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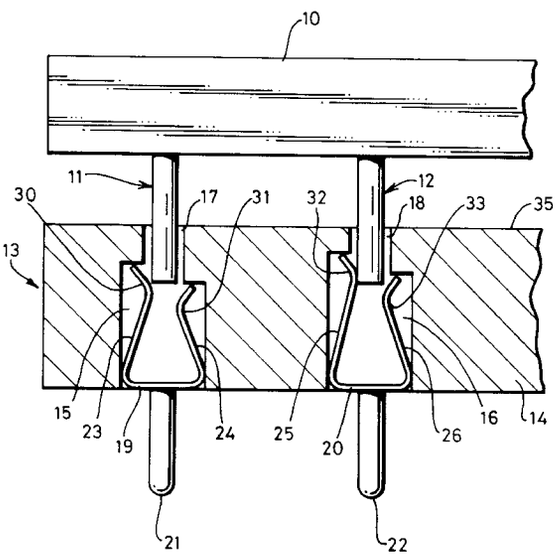
(54) Low insertion force electrical connection

(57) A pin grid array socket connector for connection to a plurality of pins (11,12) in a CPU chip (10) has a plurality of socket contacts (19,20) each socket contact having a pair of contact arms (23,24 :25,26). Each arm has a contact point (30,31,32,33) adjacent a free and thereof, the contact points of each contact being staggered such that, in use, a particular pin of the CPU chip does not make initial contact with both the contact points of the associated contact simultaneously. Adjacent contacts (19,20) are positionally staggered with respect to each other such that, in use, the associated pair of CPU chip pins (11,12) does not make initial contact simultaneously with more than one contact point.



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The invention relates to electrical connection apparatus and more particularly but not exclusively to pin grid array (hereinafter referred to by the usual term of art acronym PGA) sockets which are used for connection with, for example, central processing unit (CPU) chips which normally have in excess of 144 pins.

A problem arises in connectors with a large number of pins, for example in PGA sockets for connection of CPU chips, in that forces involved in inserting the pins into the sockets are high; this can lead both to difficulty in engagement and to damage. There is also a trend towards increasing the number of pins; for example a 586 chip has in excess of 200 pins.

Attempts have been made to reduce the insertion force of pins into PGA sockets, for example by arranging socket contacts in two staggered rows. This will reduce insertion force by approximately 50% compared to unstaggered socket contacts. An alternative approach has been to design socket contacts with staggered contact points, such that a pin does not start engagement with both contact arms at the same time, thereby reducing the insertion force. However such alternatives have not succeeded in reducing insertion force adequately and this invention addresses this problem.

According to the invention, there is provided a socket connector for connection to a plurality of pins, which socket connector has a plurality of socket contacts for engagement by the plurality of pins, each socket contact having a pair of contact arms, each arm having a contact point adjacent a free end thereof, the contact points of each contact being staggered such that, in use, a particular pin does not make initial contact with both the contact points of the associated contact simultaneously, and adjacent contacts being positionally staggered with respect to each other such that, in use, the associated pair of adjacent pins does not make initial contact simultaneously with more than one contact point.

The staggering of the contact points is preferably such that a first contact is made between a first pin of the adjacent pair and one contact point of the contact associated with the first pin, and the next contact is made between the second pin of the adjacent pair and one contact point of the contact associated with the second pin.

The third contact is preferably made between the first pin and the other contact point of the contact associated with the first pin, and the fourth contact is preferably between the second pin and the other contact point of the contact associated with the second pin.

Each contact arm preferably has an end portion extending from the contact point to the free end, which end portion lies obliquely to the direction of pin travel to ease the entry of a pin into the associated contact.

Each contact preferably has a base, the contact arms extending from the base in cantilever fashion. Each contact may be formed from sheet material. The bases of the contacts may be coplanar, and different contact point spacing from the base plane may be achieved by different lengths of the contact arms.

By way of example, one embodiment of a socket connector according to the invention will now be described with reference to the accompanying drawing, which is a sectional side view of a pair of adjacent contacts in an array of contacts.

A CPU chip is illustrated at 10 and only a small portion is shown from which two pins 11, 12 extend. As discussed previously, a CPU chip has a large number of pins, typically more than 144 and, with further developments in chips, in excess of 200 pins.

Part of a pin grid array (GPA) socket is shown at 13, the socket 13 having a body portion 14 having contact recesses 15, 16 and pin engagement holes 17, 18. It will be appreciated that the number of contact recesses and engagement holes will correspond to the number of pins in the CPU chip.

As can be seen clearly in the drawing, the contact recesses 15 and 16 are of different depth, the contact recess 16 being deeper than contact recess 15. The contact recesses 15 and 16 locate contacts 19, 20 respectively. Again, it would be appreciated that the number of contacts will correspond to the number of pins to the CPU chip. The contacts 19 and 20 have pins 21, 22, although it will be appreciated that other forms of electrical connection could be used.

Not only are the contact recesses 15 and 16 of different depths but each recess has a two height ceiling. This provides for accommodation of contacts 19 and 20, both of which have contact arms 23, 24 and 25, 26 respectively of different lengths.

The contact arms 23 and 24 are of bent metal stamped from a sheet (other way of producing the contacts are possible) and are formed with contact points 30, 31 respectively. Similarly, the contact arms 25 and 26 of the contact 16 are formed with contact points 32, 33 respectively. All four contact points 30, 31, 32 and 33 lie at different distances from upper pin engagement surface 35 of the body portion 14.

The configuration of the contacts and location of the contact points 30, 31, 32 and 33 are such that as the CPU chip is lowered into engagement with the socket 13, the pin 12 first makes contact with the contact point 32 of the contact 20. With further downward movement of the CPU chip, the pin 11 makes contact with the contact point 30 of the contact 19. Further downward movement of the CPU chip results in contact between the pin 12 and the contact point 33 of the contact 20 and, finally, the pin 11 makes contact with the contact point 31 of the contact 19. In this way, the insertion force of the CPU chip pins into the socket 13 is reduced to approximately a quarter of the force necessary for contacts in which all contact points are lev-

el, the greatest force being necessary at initial engagement of a pin with a contact point.

It will be appreciated that the contact sequence between the CPU chip pins and the contact points on the contact arms may be different. Furthermore, it will be appreciated that the invention is not limited to engagement of pin grid arrays on CPU chips; indeed, the invention is applicable to any context in which insertion force is a problem in sockets for engagement with multi-pin male connectors.

It will be appreciated that different contact point positions can be achieved not only by varying contact arm length but also by locating similar contacts at different positions relative to the pin engagement surface.

Variations and modifications to the embodiment shown may be made; the embodiment described is by way of example only and the scope of the invention is to be determined by the appended claims.

Claims

1. A socket connector for connection to a plurality of pins, which socket connector has a plurality of socket contacts for engagement by the plurality of pins, each socket contact having a pair of contact arms, each arm having a contact point adjacent a free end thereof, the contact points of each contact being staggered such that, in use, a particular pin does not make initial contact with both the contact points of the associated contact simultaneously, and adjacent contacts being positionally staggered with respect to each other such that, in use, the associated pair of adjacent pins does not make initial contact simultaneously with more than one contact point.

2. A socket connector as claimed in Claim 1 wherein the staggering of the contact points is such that a first contact is made between a first pin of the adjacent pair and one contact point of the contact associated with the first pin, and the next contact is made between the second pin of the adjacent pair and one contact point of the contact associated with the second pin.

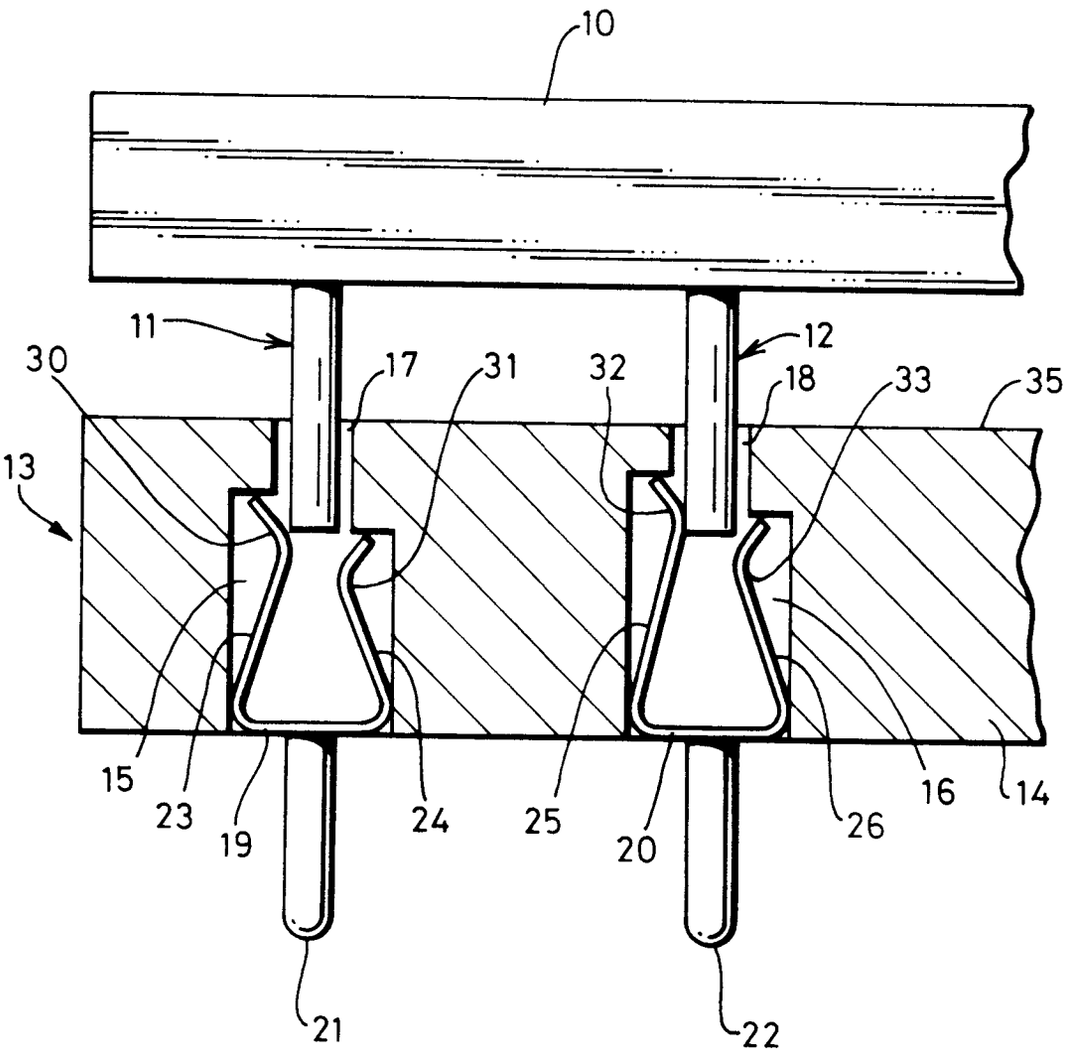
3. A socket connector as claimed in Claim 2 wherein the third contact is made between the first pin and the other contact point of the contact associated with the first pin and the fourth contact is between the second pin and the other contact pin of the contact associated with the second pin.

4. A socket connector as claimed in any one of Claims 1 to 3 wherein each contact arm has an end portion extending from the contact point to the free end, which end portion lies obliquely to the direction of pin travel.

5. A socket connector as claimed in any one of Claims 1 to 4 where each contact has a base, the contact arms extending from the base in cantilever fashion.

6. A socket connector as claimed in Claim 5 wherein the bases of the contacts are coplanar, different contact point spacing from the base being achieved by different lengths of the contact arms.

7. A socket connector as claimed in any one of Claims 1 to 6 wherein each contact is formed from sheet material.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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 4377

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 571 105 (YAMAICHI) * column 2, line 28 - line 34 * * column 3, line 16 - line 19 * * column 7, line 53 - column 8, line 17; figures 1,3,6A-6E * ---	1,4,5,7	H01R13/115 H01R13/193
A	EP-A-0 354 063 (MOLEX) * column 1, line 48 - column 2, line 9 * * column 2, line 50 - column 3, line 21; figures 1,4 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	6 October 1995	Alexatos, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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