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Burns

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[54] **GANG BONDING INTERCONNECT TAPE FOR SEMICONDUCTIVE DEVICES AND METHOD OF MAKING SAME**

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[73] Assignee: **National Semiconductor Corporation**, Santa Clara, Calif.

[21] Appl. No.: **37,181**

[22] Filed: **May 7, 1979**

Related U.S. Patent Documents

Reissue of:

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Issued: **Dec. 20, 1977**
Appl. No.: **593,474**
Filed: **Jul. 7, 1975**

[51] **Int. Cl.**[3] **H05K 1/00**; H05K 3/06

[52] **U.S. Cl.** .... **430/314**; 29/577 R; 29/827; 29/846; 148/6.2; 156/630; 156/634; 156/644; 156/656; 156/664; 427/14.1; 427/96; 430/311

[58] **Field of Search** .... 430/314, 311; 29/577 R, 29/846; 148/6.2; 156/644, 664, 630, 634, 656; 357/70; 427/14.1, 96; 174/52 R

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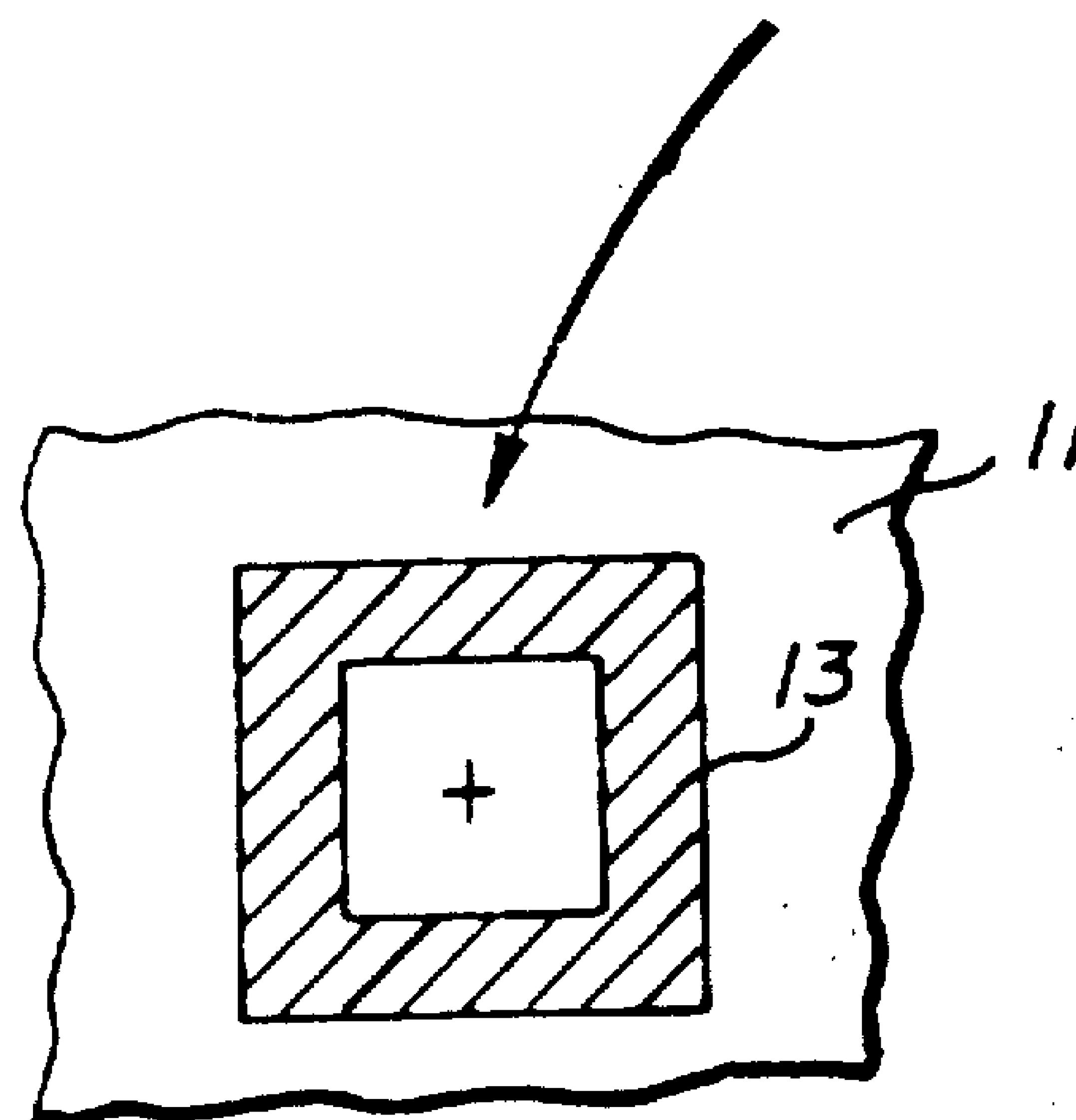
Attorney, Agent, or Firm—Gail W. Woodward; Paul J. Winters; Michael J. Pollock

[57] **ABSTRACT**

A gang bonding interconnect tape for use in an automatic bonding machine for gang bonding of semiconductive devices is fabricated by depositing a series of electrically insulative support structures, such as rings of epoxy resin, onto a metallic tape, as of copper, there being at least one of said electrically insulative support structures for individual ones of the interconnect lead patterns to be formed in said metallic tape. The side of the metallic tape, opposite to the support structure, is photoetched with a series of interconnect lead patterns with individual ones of said lead patterns being etched in registration with individual ones of said electrically insulative support structures. The individual electrically insulative support structure, preferably in the form of a ring, is located in each of the lead patterns intermediate the central region thereof and the outer region thereof for supporting the individual leads thereof in circumferentially spaced relation.

16 Claims, 10 Drawing Figures



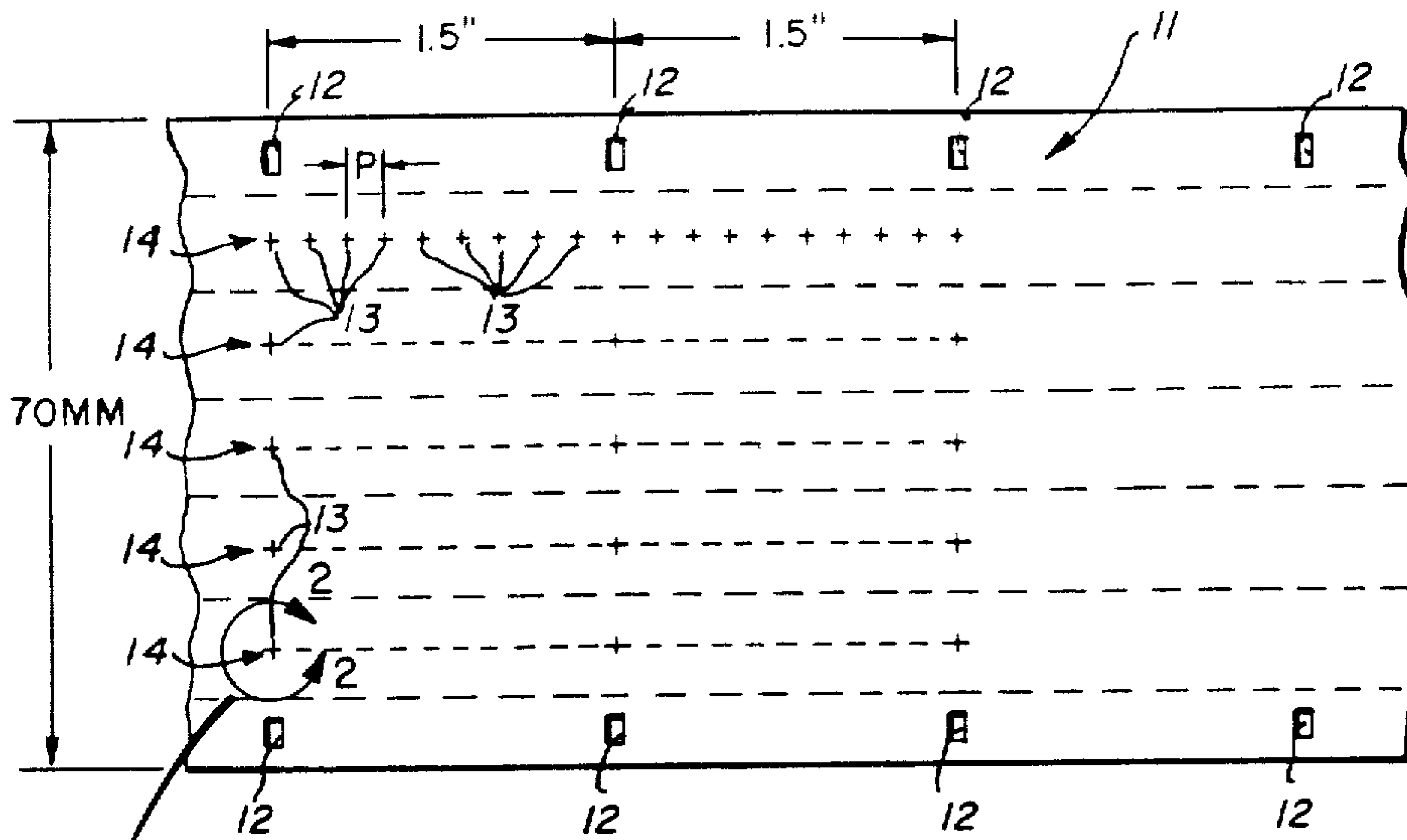


Fig_1

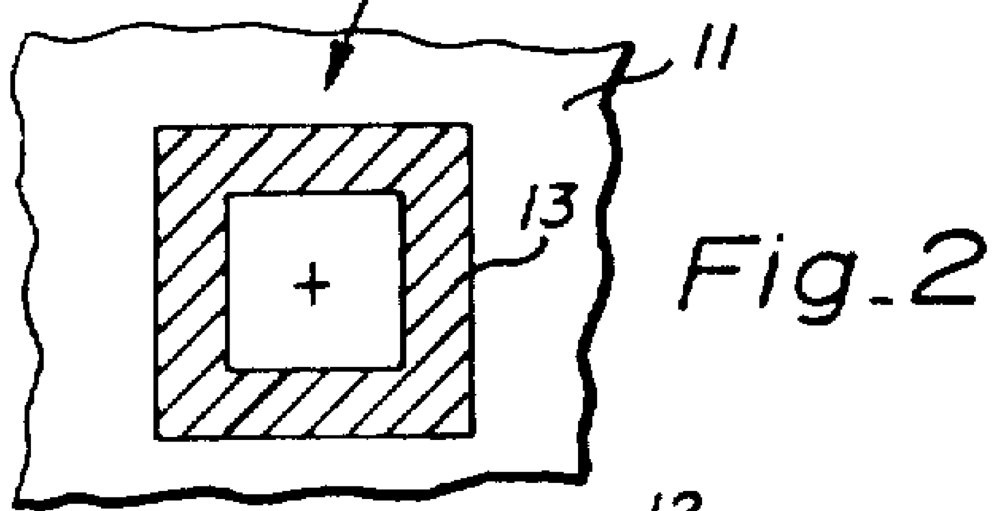


Fig_2

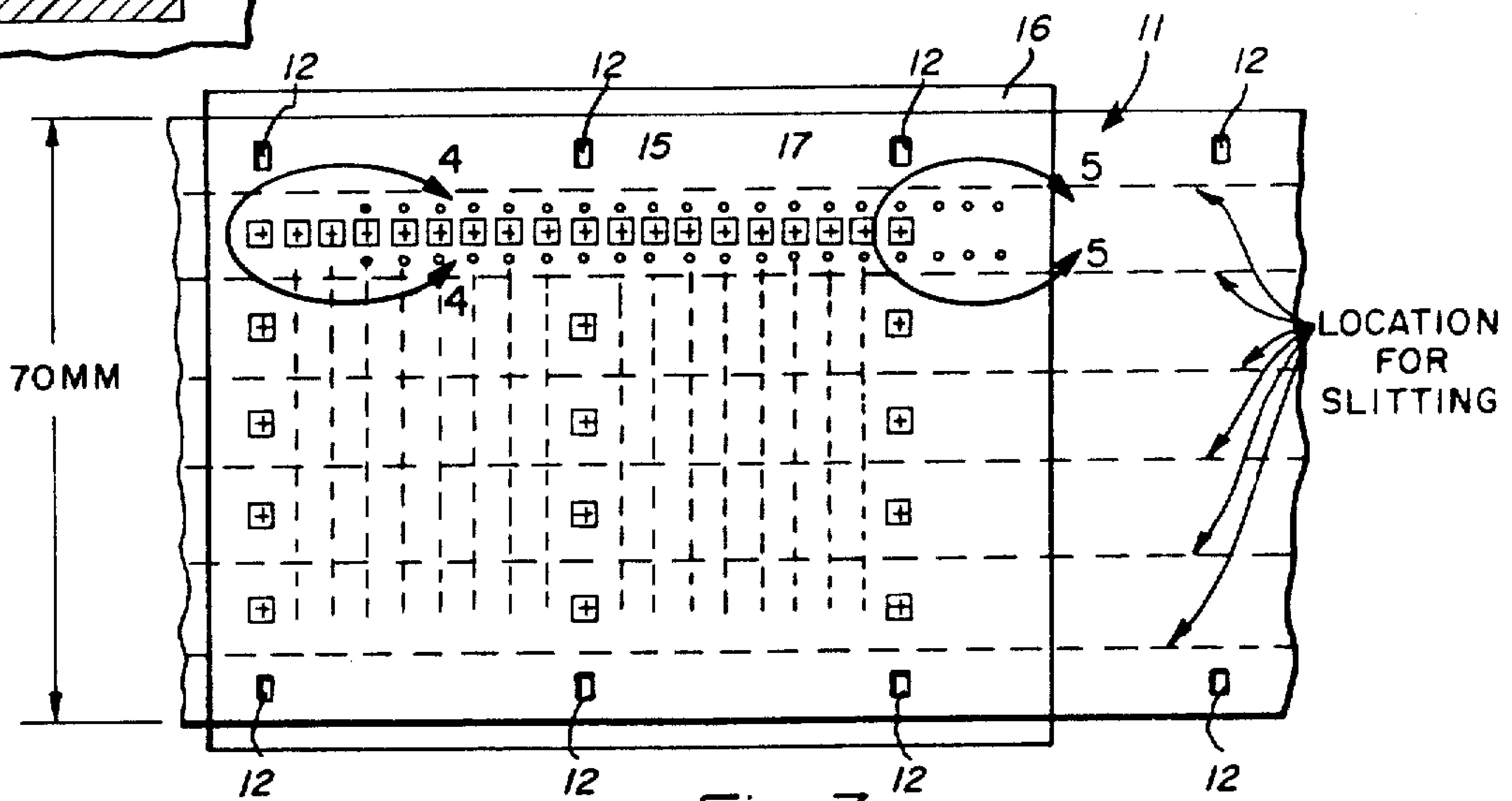


Fig_3

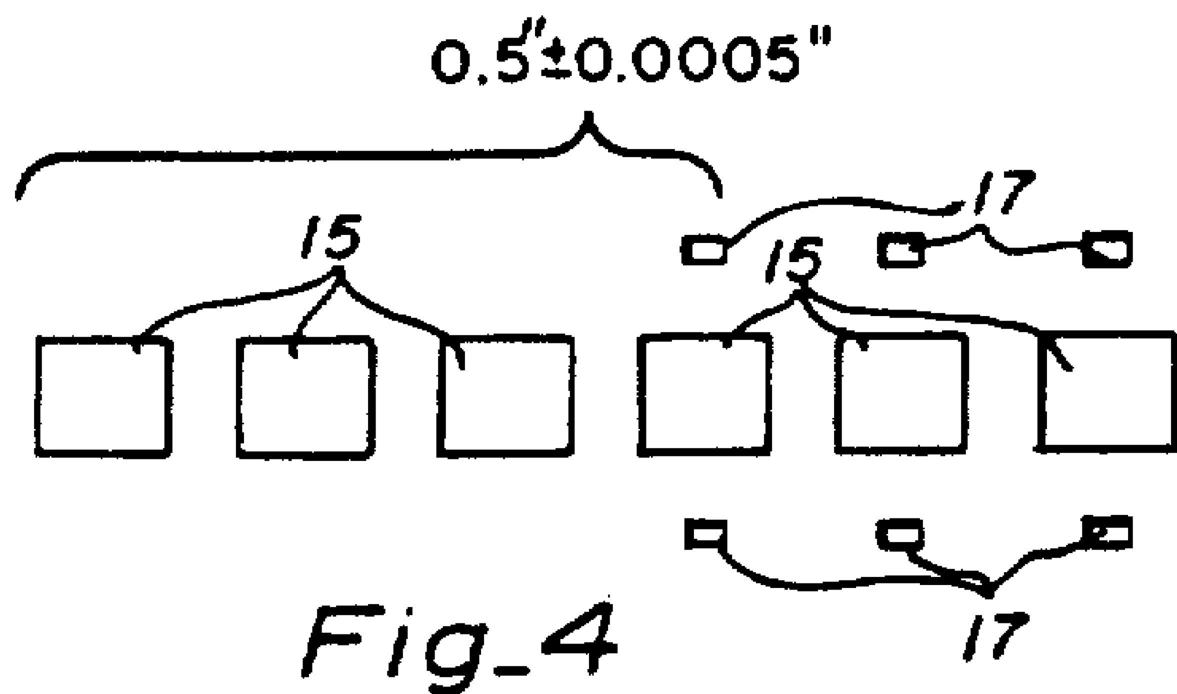


Fig_4

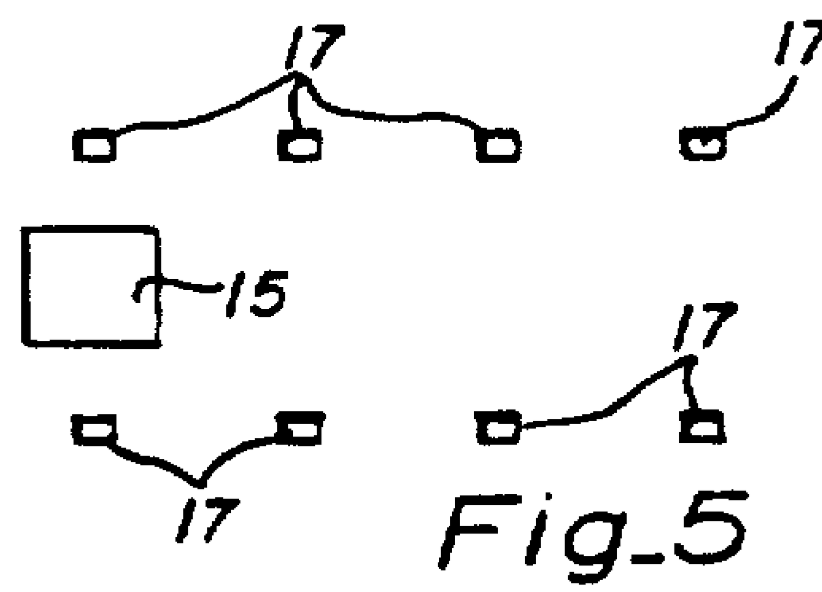
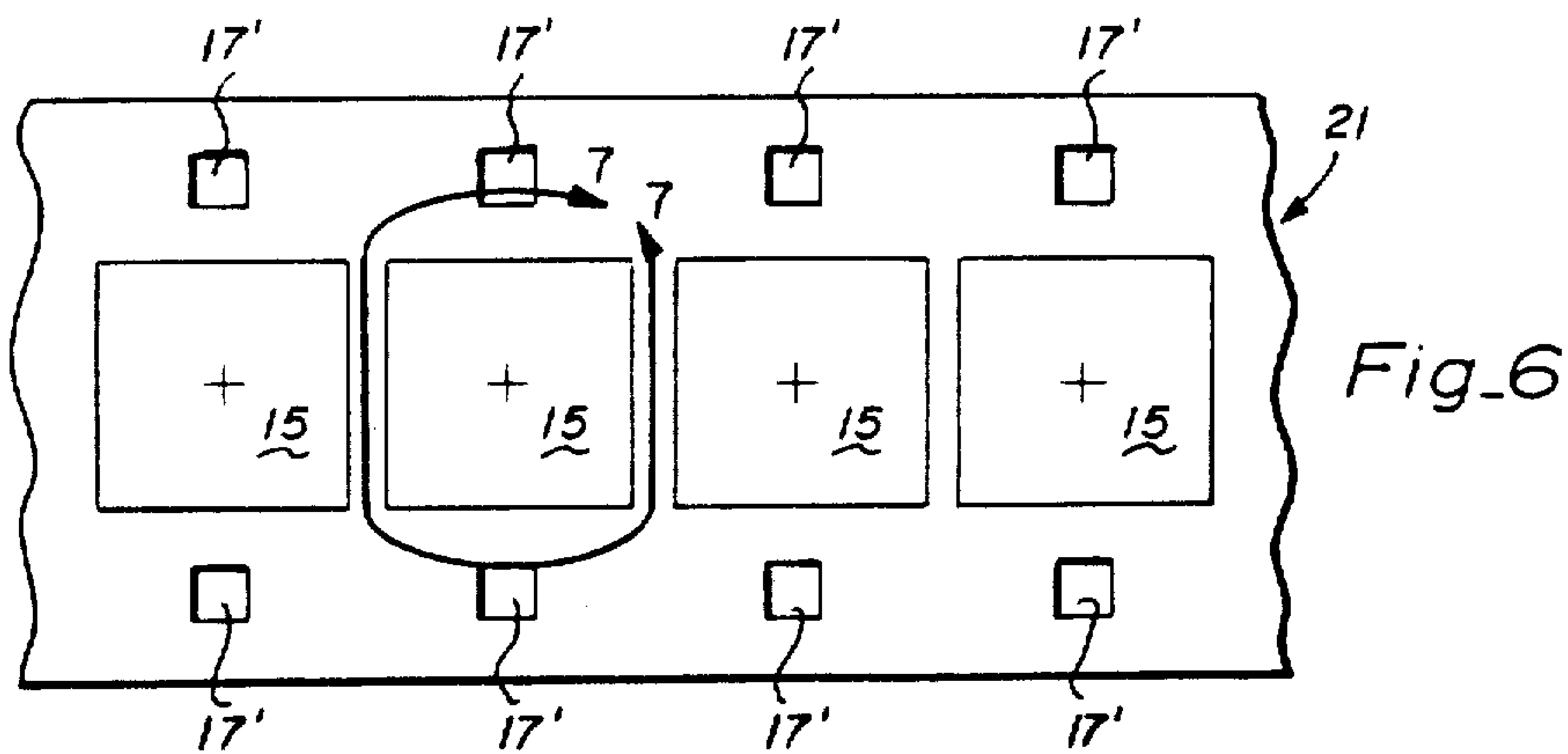
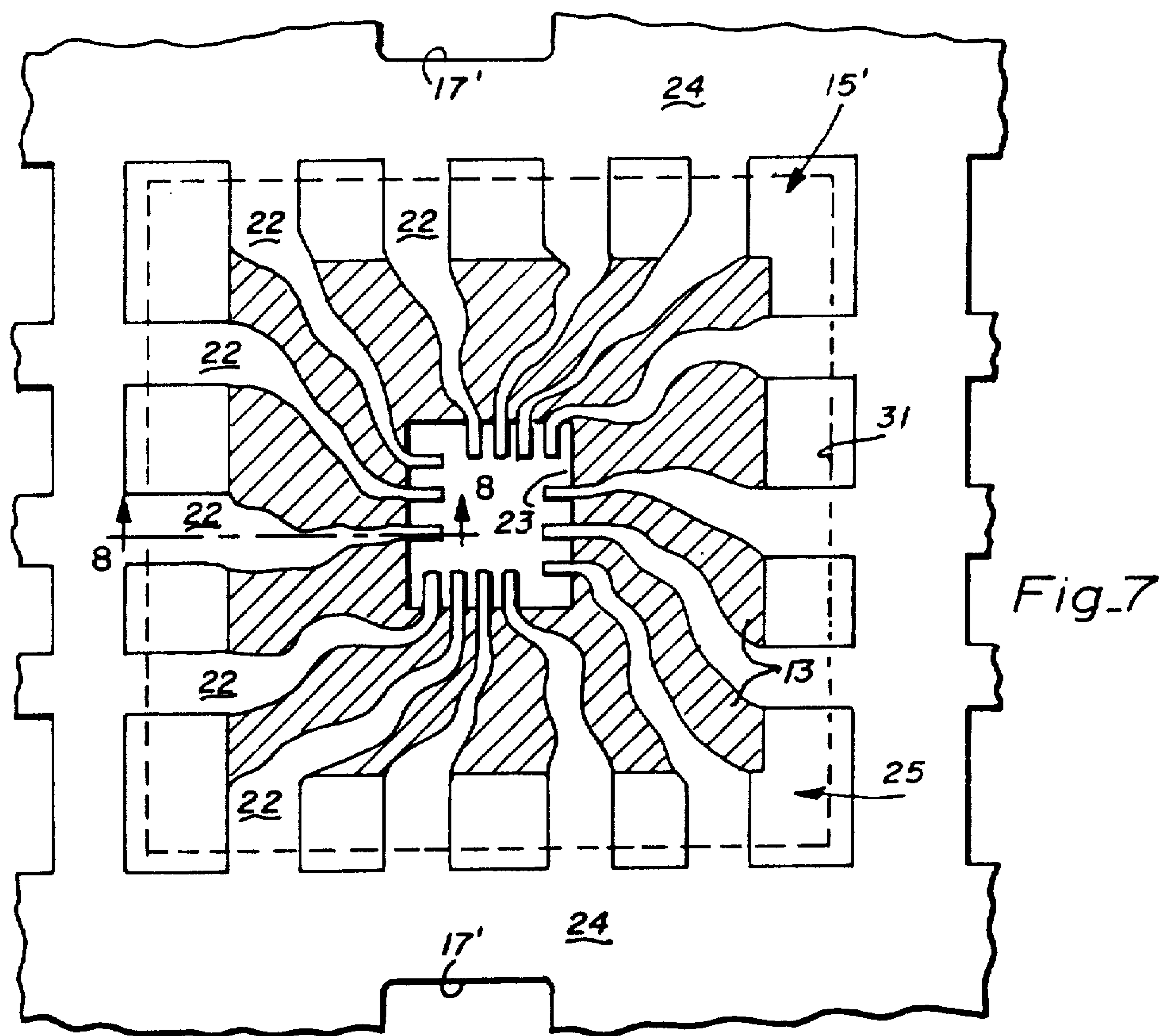
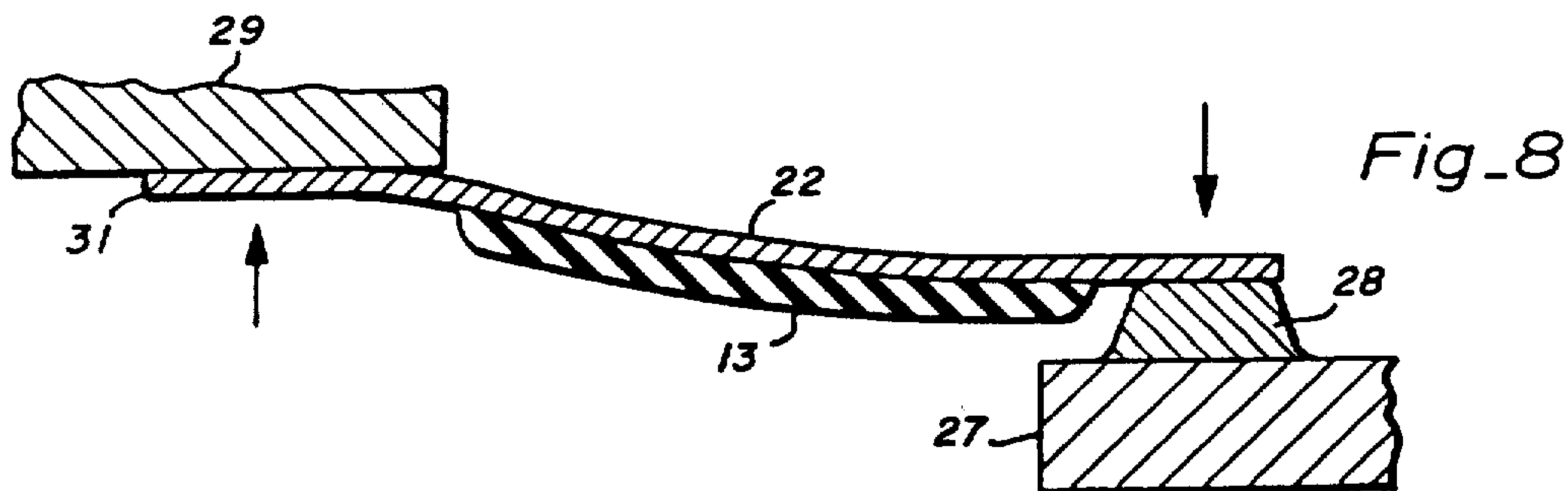


Fig_5


17'
21
7
15
Fig_6


17'
24
15'
22
31
8
23
13
25
Fig_7


29
31
22
13
28
27
Fig_8

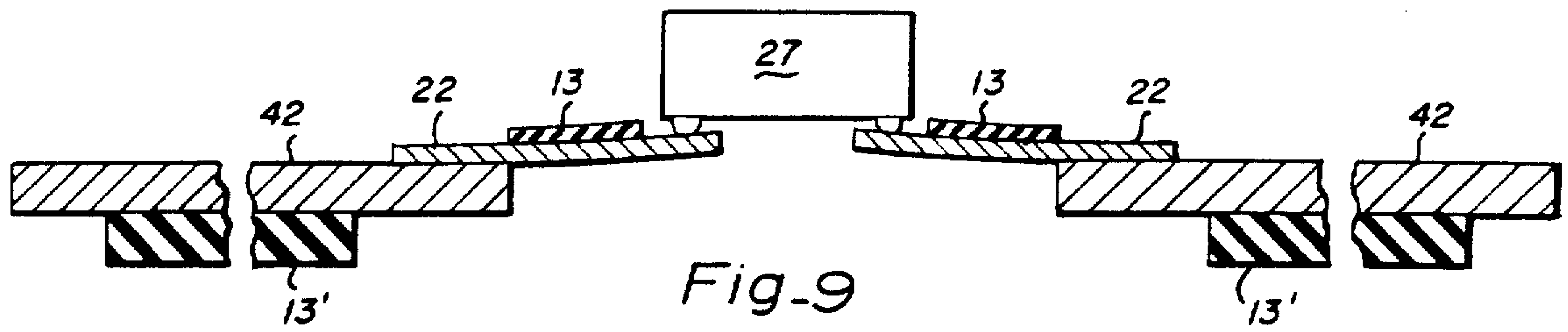


Fig_9

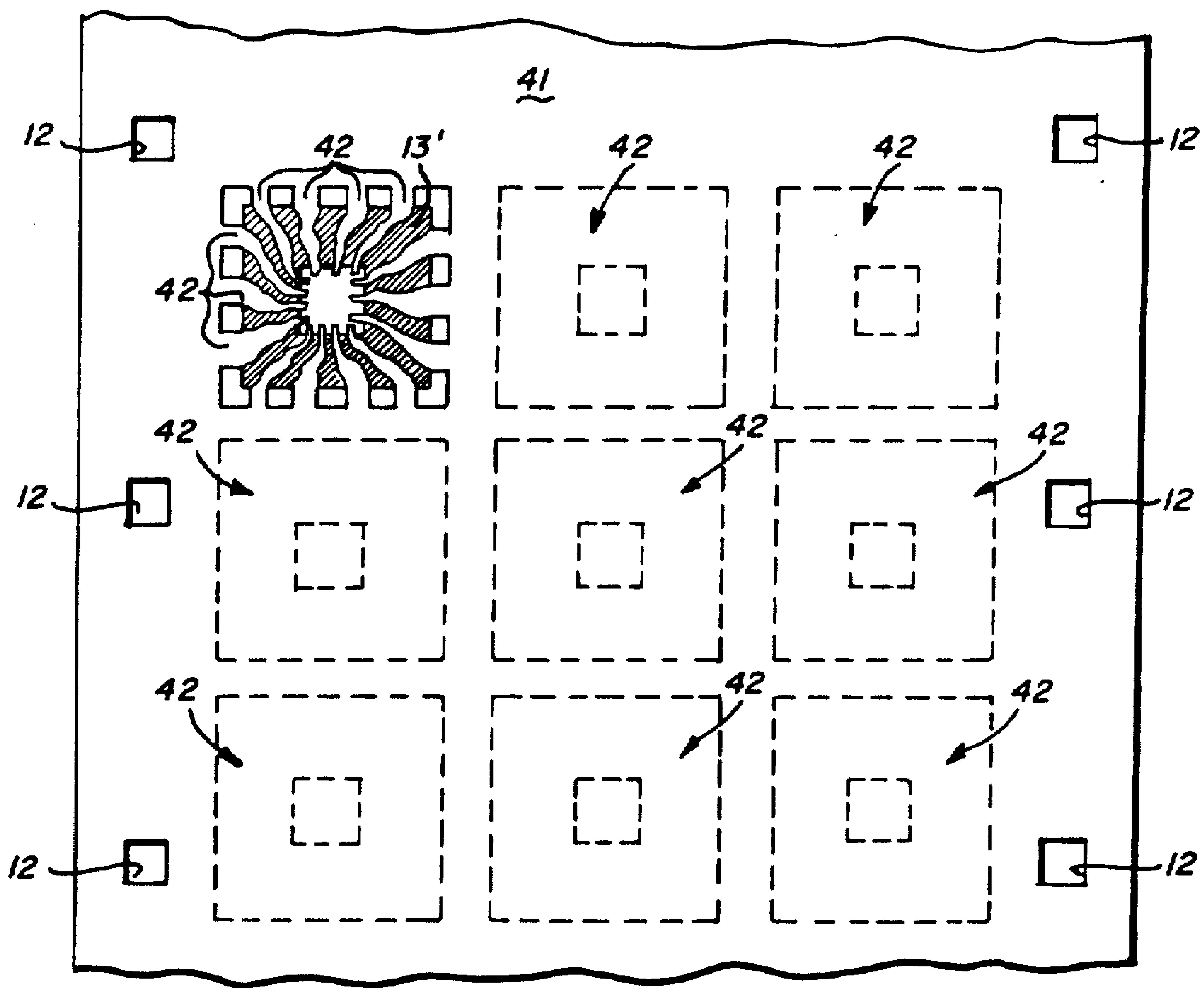


Fig_10

GANG BONDING INTERCONNECT TAPE FOR SEMICONDUCTIVE DEVICES AND METHOD OF MAKING SAME

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

The present invention relates in general to gang bonding interconnect tape for use in automatic gang bonding machines for gang bonding of semiconductive devices and to an improved tape and method of making same.

DESCRIPTION OF THE PRIOR ART

Heretofore, gang bonding interconnect tapes, having a series of interconnect patterns formed thereon, have been used in automatic gang bonding machines to gang bond the individual semiconductive dies to the inner ends of the individual lead patterns and for subsequent bonding of the outer regions of the interconnect lead patterns to a lead frame structure. In one prior method of fabricating the gang bonding interconnect tape, a 5 mil thick polyimide tape is coated on one side with a half mil thick layer of adhesive. The coated tape is then punched to provide outer sprocket holes and then centrally punched to provide the personality holes, i.e., the hole in the central region of the lead pattern to receive the die. The tape is also punched with a ring of apertures in the region of the outer lead bond to facilitate shearing of the interconnect lead pattern at the time of making of the outer lead bond to the lead frame structure. A 1.3 to 1.4 mil thick copper sheet is hot laminated over the adhesive coating to provide a laminated tape structure. The copper is coated with a layer of photoresist, and exposed to images corresponding to each of the individual interconnect lead patterns. The exposed tape is then developed, and etched to form the interconnect lead patterns in the copper sheet.

The resultant tape is fed through a first automatic gang bonding machines wherein the inner ends of the individual interconnect leads are thermal compression gang bonded to gang bonding bumps on the semiconductive device. In this first bonding step, the semiconductive device is transferred to the tape. The tape is then fed through a second automatic bonding machine wherein the individual lead patterns are sheared out of the tape and thermal compression gang bonded at their outer ends to the inner ends of a pattern of leads, such as a lead frame structure, printed circuit board or flexible circuit.

The problem with this first method of fabricating an automatic gang bonding interconnect tape is that the punching operations are relatively expensive in that the punches have only limited life and the polyimide is relatively expensive.

In a second method for fabricating an automatic gang bonding interconnect tape, a half mil thick polyimide coating is cast onto one side of a 1.3 to 1.4 mil thick copper tape. Next, the tape is coated with photoresist on both sides. The tape is then exposed simultaneously on both sides with different patterns of optical radiation, the copper side being exposed with patterns for the individual interconnect leads and the sprocket holes, whereas the polyimide side is exposed with patterns of radiation corresponding to the personality holes, the sprocket holes and the ring of perforations in the region of the shear line at the outer lead bond area. The polyimide side is then etched to provide the personality holes, the sprocket holes and the outer lead perforations. Next, the copper side is etched to provide the interconnect lead patterns, and the sprocket hole patterns. The resultant tape is then used in an automatic gang bonding machine in the same manner as previously described.

The problem with this latter method for fabrication of an automatic gang bonding interconnect tape is the cost of performing the two etching steps and, particularly, the etch of the polyimide side of the tape.

Therefore, it is desired to provide an improved method for manufacture of an automatic gang bonding interconnect tape which is less costly of manufacture and which avoids the multiple punching operations of the first method and the two different etching steps of the second method.

SUMMARY OF THE PRESENT INVENTION

The principal object of the present invention is the provision of an improved automatic gang bonding interconnect tape and method of making same.

In one feature of the present invention, a series of electrically insulative support structures are deposited onto a copper tape, there being at least one of said electrically insulative support structures or rings for individual ones of the interconnect lead patterns to be formed in the copper tape. A series of interconnect lead patterns is then formed in the tape with individual ones of the interconnect lead patterns being disposed in registration with individual ones of said electrically insulative support structures.

In another feature of the present invention the individual electrically insulative support structures are deposited onto the metallic (copper) tape by flowing the electrically insulative material through a patterned screen onto the metallic tape.

In another feature of the present invention, the electrically insulative support structures are made of an electrically insulative material selected from the group consisting of certain thermal setting and thermal plastics.

In another feature of the present invention, parallel rows of said electrically insulative support structures are deposited on the metallic tape. Parallel rows of metallic interconnect lead patterns are etched in registration with individual ones of the support structures. The tape is then slit parallel to the individual rows for separating same into individual gang bonding tapes.

In another feature of the present invention the metallic tape is punched at the outer edges thereof with a series of sprocket or locator holes utilized in subsequent steps of depositing the electrically insulative support structures on the tape and for use in exposing the photoresist coating to the patterns of radiation corresponding to individual ones of the interconnect lead patterns and associated locator holes.

Other features and advantages of the present invention will become apparent upon a perusal of the following specification taken in connection with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a metallic tape depicting the parallel rows of electrically insulative support structures deposited thereon,

FIG. 2 is an enlarged view of a portion of the structure of FIG. 1 delineated by line 2—2,

FIG. 3 is a view similar to that of FIG. 1 depicting the step of exposing the photoresist coated metallic tape to the patterns of radiation corresponding to the individual interconnect lead patterns and locator hole patterns,

FIG. 4 is an enlarged detail view of a portion of the structure of FIG. 3 delineated by line 4—4,

FIG. 5 is an enlarged detail view of a portion of the structure of FIG. 3 delineated by line 5—5,

FIG. 6 is a plan view of one of the individual automatic gang bonding interconnect lead tapes after having been separated from the composite tape of FIG. 3,

FIG. 7 is an enlarged detail view of a portion of the structure of FIG. 6 delineated by line 7—7,

FIG. 8 is an enlarged sectional view of a portion of the interconnect lead structure of FIG. 7 as bonded to a die and to an outer lead frame,

FIG. 9 is a sectional view of a semiconductor die bonded to a first interconnnect lead pattern which is in turn bonded to a second surrounding interconnect lead pattern of FIG. 10, and

FIG. 10 is a schematic plan view of an alternative interconnect tape embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2, a 1000 foot roll of wrought copper sheet having a weight of one ounce per square foot or a thickness of 1.3 to 1.4 mils is slit into a 70 millimeter width to provide a copper tape **11**. The copper tape **11** is preferably coated with copper phosphate or other materials, using conventional techniques, to promote adhesion of organic plastic materials to be subsequently applied to the copper tape. The copper tape is punched along opposite side marginal edges thereof with sprocket holes **12** to be utilized as locating holes. The holes **12** are spaced at 1.5 inch intervals along the length of the tape **11**. The copper tape is then annealed and cleaned.

A pattern of electrically insulative support structures **13**, such as rings, are then screened, as by screening, onto one face of the copper tape **11**. In the screening process, the sprocket holes **11** are utilized as locating holes for indexing the screening pattern so as to provide proper indexing for the pattern of support structure **13**. In a typical example of the screening step of the process, the support structures **13** are screened through a 3×3 inch screen pattern. The support structures **13** are deposited to a thickness of between 0.5 mils and 2 mils. The electrically insulative screening material **13** should be compatible with bonding temperatures of approximately 400° C. for 0.1 second, have a pot life of 4 hours at 25° C., be flexible in thicknesses of 0.5 to 2.0 mils, and have the electrical properties of a good dielectric. Suitable electrically insulative support structure materials include thermal setting plastic materials and thermoplastic materials. The thermal setting plastic materials include, cycloaliphatic plastics with anhydride cure, low molecular weight bisphenol with anhydride cure, both cycloaliphatic and low molecular weight disphenol with phenolic cure, silicon material such as silanol and vinyl containing siloxane cured with an SIH siloxane, polyimide, polyamide, mixtures of polyimide and polamide, phenolics, and diallylphthalate with peroxide cure. Suitable thermoplastic materials include polysulphone, polycarbonate, and ABS. The use of these materials should be compatible with the temperatures encountered in subsequent bonding steps. Thus, for thermal compression bonding where temperatures of 450° C. are encountered the aforecited epoxy and polyimide materials are most suitable.

A suitable epoxy for use in the screening step of the process includes anhydride cured cycloaliphatic epoxy resin which is liquid at room temperature and which has a relatively low viscosity at 25° C., that is, a viscosity less than 500 centipose. The epoxy resin includes a thixotroping agent to carry the viscosity from 500 to over 120,000 centipose and to provide a low yield value. A suitable thixotroping agent includes 7 to 8% by weight of fumed silica treated with silane or silazane so as to convert the silanol groups to trimethylsiloxy groups. This epoxy forms the subject matter of and is claimed in copending U.S. application Ser. No. 567,724 filed Apr. 14, 1975, *now U.S. Pat. No. 4,043,969 issued Aug. 23, 1977* and assigned to the same assignee as the present invention.

As an alternative to screening of the electrically insulative support structures **13** onto the copper tape **11** they may be applied by any one of a number of conventional methods such as injection molding, electrostatic spraying through a mask, or by transfer from a sheet of the material to the copper sheet.

For screening, the thermal setting materials are suitable when they include a suitable thixotropic agent. For electrostatic spraying through a mask, either the thermal setting materials or the thermoplastic materials may be utilized. For injection molding, either the thermal setting or thermoplastic materials may be utilized. For transfer molding, the thermal setting materials are suitable.

A number of different formats may be employed depending upon the size of the die which is to be bonded to the interconnect lead patterns to be formed on the tape. More particularly, these support structures **13** are screened onto the tape **11** in a number of parallel rows **14** extending longitudinally of the tape **11**. The number of parallel rows **14** depends upon the width of the individual tapes which are to be subsequently formed by slitting of the master tape 11.

One format corresponds to an individual tape width of 11 millimeters to be utilized with a die size less than 60×60 mils, such pattern having a pitch P of 0.1667 inch, where the pitch is the longitudinal spacing between the center of adjacent support structures **13** of a given row, there being five rows **14** of such support structures **13** in the 70 millimeter width of the master tape **11**. In such a case, a 3 inch length of the composite tape **11** will accommodate 90 support rings **13**.

A second format corresponds to an individual tape width of 13.75 millimeters for accommodating die sizes less than 90×90 mils, such pattern having a pitch P of 0.214 inch and providing four rows **14** in the 70 millimeter width of the master tape **11** and 56 die locations per 3 inch length of the master tape **11**.

A third format corresponds to an individual tape width of 16 millimeters to accommodate die sizes less than 200 mils by 200 mils, such pattern having a pitch P of 0.300 inch, there being three rows of such support structures **13** for a 70 millimeter wide master tape **11**.

This third format provides 30 die locations per 3 inch length of the master tape **11**.

After the support structures **13** have been deposited on the tape **11**, the tape is cured in an oven in an atmosphere of nitrogen gas so as to harden the individual support structures **13**. At this point the tape **11** may be inventoried, if desired.

Next, the master tape **11** having the support structures **13** deposited thereon is cleaned of the adhesion promoting coating and any oxides thereon by appropriate etching and then coated with an antioxidant coating such as chromate to promote photoresist adherence. A number of suitable antioxidant coatings including chromate are disclosed and claimed in copending U.S. application Ser. No. 582,634 filed June 2, 1975, *now U.S. Pat. No. 4,188,438 issued Feb. 12, 1980* and assigned to the same assignee as the present invention. The chromate antioxidant coating is applied to the copper tape **11** by cleaning the copper tape with hydrochloric acid and then immersing the copper tape in a plating solution of chromic acid mixed with sulfuric acid, such mixture being 2.0% chromic acid to 8% full strength sulfuric acid to 90% deionized water by volume. The tape is immersed for 1 minute at room temperature then removed, rinsed in deionized water and dried. In this process, a chromate antioxidant coating is deposited on the copper surface to a thickness of between 10 and 100 angstroms.

Next, the composite tape **11** is coated on both sides with a positive type photoresist coating of conventional type utilized in the semiconductor art.

Next, the side of the tape **11** which is opposite to that containing the support structures **13** is exposed to patterns **15** of optical radiation to which the photoresist material is sensitive. The patterns **15** of radiation are produced by a conventional 4×4 inch photo mask as utilized in the semiconductor art (see FIGS. **3-5**). The mask **16** has thereon an array of patterns **15** corresponding to the individual interconnect lead patterns to be formed in the copper tape **11**. In a typical example, the mask **16** exposes a three inch length of the tape **11**. In addition to the individual interconnect lead patterns **15**, the mask contains patterns **17** corresponding to sprocket holes **17'** for each of the tapes which are to be subsequently split from the master tape **11**.

Due to a peculiarity of the automatic gang bonding interconnect machines, the sprocket locator holes **17'** for a given interconnect pattern **15** must be axially displaced along the tape from the particular lead pattern of interest by approximately 0.5 inch for the 11 mm, 0.642 inch for the 13.75 mm and 0.6 inch for the 16 mm$\pm\approx$0.0005 inch. Thus, in the case of the 11 mm format the interconnect patterns **15** on the mask at the leading edge thereof have their respective sprocket holes **17** trailing by 0.5 inch as shown in FIG. **4**. Similarly, at the trailing edge of the mask **16** the pattern for the sprocket holes **17** lags behind the respective interconnect pattern **15** by 0.5 inch. Thus, the individual tape sprocket holes **17** are indexed to the respective lead portions **15** via the mask **16** to a tolerance of ±0.0005 inch.

On the other hand, the mask **16** is indexed to the tape **11** by means of the sprocket holes **12** at the marginal edge of the master tape **11**. These sprocket holes **12** can provide indexing of the mask **16** to the pattern of insulative support structures **13** to ±5 mils. At the overlap of one set of patterns **15** exposed on the tape **11** through the mask **16** to a subsequent set of patterns exposed through the mask **16** the overlap tolerance is ±5 mils as provided by the sprocket holes **12**. However, the automatic gang bonding machine has the capability of picking up or releasing the individual tape to compensate for the up to ±30 mil jump in spacing of the sprocket holes **17** at the overlap of two patterns. The method of indexing the lead patterns **15** to their respective locator holes on the mask **16** and indexing the mask to the tape **11** via the sprocket holes **12** is disclosed and claimed in copending U.S. application Ser. No. 593,477 filed July 7, 1975 (*now abandoned*) and assigned to the same assignee as the present invention. Suitable automatic gang bonding interconnect machines are the ILB and OLB Model No. 1-1000 manufactured and marketed by Jade Corporation of Philadelphia, Penn.

Next, the exposed photoresist coating is developed and removed by conventional methods. The copper tape **11** is then etched through the removed portions of the photoresist coating. The etched copper tape is then stripped of the photoresist coating to form the individual interconnect patterns **15'** and sprocket holes **17'**.

Next, the composite tape **11** is slit into the appropriate number of individual tape strips **21**, as shown in FIGS. **6** and **7**, such slitting occurring inbetween adjacent rows of sprocket holes **17'**. The individual gang bonding interconnect tapes **21** include a series of virgin sprocket holes **17'** along opposite marginal side edges thereof and a series of gang bonding interconnect lead patterns **15'** formed therein.

The individual patterns **15'** are personalized to the particular semiconductive die type to which they are to be bonded and each includes an array of ribbon-shaped leads **22** extending outwardly from a central aperture **23** (personality hole) to an outer region **24** of the copper tape **21**. The marginal edge of the personality hole **23** is defined by the inner lip of the electrically insulative support structure **13** (ring) and the ring **13** has sufficient radial extent to provide sufficient support for the individual leads **22** and to hold the leads **22** in the desired circumferentially spaced position in electrically insulative relation. The inner ends of the leads **22** overhang the inner periphery of the personality hole **23** for bonding to gang bonding bumps on the semiconductive die.

An annular gap **25** is defined between the outer periphery of the electrically insulative support structure **13** and the inner lip of the frame portion **24**. This gap **25** is provided to facilitate shearing of the individual leads **22** at their outer regions at the time that the interconnect lead pattern **15** is thermal compression bonded to the inner lip of the lead frame structure, as more fully described below with regard to FIG. **8**.

After the individual tapes **21** have been separated from the composite tape **11** they are inspected and spliced together into long lengths as of 1000 feet. The tape is then utilized in the conventional manner with conventional automatic gang bonding interconnect machines such as the aforementioned Jade Model No. 1-100. Briefly, in these automatic gang bonding interconnect machines, as shown in FIG. **8**, a semiconductor die **27**, having a plurality, such as **14**, gang bonding bumps **28** formed thereon, is indexed with an individual personality hole **23** by the gang bonding machine.

The gang bonding bumps typically have a height of between 1.0 and 2.0 mils and are connected at their bases to patterns of intraconnect metallization on the semiconductive die **27**. The inner ends of the leads **22** are thermal compression bonded to the gang bonding bumps **28** by the gang bonding tool, not shown, which

presses the inner ends of the leads **22** down against the upper surface of the gang bonding bumps **28**. In a typical example the gang bonding tool is made of carbon and heated to a temperature of, for example, 550° C. and presses the inner ends of the interconnect leads down against the gang bonding bumps with a pressure of approximately 8 grams per square mil for a time of approximately 0.2 seconds. The gang bonding tool gang bonds 14 of such gang bonding bumps to their respective interconnect leads **22** simultaneously.

The die **27** is held to a base support structure via a release wax and due to the heating of the die by the thermal compression tool, the wax releases the die and it is thereby transferred to the tape **21**. The tape **21** with the dies **27** attached thereto is fed through a second gang bonding machine which thermal compression bonds the outer portions of the interconnect leads **22** to the inner ends of a set of lead frame members **29**. For bonding the inner ends of the lead frames **29** to the outer ends of the interconnect leads **22**, the thermal compression tool, not shown, is brought up against the lower side of the interconnect leads **22** for pressing the upper surface of the interconnect leads into engagement with the lower surface of the lead frame structure **29**. In a typical example, the temperature of the bonding tool for the outer lead bond is approximately 450° C. and is held in engagement with the interconnect leads for approximately 0.15 seconds with a bonding pressure of approximately 25 grams per square mil.

As the thermal compression bond is made between the interconnect lead **22** and the inner ends of the lead frame **29**, the copper interconnect lead pattern **15'** is sheared along a shear line **31** located just inside the outer marginal edge of the interconnect lead pattern **15'**. In this manner, the lead attached die **27** is transferred from the tape **21** to the leadframe structure **29**.

The advantages of the automatic gang bonding interconnect tape **21** and the method of fabricating same according to the present invention include, reduction of manufacturing cost of the tape **21** and that the master tape **11** with the support structures **13** affixed thereto is less costly to inventory than the prior tape systems. In addition, the individual tapes **21** have virgin sprocket or locator holes **17'** for use in the inner lead gang bonding machine.

In an alternative embodiment of the present invention, see FIGS. **9** and **10**, a 70 mm wide copper tape **41**, as of 2.6 mil thickness, is punched with sprocket holes **12** and treated with an adhesion promoting agent, as before described. Patterns of electrically insulative support structures **13'**, such as rings, are screened, or otherwise applied, onto one face of the copper tape **41**, as before described. The tape **11** is cured and etched, as before described, to define certain interconnect lead patterns **42** which are to form lead patterns for making gang bonding connections to the outer ends of respective ones of the interconnect leads **22**, as previously bonded at their inner ends to the dies **27**. The interconnect lead patterns **42**, thus, take the place of the lead frame **29** of the previous example and the dies **27** are transferred to the flexible lead patterns **42** upon making of the gang bond between the outer ends of the inner interconnect lead patterns **22** and the inner ends of the outer interconnect lead pattern **42**. Thus the latter interconnect lead pattern **42** is similar to a flexible printed circuit board and may be punched from the tape **41** along outer shear lines **44** of the pattern for bonding or otherwise being interconnected to other electrical circuitry at the outer margin thereof.

In this latter embodiment, additional insulative structures, such as a grid pattern, are deposited at the time of depositing the insulative rings for further strengthening of the lead patterns located outside of the bonding area.

What is claimed is:

1. In a method for fabrication of a gang bonding interconnect tape for interconnecting a first pattern of leads and a second pattern of leads, such interconnect tape having a series of metallic interconnectlead patterns thereon, individual ones of said lead patterns including a plurality of ribbon-shaped metallic leads extending outwardly from an inner central portion of said pattern to an outer region of said pattern and including an individual electrically insulative support structure interconnecting a plurality of said ribbon-shaped metallic leads in a region of said pattern intermediate said outer region thereof and said inner central region thereof, the steps of:

depositing a series of said individual electrically insulative support structures onto said metallic tape, there being at least one of said individual electrically insulative support structures for individual ones of said interconnect lead patterns to be formed in said metallic tape.

2. The method of claim **1** including the step of, forming a series of said interconnect lead patterns in said metallic tape, individual ones of said lead patterns being formed in registration with individual ones of said electrically insulative support structures so as to locate individual ones of said electrically insulative support structures in a region of individual ones of said lead patterns intermediate said inner central region thereof and said outer region thereof.

3. The method of claim **2** wherein the step of forming said series of said lead patterns in said tape comprises the steps of, coating the side of said tape opposite to said deposited series of electrically insulative support structures with a photoresist coating, exposing the photoresist coating to a series of radiation images each of said images corresponding to individual ones of said interconnect lead patterns to be formed in said tape, removing the photoresist coating in the exposed patterns, and etching the tape in the regions of the removed photoresist coating to form said interconnect patterns therein.

4. The method of claim **2** wherein the step of forming said series of said lead patterns in said tape comprises the steps of, coating the side of said tape opposite to said deposited series of electrically insulative support structures with a photoresist coating, exposing said photoresist coating to parallel rows of radiation images, each of said images corresponding to individual ones of said interconnect patterns to be formed in said tape, removing the photoresist coating in the exposed patterns, and etching said tape in the regions of the removed photoresist coating to form rows of interconnect patterns therein.

5. The method of claim **4** including the step of slitting said tape in the regions thereof between and parallel to said rows of interconnect patterns to slit the tape into a plurality of tapes each having a row of said interconnect patterns thereon.

6. The method of claim **4** including the step of, punching a series of locator holes in said tape prior to the step of exposing said tape to said rows of radiation images.

7. The method of claim 4 wherein said step of exposing said tape to said rows of interconnect patterns includes the step of, exposing said tape to rows of radiation images corresponding to rows of locator holes to be formed in said tape there being at least one such row of locator hole images for each row of interconnect pattern images, and wherein the step of etching the tape includes, etching said rows of locator hole images to form at least one row of locator holes for each row of said interconnect patterns formed in said tape.

8. The method of claim 1 wherein the step of depositing said series of electrically insulative support structures on said metallic tape includes the step of, depositing a series of individual electrically insulative support rings on said tape to serve as said series of support structures.

9. The method of claim 1 wherein said tape is elongated and wherein the step of depositing said series of electrically insulative support structures on said metallic tape includes the step of, depositing rows of said electrically insulative support structures on said tape, said rows extending generally in the direction of elongation of said tape.

10. The method of claim 1 wherein said tape is made of copper.

11. The method of claim 1 wherein said step of depositing said series of electrically insulative support structures on said tape comprises the step of, flowing an electrically insulative material through a patterned screen onto said tape as a series pattern of electrically insulative portions, and allowing the electrically insulative patterns to harden into said series of electrically insulative support structures.

12. A method of producing a metal-plastic composite lead frame device for integrated circuit packaging, said lead frame device having a plurality of cantilever metal leads held in fixed alignment near their free ends by a member of plastics material, comprising the steps of:

perforating a continuous web of metallic foil with a plurality of accurately spaced registration apertures along at least one marginal edge thereof;

depositing on a first side of said foil a pattern of thin, electrically insulating plastic meterial accurately aligned with respect to said apertures, said pattern having lesser overall dimensions than said web;

coating the opposite side of said foil with a photoresist material;

imaging a lead frame pattern on said photoresist at accurately aligned positions with respect to said apertures;

developing said imaged lead frame pattern; and

passing said strip through an etching bath whereby said strip will be etched away leaving only a lead frame with the leads supported by said plastics material.

13. A method according to claim 12 wherein said pattern of electrically insulating plastic material is printed on said metal foil and has a thickness in the range of 0.5 to 2 mils.

14. A method according to claim 12 wherein said pattern of electrically insulating plastic material is preformed and bonded to said metal foil.

15. A method according to claim 12 wherein said plastic material is selected from the group including polyimides and epoxies.

16. A method according to claim 12 wherein said metallic foil is copper having a thickness in the range of 1.3 to 2.6 mils.

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