

MAL/8009

# PATENT SPECIFICATION

(11)

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- (21) Application No. 30293/75 (22) Filed 18 July 1975  
(31) Convention Application No. 49/083 893 (32) Filed 22 July 1974 in  
(33) Japan (JP)  
(44) Complete Specification published 7 June 1978  
(51) INT. CL.<sup>2</sup> H01G 1/14 13/00  
(52) Index at acceptance  
H1M 1B2A 1C3 1R  
H1S 2B 5

(19)



24

## (54) ELECTRONIC COMPONENTS

(71) We, TOKYO DENKI KAGAKU KOGYO KABUSHIKI, KAISHA a corporation duly organized and existing under the laws of Japan, of 14-6, Uchikanda 2-Chome, Chiyoda-Ku, Tokyo-to, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a finished or partly finished electronic component such as, for example, a capacitor or a resistor (in the present Specification and claims, the term "electronic component" is used to include generically both finished products and partly finished products thereof) and to a method of making the same.

In the manufacture of electronic components, for example capacitors, there has hitherto been employed a method of continuous feeding of capacitors whose lead wires are held by a support member, to a step of soldering, coating, or measurement in which method, as shown in Figure 1, a pair of rolls 1 and 2 is used to advance the support member. Alternatively for intermittent feeding there may be employed a method as shown in Figure 2, wherein capacitors are intermittently fed by utilization of a step plate 4 adapted to engage and advance the lead wires 5. According to these conventional methods, however, the feed error is excessive and when lead wires 5 are utilized, processing operations cannot be performed sufficiently in good conditions because of bending of the lead wires 5 or change of distances between the lead wires 5. Accordingly, capacitors of good quality are obtained only with difficulty by these conventional methods and great obstacles are encountered in automation of the steps of manufacture, assembly and mounting of finished products and in the effective conduct of these steps at high

speed.

According to one aspect of the present invention, there is provided an assembly of a plurality of electronic components in which lead wires of the components are releasably affixed upon a separate elongate support member having drive-cooperating means disposed at prescribed distances in the longitudinal direction adapted to cooperate with a drive means for transporting said support member.

According to a further aspect of the present invention, there is provided a method for the preparation of electronic components, including transporting and processing electronic components by utilizing drive-cooperating means of a separate elongate support member which supports, and upon which are releasably affixed, lead wires of the electronic components, said drive-cooperating means being disposed at prescribed distances in the longitudinal direction on said supporting member and cooperating with a drive means for transporting the supporting member.

By use of the present method, the positioning of the electronic components relative to subsequent processing stations can be precisely determined, and deformation of lead wires is prevented thereby to maintain the required positions of and distances between the lead wires, whereby operations e.g. of assembly of finished products, processing of the partly finished electronic components and transportation can be performed precisely and at high speeds with high safety, high certainty, and high reliability, and automation and saving of labour can be greatly facilitated in these operations.

In the assembly and method of the present invention, the support member may, if desired, support the lead wires of an electronic component parallel to one another.

Embodiments of the invention will now



(25)

be more particularly described, by way of example, with reference to the accompanying drawings, wherein:—

Figure 1 is a diagram illustrating a conventional method of feeding an electronic component, utilizing a support member;

Figure 2 is a diagram illustrating another conventional method of feeding an electronic component, utilizing a step and return plate;

Figures 3 to 5 are perspective views illustrating embodiments of a support member for use with the present invention;

Figure 6 is a diagram illustrating an embodiment of the method of the present invention;

Figures 7 and 8 are front views illustrating other embodiments of the method of the present invention;

Figures 9 and 10 are diagrams illustrating still other embodiments of the method of the present invention; and

Figures 11 to 17 are diagrams illustrating examples of the shape of an engaging portion of a support member of the invention.

This invention will now be described, by way of example only, with reference to the manufacture of capacitors as an example of the electronic components, by reference to Figs. 3 to 17 of the accompanying drawings.

As is shown in Figure 3, a plurality of U-shaped lead wires 5 is disposed along a support member 3, the lead wires 5 are fixed upon the support member 3 by an adhesive tape 8 and engaging holes 10 are formed spaced apart equidistantly in the longitudinal direction through the support member 3 by means of a suitable punch. Instead of using adhesive tape the leading wires 5 could be otherwise fixed upon the support member 3. Between the limbs of each U-shaped lead wire 5 is arranged a capacitor element 19 such that the capacitor element 19 is supported and gripped by the lead wires 5, so as to form a number of partly finished capacitors.

In the alternative embodiment, shown in Figure 4, the lead wires 5 are fixed in dovetail grooves 12 to form a number of partly finished capacitors secured upon a support member 3, and engaging holes 10 are formed equidistantly in this support member 3. In the further embodiment shown in Figure 5, the lead wires 5 are inserted into through holes 15 to form a number of partly finished capacitors secured upon a support member 3, and engaging holes 10 are formed equidistantly in the support member 3.

In each of the embodiments of the perforated support member shown in Figure 3 to 5, the support member 3 may be made of, for example, paper, metals, or synthetic resins. Further, the support member 3 may

be continuous or it may have a prescribed limited length.

One embodiment of a method of feeding and transporting a number of partly finished capacitors thus held by the support member 3 is illustrated in Figure 6. Projecting pins 22 are fixed on the periphery of a feed wheel 21 as a transportation mechanism, and the distance between each two adjacent projecting pins 22 is the same as the distance between each two adjacent holes 10 formed in the support member 3. A cooperating wheel 23 is disposed so that holes 24 therein receive the projecting pins 22 of the feed wheel 21, the projecting pins 22 in this engaged state passing through the holes 10 in the support member 3. In this state, the partly finished capacitors can be transported positively and accurately. As shown in Figure 7, good results are obtained when the transportation is conducted under such conditions that the support member 3 is pressed by a peripheral face 26 of the feed wheel 21. Such a method of transportation can be applied not only to the transportation of the partly finished capacitors but also to the transportation of the finished capacitors between such steps as, for example, inspection, assembly and packaging.

Instead of holes 24 to be engaged with the projecting pins 22 of the feed wheel 21, a peripheral groove 28 for the projecting pins 22 may be formed on the wheel 23 as shown in Figure 8. In this embodiment, the projecting pins 22 of the feed wheel 21 (Figures 6 and 7) are located in the holes 10 in the support member 3, and the support member 3 is transported in such a state that it is pressed by the peripheral faces 26, 25 of the feed wheel 21 and the cooperating wheel 23, respectively. When a flexible support member 3 is employed, as shown in Figure 9, a direction of feed of the support member 3 (indicated by an arrow), namely the direction of feed of the electronic components supported by the support member 3, can be reversed by a reverse wheel 31. In this case, a wheel such as the cooperating wheel 23 (Figures 6 to 8) need not be employed.

In the same manner as described in relation to the first embodiment, pins 32 as shown in Figure 10 may be used as a feed mechanism and the partly finished capacitors can be transported by engagement of these pins with the holes 10 and movement of the pins 32 along the path defined by the arrows.

Furthermore, such feeding of the partly finished capacitors as described above can be effected continuously or intermittently.

Engaging regions such as, for example, the holes 10, formed in the support mem-



28

ber 3 or the like are not used merely for transportation but also for positioning the support member 3 during, for example, performance of a processing operation upon the partly finished capacitors. In general two holes 10, one on either side of a partly finished capacitor to be processed, are simultaneously used for positioning of the partly finished capacitor. However, the positioning can be done sufficiently precisely even by use of one hole 10.

The shape or form of the hole 10 or 24 or the groove 28 cooperating with the drive means is not particularly critical. As an alternative to the through holes 10 of the foregoing examples, there can be used non-penetrating holes or grooves formed in the support member 3, groove-like concavities, or the like. Examples of such holes or grooves are illustrated in Figures 11 to 14. Such a hole or groove may be formed either inside an edge of the supporting member 3 or on the edge of the supporting member 3 as a notch. The hole or groove may have a round, oval, square, or triangular form. These holes or grooves may be arranged in a single row or a plurality of rows or in a zigzag line. As regards the pitch or disposition of these holes or grooves as engaging regions, on or a plurality of engaging regions may be disposed per electronic component, or a plurality of electronic components may be disposed per engaging region. One of such manners or arrangement is appropriately chosen, or two or more of these manners of arrangement are used in combination. In short, the engaging regions are so formed and arranged that such undesired phenomena as, for example, slip, error of pitch, and deformation of the lead wire 5 are not caused. The tapered grooves 12 (Figure 14) may be used not only as engaging regions for feeding and transportation but also for holding and supporting the lead wires 5 as illustrated in Figure 4, whereby the structure may be simplified. Further, in the embodiment shown in Figure 3, if a back of the support member 3 is made concave between the lead wires 5 of one electronic component to form a concave portion and a corresponding wart-like projecting portion on a front side of the support member 3 then, with the aid of an adhesive tape as shown in Figure 15, falling of the electronic component can be effectively prevented.

Of methods for forming the engaging portions such as holes 10, there may be mentioned a method in which boring is conducted while the lead wires 5 are held upon the support member 3 and the resulting holes are utilized for subsequent operations, and a method in which a support member 3 having the holes 10 per-

forated therethrough is utilized and the leading wires 5 are fixed to the support member 3 between these holes 10 synchronously with feeding of the support member 3 by means of these holes 10. Transportation and positioning of the support member can be performed by not only the above-mentioned feed mechanism utilizing projecting pins 22 but also by means of a feed mechanism comprising matching projection portions. Further, transverse projecting portions may be utilized to cooperate with groove-like concavities in the support member 3.

In the foregoing embodiments, relatively small concavities or holes 10, 24 are illustrated as the engaging regions. In the present invention, it is also possible to adopt arrangements such as those shown in Figures 16 and 17 where the concave portions are relatively large and the convex portions, i.e. the engaging portions, are relatively small, or it is possible to use pin-like portions, projecting on and formed on the supporting member 3, as the convex portions.

As is apparent from the foregoing, transportation and positioning of the support member bearing the partly finished capacitors can be performed by engaging portions disposed equidistantly on the supporting member. Accordingly, the position of the capacitor member *per se* or the distance between consecutive capacitors can be fixed with precision. Further, since the lead wires do not receive directly a driving force, the lead wires are effectively prevented from being damaged, bent, or deformed. Therefore, the position of and distance between not only the capacitor members but also of and between the lead wires can be fixed. Accordingly, when a completed capacitor is forwarded to a step of a subsequent operation, for example, a step of inserting the capacitor into a print plate by use of an inserting device, the position of the capacitor can be fixed assuredly with certainty and errors in positioning can be substantially prevented. Therefore, insertion can be performed at high speed with great reliability, and automation of the step of insertion and labour-saving at this step, which have been difficult in conventional methods, can be effectively achieved.

The engaging regions or portions may be spaced apart equidistantly, in the longitudinal direction or they may be arranged at differing prescribed distances.

The lead wires need not be disposed parallel, and they may be arranged non-parallel to one another.

Moreover, long products can be prepared very easily using the mechanisms described herein and, on packaging, the products can



- be arranged in a very compact form without bending of lead wires, and transportation of the products can be greatly facilitated. Further, connection of two or more of the electronic components can be performed very easily with high accuracy if engaging regions such as, for example, holes are utilized as base points for carrying out the connection.
- 10 The present invention may, if desired, comprise either an entire process comprising all manufacturing steps of recovery of a finished product or a partial process consisting of one or only some of these steps of preparation.
- 15 Moreover, the present method may, if desired, comprise a process in which holes serving as engaging regions are formed simultaneously when lead wires of an electronic component such as, for example, a capacitor are supported on a support member, the support member is fed and transported continuously or intermittently by utilization of these holes and the partly finished electronic component such as, for example, a capacitor, is subjected to such operations as soldering, coating, measurement, withdrawal, and shifting in a state in which it is held and supported precisely and positively. The present invention includes a process wherein holes and grooves are equidistantly formed as engaging regions on a support member, transportation or positioning is conducted utilizing these engaging regions and processing is carried out while the lead wires are held in the grooves, and also includes a process in which only grooves are formed as engaging regions and used for holding lead wires, these engaging regions being also utilized for transportation and positioning.
- WHAT WE CLAIM IS:—
- 45 1. An assembly of a plurality of electronic components in which lead wires of the components are releasably affixed upon a separate elongate support member having drive-cooperating means disposed at prescribed distances in the longitudinal direction adapted to cooperate with a drive means for transporting said support member.
  - 50 2. An assembly as claimed in claim 1, wherein the drive-cooperating means are spaced apart equidistantly.
  - 55 3. An assembly as claimed in claim 1 or claim 2, wherein the lead wires of the electronic components extend in parallel to each other.
  - 60 4. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are holes formed in the support member.
  5. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are grooves formed in the support member.
  6. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are projections formed on the support member.
  7. An assembly as claimed in any of claims 1 to 6 wherein said support member comprises a support strip, the lead wires being affixed thereto by means of an opposing support tape having adhesive on the face thereof facing said support strip, said support strip and said support tape cooperating to hold firmly said lead wires therebetween.
  8. An assembly as claimed in any of claims 1 to 7, wherein said lead wires of the components are spaced apart equidistantly.
  9. An assembly as claimed in any of claims 1 to 8, wherein said drive-cooperating means are spaced apart at distances corresponding to those between said lead wires of the components.
  10. An assembly of a plurality of electronic components, substantially as hereinbefore described with reference to any of Figures 3 to 17 of the accompanying drawings.
  11. A method for the preparation of electronic components, including transporting and processing electronic components by utilizing drive-cooperating means of a separate elongate support member which supports and upon which are releasably affixed lead wires of the electronic components, said drive-cooperating means being disposed at prescribed distances in the longitudinal direction on said supporting member and cooperating with a drive means for transporting the supporting member.
  12. A method as claimed in claim 11, wherein the drive-cooperating means are disposed on the supporting member equidistantly in the longitudinal direction.
  13. A method as claimed in claim 11 or claim 12, wherein the lead wires of the electronic components extend in parallel to each other.
  14. A method as claimed in any of claims 11 to 13, wherein the drive-cooperating means are holes formed in the





27

be arranged in a very compact form without bending of lead wires, and transportation of the products can be greatly facilitated. Further, connection of two or more of the electronic components can be performed very easily with high accuracy if engaging regions such as, for example, holes are utilized as base points for carrying out the connection.

The present invention may, if desired, comprise either an entire process comprising all manufacturing steps of recovery of a finished product or a partial process consisting of one or only some of these steps of preparation.

Moreover, the present method may, if desired, comprise a process in which holes serving as engaging regions are formed simultaneously when lead wires of an electronic component such as, for example, a capacitor are supported on a support member, the support member is fed and transported continuously or intermittently by utilization of these holes and the partly finished electronic component such as, for example, a capacitor, is subjected to such operations as soldering, coating, measurement, withdrawal, and shifting in a state in which it is held and supported precisely and positively. The present invention includes a process wherein holes and grooves are equidistantly formed as engaging regions on a support member, transportation or positioning is conducted utilizing these engaging regions and processing is carried out while the lead wires are held in the grooves, and also includes a process in which only grooves are formed as engaging regions and used for holding lead wires, these engaging regions being also utilized for transportation and positioning.

#### WHAT WE CLAIM IS:—

1. An assembly of a plurality of electronic components in which lead wires of the components are releasably affixed upon a separate elongate support member having drive-cooperating means disposed at prescribed distances in the longitudinal direction adapted to cooperate with a drive means for transporting said support member.

2. An assembly as claimed in claim 1, wherein the drive-cooperating means are spaced apart equidistantly.

3. An assembly as claimed in claim 1 or claim 2, wherein the lead wires of the electronic components extend in parallel to each other.

4. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are holes formed in the support

member.

5. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are grooves formed in the support member.

6. An assembly as claimed in any of claims 1 to 3, wherein the drive-cooperating means are projections formed on the support member.

7. An assembly as claimed in any of claims 1 to 6 wherein said support member comprises a support strip, the lead wires being affixed thereto by means of an opposing support tape having adhesive on the face thereof facing said support strip, said support strip and said support tape cooperating to hold firmly said lead wires therebetween.

8. An assembly as claimed in any of claims 1 to 7, wherein said lead wires of the components are spaced apart equidistantly.

9. An assembly as claimed in any of claims 1 to 8, wherein said drive-cooperating means are spaced apart at distances corresponding to those between said lead wires of the components.

10. An assembly of a plurality of electronic components, substantially as hereinbefore described with reference to any of Figures 3 to 17 of the accompanying drawings.

11. A method for the preparation of electronic components, including transporting and processing electronic components by utilizing drive-cooperating means of a separate elongate support member which supports and upon which are releasably affixed lead wires of the electronic components, said drive-cooperating means being disposed at prescribed distances in the longitudinal direction on said supporting member and cooperating with a drive means for transporting the supporting member.

12. A method as claimed in claim 11, wherein the drive-cooperating means are disposed on the supporting member equidistantly in the longitudinal direction.

13. A method as claimed in claim 11 or claim 12, wherein the lead wires of the electronic components extend in parallel to each other.

14. A method as claimed in any of claims 11 to 13, wherein the drive-cooperating means are holes formed in the





support member.

15. A method as claimed in any of claims 11 to 13, wherein the drive-  
5 cooperating means are grooves formed in the support member.

16. A method as claimed in any of claims 11 to 13, wherein the drive-  
10 cooperating means are projections formed on the support member.

17. A method for the preparation of

electronic components, substantially as hereinbefore described with reference to Figures 6 to 10 of the accompanying draw- 15  
ings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1978.  
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies  
may be obtained.

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