Nov. 10, 1970 M. W. BANG 3,538,602

METHOD FOR MAKING STATORS FOR ROTARY ELECTRIC SWITCHES

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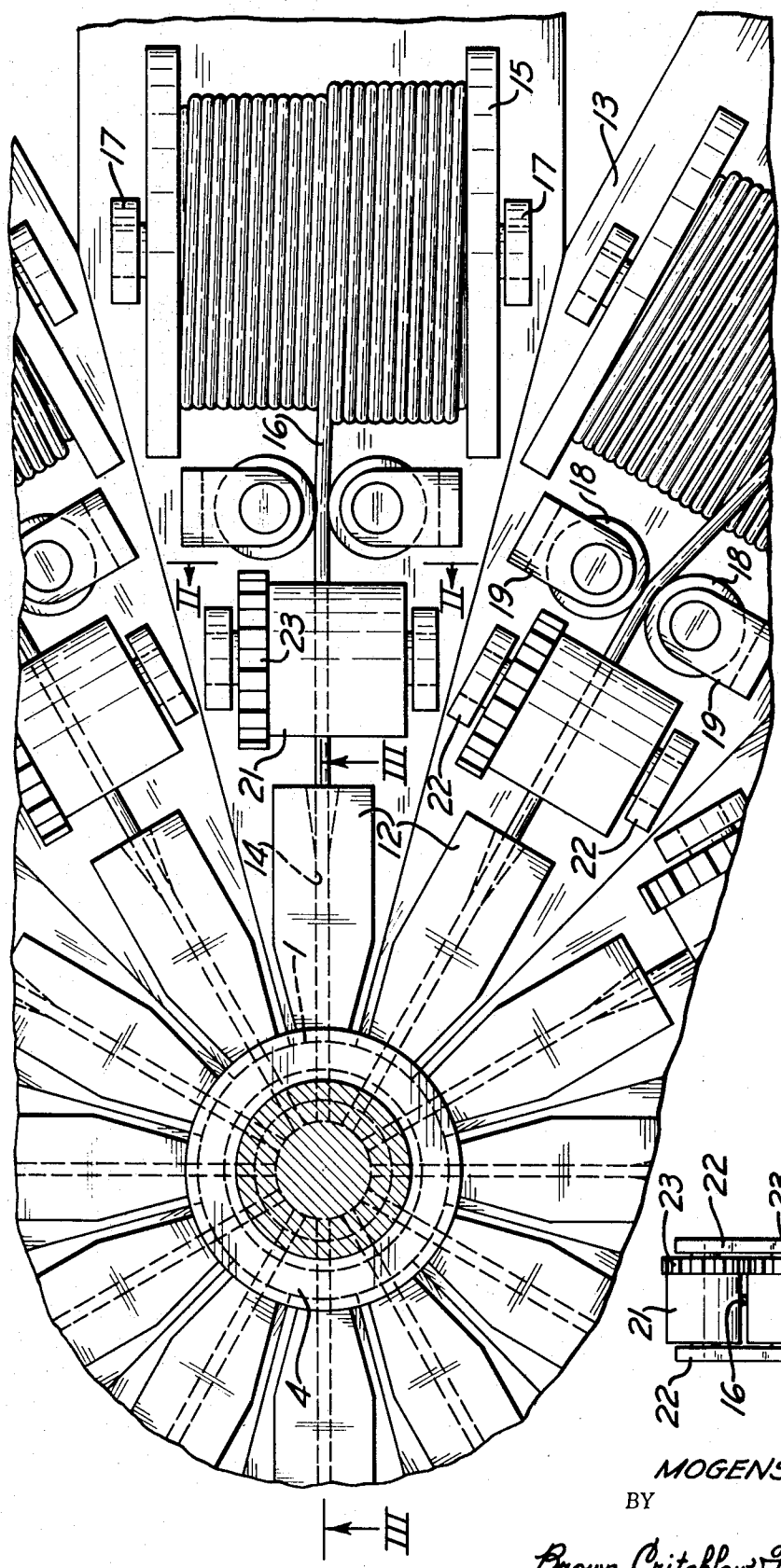


Fig. 1

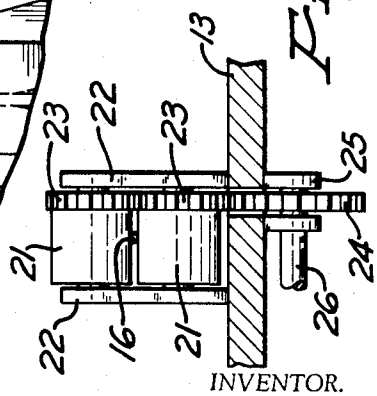


Fig. 2

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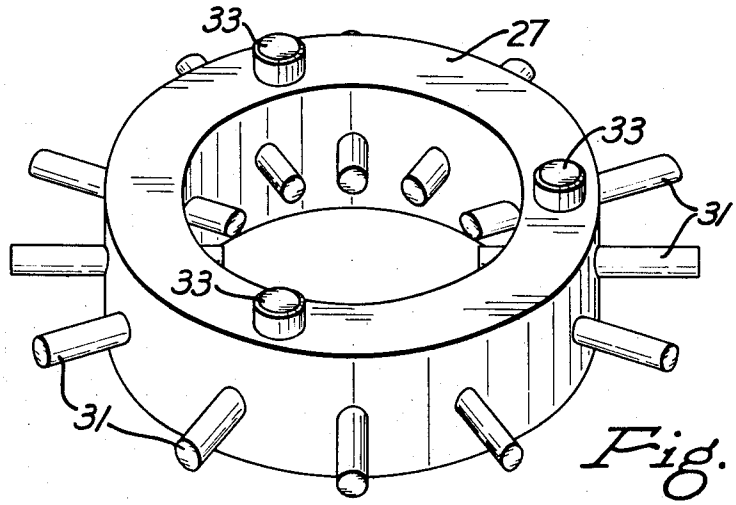


Fig. 7

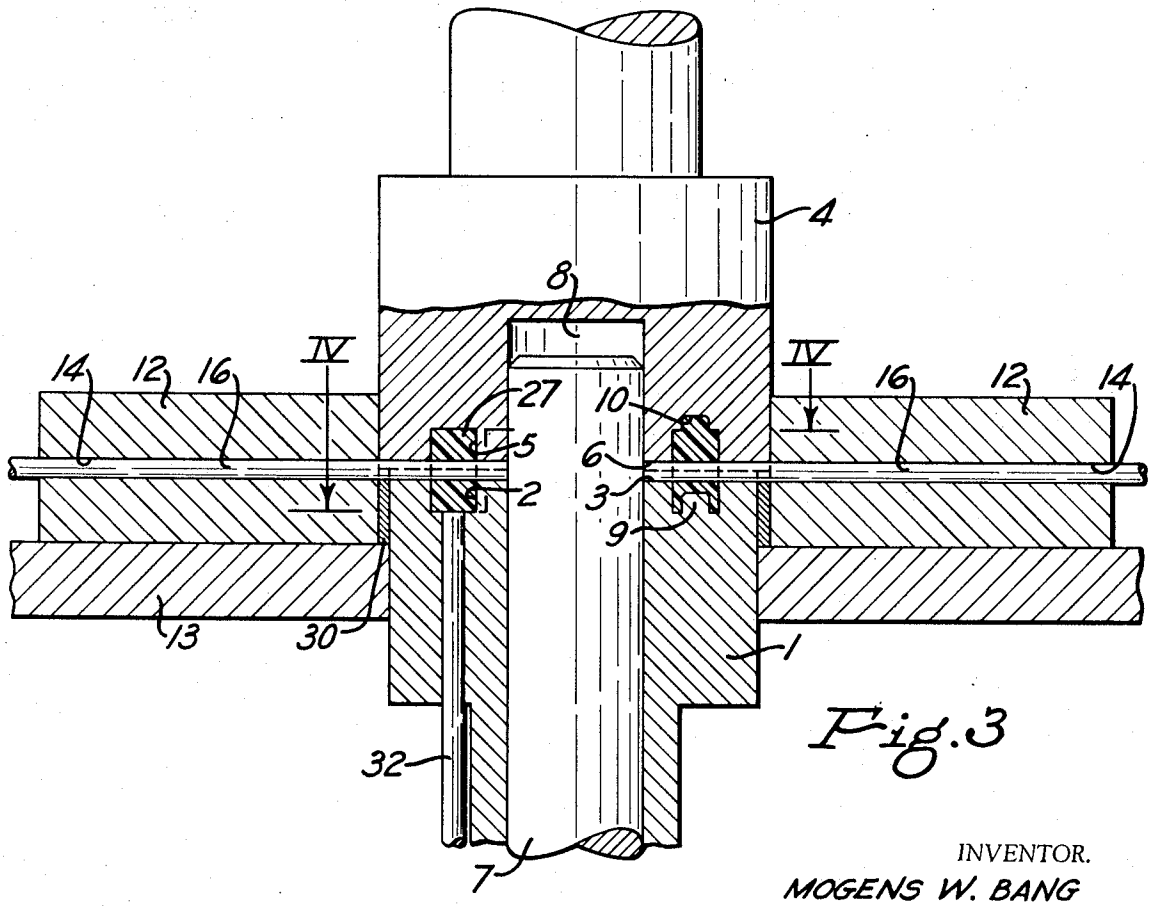


Fig. 3

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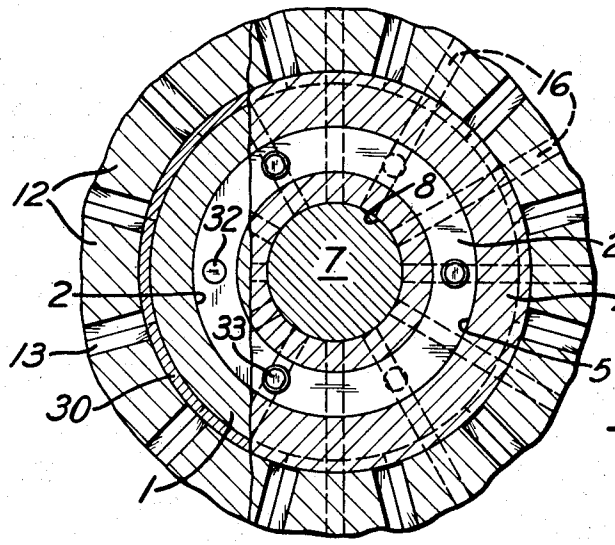


Fig. 4

Fig. 5

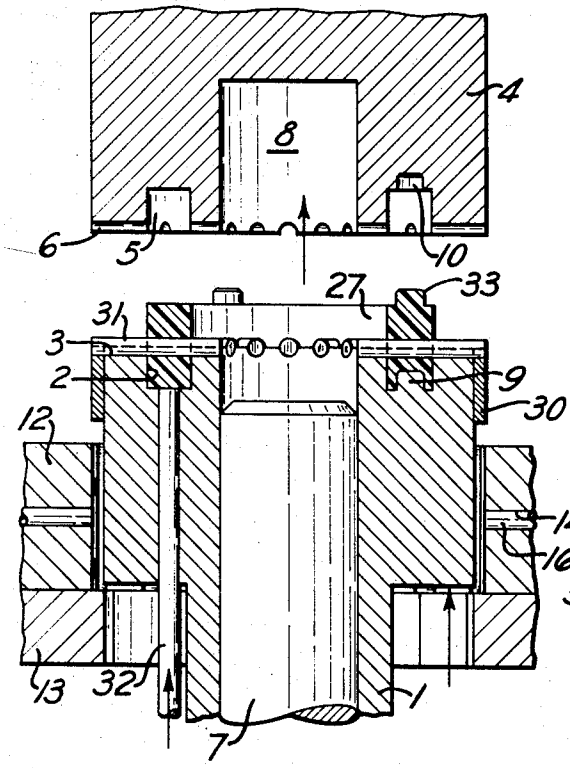
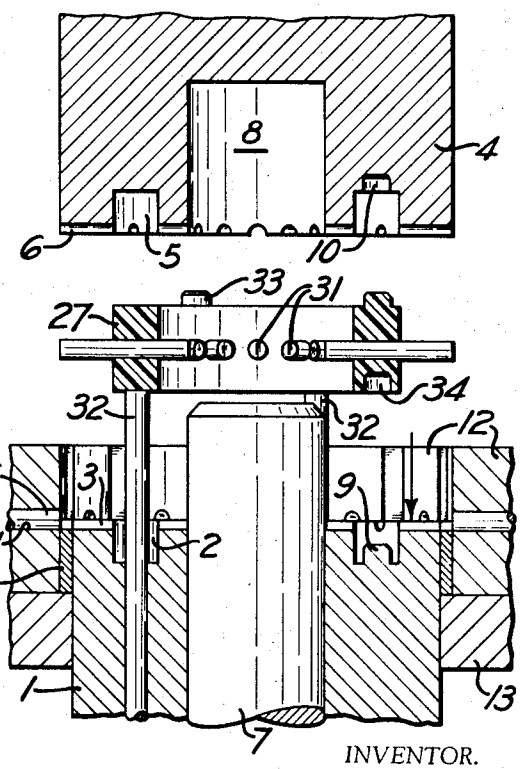


Fig. 6



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3,538,602

METHOD FOR MAKING STATORS FOR ROTARY ELECTRIC SWITCHES

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U.S. Cl. 29—622 6 Claims

ABSTRACT OF THE DISCLOSURE

A plurality of wires are fed radially inward toward a common central point and then are stopped a predetermined distance from it. Then a rigid ring of insulating material, concentric with the same point, is molded around the wires near their inner ends, after which the wires are severed a short distance from the outside of the ring. The short lengths of wire left embedded in the ring project from the inside to form electric contact pins, and project from the outside to form electric terminals. The severing of the long wires may be done by lifting the mold, in which the wires are embedded in the insulating ring, to cut the wires where they emerge from wire-guiding means around the mold.

BACKGROUND OF THE INVENTION

One kind of rotary electric switch is shown in Pat. 3,258,547. In that switch circumferentially spaced metal members, molded into a ring of insulating material, project inwardly and outwardly from the ring. The unit forms a stator, in which the exposed inner ends of the metal members form stationary electric contacts and their outer ends form terminals for connecting wires to the contacts. A similar stator, but one in which a continuous metal collector ring is substituted for the separate contacts, is clamped against the first ring. In the space encircled by the two rings a rotor is mounted, which carries one or more electric bridging contacts that engage the collector ring and some of the fixed contacts. Other sets of stators may be mounted in alignment with those just mentioned to produce a multiple switch.

The above-mentioned patent shows how the contacts and terminals are molded in the insulating ring. The process involves punching out a sheet metal ring of a predetermined shape, molding it in the insulating ring and then again punching the metal ring to separate the contacts from one another. This requires at least three different operations, which are time consuming and add to the cost of making the switch. It also requires intricate dies for the punching operations. Burrs are left on the contacts, which must be removed or the stator oriented so that the bridging contacts will not be affected by the burrs. As the diameter of this type of switch is reduced, the punching dies become more difficult to make and maintain. Also, the width of the stationary contacts likewise must be reduced and, for punching purposes, the metal must be thin. This increases the possibility of burrs and deformation of the contacts, and it also makes the construction weak mechanically. Furthermore, the range of punchable material is limited, plating problems arise, and contact material and plating material are wasted.

It is among the objects of this invention to provide a method and apparatus for making rotary switch stators, which eliminates dies and punching operations, which eliminates burrs due to punching, which allows a greater choice of material, which avoids waste, which does not require complicated and expensive tooling, which is adapted to automated manufacture, and which produces

stators of any desired size with adequate mechanical strength.

The invention is illustrated in the accompanying drawings, in which

FIG. 1 is a fragmentary plan view of my apparatus for making stators;

FIG. 2 is a reduced vertical section taken on the line II—II of FIG. 1;

FIG. 3 is an enlarged vertical section taken on the line III—III of FIG. 1;

FIG. 4 is a horizontal section taken on the line IV—IV of FIG. 3;

FIGS. 5 and 6 are vertical sections, similar to FIG. 3, showing two further steps in the method; and

FIG. 7 is an enlarged prospective view of a stator made by my method and apparatus.

Referring to FIGS. 1 to 4 of the drawings, a circular lower mold **1** can be raised and lowered at regular intervals by any suitable means, such as by a lever or a cam (not shown). The top of the mold is provided with an annular recess **2** concentric with the mold, and with a plurality of circumferentially spaced radial grooves **3** extending inwardly from its outer edge to the recess and inwardly from the recess a predetermined distance. Directly above the lower mold there is an upper circular mold **4**, provided in its bottom with an annular recess **5** that registers with the recess in the lower mold when both molds are in their lower position with the upper one seated on the lower one. The diameter of the upper mold may be slightly greater than that of the lower mold for a reason that will be explained presently. The upper mold can be moved up and down by well-known means. The bottom of the upper mold also is provided with radial grooves **6** registering with lower grooves **3** to form radial passages. Generally, the passages will be spaced apart uniformly.

The inner ends of these passages are closed by blocking means that may take any of various forms. The blocking means may be central portions of one or both molds, or a separate member. Preferably, the passages are blocked by a stationary vertical post **7** extending up through the hollow center of the lower mold, which slides up and down on the post and is guided by it. By providing the bottom of the upper mold with an upwardly extending axial bore **8** to receive the upper end of a post, the latter will help hold the upper mold in registry with the lower mold when the mold is closed.

Preferably, the lower mold recess **2** contains three upwardly projecting bosses **9** spaced apart uniformly. Above each of these bosses the top of the recess in the upper mold is provided with a corresponding socket **10** which is slightly smaller in diameter than the bosses.

At the outer end of each of the radial mold passages there is a guide block **12** rigidly mounted on a suitable support, such as a table **13**, and provided with a passage **14** extending through it in line with the adjoining mold passage. The inner ends of the guide block preferably substantially engage the upper mold. Spaced outwardly away from the outer end of each of these guide blocks there is a reel **15** of wire **16** of a size to fit in the passages. The reels are journalled in bearings **17** mounted on the table. Between each reel and the adjacent guide block there is a pair of idle vertical rollers **18** journalled in brackets **19** secured to the table. Between the rollers and the guide block there is another pair of rollers **21**, which are horizontally disposed, journalled in supports **22** rigidly mounted on the table. The ends of rollers **21** are provided with meshing gears **23** driven from below by a gear **24** projecting up through a slot in the table, as shown in FIG. 2. The bottom gear is journalled in bearings **25** attached to the bottom of the table and is driven intermittently by its shaft **26** from suitable driving

means (not shown) such as a motor controlled by a timer. The driven rollers pull wires from the reels and feed them through guide blocks **12**. The two sets of rollers for each wire help to straighten it as it is uncoiled from a reel.

In the operation of the apparatus, the horizontal rollers **21** are driven intermittently to unwind wires from the reels and push them through the guide blocks and the radial mold passages into engagement with the center post **7**, which serves as a stop. The rollers then are stopped temporarily. If the post is round, all wires within the mold will be the same length. If it is desired that some of them be longer than others, the post can be provided with flattened areas at the inner ends of some of the passages. Although it is preferred to feed the wires into the mold passages while the mold is closed, it is possible to feed them through the open grooves in the lower mold while the upper mold is raised, after which the mold is closed. In either case, after the wires have entered the mold and engaged the post, thermoplastic or thermosetting resin in the mold cavity is molded into a ring **27**, in which portions of the wires are embedded as shown in FIG. 3. The resin may be supplied to the cavity in various ways, such as in dry form before the mold is closed, or in liquid form after closing.

As soon as the resin in the molding cavity has cured sufficiently to retain its shape, the molds are moved upwardly together on the post. When they start to rise, a cutting ring **30** that encircles the upper portion of the lower mold directly below the overhang of the upper mold cooperates with the inner ends of guide blocks **12** in cutting the wires in two. The cutting ring is notched at the outer end of each lower groove. As shown in FIG. 5, the cutting leaves wire pins **31** projecting horizontally from both sides of the ring.

After the wires have been cut, the lower mold stops and the upper mold continues to move upwardly away from it far enough to leave the top of the molded ring fully exposed (FIG. 5). Then, as shown in FIG. 6, the ring with the pins embedded in it is removed from the lower mold by lowering that mold while supporting the ring on three or more temporarily stationary ejection rods **32** slidably mounted in the lower mold below its recess **2**. These rods are movable up and down by cams or the like. The ejection rods rose high enough with the rising lower mold to support the ring above the post when the rods stopped and the mold moved down around them, so the ring can be removed laterally from the rods without interference from the post. After removal of the ring, the ejection rods are lowered again to their lowest position and the wires are fed forward against the stop post, following which a new ring is molded and then the molds are raised to cut the wires as before. If it is found that the molded rings tend to stick in the upper mold and pull out of the lower mold, ejection rods can be incorporated in the upper mold as well.

It will be seen in FIG. 7 that this apparatus forms a stator for a rotary electric switch, the stator consisting of a rigid insulating ring **27** in which radial pins **31** are embedded. The pins project inwardly and outwardly from the ring to form electric contact pins inside the ring and electric terminals around it. The ring has bosses **33** on top and boss-receiving sockets **34** (FIG. 6) in its bottom. A metal collector ring (not shown) can be placed on the stator and held in correct position thereon by bosses

33 projecting through holes in the metal ring. The bosses and sockets also provide means for holding a plurality of stators in axial alignment.

Only a simple mold is required. Punches and dies are unnecessary. There are no burrs to remove. Wires of any desired composition can be used, and they can be plated before being brought to this apparatus. There is no waste of contact and terminal metal because nothing is punched out. All of each wire is used. No thought need to be given to deforming the contact material because it is not punched. The wires are fully supported during the severing step. All of this results in less expensive stators.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The method of making the stator of a rotary electric switch, comprising providing a plurality of wires with straight end portions arranged in spaced radial positions around a center point, feeding the wires inwardly toward said point, stopping the inwardly moving inner ends of the wires in predetermined positions by engaging spacing means with said ends which spaces said ends from said point, molding a rigid ring of insulating material concentric with said point around the wires but spaced from their inner ends to form free electric contact pins projecting from the inside of the ring, severing the wires outwardly of said ring to form outwardly projecting terminals integral with said contact pins, removing the stator thus formed, and again feeding the wires inwardly toward said point to repeat the cycle.

2. The method recited in claim **1**, in which the wires are withdrawn from coils and pushed through straight passages to straighten and guide said end portions.

3. The method recited in claim **1**, in which said stopping of the inner ends of the wires is accomplished by their engaging said spacing means concentric with said center point.

4. The method recited in claim **1**, including raising said ring as the wires are being severed.

5. The method recited in claim **1**, including stopping the inner ends of all of said wires the same distance from said center point.

6. The method recited in claim **1**, in which the inner ends of most of said wires are stopped the same distance from said center point, and any remaining wires are stopped a shorter distance from said point, whereby to form contact pins of different lengths.

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U.S. Cl. X.R.

18—5, 36, 16.5; 29—529, 629, 630; 200—11; 264—272