barb 50 is provided on either side of the minor axis of the terminal 36 along the edge furthest from the commutator segment 34.

As can be seen from Figure 3, the base 38 and the overlay 40 of the commutator segment 34 are of arcuate form which conforms to the external radius of the commutator support section 12 of the body 10. The lug 42 extends below the base 38 and back along the length of the commutator section 34 with the tag 44 projecting below the lug 42. Terminal 36 is bent upright from the commutator segment 34 and the arms 52 of the terminal 36, which include the respective key hole formations 48, are bent at 90 degrees to the central portion 54 of the terminal. The arms 52 therefore extend parallel to each other and to the longitudinal axis of the commutator segment 44, and forward along the length thereof. The free ends 56 of the terminal 36 are bent so as to be inclined towards each other when the arms 52 have been bent parallel to each other.
The reduction in size from the centre of the cut portion 46 to the start of the key hole portion 48 provides a funnel for guiding the arm 52 onto the winding portion 32. Circular end 66 of cut out 48 ensures that the edges of the cut out 48 have a certain resilience to separation by the armature portion 32.

The front end of the body 10 is provided with five longitudinal recesses 70 which are cut away at the forward ends so as to meet the curved external surface of the commutator supporting section 12.

The armature is assembled in the following manner.

The body 10 is placed on the armature shaft with the spacer 16 against the base of the lamination stack. The lead wire of the armature winding is inserted into the housing 18 by laying the end of the wire 32 in the slots 30 provided in the side wall 20 of the housing 18. The wire 32 is drawn back into the housing 18 until it rests against the boss 28. From this start, the first armature coil is wound. At the end of the first coil winding the armature is indexed
and the wire 32 is laid in the same manner in the next housing 18 without breaking the continuity of the wire 32.

This process is repeated until all coils have been wound and the tail end of the winding is then laid in the slots 30 of the first housing 18 and pushed back until it is adjacent to the lead end which was placed against the boss 28 at the beginning of the winding operation. The wire 32 is then cut and the armature removed from the winding machine. In the event that difficulty is encountered in removing the insulation on both the lead and tail ends of the winding, these may be laid in a double housing and the commutator segment co-operating therewith may have two terminals for respective engagement with each end of the winding.

The body 10 now has a winding portion 32 comprising insulated wire (e.g. enamel coated wire) laying in each of the housings 18. Each of the winding portions 32 is under tension and is pulled tight against the respective boss 28.
A tool (not shown) then removes insulation from the winding portions at least in the regions where the arms 52 of the terminals 36 are to make contact with the winding portions. Preferably, the tool removes the insulation from all winding portions simultaneously. Whilst it is envisaged that the tool will remove the insulation by severing and displacing the insulation other methods of removing the insulation may be considered and are included within the scope of the invention.

The commutator segments 34 are then placed on the supporting section 12 of body 10 and are slid along the sections 12 so that the terminals 36 enter respective housings 18 and the lugs 42 enter the respective recesses 70.

As the terminal 36 approaches the winding portion 32 held in the housing 18, the slots provided by cut outs 48 move over bared parts of the wire 32 whilst the central portion 54 of the terminal 36 passes over the boss 28. The slots are narrower than the wire diameter and intimate metal to metal contact is therefore provided between the wire 32 and the terminal 36. The barbs 50 grip the cover 24 of the housing and therefore retain the terminal in the
housing. Additional retention may be provided by contact between the central portion 54 of the terminal and the boss 28. The arms 52 of the terminal 36 act as double cantilever springs and exert a continuous pressure on the wire 32. As the terminal 36 enters the housing 18, lug 42 of commutator segment 34 enters the recess 70 and tag 44 is forced into the material of the body 10 so as to rigidly restrain the lug 42 within the recess 70.

The commutator segment is thus held rigidly against section 12 of the body 10.

The above embodiment is given by way of example only and various modifications will be apparent to a person skilled in the art without departing from the scope of the invention. For example, the commutator could be a face plate commutator similar to that described in our co-pending British Patent Application No.8629625. The insulation could be removed from the winding portion just prior to laying the latter in a housing. The open end of the slot could face away from the armature stack so that the winding portion could be drawn into the slot during winding of armature, although in this case the winding operation will need to be suspended each time it is necessary to remove insulation.
The invention is particularly but not exclusively applicable to armature windings of fractional horsepower electric motors.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of connecting an armature winding to a commutator segment, the commutator segment being provided with an integral terminal having a slot which is open at one end for receiving a portion of the armature winding and which is arranged so as in use to straddle and grip said winding portion to establish and maintain electrical contact between the terminal and the winding portion, the method comprising the steps of:

(a) removing insulation from at least part of said winding portion, and

(b) subsequent to step (a), moving the terminal and the winding portion relative to one another so that a bared part of the winding portion enters the slot and the slot straddles and grips the bared part of said winding portion to establish and maintain electrical contact between the terminal and the winding portion.

2. A method as claimed in claim 1, wherein the armature comprises a housing for said terminal.
3. A method as claimed in claim 2, wherein said winding portion is located in said housing prior to step (b) and in performing step (b) the terminal is inserted into said housing such that the slot straddles and grips said bared part of said winding portion.

4. A method as claimed in claim 3, wherein step (a) is performed after the winding portion is located in said housing.

5. A method as claimed in claim 4, wherein the insulation is removed from said winding by a cutting tool inserted into the housing.

6. A method as claimed in claim 4 or claim 5, wherein the armature has a plurality of housings and wherein insulation is removed from winding portions in each of said housings simultaneously.

7. A method of connecting an armature winding to a commutator segment, substantially as hereinbefore described with reference to the accompanying drawings.

8. An armature made according to the method set forth in any one of the preceding claims.
9. An electric motor comprising an armature as claimed in claim 8.

10. A method of connecting an armature winding to a commutator segment substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 27th day of August 1987

JOHNSON ELECTRIC INDUSTRIAL MANUFACTORY, LIMITED
By their Patent Attorney
GRiffITH HASSEL & FRAZER