July 15, 1958 L. A. McCARTHY 2,842,842

METHOD OF ASSEMBLING ARTICLES

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FIG 1

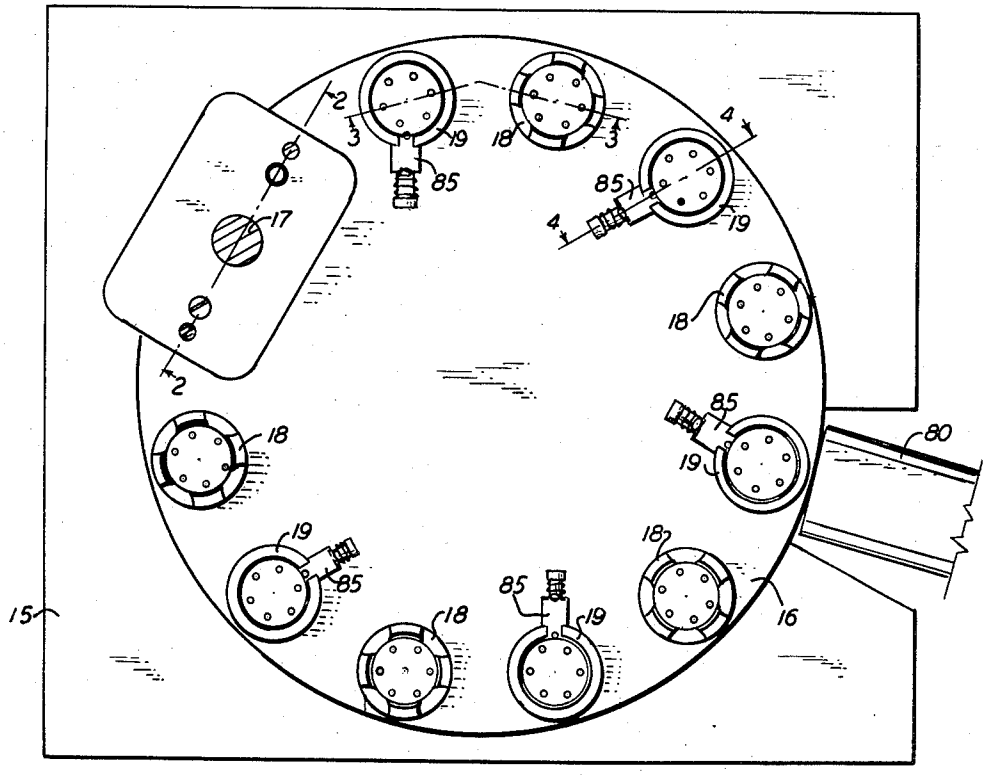


FIG 7

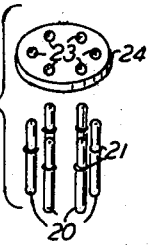


FIG 9



FIG 11

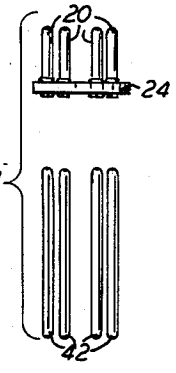


FIG 13

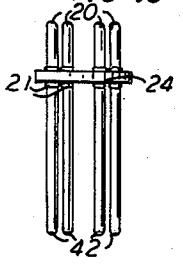


FIG 8

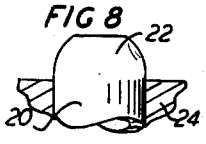


FIG 10

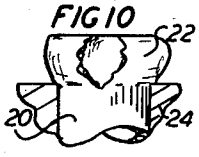
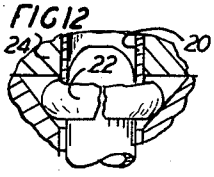


FIG 12



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METHOD OF ASSEMBLING ARTICLES

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FIG 2

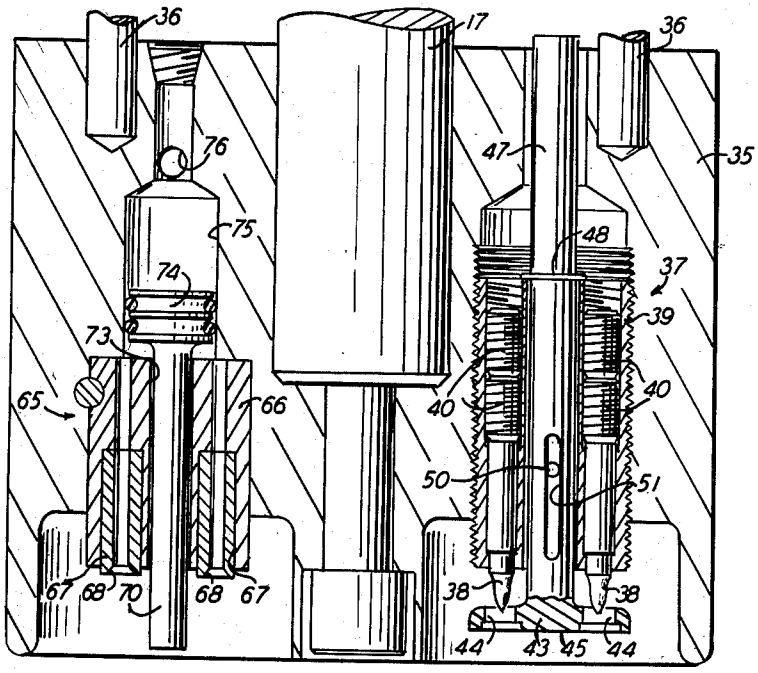
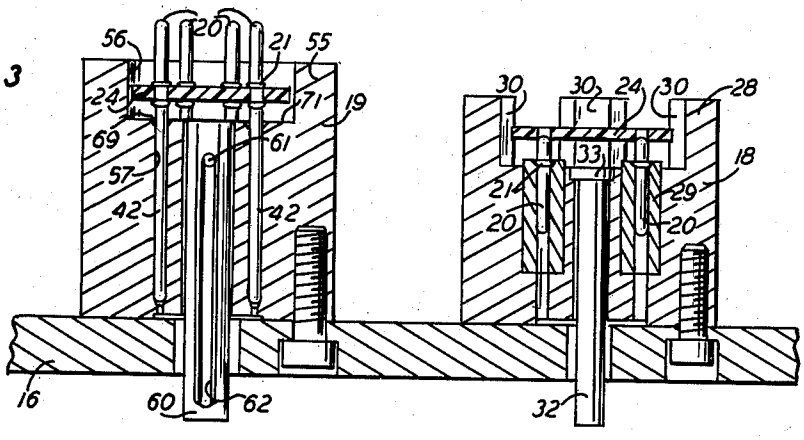


FIG 3



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FIG 5

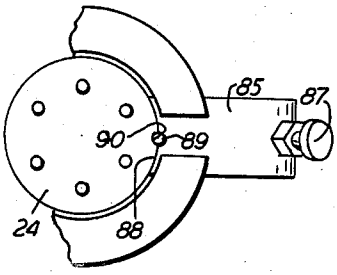


FIG 4

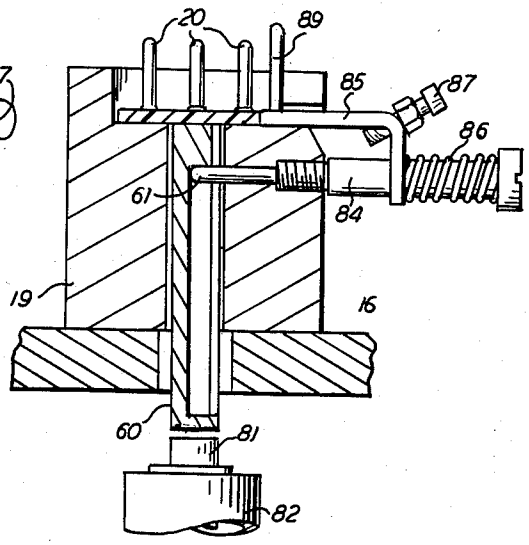
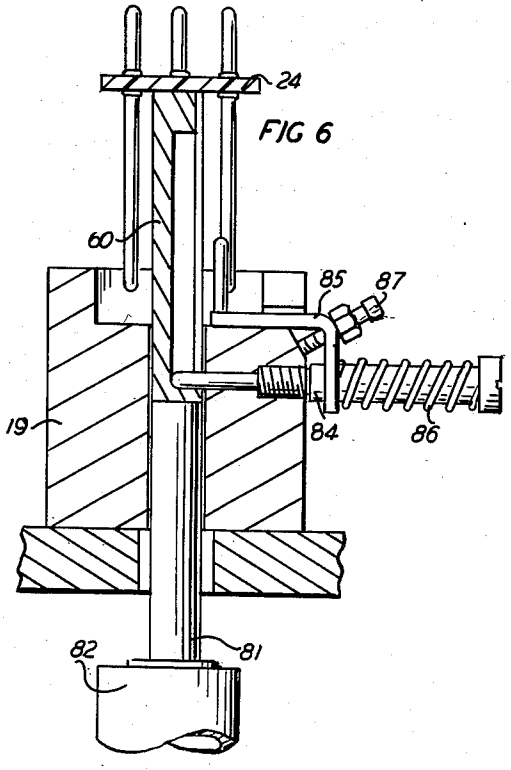


FIG 6



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2,842,842

METHOD OF ASSEMBLING ARTICLES

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Application March 31, 1953, Serial No. 345,908
1 Claim. (Cl. 29—505)

This invention relates to methods of forming articles, particularly articles having apertured parts in which terminals are mounted for electrical units.

A newly designed electrical unit of the coil wound resistance type, proposed the use of terminals mounted in apertures of a dielectric member and being of sufficient length to provide outer portions extending from one side of the dielectric member for reception in the conventional sockets, the terminals also having inner portions extending greater distances from the other side of the dielectric member to receive form wound coils leaving their innermost ends exposed for the securing of the lead wires of the coils thereto. The terminals were to be of the conventional tubular type employed in vacuum tubes and the like but terminals of the desired length for this electrical unit were not available commercially. However, among the commercially known terminals of this type, there were two, one of which could constitute the outer portion for reception in the conventional socket and the other if connected end-to-end to the first, would be of sufficient length to support the coil and leave an exposed portion to which the lead of the coil could be secured. This was the problem, the solution of which was necessary for the completion of the new type electrical coil unit.

The object of the present invention is a method of solving the aforementioned problem.

With this and other objects in view, the invention comprises an apparatus by the aid of which a method may be practiced for forming an article of a tubular member and a pin-like member comprising first flaring outwardly one end of the tubular member, then positioning one end of the pin-like member in the outwardly flared end of the tubular member and forcing the outwardly flared end of the tubular member inwardly to secure the members together.

In the present embodiment of the invention, the apparatus for carrying out the method steps includes a turret type table movable intermittently about its axis relative to a press, the ram of which carries two forming punches adapted to cooperate with two sets of forming dies disposed in pairs adjacent the periphery of the table. In one set of dies the tubular members are supported for registration with the apertures of a dielectric member and when these dies register with their respective punch unit, the dielectric member is moved to rest on the shoulders of the tubular members after which the upper ends of the tubular members are flared outwardly, securing them to the dielectric member and opening them sufficiently to receive the upper ends of pin-like members which will be fed to the other set of dies. Therefore, during one cycle of operation of the table, two operations are performed at each interval of rest, one the connecting of the tubular members to the apertured part or dielectric member by flaring outwardly the upper ends of the tubular members and also the securing of one of these partially completed articles which has previously passed through one cycle of operation of the apparatus to the upper ends of the pin-like members.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings wherein:

Fig. 1 is a top plan view of the apparatus with a portion of the press removed;

Fig. 2 is an enlarged sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view taken along the line of 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view taken along the line 4—4 of Fig. 1 illustrating the associated ejecting means unoperated;

Fig. 5 is a fragmentary top plan view of the structure shown in Fig. 4;

Fig. 6 is a view of the structure shown in Fig. 4 illustrating the associated ejecting means operated;

Fig. 7 is an isometric exploded view of a set of tubular members and the apertured part prior to assembly;

Fig. 8 is a fragmentary detailed view of the upper end of one of the tubular members prior to being flared outwardly;

Fig. 9 is a side elevational view of the tubular members and apertured part assembled;

Fig. 10 is a fragmentary detailed view illustrating one of the tubular members after its end has been flared outwardly;

Fig. 11 is a side elevational view of the portion of the article shown in Fig. 9 inverted relative to the pin-like members to which it is to be secured;

Fig. 12 is an enlarged fragmentary sectional view illustrating the completion of the forming means adjacent one portion of the article; and

Fig. 13 is a side elevational view of the completed article.

Referring now to the drawings, attention is first directed to Fig. 1 which illustrates a main support **15** having a turret type table **16** mounted thereon and movable by suitable means clockwise relative to a press, only the ram **17** of which is shown. The table **16** has two sets of dies **18** and **19** disposed at equally spaced positions about the table so as to present pairs of the dies successively to the press. Attention is now directed to Fig. 7 which illustrates a commercially known type of tubular member **20** having a shoulder or bead-like portion **21** disposed a given distance relative to one end thereof. The tubular members **20** have their ends rounded, as at **22**, so that they may be received readily in the conventional sockets, leaving their extreme ends partially open, however. A group of the tubular members **20** are to be assembled in apertures **23** of a dielectric member **24**.

Attention is now directed to the die **18** shown in Fig. 3. As the dies **18** are identical in structure, a description of the die **18** in Fig. 3 will apply to all the dies **18** of the apparatus. This die includes a main member **28** apertured at known spaced positions in a circular arrangement corresponding to the circular arrangement of the apertures **23** in the dielectric member **24** to receive tubular die members **29** having countersunk upper ends to receive the beads **21** of the tubular members **20**. The main member **28** has upwardly extending portions with arcuate surfaces **30** serving to locate the member or part **24** centrally in the die to cause its apertures to register with the tubular members **20**. An ejector element **32** having an enlarged head portion **33** is disposed in a central aperture of the die **18** with its head portion resting in a recess thereof and adapted to be actuated by a ram of an air cylinder, not shown, at a position adjacent the end of the first cycle of operation of the table to eject the partially completed article from the die **18**.

Attention is now directed to the ram **17** in Fig. 2 which has a punch holder **35** mounted thereon and adapted for reciprocable movement with the ram in a guided path assisted by the conventional guide rods **36**. A punch unit **37** to function in cooperation with the dies **18**, includes a set of punches **38** disposed in circular arrangement and adjusted in the apertures of their supporting member **39** by pairs of threaded elements **40**. The lower ends of the

punches 38 are pointed and suitably tapered to enter the upper ends of the tubular members 20 and flare them outwardly sufficiently to secure the tubular members to the apertured part 24 and adapt them to receive pin-like members 42. Associated with the punches 38 is a member 43 with apertures 44 adjacent each punch and a surface 45 adapted to engage the apertured part 24 and move it downwardly to rest on the shoulders or beads 21 of the tubular members 20. A shank 47 integral with the central portion of the member 43, extends upwardly through a central aperture in the member 39 and by the aid of a retaining ring 48 fixed to the shank at a given position, the member 43 is normally positioned as illustrated in Fig. 2 but permitted to move axially but not rotatably, due to a pin 50 carried by the member 39 and positioned to ride in an elongate aperture 51.

The dies 19 include main members 55 suitably recessed at 56 and having equally spaced apertures 57 for the pins 42. The pins 42 are substantially identical in general contour to the tubular members 20 with the exception of their differences in length and the elimination of the beeds present in the tubular members 20. A set of the pins or pin-like members 42 are disposed in the dies 19 at the loading position, which is the lowermost position in Fig. 1, after which the partially completed article, including the tubular members 20 and the apertured part 24 are positioned to rest on the upper ends of the pin-like members and travel in this manner to the punch. Each die 19 is centrally apertured for an ejecting rod 60 which normally rests on a pin 61 carried by the main member 55 and extending into an elongate aperture 62 whereby the ram may be moved longitudinally to eject the article when completed from the die.

Attention is now directed to the punch unit 65 which is to cooperate with each die 19 to complete the formation of each article. The punch 65 has an apertured member 66 in which hollow punch members 67 are disposed, these members having beveled lower ends 68, to engage the beads 21 to force the outwardly flared ends of the tubular members into beveled upper ends 69 of the apertures 57 of each die 19. As a result the outwardly flared ends of the tubular members will be swaged inwardly (Fig. 12) into intimate engagement with the pin-like members after a ram 70 has caused the initial assembly of the tubes 20 and part 24 downwardly until the part is adjacent the lower surface 71 of the recess 56. This action of the ram causes interengagement of the tubes and pin-like members after which the swaging operations are completed.

The ram 70, disposed in a central aperture 73 of the member 66, has a piston-like upper end 74 movable in a cylinder 75 to which air under a known pressure is admitted from an inlet 76.

Attention is now directed to the ejecting means for the completed article which operates when each die 19 is located adjacent a chute 80, Fig. 1. When in this position, the rams 60 will be located singly in alignment with an ejecting rod 81 of an air cylinder 82 the operation of which, as illustrated in Fig. 6, is sufficient to completely eject the completed article from the die 19 after which it may pass down the chute 80 to a receptacle, not shown. The pin 61 in the present embodiment of the invention is a part of a threaded member 84 mounted at the back of each die 19 and carrying an element 85 normally urged by the force of a spring 86 inwardly a distance limited by an adjustable stop 87. The upper portion of the element 85 has an arcuate end 88 in which a pin 89 is mounted to enter a recess 90 of the apertured part 24 to locate the part accurately in the die. If desired, the element 85 may function to urge the completed article toward the chute 80 when ejected from the die 19.

Considering now the various method steps, let it be assumed that during the first operating cycle of the table 16, sets of tubular members 20 and their respective aperture part 24 are fed to the successive dies 18 so that starting with the second operating cycle of the table, the partially completed article shown in Fig. 9 will be ejected from the successive dies 18 prior to reaching the loading position and all successive intermittent motions of the table will provide the operator with the partially completed article which the operator may place, in an inverted position as shown in Figs. 3 and 11, on the set of pin-like members 42. Therefore, although the tubular members 20 and the parts 24 travel for the most part through two operating cycles of the apparatus, an article composed of long terminals secured intermediate their ends in apertures of a dielectric member are completed during each interval of rest of the table. The means for operating the press and the ejecting means are operated in timed relation with the table so that their operations will occur during the intervals of rest of the table.

During the first forming operation through the cooperation of the punch unit 37 with one of the die members 18, it will be noted that the element 43 will move in advance of the punches 38 moving the apertured part 24 until it rests on the beads 21 before the punches 38 will enter the upper ends of the tubular members and flare them outwardly. Furthermore, the element 43 will hold the part 24 and the tubular members against movement during upward movement of the punch unit 37 to strip the article from the punches.

A similar action takes place between the punch unit 65 and the respective dies 19. The pressure on the ram 70 is sufficient to move the assembled tubular members 20 and part 24 downwardly over the upper ends of the pin-like members 42 after which the punch members 67 will engage the beads 21 of the tubular members 20 forcing the outwardly flared portions of the tubular members into the beveled upper ends 69 of the apertures 57 completing the formation of the article. The completed article continues to travel clockwise with the table until it reaches the chute after which it will be ejected through operation of the air cylinder 82 as illustrated in Figs. 4 and 6.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

The method of forming an article of a part having an aperture therein, a tubular member having an outwardly extending shoulder intermediate its ends and a pin-like member, the aperture and the members having diameters which are substantially equal, the method comprising positioning the tubular member in the aperture of the part so that the shoulder will engage one surface of the part and the adjacent end of the tubular member will extend beyond the opposing surface of the part, flaring outwardly the said adjacent end of the tubular member beyond the aperture to adapt it to receive the pin-like member, positioning one end of the pin-like member in the outwardly flared end of the tubular member, and swaging the outwardly flared end inwardly to secure the members together and form a shoulder engaging the said opposing surface of the part to cooperate with the other shoulder to hold the secured members in the aperture of the part.

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