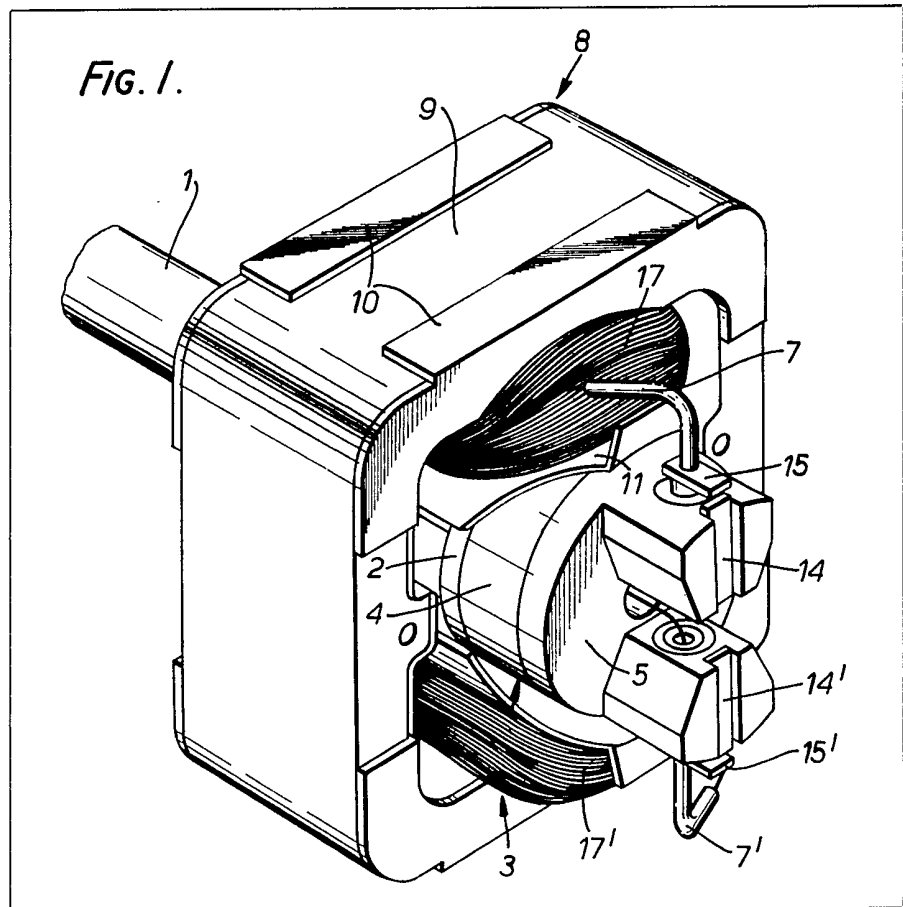


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(54) A wire guiding head for winding stator coils

(57) A wire guiding head 3 for an apparatus for winding a stator 8 of an electric machine, which stator is provided with coil supports 11, 11', enables winding to be performed without winding formers and associated elements. The wire guiding head 3 is mounted on a reciprocably movable winding tube 1 which may be rotated and carries bearings allowing pivoting of radially outwardly projecting winding nozzles 7, 7' (having their ends bent through 90°) which are located during winding between the inner surface of the laminated yoke 9 and the outer surfaces of the stator poles. An accurate application of the wire in layers takes place directly on the surfaces of the coil supports 11, 11'.



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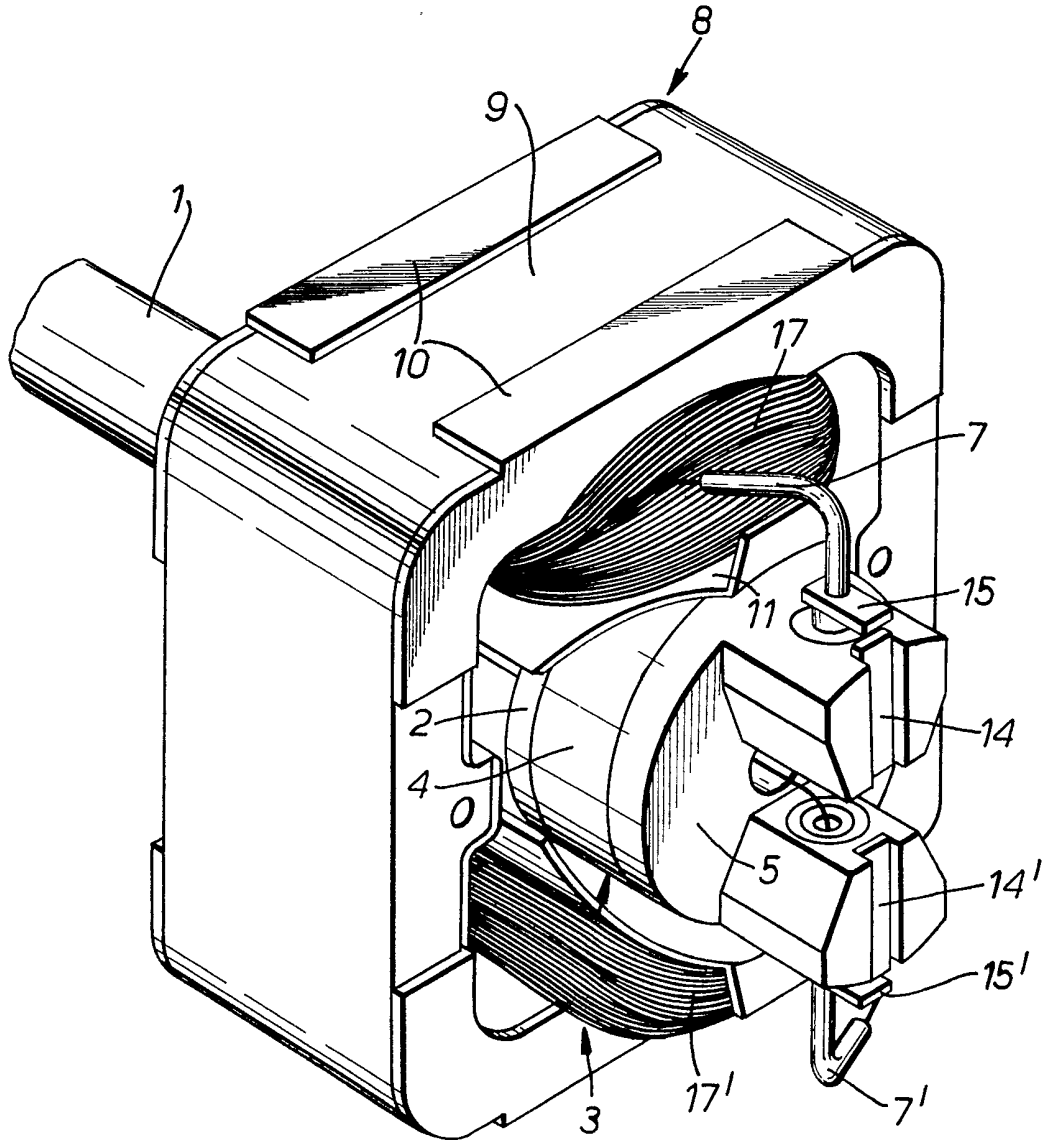
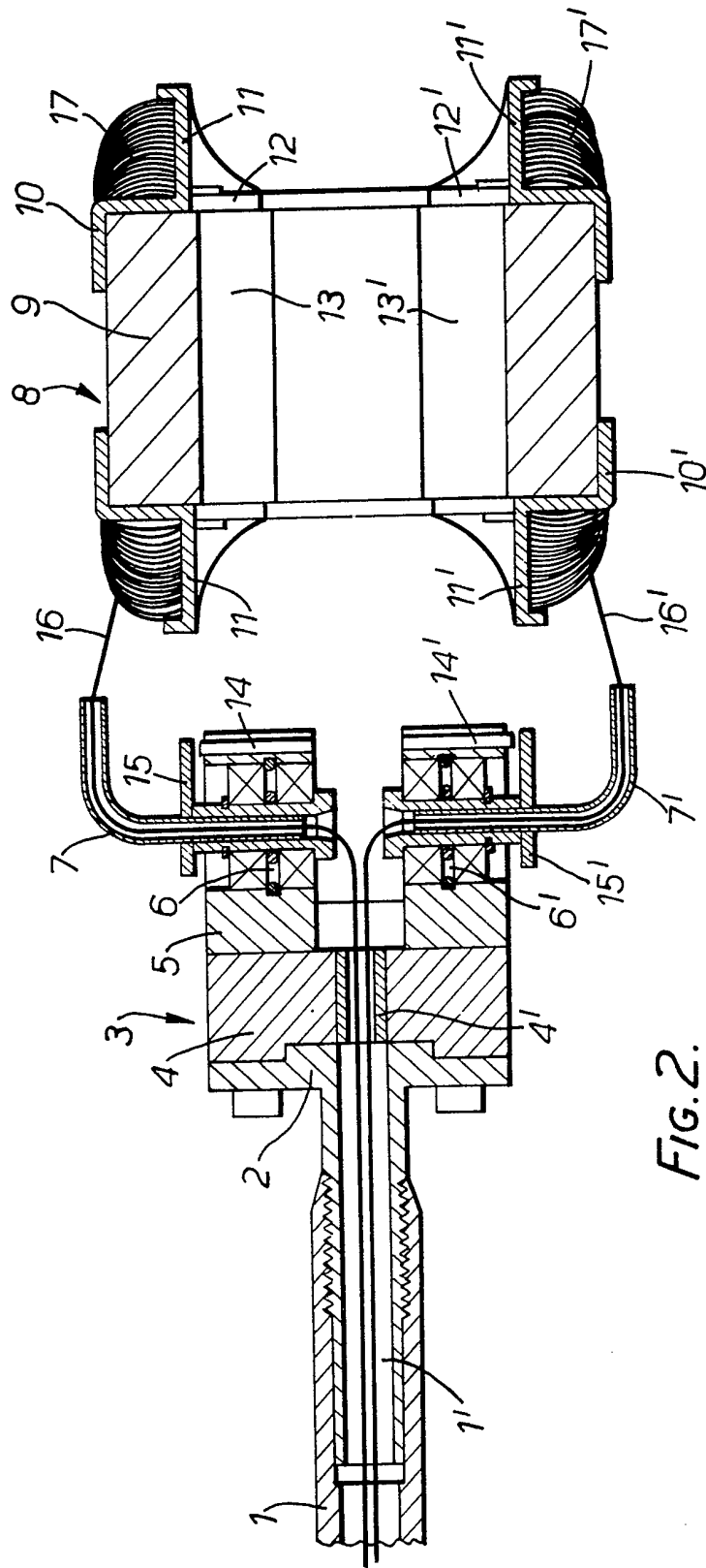


Fig. 1.



## SPECIFICATION

**A wire guiding head**

5 The invention concerns a wire guiding head for an apparatus for winding stators of electric machines provided with supports for the stator coils, the apparatus comprising an axially movable and pivotable hollow winding tube and wire guiding nozzles.

10 With known stator winding apparatus, winding formers are required for winding the stator coils over which the individual windings of the coils are slidingly guided for forming those stator coils. The winding formers must be applied to the laminated yoke and positioned and locked, and finally unlocked and unclamped once again after winding. However, before removing the wound stator from the apparatus mounting, the coil windings must be fixed to the end windings by hand, for example by adhesive tape.

15 In order to make linking up of such stator winding apparatus possible in transfer lines, coil supports have been used, for example for fixing the field coils to the stators and each of which projects outwardly from the end of the laminated yoke in the region of the poles in the form of walls formed as ring segments. In that way, the wound laminated yoke can be removed directly from the stator winding apparatus after the winding operation without additional hand grips.

20 In so doing, there is a disadvantage as previously that expensive accurately sited winding formers are required for each stator coil. A further disadvantage can be seen in the fact that often application of the wire over the winding formers without crossing cannot be guaranteed.

25 In accordance with the invention, there is provided a wire guiding head for an apparatus for winding stators of electrical machines provided with coil supports, said head being arranged on an axially movable and pivotable hollow winding tube and wire guiding nozzles being rotatably mounted in bearings and arranged to project radially with respect to the winding tube.

30 With this wire guiding head, the previously required expensive winding formers including the corresponding clamping, unclamping and locking elements are superfluous for the winding of stators, whereby the manufacturing time is also reduced.

35 By omitting the locking elements, the spaces between the laminated yoke and the inside of the winding head provided for that purpose are no longer required whereby the winding head is lower and thus the height of the electric motor is smaller and with it the use of copper in the winding is reduced.

40 The wire guiding head guarantees a more accurate application of wire directly to the walls of the supports in layers whereby a

higher filling factor is achieved with the same groove cross section.

45 An embodiment of the invention will now be described, by way of example only with reference to the accompanying drawings, in which:—

50 *Figure 1* is a perspective view of a wire guiding head in accordance with the invention and shown in the winding position; and

55 *Figure 2* is a longitudinal section through the wire guiding head.

60 A partial view of an apparatus for winding stators, for example a two-pole stator 8, is shown and comprising a hollow winding tube 1 at the end of which is arranged a fixing flange 2 receiving exchangeably a wire guiding head 3 provided with winding nozzles 7,7'. The wire guiding head 3 consists of an intermediate flange 4 of a mounting 5 which is provided, corresponding to the number of poles (for example two) with two opposite bearings 6,6' wherein the intermediate flange 4 has a bush 4' in the centre for guiding the wire and which is inserted axially in the bore 1' of the winding tube 1. The stator 8 consists in known manner of a laminated ke 9, end insulation members 10,10' provided with coil supports 11,11' and groove insulation 12,12'. Winding nozzles 7,7' are arranged radially with respect to the winding tube 1, and are rotatable in the opposite bearings 6,6', the nozzles projecting outwardly for a predetermined distance from the outsides of the bearings 6,6'. Preferably, ball bearings are provided in the bearings 6,6' for the rotatable winding nozzles 7,7'. The winding nozzles 7,7' consist of a wear resistant material and the portions of the winding nozzles 7,7' projecting out of the bearings 6,6' can be bent through about 90°, as shown. For retaining the winding nozzles 7,7' in a predetermined position after a break in the wire, permanent magnets 14,14' are provided in the mounting 5, for contact with the winding nozzles 7,7' via contact tags 15,15'.

65 The operating procedure of the apparatus, with which the stators are wound by means of the wire guiding head 3 (and without the use of winding formers), is as follows:

70 A stator 8 provided in known manner with end insulating members 10,10' including coil supports 11,11' and groove insulating members 12,12' is automatically fed to a stator winding apparatus and fixed in the winding position. The supports 11,11', which extend in the region of the poles axially outwards from the ends of the laminated yoke 9, have walls formed like ring segments for receiving the coils 17,17'. The winding of the stators takes place in the normal manner by means of the winding tube 1 which has the exchangeable wire guiding head 3 provided with two or more winding nozzles 7,7' arranged at its end. The wire guiding head 3 is moved axially to and fro in the bore of the stator 8 to be

wound. In the region of the poles, it performs an additional limited rotary movement. In this manner, the winding wires 16,16' guided in the winding tube 1 and through the bush 4' 5 in the mounting 5 of the wire guiding head 3 are passed to and fro through the stator bore in order to form each of the coils on one side and the coils 17,17' on the poles 13,13' by means of the rotary movement of the wire 10 guiding head 3, the winding wires 16,16' being applied by means of the rotatable winding nozzles 7,7' directly on both sides of the stator laminations to the walls of each of the supports 11,11'. The rotatable winding 15 nozzles 7,7' projecting from the bearings 6,6' are located during the winding in the region between the inner surface of the lamination 9 and the outer surfaces of the poles 13,13' so that an accurate application of the wire in 20 layers takes place directly against the walls of the supports 11,11'.

Since no winding formers are required during the winding, the stators 8 can be used without the otherwise required intermediate 25 spaces for the reception of the winding formers and locking elements.

#### CLAIMS

1. A wire guiding head for an apparatus 30 for winding stators of electrical machines provided with coil supports, said head being arranged on an axially movable pivotable hollow winding tube and wire guiding nozzles being rotatably mounted in bearings and ar- 35 ranged to project radially with respect to the winding tube.

2. A wire guiding head according to claim 1, in which the winding nozzles project for a predetermined distance out of the bearings 40 and then bend through about 90°.

3. A wire guiding head according to claim 1 or 2, in which the winding nozzles comprise a wear resistant material.

4. A wire winding head according to any 45 preceding claim, in which the winding nozzles are provided with contact tags for registering with permanent magnets carried by the head.

5. A wire winding head substantially as herein described with reference to the accom- 50 panying drawings.