The Universal Contact Device for Monitoring Printed Circuit Cards.

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Analysing the reasons hindering creation of the universal contact device, the construction of the universal contact device which has contact pins in all knots of an abacus with a pitch 1.25-mm is developed. The accounts of basic elements and knots of the universal contact device are given.

Recently at the enterprises the large distribution is received with automated control and measuring systems on the basis of managing electronic - computers for monitoring multilayer printed circuit cards. The development and manufacturing of contact devices takes a significant place in all amounts of works on designing and manufacturing of means of monitoring. The attempt of creation of constructions of the universal contact device, which has contact pins in all knots of an abacus with a pitch $A = 1.25\,\text{mm}$, meets large difficulties.

A successful solution of this problem needs serious development of constructions of the most contact element in the plan of its miniaturisation and problems of laying of large number of conductors going to these elements, in view of providing of access to them for repair and replacement of contacts.

By the most simple and reliable solution of the first part of a problem was the fulfilment of a contact element as an elastic rod covered with an elastic dielectric, to which one end face the conductor of the control device is soldered, and on the friend the taper forming dot contact to an inspected surface is executed. This optimal solution was that in one element the functions of collector and of spring being two integral parts of any contact device are combined.

However for want of pitch $A = 1.25\,\text{mm}$ will produce the universal contact device of such construction rather complicatedly because of difficulties of mounting stipulated by a high denseness of a disposition of contact elements on unit of square. So, for want of pitch $A = 1.25\,\text{mm}$ the specific denseness makes $\rho = 64$ *unit on sq.cm*. For this reason it is difficult to check and practically it is impossible to correct a breakaway of a conductor of connection of contact elements with the control device. The probability of a breakaway is rather high, as the contact elements are mobile, and the number them is great.

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The universal contact device for monitoring multilayer printed circuit cards with a size of a field $B \times L$, in which the necessity of a soldering of conductors to contact elements is eliminated, is represented on Figure 1. It represents the basis 1 with the base pins, fixed on it, (2), on which the package from auxiliary printed circuit cards (3) is installed. The upper, intermediate and lower auxiliary payment are represented on Figure 2-4.

The printed conductor (4) auxiliary payment (3) is supplied with a bonding contact pad (6), on which by the lower extremity the contact element (10) rests, and upper extremity it contacts to the checked payment (12).

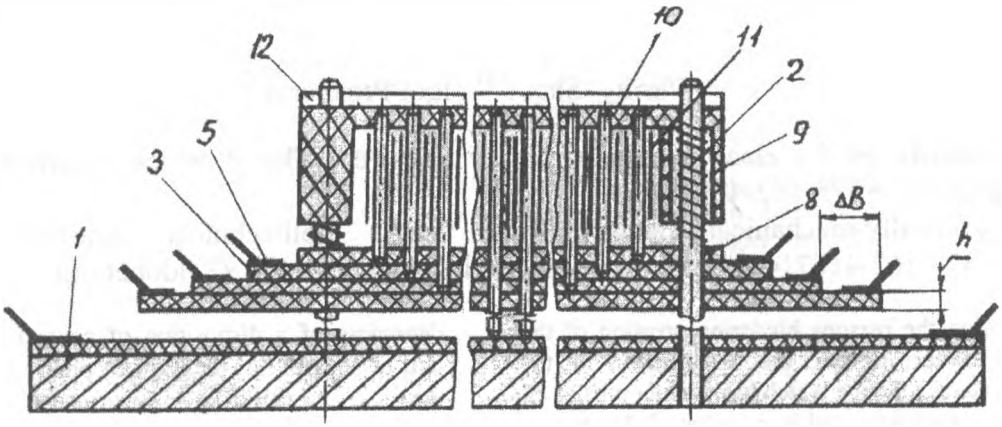

Figure 1. The universal contact device for monitoring printed circuit cards

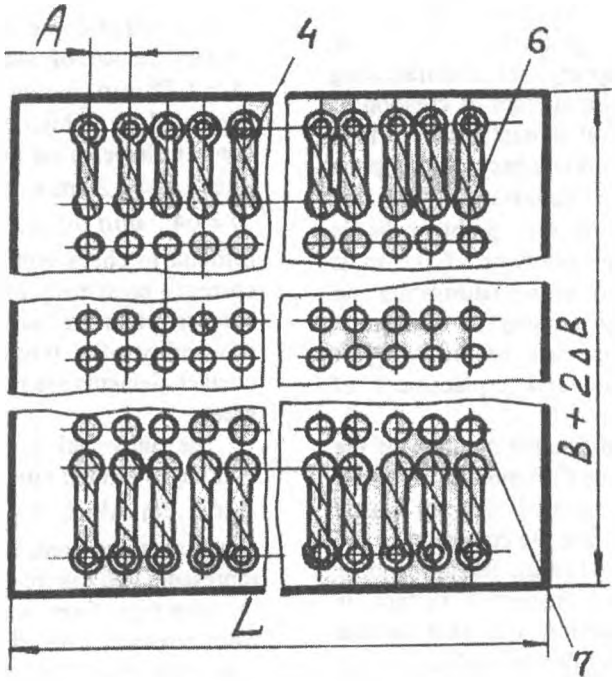

Figure 2. The upper auxiliary payment

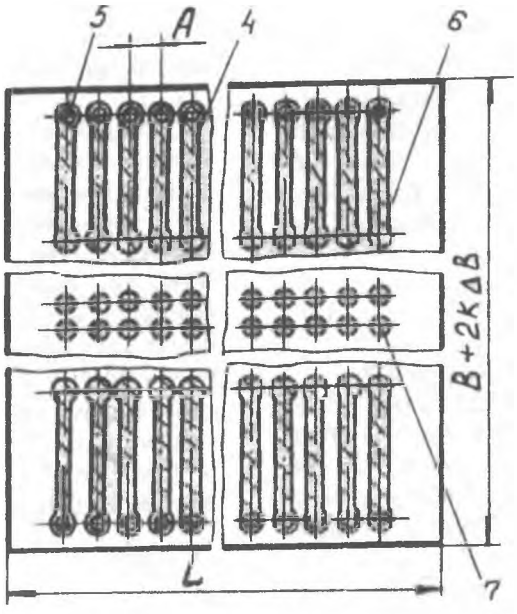

Figure 3. The intermediate auxiliary payment

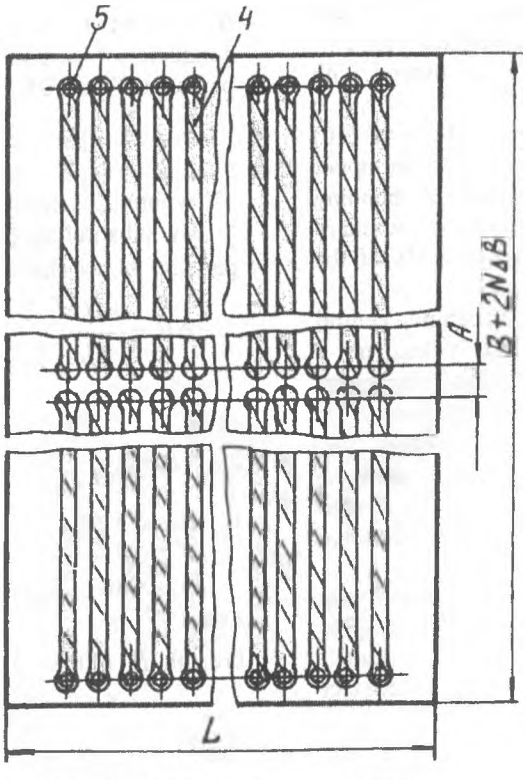

Figure 4. The lower auxiliary payment

On the lower auxiliary payment Figure 4 the distance between pins of bonding contact pads (6) counter printed conductors (4) is equal to a pitch A, and on each consequent payment this distance is more, than on previous on a double pitch $2A$ Abacus. This implies, that the number N Auxiliary payment (3) in a package is determined by expression

$$N = \frac{B}{2A} \qquad (1)$$

Here B - breadth of the inspected payment.

The distance between pins of printed conductors (4) also is equal to a pitch A. On a free field of all auxiliary payment, except for lower, the orifices (7) are executed, which disposition corresponds to a disposition of an abacus of the checked payment (Figure 2, 3).

On base pins (2) the flat (8) and π-figurative (9) guides are installed. Last is installed above first. Guides (8) and (9) have coaxial orifices, which centres correspond to knots of an abacus of the checked payment. In orifices of guides (8), (9) and auxiliary payment (3) packages contact elements (10) are installed, which surface is covered with elastic dielectric (11).

Both central numbers of contact elements (10) pass through orifices in guides (8), (9) in upper auxiliary payment and concern face of bonding contact pads (6) by the one end of lower auxiliary payment, and other - bonding contact pads of the checked payment.

The length of the following behind central numbers of contact elements (10) is less on a thickness of the auxiliary payment. They concern by the lower end face of bonding contact pads (6) on following for the lower auxiliary payment etc. contact elements (10), located in extreme numbers, pass through orifices in guides (8), (9) and lower end face (6) upper auxiliary payment concern bonding contact pads.

The universal contact device for monitoring printed circuit cards works as follows. On base pins (2) of the inspected payment (12) should be installed and pressed to the upper end faces of contact elements (10), which are curved elastically. The dielectric cover (11) protects contact elements (10) from closure among them. Since the lower end faces of contact elements rest on appropriate bonding contact pads (6) printed conductors (4), connected with output pins (5), the bonding contact pads of the inspected payment appear on-line to the electronic device through electrical circuits consisting of contact elements (10), printed conductors (4) auxiliary printed circuit cards of (3) and output pins (5).

Let's reduce necessary accounts of configuration items of the universal contact device, which are useful to its manufacturing.

So each consequent auxiliary payment (3) of the package is wider than previous on magnitude $2\Delta B$, which is required for laying conductors of connection of contact elements with the control device. Let's calculate an increment of a breadth ΔB on one edge of the payment. Height of stacking of conductors is equal to a thickness of the payment h (Figure 1); i.e. the conductors are stacked up to a level of the following payment. Let's make the equation for definition ΔB

$$\Delta B h = \frac{n\pi d^2}{4} \qquad (2)$$

Where d - diameter of used conductors.

The amount of conductors n, which can be put on one ledge on an edge of the control device along it of length L, is determined by number of printed conductors 4 (or bonding contact pads 5) of auxiliary payment (Figure 2).

$$n = \frac{L}{A} - 1 \qquad (3)$$

Where L - length of the inspected payment.

By substituting (3) in (2) and by dividing both parts on h, we shall receive:

$$\Delta B = \frac{\pi d^2}{4h}\left(\frac{L}{A} - 1\right) \qquad (4)$$

The breadth of the contact payment from a package, where $K \in 1..N$ Settles up by following expression:

$$B + 2K\Delta B = B + \frac{K\pi d^2}{2h}\left(\frac{L}{A} - 1\right) \qquad (5)$$

By substituting instead of K In expression (5) value N from (1), we shall receive a dimensional breadth B_1 of the control device:

$$B_1 = B\left(1 + \frac{\pi d^2}{4Ah}\left(\frac{L}{A} - 1\right)\right) \qquad (6)$$

Height H package of the auxiliary payment (3) is determined by following expression:

$$H = Nh = \frac{Bh}{2A} \qquad (7)$$

Conclusions

1. The construction of the circumscribed universal contact device with a pitch of 1.25 mm has high reliability, adaptability to manufacture of manufacturing and maintainability. There are no mobile soldered junctions in it and the denseness of the soldering in some times is lower than in control devices, now in use in production.
2. Obtained in the work the settlement expressions allow to calculate at a stage of designing all necessary sizes of elements of the contact device, with specific basic data B, L, A, defining parameters of the inspected payment.
3. The given device was used in creation of a system of recognition of electronic blocks with the erased marks of integrated chips and unknown topology of multilayer printed circuit cards.