July 9, 1968 T. E. GANNOE 3,391,456

MULTIPLE SEGMENT ARRAY MAKING

Filed April 30, 1965 2 Sheets-Sheet 1

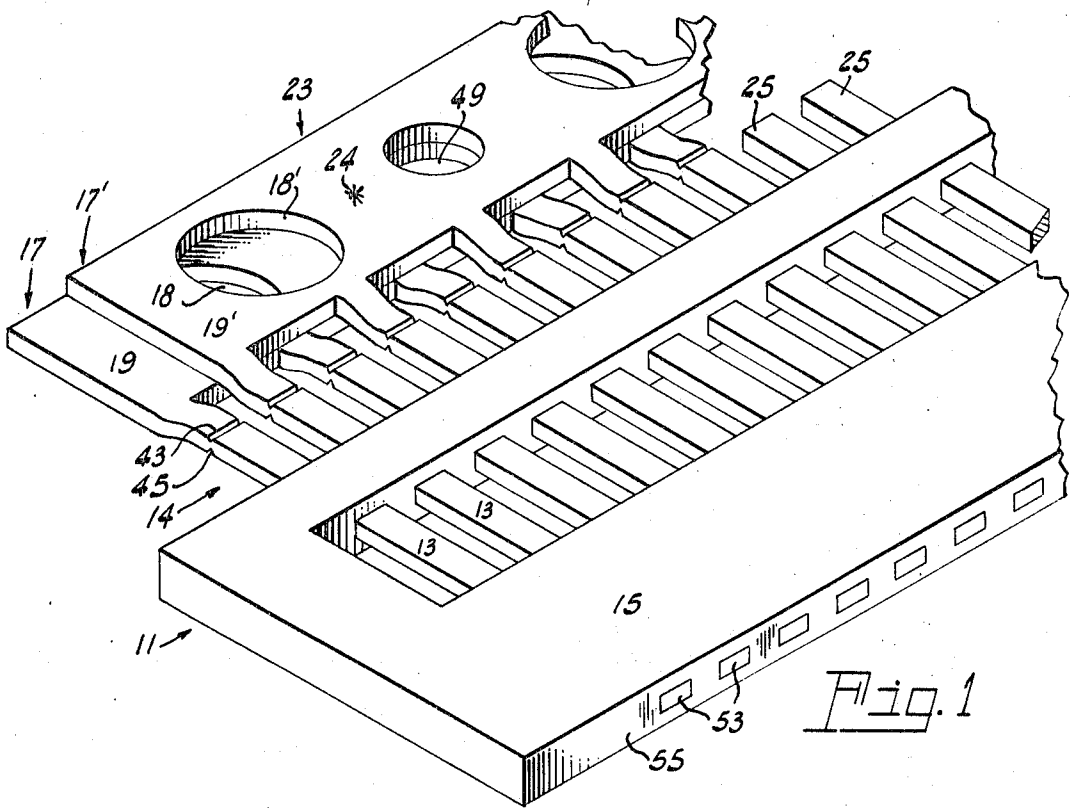



Fig. 1

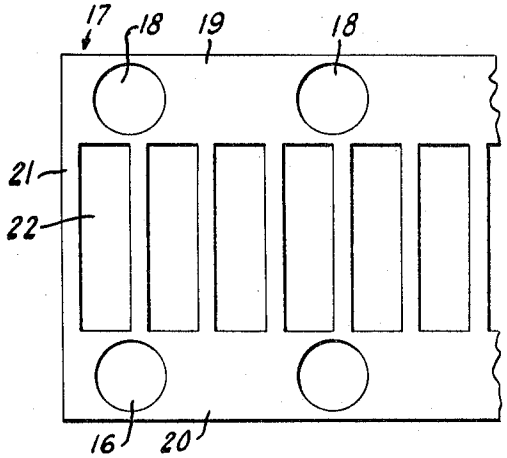



Fig. 3

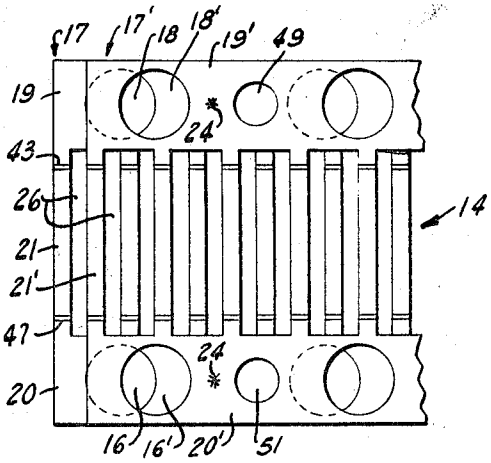



Fig. 4

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MULTIPLE SEGMENT ARRAY MAKING

Filed April 30, 1965 2 Sheets-Sheet 2

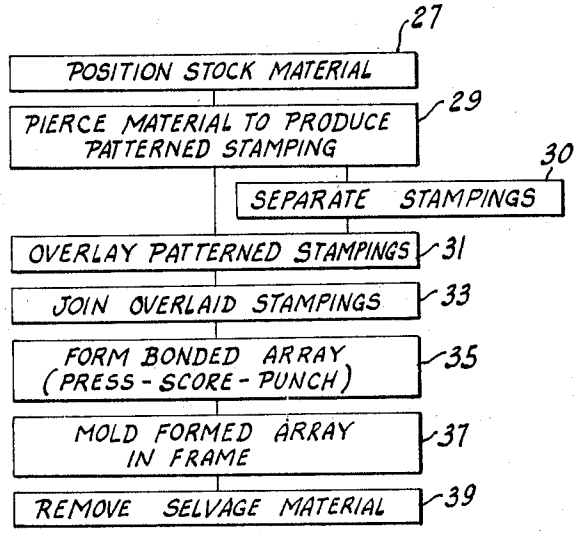



Fig. 2

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3,391,456

# MULTIPLE SEGMENT ARRAY MAKING

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3 Claims. (Cl. 29—625)

## ABSTRACT OF THE DISCLOSURE

A method for fabricating an array of closely spaced thin metallic segments wherein like patterned stampings of this material are assembled one upon the other in laterally displaced overlay relationship, the segments of one stamping being centered over the spacings of the related stamping with jointure therebetween effected along the selvage portions of the overlaid stampings. Pressing of the segments of each stamping into the spacings of the related stamping provides a plurality of closely spaced segments oriented in a substantially common plane. Molding a portion of the array into an insulative material provides support therefor.

This invention relates to plurally segmented metallic structures and more particularly to an array of closely spaced and substantially parallel thin metal segments and a method for fabricating the same.

In the manufacture of electrical connective apparatus, there are situations wherein it is necessary to facilitate a multiplicity of similar connections within a confined area. This is particularly true, for example, in replaceable electrical programming in which specialized circuitry is contained in a modular or unitized construction having a number of similar spaced-apart contact areas usually arranged in a compact planar array. Though wide diversifications in pluralized connector construction are utilized, the basic connective areas are conventionally in the form of a plurality of metallic strips, usually of thin gauge material, arranged in close spaced relationship. These strips are usually supported and collectively reinforced by suitable plastic material in a subsequent integrating operation to provide a unitized structure having therein a plurality of spaced connective areas.

By one method of fabrication, the metal strips forming the connective areas have been individually loaded into a multiple spaced jig for subsequent forming and unitized plastic reinforcing, but such a procedure requiring separate handling of a number of like pieces has been found to be both time consuming and expensive.

Another procedure for fabricating an array of connectors has been by die stamping a piece of thin gauge metal material to produce a plurally segmented preform. This by its very nature produces a stamping that is flimsy and prone to bow or deform. When close spacing between adjacent segments is desired, for example, spacings of less than .010 inch, the cost of die maintenance increases excessively and useful die life become exceptionally short. As the widths of the spacings decrease, the die life:die cost ratio soon becomes an uneconomic relationship. Furthermore, in normal manufacturing practices there is a limit to the accuracy of fine spacing between adjacent segments that can be feasibly and efficiently achieved by a die fabrication procedure.

Accordingly, it is an object of the invention to reduce the aforementioned disadvantages and to achieve a closely spaced array of substantially parallel thin metal segments that can be economically fabricated.

Another object is to provide a method for producing an array of closely spaced segments of thin metal material wherein efficient die maintenance is realized.



A further object is to produce an array of closely spaced segments of thin metal material having a minimum bowing characteristic.

Still another object is to efficiently fabricate a reinforced, closely spaced, plurally segmented metallic connector structure requiring a minimum number of manufacturing steps.

The foregoing objects are achieved in one aspect of the invention by the provision of fabricating a metallic multiple segment array that is suitable for utilization in a multiple contact electrical connector structure wherein similar stampings, pierced from thin metal material are assembled one upon the other in overlay relationship. Each of the stampings has edge oriented carrying strips or selvage portions with a transverse plurality of spaced parallel segments therebetween. Each of the segments has a width greater than the thickness of the material and the spacings separating the segments are wider than the width of the segments. Two of these similarly patterned stampings are overlaid in an offset manner to position the segments of a first stamping in centered relationship over the spacings of a second stamping, whereupon the selvage portions of the two stampings are joined together. This joining procedure forms a bonded array of closely spaced metallic segments having reinforced selvage portions. Forming of the bonded array provides a formed array having a shaped relationship between the combined segments therein. The subsequent integrating of insulative material to discrete portions of the shaped insert, as by joining formed insulative laminations to either side thereof or by a conventional plastic molding procedure, provides support and insulative separation for the closely spaced array of segments. Thus, a multiple contact electrical connector structure is formed wherein at least a portion of the selvage material is removed to provide individual ends for at least some of the segments.

For a better understanding of the present invention, together with other and further objects, advantages, and capabilities thereof, reference is made to the following specification and appended claims in connection with the accompanying drawings in which:

FIGURE 1 is a partial perspective showing a type of basic electrical connector structure having multiple contact areas;

FIGURE 2 is a flow diagram listing the steps in the fabrication of a substantially parallel array of closely spaced metallic segments;

FIGURE 3 is a plan view showing a patterned stamping; and

FIGURE 4 shows a plan view of two patterned stampings in offset overlaid relationship.

In referring to the figures, there is shown a type of basic connector structure **11** having therein a plurality of substantially parallel closely spaced metallic segments **13** as a formed array **14** which is embedded in an insulative plastic supporting and reinforcing frame **15**. The plural segments **13** of formed array **14** are the combined segments of two separate overlaid stampings **17** and **17'**; i.e., the first and second like stampings, respectively. Since both stampings are of like fabrication, the respective parts of the second stamping **17'** are referenced by the same numbers as used for the first stamping **17** with prime exponential (') designations added for identification. The two related stampings each have oppositely disposed edge carrying strips or longitudinal selvage portions **19** and **19'** and **20** and **20'**, respectively. The stampings are overlaid or positioned in offset relationship and are bonded together along the respective selvage portions. This joining of the two stampings provides a related plurality of the respective parallel segments **21** and **21'** integral to the respective stampings. Since FIGURE 1 is

not intended to illustrate a complete or specific connector structure **11**, finalized shaping of the segments or the terminations thereof are therefore not necessarily delineated in the drawing. Although one form of segment termination is shown, the invention is not to be limited or restricted thereto. For example, upon removal of the combined selvage portions **20** and **20'**, as shown in FIGURE 1, the oppositely disposed combined selvage portions **19** and **19'** may be retained to provide a common electrical connection **23** for all segments; or the selvage portions **19** and **19'** may also be removed either in total or in part to form individual connective stubs **25**, which, while not shown, can be further shaped or refined to provide a variety of formed contacts.

The sequential steps, for fabricating the aforementioned formed array **14**, are listed in the block diagram of FIGURE 2 with FIGURES 3 and 4 illustrating the sequence of fabrication as evidenced during the several stages of manufacturing.

Thin gauge metallic stock material, as for example, brass or other types of copper alloys of .010 inch thickness, is in the form of sheet or strip and is positioned for fabrication as designated in block **27**. This material is oriented in a die, not shown, as at step **29** to discretely pierce the material and produce a first patterned stamping **17**. Along both sides of this first stamping are longitudinal selvage portions **19** and **20**. Sections of material intermediate thereto are selectively removed to form a transverse plurality of parallel segments **21**, the edges of which define intervening spacings **22** therebetween. As an example, the widths of the segments **21** are in the order of .018 inch with the spacings **22** therebetween being .032 inch. Thus, the spacings are .014 inch wider than the defining segments. For the example stated, this width relationship is repetitive throughout the patterned stamping. Segment and spacing dimensions of the above order of values are efficiently and economically achieved by conventional die piercing techniques.

Along both selvage portions **19** and **20** are a series of spaced pilot holes **16** and **18**, respectively, which are utilized for mechanical movement of the material to facilitate a progressive piercing operation.

If as previously mentioned, the piercing is performed as a progressive stamping from substantially continuous strip, the stamped material is separated into like stampings as denoted in block **30**.

At least two individual patterned stampings designated as first and second like stampings **17** and **17'**, each having a plurality of segments as desired, are overlaid in an offset manner as indicated in step **31**. This overlaying of the patterned stampings **17** and **17'** is consummated in a jig, not shown, in a manner to position the segments **21'** of the second patterned stamping **17'** in centered relationship over the spacings **22** of the first pattern **17**. This overlay positioning of the two stampings **17** and **17'** effects a combined array of closely spaced segments oriented in adjacent parallel planes.

With the respective patterned stampings being thus positioned, a joining operation is initiated as designated by step **33** wherein a plurality of suitable bonds or welds **24** are made along the respective superimposed selvage portions to form a bonded array **14**. The welding of the two selvage thicknesses provides beneficial longitudinal reinforcement to the bonded array to prevent bowing or warping deformation thereof.

The first and second patterns **17** and **17'** being thus combined, the resultant bonded array is next subjected to a forming operation as shown in block **35**, whereby the insert is pressed or plastically formed to provide a shaped relationship between the combined segments. With particular reference to FIGURES 1 and 4, the segments **21'** of the second patterned stamping **17'** are, for example, formed or pressed into the spacings **22** between the segments **21** of the first patterned stamping **17**, and in like manner, the segments of the first stamping are formed or pressed into the spacings of the second stamping. Thus, a formed array of closely spaced segments is provided having similar portions in a common plane that is extremely difficult to fabricate in any other manner. As previously mentioned, the spacings in each pattern are .014 inch wider than the respective segments. When these segments are oriented on centers relative to the compatible spacings, there is a clearance **26** between adjacent combined segments of substantially .007 inch which is less than the thickness of the material. This is not to be considered limitative as much smaller spacings can be advantageously realized by this method of fabrication.

In addition to shaping the adjacent segments into a desired relationship, the forming operation **35** can also include a grooving or scoring operation to impart or impress score lines **43**, **45**, and **47** to one or both surfaces of the combined segments of the formed array in those regions where subsequent segment separation is desired, for example, to facilitate discrete selvage removal.

Furthermore, since the forming step **35** is substantially a die-press operation, additional punching can be consummated therein; such as, the piercing of tool locating holes **49** and **51** through the respective bonded selvages. Such holes are beneficial to properly orient the formed array with appropriate tooling in the ensuing molding operation which is designated by block **37**.

The application of plastic material to the formed array provides a supportive frame **15** of insulative thermoplastic material to form a connector structure **11** as described in the early part of this specification and illustrated in FIGURE 1.

The removal of selvage material is indicated in block **39**. As aforementioned, this selective separation or breakoff of at least a portion of the selvage material from the formed array embeded in the connector structure is made possible by flexure along the score lines **43** and **45** to provide individual ends for at least some of the segments, i.e., connective stubs **25**. In addition, the bonded selvage portions **20** and **20'** are removed along the score line **47** to provide, for the segments, individual ends **53** that are substantially flush with the longitudinal edge surface **55** of the frame **15**.

While the overlaying of two patterned stampings has been described and shown, it is feasible for more than two stampings to be overlaid with the segments in offset relationship and joined in a similar manner to provide a multiple segment array. Furthermore, the segments of the respective stampings can be of different shapings if a varied array is so desired.

Thus, a thin metal formed array having closely spaced segments therein has been shown and described in conjunction with a feasible and economic method for fabricating the same. The resutlant plurality of thin metallic segments in the formed array are accurately and closely spaced and reinforced in a manner heretofore unachieved. In addition, this precision-dimensioned array can be manufactured in a practical and economic manner.

While there has been shown and described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention as defined by the appended claims.

What is claimed is:

**1.** A method for fabricating a related array of closely spaced segments formed from thin conductive material of substantially uniform thickness, comprising the steps of:

piercing said material in a suitable die to form a patterned stamping having longitudinal selvage portions extending along two opposed edges thereof with a plurality of related like-formed segments of given width transversely disposed intermediate said selvage portions, said plural segments having spacings therebetween of widths greater than said widths of

said segments, and said widths of said segments being greater than said thickness of said material;

overlaying at least two of said similarly patterned stampings in an offset manner to position said segments of a first stamping in centered relationship over the spacings of a second stamping to effect a combined array of closely and substantially equally spaced segments oriented in adjacent parallel planes, said selvage portions of said first stamping being in overlay relationship with said selvage portions of said second stamping;

joining electrically and mechanically said overlaid stampings along said overlaid selvage portions to form a bonded array of closely spaced segments having reinforced selvage portions; and

forming said bonded array of segments by pressing to plastically deform the segments of each patterned stamping into the spacings between the segments of the related patterned stamping to provide an array of closely spaced segments oriented in a substantially common plane having substantially equal spacings therebetween.

2. A method for fabricating a substantially parallel array of closely spaced metallic segments according to claim 1 wherein the spacing between said adjacent segments is less than the thickness of said segment material.

3. A method for fabricating a substantially parallel array of closly spaced segments formed from thin conductive material of substantially uniform thickness, comprising the steps of:

piercing said material in a suitable die to form a patterned stamping having longitudinal selvage portions extending along two opposed edges thereof with a plurality of substantially parallel segments of given width transversely disposed intermediate said selvage portions, said plural segments having spacings therebetween of widths greater than said widths of said segments, and said widths of said segments being greater than said thickness of said material;

overlaying at least two of said similarly patterned stampings in an offset manner to position said segments of a first stamping to effect a combined array of closely spaced segments oriented in adjacent parallel planes, said selvage portions of said first stamping being in overlay relationship with said selvage portions of said second stamping;

joining electrically and mechanically said overlaid stampings along said overlaid selvage portions to form a bonded array of closely spaced segments having reinforced selvage portions;

forming said bonded array of segments by pressing to plastically deform the segments of each patterned stamping into the spacings between the segments of the related patterned stamping to provide a formed array of closely spaced segments oriented in a substantially common plane and having substantially equal spacings therebetween;

integrating a portion of said formed array of related segments into insulative material to provide support and insulative separation for discrete areas of said segments to form a molded array-containing structure; and having a plurality of spaced metallic segments extending therefrom; and

removing at least a portion of said selvage material from said formed array of segments incorporated in said molded structure to provide individual ends for at least some of said segments in said array.



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