

ZERO INSERTION FORCE PIN GRID ARRAY SOCKET**Field of the Invention**

The present invention relates to an electrical connector and, in particular, a zero insertion force, pin grid array socket.

Integrated circuits (IC's) have become the world's standard for electronic circuits. These range from basic transistor networks to complex memory, microprocessor and multi-chip module circuits. The common denominator to all such circuits is that they are produced en masse on a substrate such as silicon and then separated into individual units commonly known as chips. The majority of chips are then mounted in a carrier for subsequent incorporation into end products. The basic size, shape and construction of the carrier is commonly known as the package and many standard packages have emerged. Some examples are commonly known as DIP, SOJ, PLCC, QFP and PGA. Chip packages have developed to accommodate both circuit function, i.e., number and placement of leads, and assembly trends, i.e., through-board and surface mount solder assembly. While the majority of IC devices are soldered in place, several factors such as device availability, testing, upgrades, etc., have traditionally shown that there is a need to socket IC's regardless of their package. IC sockets are known in the art for receiving pin grid array (PGA) packages. Previous PGA sockets required a high insertion force or low insertion force. Such sockets resulted in lead damage due to the high insertion and withdrawal forces. Presently, IC packages have increasingly larger pin counts due to the continued miniaturization of the IC's.

Such increased pin counts require zero insertion force (ZIF) sockets. For example, Intel, Inc. OverDrive™ Processor Sockets are known in the art. Generally, the contacts used in these sockets are referred to as normally closed contacts. Such ZIF PGA sockets are known in the art but include complex and expensive designs. Such contact designs are stressed greatly as the insertion forces increase. Also, such common contact designs have large plating areas which increase cost. Further, such socket designs do not provide for adequate cooling of the IC packages. Accordingly, there is desired a ZIF PGA socket design which overcomes the aforementioned shortcomings.

Summary Of The Invention

It is, therefore, an object of the present invention to provide a socket which includes a contact design which is quickly and inexpensively manufactured.

It is another object of the present invention to provide a socket having a contact design which provides for a selective plating area.

It is a further object of the present invention to provide a socket having a contact design which provides for low stress-strain upon increase of normal force.

It is another object of the present invention to provide a contact design providing for great elastic range upon insertion.

It is a further object of the present invention to provide a contact which may be generated on a die having small centers to reduce material usage.

It is another object of the present invention to provide an air-gap to provide additional cooling of the IC package.

According to the above object of the present

invention, a zero insertion force, pin grid array IC socket comprises a cover slidably engaged to a base and the cover having an array of holes formed therethrough corresponding to an array of passages in the base for receiving a corresponding array of IC pins. The passages of the base include contacts having a generally tuning-fork shape, having a tail portion and a U-shaped portion having a pair of torsional beams. The U-shaped portion has an open side including retention arms being bent at a 45° angle to the plane of the tail and U-shaped portion. The open portion of the contact includes a pair of wipe surfaces and shoulders. The wipe surfaces are at the stamped edge of the contact.

The contact includes a pair of continuous torsional beams having a surface area of at least forty percent of the surface area of the entire contact. The torsional beam provides for a low stress/strain force ratio.

The contact includes a pair of wipe surfaces along the stamped edge or the first side of the open end of the contact. This arrangement provides for a reduced selective plating area. A selective plating area includes an area less than an eightieth of the size of the entire contact.

Further, the array of holes, the corresponding passages and the corresponding contacts have approximately .070 inch spacing.

These and other features of the invention are set forth below in the following detailed description of the presently preferred embodiments.

Brief Description of the Drawings

Figure 1 is a perspective view of the socket of the present invention.

Figure 2 is a partial side elevation cut-away view

of Figure 1 taken at line 2-2.

Figure 3 is a plan view of the socket of Figure 1.

Figure 4 is a plan view of the socket of the present invention having the cover removed.

Figure 5 is an enlarged plan view of Area A of the socket of Figure 4.

Figure 6 is a side elevation cut-away view of the socket of Figure 5 taken at line 6-6.

Figure 7 is a side elevation cut-away view of the socket of Figure 5 taken at line 7-7.

Figure 8 is a perspective view of a contact of the present invention.

Figure 9 is a perspective view of a contact of the prior art.

Figure 10 is an enlarged view of an alternative embodiment of the socket of the present invention.

Figure 11 is a side elevation cut-away view of the socket of Figure 10 taken at line 11-11.

Figure 12 is a perspective view of a contact of an alternative embodiment of the present invention.

Figure 13 is a perspective view of a contact of a further alternative embodiment of the present invention.

Figure 14 is a side elevation cut-away view of an alternative embodiment of the present invention.

Detailed Description of the Presently Preferred Embodiments

An embodiment of the zero insertion force, pin grid array socket of the present invention is best understood by Figures 1-12. Turning to Figure 1, socket 10 is shown in perspective view having base 20 and cover 40. The cover 40 includes an array of holes 42 for receiving pins of an IC package. The socket 10 includes an actuator 60 for sliding the cover 40. Figure 1 shows

the actuator 60 in an intermediate position. By moving the actuator 60 in the direction of arrow 61, the cover 40 will be slid in the direction of arrow 41 to move the cover 40 into the opened position. In this position, the IC package will be mounted to the socket 10 via insertion of the IC package pins through the corresponding array of holes 42 of the cover 40. The array of pins of the IC package are inserted through the array of holes 42 of the cover 40 and into the corresponding array of passages of the base 20. Due to the design of the contacts and the passages of the base 20, the insertion of the pins requires a zero insertion force. Following full insertion of the pins into the holes 42 and passages of the base 20, the actuator 60 is moved in the direction of arrow 62 causing the cover 40 to slide in the direction of arrow 43, forcing the pins into their fully mated position with the contacts mounted in the passage of the base 20.

The cover 40 is mounted to the base 20 via outer latches 51 which engage hooks 53 of the base 20. As well, the cover 40 includes inner latches 52 which engage inner hooks 54. In a preferred embodiment, the latches 51,52 are integrally molded with the cover 42, and the hooks 53,54 are integrally molded with the base 20. The latches include an opening 55. The opening 55 has a sufficient width greater than the hooks 53,54 so that the cover 40 may slide freely in direction of the arrows 41,43 without abutting the hooks 53,54. While the latches 51,52 act to retain the cover 40 onto the base 20, they also provide a means for limiting warpage of the cover 40. The IC packages which are mounted to the socket 10 can undergo great changes in heat dissipation. Such heat may cause the warpage of the socket 10. To

avoid such warpage in a preferred embodiment, four outer latches 51 are oriented on either side of the inner portion of the socket 10.

The socket 10 includes on its cover stand-off hole 46. The stand-off hole 46 receives a stand-off mounted on selected pins of the IC package. According to specific industry specifications, each IC package includes four stand-off pins adjacent to the center of the package. The stand-offs are received by the stand-off holes 46 of the present invention and maintain an air-gap between the cover 40 of the socket 10 and the IC package (See Figure 2). The actuator 60 of the present invention, in its preferred embodiment, includes an end portion 64 which is bent at an angle of approximately 15° - 30° from the axis of the shaft 65 of the actuator 60.

The bent end 64 of the actuator 60 allows for the actuator 60 to be easily grasped to move the actuator 60 from its closed position to the open position. Especially when an IC package is mounted to the socket 10, the bent end 64 of the actuator 60 is easily grasped. The actuator 60 is mounted in a channel 67 of the base 20. The channel 67 has an open end 68 and a closed end 69. At the closed end 69, a retaining wall 70 extends from the edge of the base 20 and is perpendicular to channel 67. A retaining wall 70 retains the actuator 60 within channels 67 upon attachment of the cover 40 over the actuator 60 and onto the base 20.

Figure 2 shows a partial side elevation cut-away view of Figure 1 taken at line 2-2 and also shows an IC package 80 mounted to the socket 10. The base 20 includes passages 22. Mounted within most passages 22 are contacts 30. Mounted to the base 20 is the cover 40. The cover 40 includes the holes 42. Generally, these

holes 42 are beveled to allow the easy insertion of pins 81 of the IC package 80. As the stand-off 82 has a diameter which is larger than the diameter of the stand-off hole 46, the stand-off 82 prohibits the pin from being inserted any further into the socket 10. As the stand-off 82 of the pin 83 is spaced between .200 inches to .180 inches from the base of the IC package 80, there is provided an air-gap 85 of equal spacing. This air-gap 85 provides for the circulation of air between the IC package 80 and the socket 10. The air-gap 85 allows for heat reduction to occur for the IC package 80 and the socket 10.

Figure 3 is a plan view of the socket 10 of Figure 1 having the cover 40 and the base 20. The cover 40 includes holes 42 which include a beveled opening for receiving the pins of an IC package. The stand-off holes 46 are through-holes which do not have a beveled opening. An actuator lever 60 is mounted in channel 67 of the housing 20 and is retained to the socket 10 via retention wall 70. The actuator 60 may be mounted on either the right or left side of the socket 10. Outer latches 51 engage hooks 53. Inner latches 52 engage hooks 54.

Figure 4 is a plan view of the socket 10 having the cover 40 removed. The base 20 is shown having an array of passages 22. The contacts 30 are mounted in the passages 22. The channel 67 is shown having the actuator removed. In a preferred embodiment, the socket 10 houses two hundred thirty-six contacts on .100 inch spacing. Generally, the socket 10 has an overall dimension of 1.940 inch x 2.430 inch x .320 inch. In a preferred embodiment, the housing of the cover and base are injection molded from a polymeric material.

Turning to Figure 5, an enlarged plan view of

Section A of Figure 4 is shown. The base 20 includes the passages 22 having the contact 30 mounted therein. Upon initial insertion of the pins of an IC package, the pins are inserted through the cover 40 and are received in zero insertion force bore 25. The zero insertion force bore 25 has a diameter greater than the diameter of the pin of the IC package. The pin is then slid in direction of arrow 24 and is moved from zero insertion force bore 25 into passage 22 via the movement of the cover 40. The pin first contacts shoulders 31,34 of the retention arms 35 of the contact 30. The pin then continues past shoulders 31 to arrive in its fully mated position against wipe areas 32,33.

Figure 6 is a side elevation cut-away view taken at line 6-6 of Figure 5. The base 20 includes the passages 22 having the contacts 30 mounted therein. The contact 30 includes a tail 38 and a U-shaped section 37 at the opposite end from the tail 38. The U-shaped section 37 has at its open end retention arms 35. The retention arms 35 are bent at approximately a right angle to the plane of the tail 38 and the U-shaped section 37 and parallel to the stamped edge of the contact 30. The tails 38 of the contacts 30 are inserted into apertures 29 of the base 20.

Figure 7 is a side elevation cut-away view of Figure 5 taken at line 7-7. The base 20 is shown having the passages 22 having the contacts 30 mounted therein. The contacts 30 have the tail 38 and at the opposite end the U-shaped section 37. The U-shaped section 37 has at its open end the retention arms 35. The contacts 30 also include wings 26 for providing a friction fit of the contact 30 within the passage 22.

Turning to Figure 8, the contact 30 includes the

tail 38 at one end and the U-shaped section 37 at the other end. The U-shaped section 37 includes an open end having torsional beams 27,28. At the end of the torsional beams 27,28 are the retention arms 35. The retention arms 35 are bent at an angle to the U-shaped section 37 and the tail 38 of the contact 30. The angle at which the retention arms 35 are positioned may vary from between 45°-90°. The retention arms 35 of the contact 30 include the shoulders 31,34 and the wiping areas 32,33.

The insertion of the pin of the IC package into the contact 30 is represented by pins 81a,81b. Generally, the contact 30 is a stamped contact of a copper alloy or phosphor bronze. The contact 30 is stamped on a die in a unitary plane. The unitary plane is that of the tail 38 and the U-shaped section 37. The stock that the contact 30 is stamped from, in a preferred embodiment, has a stamped edge or a first side 11 which generally has a thickness of .005 inch and a wipe area 33 which is approximately .030 inches long, providing a total wiping surface area of .00036 square inches compared to the total contact surface area which is .031 square inches or approximately eighty-six times the wiping surface area. This small wiping area allows for selective plating of a small area of the contact 30. Prior to the forming of the retention arms 35 at approximately a right angle, the contact 30 in its unitary plane is plated at this selective wiping area 33 or target area. A method of forming the socket includes preparing a plurality of contacts on a die in a unitary plane plated generally at the selective wiping area 33. It can be seen that the overall design of this contact 30 allows for a great reduction in the plating materials required for this

contact 30. In a preferred embodiment, gold plating is adhered to the wipe areas 32,33 and due to the small area, the plating costs are greatly reduced. Such plating techniques may include mask plating or controlled depth plating. Such plating techniques may be applied either before or after bending of the retention arms 35. As well, the contact design of the present invention allows for the contacts to be spaced on the die on .100 inch spacing so that they may be quickly and easily inserted into the passages 22 of the base 20 and providing for minimal material usage.

The IC package pin 81a is initially inserted into the zero insertion force bore and is then slid in the direction of arrow 24. The pin 81a is slid between the retention arms 35 of the contact 30. The pin 81a initially contacts shoulders 31,34 of the retention arms 35. As the pin 81a slides past shoulders 31,34, the greatest amount of force is received by the contact 30. Because each retention arm 35 is a unitary member with the entire torsional beams 27,28 and the U-shaped portion 37, the entire force received at the shoulder 31 is spread along the entire length of the torsional beams 27,28 of the U-shaped section 37. The force of the pin 81a against the shoulders 31 causes the torsional beams 27,28 including the retention arms 35 to deflect in a torsional manner in the direction of arrow 39. Each torsional beam 27,28 of the contact 30 receives this torsional deflection upon insertion of the pin 81a.

The present contact design provides for the contact being stamped from a sheet of material having a narrow Z dimension or thickness or first side 11. The rolled surface of the material is of sufficient width and length for the X-Y dimensions of the contact and define a second

side 12 and a third side 13. The retention arms 35 are bent at an angle to the second side 12 or third side 13 of the contact 30. Such bending along the relatively lengthy crease 15, as compared to the thickness of the first side 11, provides for a large surface area of the contact 30 for the torsional motion 39 induced by the normal force of pins 81a, 81b to be transferred beyond the retention arms 35 and to the entire torsional beam 27, 28. Such torsional beams 27, 28 provide for the advantages of the present invention of a low stress/strain force ratio and a great elastic range, as compared to the straight cantilever designs of the prior art (See Figure 9). The prior art contact designs have the retention arm 82 bent (or stamped at an angle to the first side 11' which provides only the narrow thickness of the contact to receive torsional forces of the retention arm, which are not transferred to the beam 83 of the contact 80. Due to the dispersion of the normal force of the pin 81a of the present invention along the entire torsional beams 27, 28 length, the stress-strain measurement is lessened for this contact design. Thus, the torsional beams have a surface area of at least forty percent of the entire contact surface area, provide for greater elastic range than the contacts of the prior art, while maintaining sufficient normal forces.

After the pin 81a is slid past shoulders 31 of each retention arm 35, it attains its final mating position against wiping areas 32, 33. The pin 81b is shown in the final mated position abutting wiping areas 32, 33 of the retention arms 35 of the contact 30. The distance between the wiping areas 32, 33 is only slightly greater than that between the shoulders 31, 34, and the force of the contact 30 against the pin 81b is a sufficient normal force to

hold the pin 81b therein.

Figure 9 shows a prior art contact 80 of a generally straight cantilever design. The contact 80 includes only a single wiping area 81 and includes a retention arm 82 which is formed at an angle to the first side 11' or thickness of the contact 80. Pin 91a is moved to its mated position 91b next to the wiping area 81. Upon such movement, the entire force is taken up by only the retention arm 82. The majority of the body of the contact 80 including beams 83 is not acted on by the normal force of the pins 91a,b. As well, the prior art contact design requires a large area to be plated. Due to the shape of the contact 80, it is generally necessary to plate the entire retention arm 82 and sometimes the whole upper portion of the contact 80. Such prior art contacts do not have the advantage of the contact of the present invention in that two wipe areas are not provided, insertion forces are not deflected throughout the majority of the contact surfaces and selective plating of small areas cannot be undertaken.

Turning to Figures 10 and 11, an alternative embodiment of the present invention is disclosed. This application, thus far, has discussed a socket in a preferred embodiment, having 236 contacts on .100 inch spacing. In the alternative embodiment, it is preferred to have a more densely spaced socket having approximately 320 contacts. The contacts are interstitially placed between the .100 inch x .100 inch grid to provide a .070 inch x .070 inch grid. Figure 10 shows an enlarged plan view of a section of such a socket having approximately .070 inch x .070 inch spacing. Base 120 includes passages 122 having contact 130 mounted therein. A zero insertion force bore 125 has a diameter greater than the

diameter of a pin of an IC package to be inserted therein. The contact 130 includes retention arms 135. The contact 130 functions similarly to the previously described embodiment discussed in Figures 5 and 6. The retention arms 135 are bent at an angle of between 0° and 90° . Orientation of the retention arms at an angle allows the passages 122 supporting the contact 130 to be narrowed, allowing for a more densely spaced socket. Passage 122' and contact 130' are interstitially spaced in the socket base 120 between the other passages 122.

Turning to Figure 11, a side elevation cut-away view taken at line 11-11 of Figure 10 is shown. The base 120 includes passages 122 having the contacts 130 mounted therein. The contact 130 includes a tail 138 and a U-shaped section 137 at an opposite end from the tail 138. The U-shaped section 137 has at its open end retention arms 135. The retention arms 135 are bent at between 0° and 90° to the place of the tail 138 and the U-shaped section 137. In the preferred embodiment, the retention arms 135 are bent at approximately 45° from the place of the tail 138 and the U-shaped section 137. The bent retention arms 135 allow for a more densely spaced socket and the inclusion of interstitially spaced contact 130' in the socket. The tails 138 of the contacts are inserted into apertures 129 of the base 120.

Turning to Figure 12, a perspective view of an alternative embodiment of the present invention is disclosed. A contact 230 includes a tail 238 at one end and a U-shaped section 237 at the other end. The U-shaped section 237 includes an open end having torsional beams 227, 228. At the end of the torsional beams 227, 228 are retention arms 235. The retention arms 235 are bent at an angle to the U-shaped section 237 and the tail

portion 238 of the contact 230. The angle at which the retention arms 235 are positioned may vary from between 45° - 90° . The retention arms 235 of the contact 230 include wiping areas 232,233. The contact 230 and the wiping areas function similar to that as the contact shown in Figure 8.

The contact tail 238 includes a buffer area 239 which includes an S-shaped bend adjacent to the terminal portion 236 of the tail portion 238. The terminal portion 236 has a J-lead shape to provide for surface mounting of the contact 230. In an alternative embodiment, the terminal portion 13 may also be a gullwing-shaped tail. The buffer area 239 of the tail 238 provides flexibility to the tail 238 of the contact 230. Such flexibility compensates for thermal mismatch and bow and warpage of printed circuit boards and of the socket. The contact 230 is mounted in a socket which includes mechanical fasteners in order to fasten the socket to a printed circuit board and apply a normal force between the terminal portion 236 and the pad of the printed circuit board by exposing the solder pad to heat and reflowing the solder so that a solder joint providing an electrical connection is made between the terminal portion 236 of the contact 230 and the solder pad and printed circuit board. After the solder pad has cured, the buffer area 239 lessens torsional forces which might weaken or stress the solder joint. Any forces due to thermal mismatch or bowing and warping of the printed circuit board or the socket will be taken up by the buffer area 239 to avoid fracturing of the solder joint.

Figure 13 shows a further alternative embodiment of the present invention having contact 230' which includes only a single beam 228' and a single retention arm 235'.

Such a contact may be used in higher density applications wherein the contact 230' is mounted in a socket in an interstitial pattern. The contact 230' also includes a tail portion 238' which includes a buffer area 239' and a terminal portion 236' which allows for surface mounting of the contact 230' providing the thermal mismatch characteristics as discussed in Figure 12.

Turning to Figure 14, a side elevation cut-away view similar to that of Figure 6 is shown. However, the contacts of Figure 12 or 13 are shown mounted within the socket. The base 220 includes passages 222 having a contact 230 mounted therein. The contact 230 includes the tail 238 and the retention arm 235 at the opposite end. The contact 230 functions similarly to the aforementioned contacts of Figures 1-8 in that the retention arm 235 and the passage 222 receive a pin therein. The contact 230 includes a buffer area 239 which is an S-shaped section of the tail 238 including the terminal portion 236 which is mounted and soldered to the solder pad 200. The solder pad 200 is attached to a printed circuit board. Any thermal mismatch which occurs between the circuit board and the base 220 may be taken up by the buffer area 239 so that the solder joint between the terminal portion 236 and the solder pad 200 does not fracture. In a preferred embodiment, the contact 230 having the buffer area 239 allows for torsional movement between the base 220 and a printed circuit board in an axial direction of up to .005 inch and laterally up to .010 inch.

It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without

departing from the spirit and scope of the present invention and without diminishing the attendant advantages. It is, therefore, intended that such changes and modifications be covered by the appended claims.



PATENT CLAIMS:

1. An electrical socket comprising:
a base having an array of passages for receiving pins of an IC package;
contacts mounted in said passages including a generally tuning-fork shape having a tail at a first end and pair of torsional beams at the opposite end, a first side of said contacts defined by the thickness of the material from which the contacts are stamped, a second side perpendicular to said first side and defined by the rolled surface of said material, said torsional beams having retention arms at an angle of 45° to said second side, said retention arms having shoulders and wiping areas.
2. The socket of Claim 1 wherein said contact receives plating at said wiping areas and the entire surface area of said contact being at least eighty times the surface area of said wiping area.
3. The socket of Claim 1 wherein said pair of torsional beams have a total surface area of at least forty percent of the entire surface area of said contact.
4. The socket of Claim 1 wherein said wiping areas are at said first side of said contacts.
5. The socket of Claim 1 wherein said shoulders are at said first side of said contacts.
6. The socket of Claim 1 including zero insertion force bores adjacent to said passages.
7. The socket of Claim 1 wherein said insertion path of said pins is parallel to said retention arms.
8. The socket of Claim 1 wherein said array of passages and said corresponding contacts have approximately .070 inch spacing.



9. An electrical socket comprising:
a base having an array of passages on approximately .070 inch spacing formed therethrough for receiving pins of an IC package; and

contacts mounted in said passages including a generally tuning-fork shape having a tail at a first end and a U-shaped section having a pair of torsional beams at the opposite end.

10. The socket of Claim 9 wherein said torsional beams include retention arms at an angle of 45° to the plane of said U-shaped section.

11. The socket of Claim 9 wherein said torsional beams include retention arms having wiping areas, the entire surface area of said contacts being at least eighty times of the surface area of said wiping area.

12. The socket of Claim 10 wherein said bent retention arm forms a crease having a length greater than a thickness of said contact.

13. A method of forming an electrical socket including the steps of:

molding a base having an array of passages formed therethrough;

stamping a plurality of contacts having a generally tuning-fork shape including a U-shaped portion having torsional beams having wiping areas and said torsional beams having retention arms at an angle of 45° to the plane of the U-shaped portion;

plating said wiping areas; and

inserting said contacts in said passages.

14. The method of Claim 13 wherein wiping areas have a surface of less than an eightieth of the surface area of said contact.



15. The method of Claim 13 wherein said torsional beams have a surface area of at least forty percent of said contact area.

16. The method of Claim 13 wherein said contacts create a normal force through torsional movement of said U-shaped portion.

17. The method of Claim 13 wherein said plating step includes selective plating of said wiping areas.

18. The method of Claim 13 wherein said plating step includes controlled depth plating of said wiping areas.

19. The method of Claim 13 further comprising:
the step of bending said torsional beams at an angle to the plane of said U-shaped section before plating.

20. The method of Claim 13 further comprising
the step of:

bending said torsional beams at an angle to the plane of said U-shaped section after plating.

21. A zero insertions force, pin grid array socket comprising:

a cover slidably engaged through a base and having an array of holes formed therethrough:

said base having a corresponding array of passages to said holes, said holes and corresponding passages for receiving pins of an IC package:

contacts mounted in said passages including a surface mount tail for mounting said socket via surface mount to a printed circuit board.

22. The socket of Claim 21 wherein said tail includes a buffer area.

23. The socket of Claim 21 wherein said buffer



area is an S-shaped portion for buffering thermal mismatch forces.

24. The contact of Claim 21 wherein said buffer portion provides for torsional movement of said socket as great as .010 inch.

25. The socket of Claim 21 wherein said contact includes a torsional beam.

26. The socket of Claim 21 wherein said contact includes a retention arm for receiving said pin.

27. A zero insertion force, pin grid array socket comprising:

a cover slidably engaged to a base and having an array of holes formed therethrough;

said base having a corresponding array of passages to said holes, said holes and corresponding passages for receiving pins of an IC package; and

contacts mounted in said passages including a buffer area.

28. The socket of Claim 27 wherein said buffer area is an S-shaped portion of said contact.

29. The socket of Claim 27 wherein said contact includes a surface mount tail.

30. The socket of Claim 29 wherein said surface mount tail is a J-lead shaped tail.

31. A zero insertion force, pin grid array socket comprising:

a cover slidably engaged to a base and having an array of holes formed therethrough;

said base having a corresponding array of passages to said holes, said holes and corresponding passages for receiving pins of an IC package; and

a means for buffering thermal mismatch forces between said socket and a printed circuit attached



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thereto.

32. The socket of Claim 31 wherein said buffering means includes a contact having an S-shaped buffer area.

33. The socket of Claim 31 having a J-lead shaped surface mount contact tail.

34. The socket of Claim 31 including a contact mounted in the passages having a single retention arm.

35. The socket of Claim 31 including a contact mounted in the passages having a pair of retention arms.

36. A zero insertion force, pin grid array socket comprising:

a cover slidably engaged to a base and having an array of holes formed therethrough;

said base having a corresponding array of passages to said holes, said holes and corresponding passages for receiving pins of an IC package;

contacts mounted in said passages including a generally tuning-fork shape having a tail at a first end and a pair of torsional beams at the opposite end, a first side of said contacts defined by the thickness of the material from which the contacts are stamped, a second side perpendicular to said first side and defined by the rolled surface of said material, said torsional beams having retention arms at an angle of 45°-90° to said second side, said retention arms having shoulders and wiping areas.

37. The socket of Claim 36 wherein said contact receives plating at said wiping areas and the entire surface area of said contact being at least eighty times the surface area of said wiping area.

38. The socket of Claim 36 wherein said pair of torsional beams have a total surface area of at least



forty percent of the entire surface of said contact.

39. The socket of Claim 36 wherein said wiping areas are at said first side of said contacts.

40. The socket of Claim 36 wherein said shoulders are at said first side of said contacts.

41. The socket of Claim 36 including zero insertion force bores adjacent said passages.

42. The socket of Claim 36 wherein said insertion path of said pins is parallel to said retention arms.

43. The socket of Claim 36 wherein said retention arms are at a 90° angle to said second side.

44. A zero insertion force, pin grid array socket comprising:

a cover slidably engaged to a base and having an array of holes formed therethrough;

said base having a corresponding array of passages to said holes, said holes and corresponding passages for receiving pins of an IC package;

contacts mounted in said passages including a generally tuning-fork shape having a tail at a first end and a U-shaped section having a pair of torsional beams at the opposite end.

45. The socket of Claim 44 wherein said torsional beams include retention arms at an angle of 45°-90° to the plane of said U-shaped section.

46. The socket of Claim 44 wherein said torsional beams include retention arms having wiping areas, the entire surface area of said contacts being at least eighty times of the surface area of said wiping area.

47. The socket of Claim 44 wherein said bent retention arm forms a crease having a length greater than



the thickness of said contact.

48. A method of forming a zero insertion force, pin grid array socket including the steps of:

molding a cover slidably engageable to a base and having an array of holes formed therethrough;

molding said base having a corresponding array of passages to said holes;

stamping a plurality of contacts on .100 inch spacing having a generally tuning-fork shape including a U-shaped portion having torsional beams having wiping areas;

plating said wiping areas; and

inserting said contacts in said passages.

49. The method of Claim 48 wherein said wiping areas have a surface area of less than an eightieth of the surface area of said contact.

50. The method of Claim 48 wherein said contacts create a normal force through torsional movement of said U-shaped portion.

51. The method of Claim 48 wherein said plating step includes selective plating of said wiping areas.

52. The method of Claim 48 wherein said plating step includes controlled depth plating of said wiping area.

53. The method of Claim 48 further comprising the step of:

bending said torsional beams at an angle to the plane of said U-shaped section before plating.

54. The method of Claim 48 further comprising the step of:

bending said torsional beams at an angle to the plane of said U-shaped section after plating.

55. A zero insertion force pin grid array



socket comprising:

a cover slidably engaged to a base having an array of holes formed therethrough;

said base having a plurality of passages, said passages corresponding to said holes of said cover and for receiving pins of an IC package:

a means for providing an air-gap between said cover and said IC package.

56. The socket of Claim 55 wherein said air-gap means includes a stand-off hole through said cover for receiving an IC package pin having a stand-off thereon wherein insertion of said stand-off pin in said stand-off hole causes the said stand-off to abut the top surface of said cover.

57. The socket of Claim 55 including an actuator having an end portion bent at a 10°-30° angle from the shaft of the actuator.

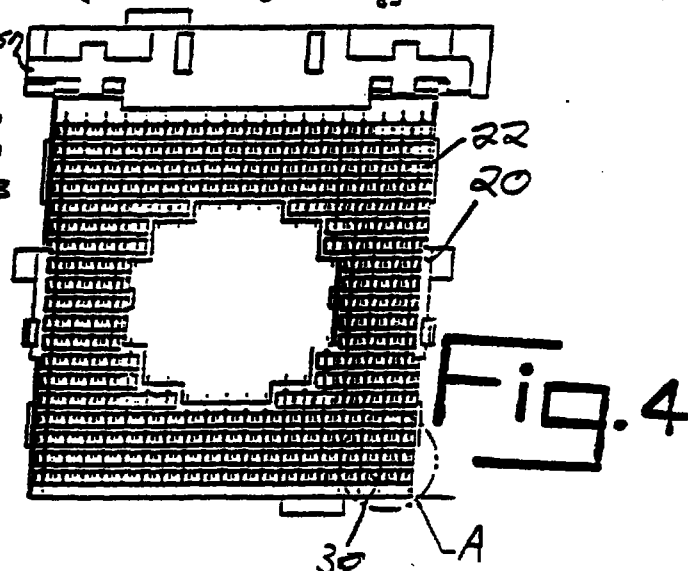
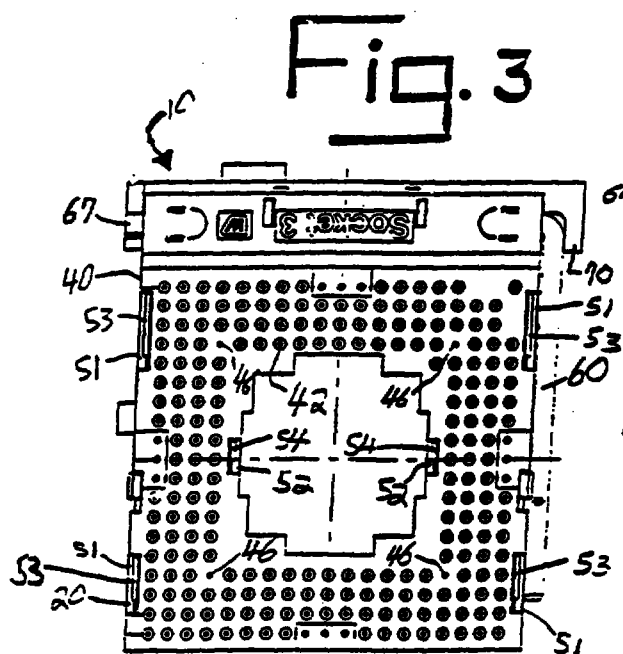
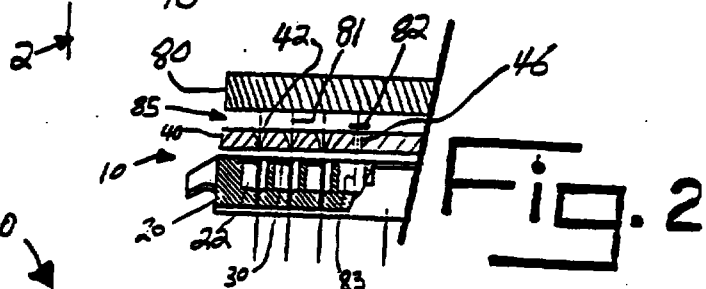
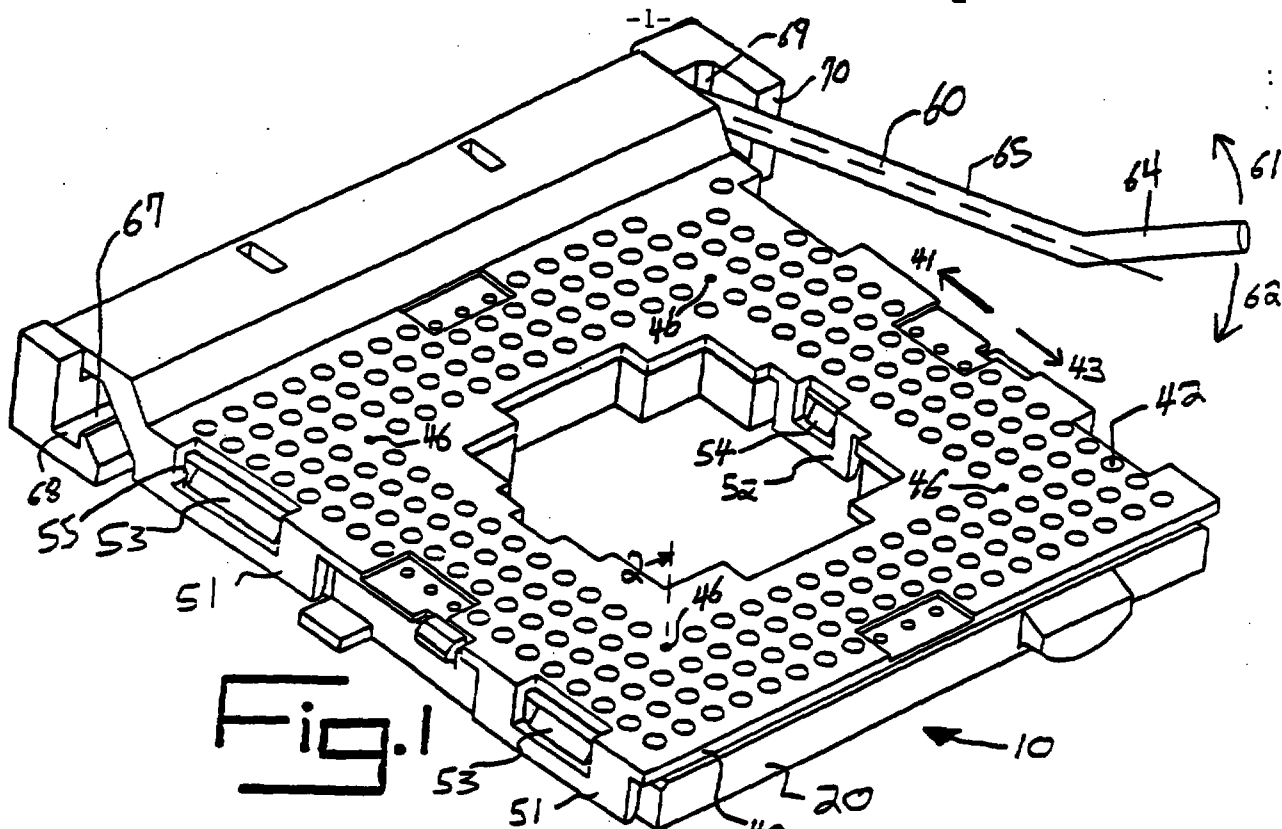
58. The socket of Claim 55 wherein said base includes a retention wall adjacent to a channel for receiving an actuator, said retention wall retaining said actuator through said base.

59. The socket of Claim 55 having outer latches for securing said cover to said base; and

inner latches for securing said cover to said base.

60. The socket of Claim 59 wherein said outer latches are integral with said cover and engage hooks integrally formed to said base.

61. The socket of Claim 60 wherein said inner latches are integrally formed with said cover and engage hooks integrally formed with said base.



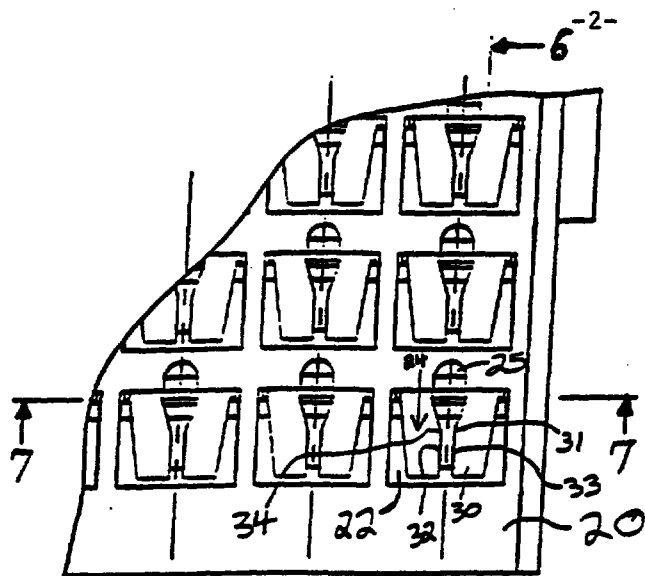


Fig. 5

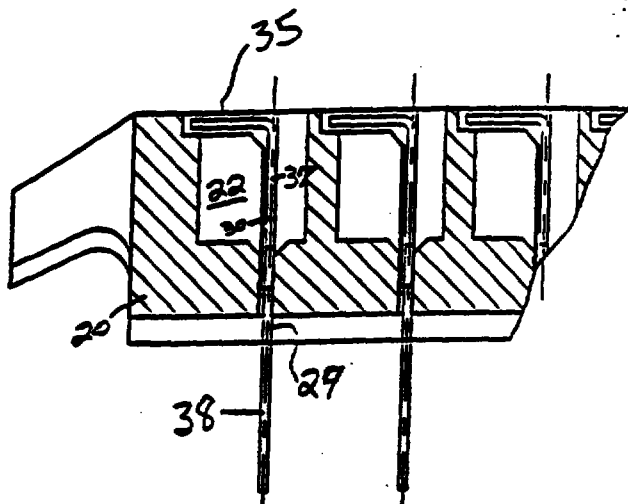


Fig. 6

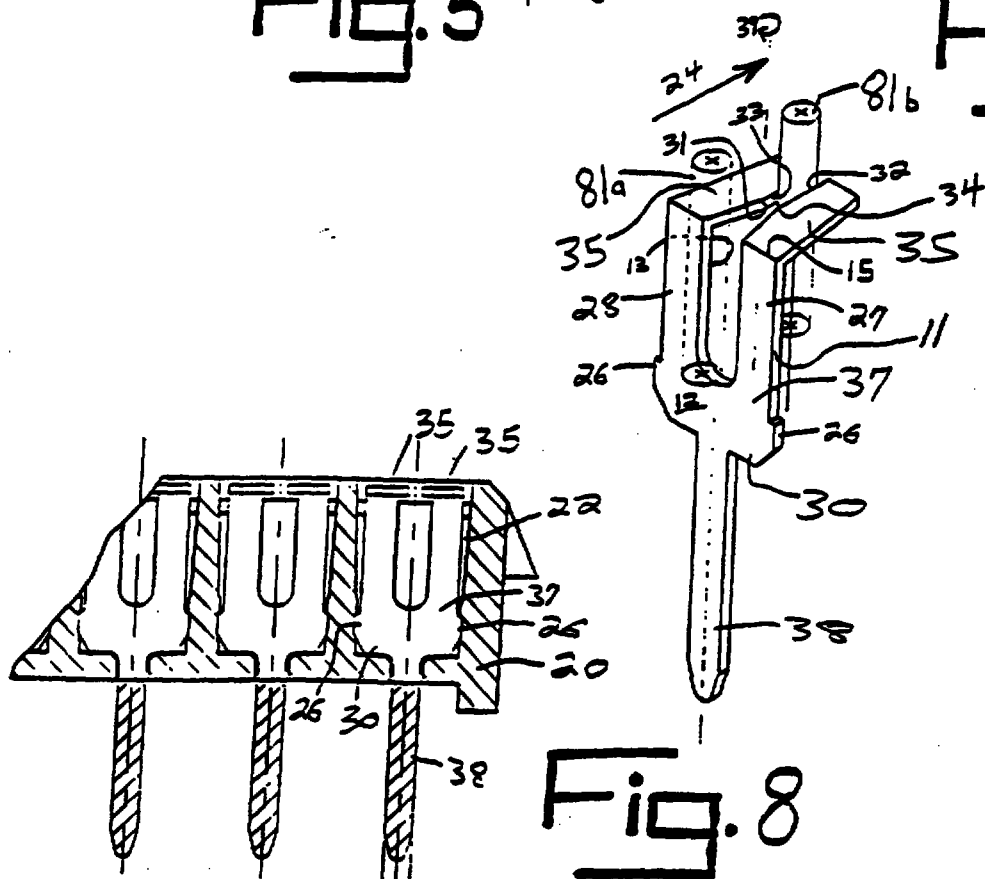


Fig. 7

Fig. 8

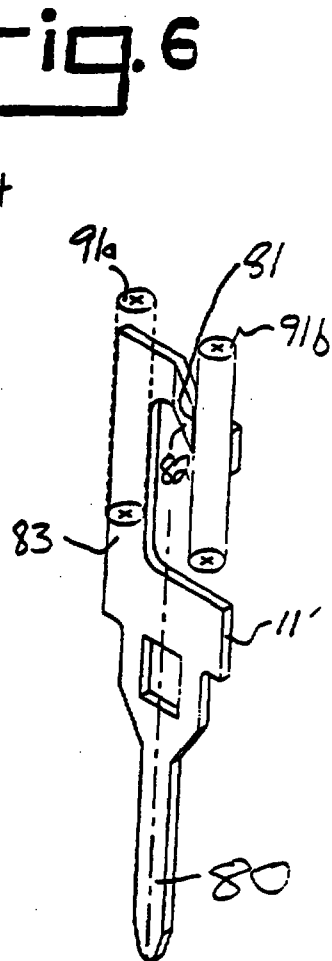
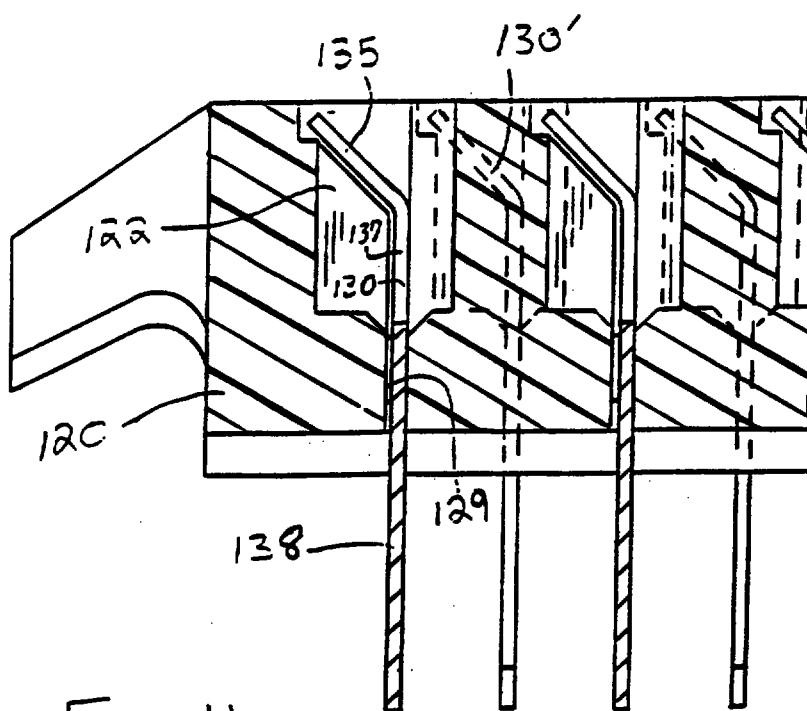
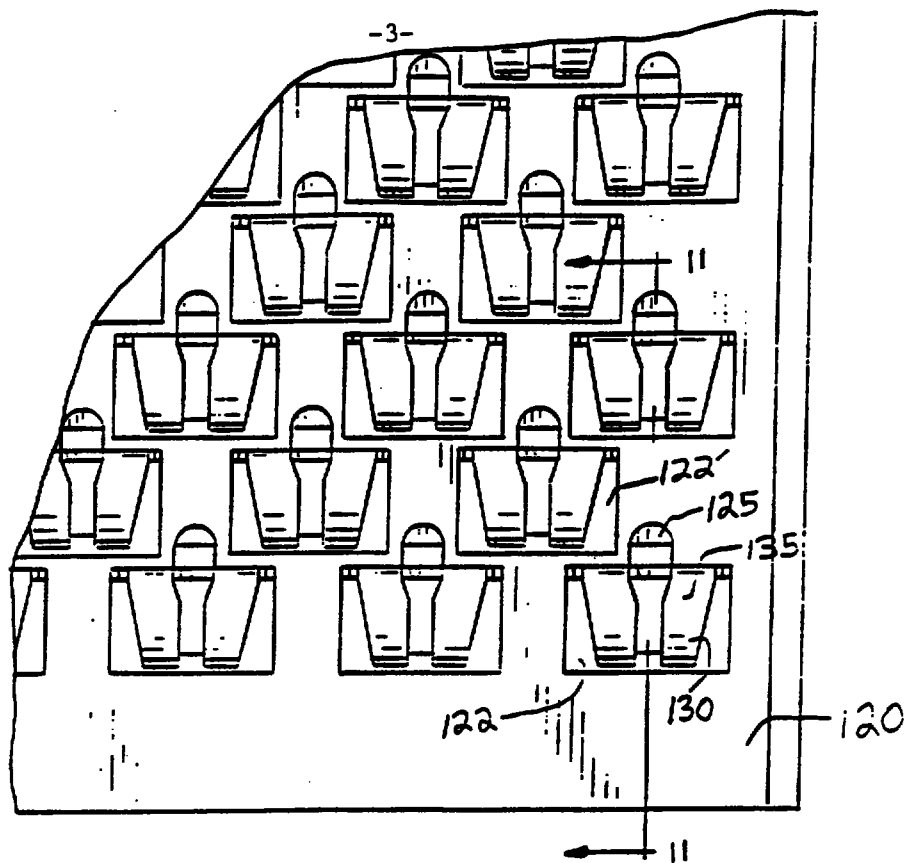


Fig. 9
PRIOR ART



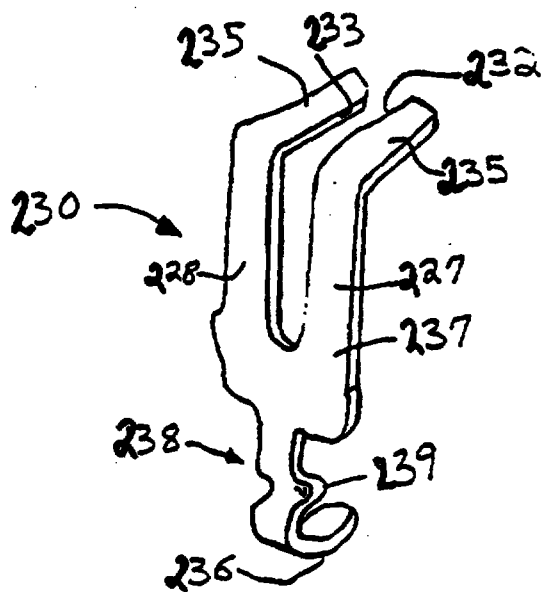


Fig. 12

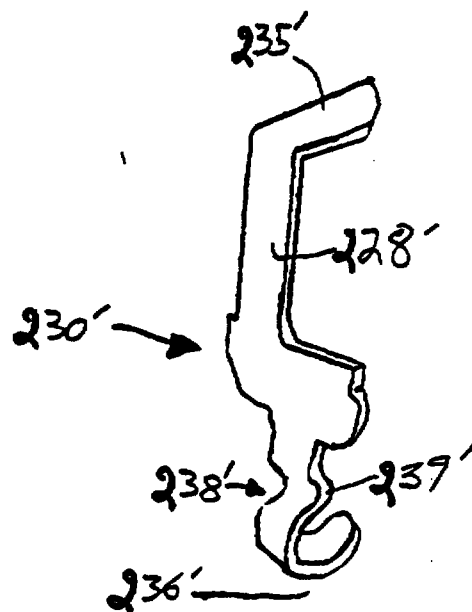


Fig. 13

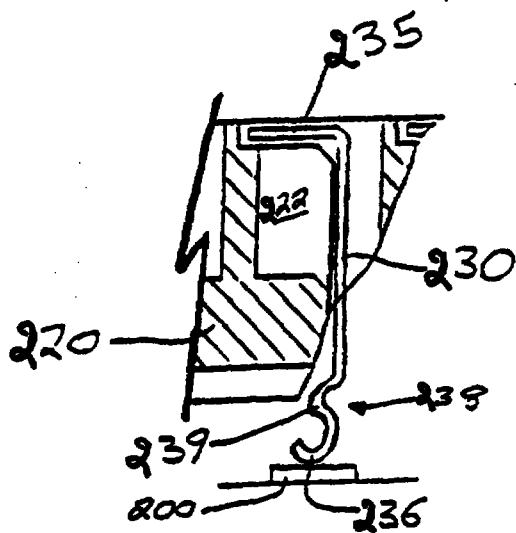


Fig. 14

THIS SHEET HAS BEEN
REPLACED

ABSTRACT OF THE DISCLOSURE

ZERO INSERTING FORCE PIN GRID ARRAY SOCKET

A zero force pin grid array socket includes a cover slidably engaged to a base and having an array of holes formed therethrough. The base has an array of holes formed therethrough. The base has an array of corresponding passages, the passages receiving pins of an IC package inserted through corresponding holes of the cover. Contacts are mounted within the passages and include a generally tuning-fork shaped contact having torsional beams which deflect the insertion forces of the pin of the IC package which have a surface area of at least forty percent of the entire surface area of the contacts. The contacts include wiping areas which are plated which have a surface area of less than an eightieth of the entire surface of the contact. The socket cover includes a means for providing an air-gap between the cover and the IC package.

This Sheet Has Been Replaced



REPLACEMENT SHEET

Date : 27 NOV 1996

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FIGURE 1