Jan. 23, 1968 E. KITZMILLER ETAL 3,365,619

COMPONENT MOUNTING APPARATUS WITH IMPROVED TERMINAL STRIP MEANS

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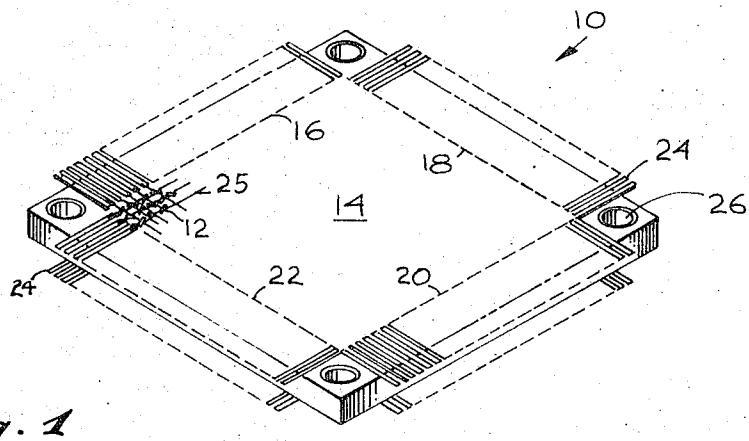


Fig. 1

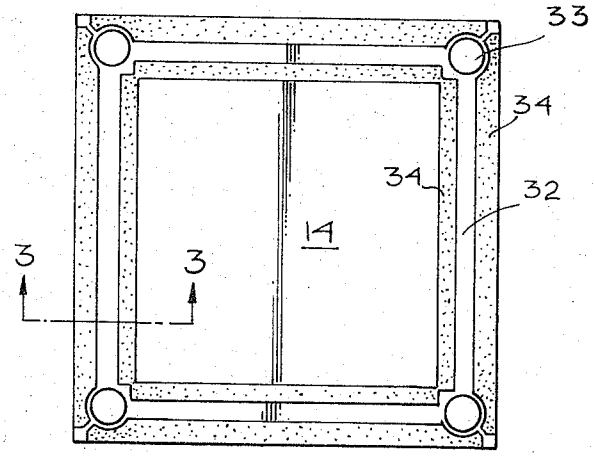


Fig. 2

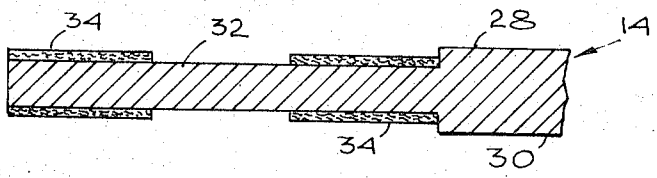


Fig. 3

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Fig. 5

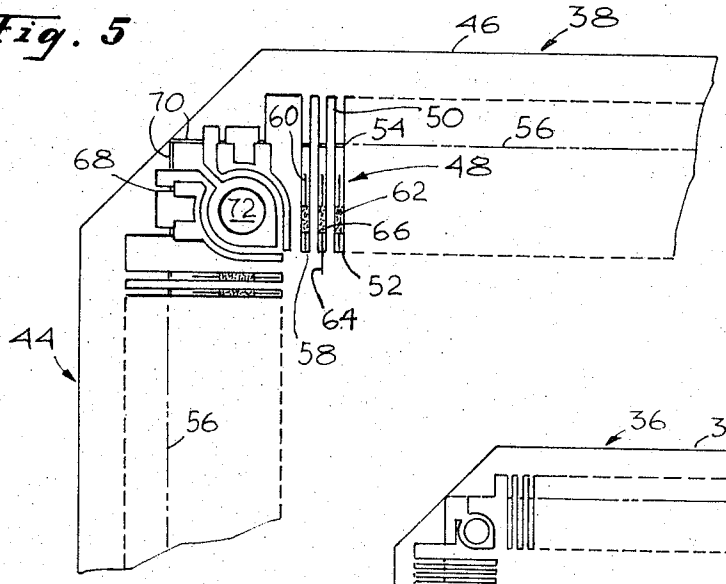
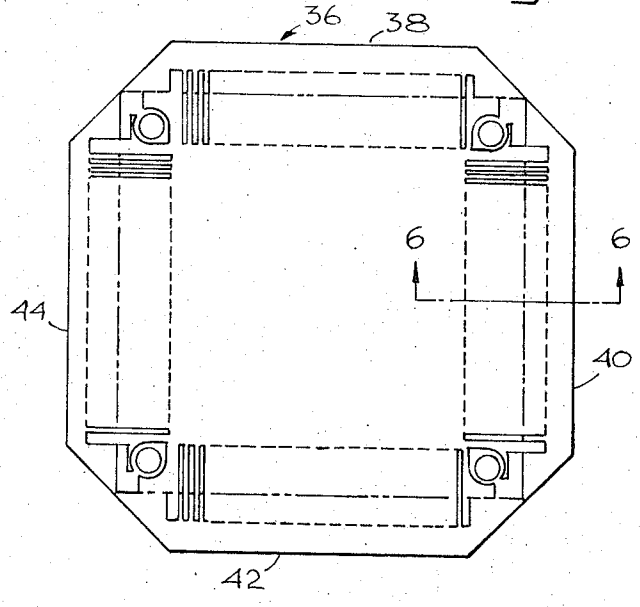



Fig. 4



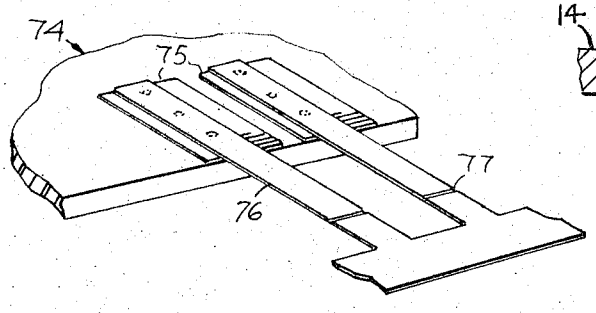




Fig. 7

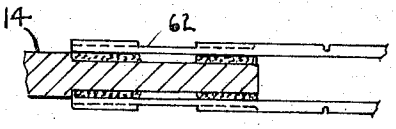



Fig. 6

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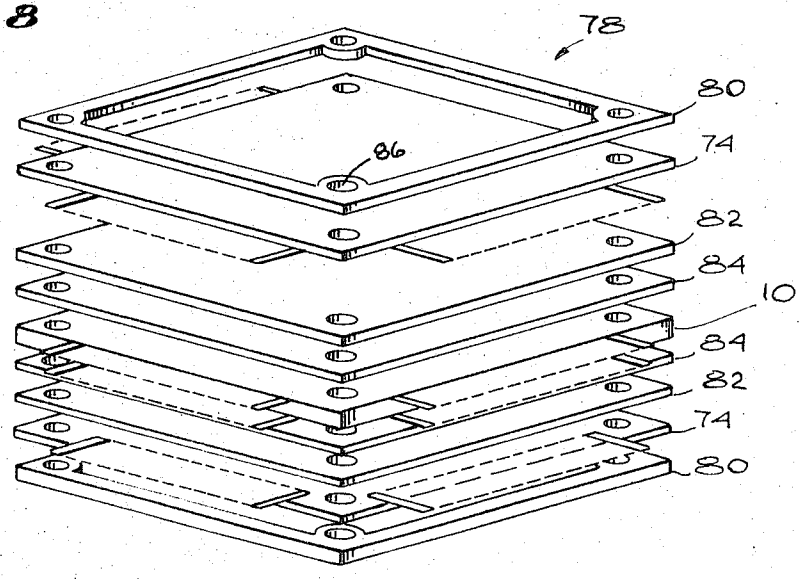
Fig. 8



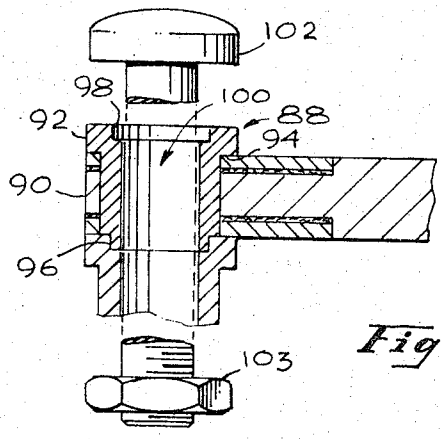




Fig. 9

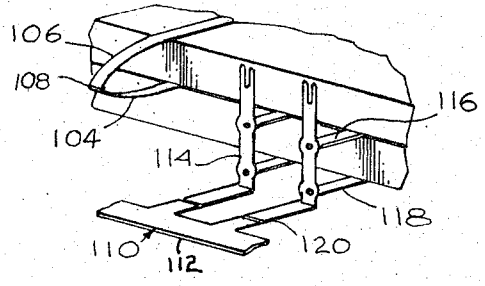



Fig. 10

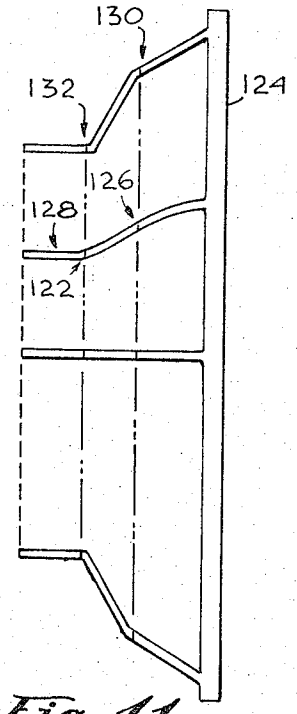



Fig. 11

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United States Patent Office 3,365,619
Patented Jan. 23, 1968



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# COMPONENT MOUNTING APPARATUS WITH IMPROVED TERMINAL STRIP MEANS

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Filed Oct. 23, 1965, Ser. No. 504,036
14 Claims. (Cl. 317—101)

## ABSTRACT OF THE DISCLOSURE

A component mounting structure for magnetic cores and the like. The structure includes a conductive base plate on which a plurality of cores can be secured in a rectangular matrix arrangement. A conductive integral frame essentially comprised of one or more comb structures is provided. Each comb structure is comprised of a plurality of teeth or terminals extending from a back bar. The free ends of the terminals are physically adhered to and electrically insulated from the base plate. The terminals in each comb structure are provided with aligned portions having a reduced cross-section so as to form a score line along which the comb structure can be easily broken to remove the back bar and leave the terminals extending from the base plate.

This invention relates both to a mounting apparatus for magnetic cores and the like and to a method of fabricating such an apparatus.

Significant advances have been made in recent years in reducing the size of various components employed in modern electronic systems, such as digital computers. Although the miniaturization of such components has alleviated many problems, it has also created many other fabrication and packaging problems. For example, in the fabrication of the magnetic core memories comprised of many closely packed cores, each on the order of 20 mils for example, it is usually very difficult to thread conductors through the cores and satisfactorily connect such conductors to other conductors. Of course, the prior art is replete with different types of core mounting devices but many of these devices become unsuitable as the required core density increases.

In view of the foregoing, it is an object of the present invention to provide an improved apparatus for mounting magnetic cores and the like, together with a method of fabricating such an apparatus.

In accordance with a first aspect of the present invention, a base plate is provided on which a plurality of cores can be secured in a rectangular matrix arrangement, for example. An integral frame essentially comprised of one or more comb structures is provided. Each comb structure is comprised of a plurality of teeth or terminals extending from a back bar. The free ends of the terminals are physically adhered to the base plate. The terminals in each comb structure are all provided with aligned portions having a reduced cross-section so as to form a score line along which the comb structure can be easily broken to remove the back bar and leave the terminals extending from the base plate.

In accordance with a further aspect of the present invention, guide means are provided on each terminal for facilitating the connection of a conductor thereto.

In accordance with a still further aspect of the present invention, first and second score lines are provided on the terminals to permit the back bar to be broken initially along the first line to thereby leave long terminals which are useful for test purposes and subsequently along the



second line to shorten the terminals for permanent installation.

In accordance with a still further aspect of the present invention, the base plates are formed of a material having good thermal and electrical conductivity characteristics. The base plates when employed in a stack assembly are preferably connected to spacer elements which are formed of a material also having good thermal and electrical conductivity characteristics. Therefore, a convenient electrical ground path is provided. In addition, a good thermal path is provided which reduces the effects of temperature variations on the stack.

In accordance with a still further aspect of the present invention, the spacer elements are formed so as to tightly nest in one another to prevent any relative lateral movement which would otherwise occur when the stack is subjected to vibration.

In accordance with a still further aspect of the present invention, a comb structure is employed to interconnect aligned terminals in adjacent planes in the stack.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself will best be understood from the following description when read in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a core memory mounting apparatus constructed in accordance with the present invention;

FIGURE 2 is a plan view of a base plate forming part of the mounting apparatus of FIGURE 1;

FIGURE 3 is a sectional view taken substantially along the plane 3—3 of FIGURE 2;

FIGURE 4 is a plan view illustrating a terminal frame employed in the apparatus of FIGURE 1 superposed on and adhered to the base plate of FIGURES 2 and 3;

FIGURE 5 is an enlarged plan view illustrating in detail one corner of the terminal frame of FIGURE 4;

FIGURE 6 is a sectional view taken substantially along the plane 6—6 of FIGURE 4 illustrating the manner in which the terminal frame is adhered to the base plate;

FIGURE 7 is a partial perspective view illustrating the manner in which the terminals can be connected to circuit boards in accordance with the teachings of the present invention;

FIGURE 8 is a perspective view illustrating the manner in which a stack can be constructed employing devices constructed in accordance with the teachings of the present invention;

FIGURE 9 is an enlarged sectional view illustrating the manner in which a spacer element is employed to interconnect adjacent devices in the stack of FIGURE 8;

FIGURE 10 is a perspective view illustrating two techniques for interconnecting spaced superposed terminals which extend from the stack of FIGURE 8; and

FIGURE 11 illustrates a second embodiment of the invention in which a terminal strip incorporating two score lines is provided.

Attention is now called to FIGURE 1 which illustrates a perspective view of a mounting device or board **10** constructed in accordance with the present invention which can be used for example to carry components such as magnetic cores **12**. Usually, the cores **12** are arranged in a rectangular matrix and are adhered to the top and bottom surfaces of a base plate **14**. The base plate **14** in FIGURE 1 is illustrated as being substantially rectangular, thus defining four sides **16**, **18**, **20**, and **22**.

A plurality of spaced terminals **24** project outwardly from each of the base plate sides substantially in alignment with the top and bottom base plate surfaces. Each terminal **24** is intended to be aligned with either a row or column of the core matrix adhered to the base plate

14. As will be seen in greater detail hereinafter, each of the terminals 24 is intended to be connected to a conductor 25 which threads all of the cores in the row or column corresponding to that terminal.

The boards 10 have apertures 26 defined therein, preferably at each corner thereof. Rods are adapted to be projected through aligned apertures 26 in different boards in a manner to be described for aligning the boards and holding them together to form a stack assembly (FIGURE 8). Prior to considering any further functional characteristics of the mounting board 10 of FIGURE 1, the construction of the board will be described and for that purpose, reference will now be made to FIGURES 2 through 6.

FIGURES 2 and 3 illustrate in detail the base plate 14 which is provided with a top surface 28 and a bottom surface 30. Projecting from each of the sides of the base plate 14 is a flange 32 which preferably extends about the full perimeter of the base plate. For reasons to be discussed in greater detail hereinafter, the base plate 14 and flange 32 are preferably integrally formed of a material such as aluminum having good electrical and thermal conductivity characteristics. Apertures 33 are formed in the flange 32 adjacent each corner of the base plate 14.

Adhesive material 34 is deposited on the upper and lower surfaces of the flange 32. The adhesive material 34 is preferably formed of a high temperature epoxy resin which is preformed into strips. However, many different types of adhesives can be used in the intended application and there is no intention here to restrict the characteristics of the adhesive 34.

As previously noted, magnetic cores 12 are adapted to be mounted on both surfaces 28 and 30 of the base plate 14 in the form of a rectangular matrix. It is also intended that a different terminal be provided for each row and column of the matrix to which a conductor 25 threaded through the rows or columns can be connected. In accordance with the present invention and as is shown in detail in FIGURES 4 and 5, an integral frame 36 is provided which conforms generally to the shape of the base plate 14. That is, the frame 36 is rectangular like the base plate 14 and is essentially comprised of four comb structures 38, 40, 42, and 44 whose relative orientation is the same as that of the sides 16, 18, 20, and 22 of the base plate 14. Each comb structure is comprised of a back bar 46 from which extends a plurality of spaced and aligned teeth or terminals 48. The entire frame 36 is formed of a conductive material by any suitable process such as stamping or etching. The frame can, for example, be formed of nickel, a beryllium copper alloy, a Phosphor bronze alloy, or other suitable materials.

End 50 of each of the terminals 48 is formed integral with the back bar 46. End 52 of each of the terminals 48, remote from the back bar 46, is free. Each of the terminals 48 includes a portion 54 of reduced cross-section. The portions 54 on all of the terminals in each comb structure are aligned to form a score or break away line 56.

Adjacent the free end 52 of each of the terminals 48, first and second narrow guide depressions 58 and 60 are provided separated by a land 62. A conductor 64 is adapted to be seated in the depression 58 projecting on to the land 62 to which it can be connected by soldering or welding as shown at 66. The conductor 64 can thereby be electrically connected to a second conductor (not shown) which is received within the depression 60 and soldered or welded to the land 62 of the same terminal 48.

As previously noted, the frame 36 is integrally formed of a plurality of comb structures. An apertured element 68 is provided at each corner of the frame thus forming part of and interconnecting adjacent comb structures. More particularly, the elements 68 are integrally formed with the back bars of two adjacent comb structures. Thus, in FIGURE 5 the element 68 is formed integral with the back bar 46 of comb structures 38 and 44. A line of reduced cross-section 70 is defined between the elements 68 and the back bars 46 from which they extend. The lines 70 are aligned with the score lines 54 defined in the terminals 48.

Each of the elements 68 defines an aperture 72 therein. In constructing the board 10 of FIGURE 1, the frame 36 is placed on the base plate 14 so that the free ends 52 of the terminals 48 engage the adhesive 34 and are retained thereon. The adhesive 34 insulates the terminals 48 from the base plate 14. Each of the apertures 72 defined in the elements 68 should be aligned with the apertures 33 defined in the base plate flange 32. Depending upon the type of adhesive 34 employed, it may be necessary to subject the composite structure shown in FIGURES 4 and 6 consisting of the base plate 14 and frames 36 adhered adjacent both sides thereof, to heat and pressure. In any event, once the terminals 48 are adequately adhered to the adhesive 34, the back bars 46 can be broken away from the terminals 48 along the score lines 54 merely by bending the back bar 46 about the line 54. As a consequence of severing the back bars 46 from the terminals 48, the terminals 48 are left on the adhesive 34 with portions thereof extending beyond the extremities of flange 32. Thus, one end of the terminals 34 can be connected to conductors (e.g. conductors 64) threaded through the core rows and columns while the second end can be connected to other external conductors or other projecting terminals. It should be appreciated that by employing the apparatus and method discussed in FIGURES 2 through 6, it is possible to easily provide many parallel terminals on the base plate 14 which are accurately positioned with respect to each other and to the base plate. It should further be appreciated that by utilizing the apparatus and technique disclosed, the terminals 48 are provided on the base plate 14 much more easily and at a substantially lower cost than would be possible if the terminals were to be handled individually.

Attention is now called to FIGURE 7 which illustrates that the general technique of the invention can be employed to connect terminals to otherwise reasonably conventional circuit boards. More particularly, a circuit board 74 can be provided having pads 75 formed thereon. Terminals 76 can be connected to the pads either by soldering or welding. The terminals 76 are preferably all initially connected to the board prior to breaking away the back bar therefrom along a line 77. The circuit board 74 can be used in an assembly stack 78 (FIGURE 8) for, for example, carrying diode decoding circuits.

Attention is now called to FIGURE 8 which shows a completed stack assembly which includes a pair of end compression members 80. Adjacent the end compression members 80 are the previously-mentioned circuit boards 74 which carry circuits necessary to the operation of the core memory. A pair of end stiffening plates 82 can be provided adjacent the circuit boards 74. Spacer boards 84 are preferably provided between the stiffening plates 82. One or more memory plane boards are disposed between the spacer plates 84.

The individual members of the stack 78 of FIGURE 8 are all provided with aligned apertures 86. Received in each of the apertures is a spacer element 88 (FIGURE 9) which has a central portion 90 which conforms to and is preferably force fitted into the aperture 86 (aperture 33 of base plate 14). The spacer element 88 is provided with an enlarged upper flange 92 defining a shoulder 94 adapted to engage the top surface of the plate or board in which it is inserted. A smaller plug portion 96 is provided on the lower end of each spacer element 88. Each of the upper flange portions 92 is provided with a receptacle 98 for receiving in tight nesting relationship the plug portion 96 from a spacer element disposed in an aperture in an adjacent plate or board.

All of the spacer elements 88 are provided with a central opening 100 adapted to receive a rod 102 therethrough. The rod 102 is preferably terminally threaded

to engage a nut **103** which clamps the various spacer elements **88** together. By nesting the lower plug portion **96** in the receptacles **98**, the plates in the assembly stack **78** are prevented from lateral movement relative to one another which would otherwise occur when the stack assembly is subjected to vibration. It should be noted that as a consequence of the spacer elements being force fitted into the apertures in the boards and plates, there will be intimate contact therebetween thus providing high conductivity electrical and thermal paths. The rod **102** is in turn intimately coupled to the spacer elements and thus any temperature variations will be well distributed throughout the stack **78** thereby minimizing any adverse effect such variations might otherwise have.

From FIGURE 8, it should be apparent that the resulting stack provides a plurality of vertically aligned terminals projecting from the circuit boards **74** and mounting boards **10**. FIGURE 10 illustrates two techniques for interconnecting these terminals. In accordance with the first technique, terminals **104** and **106** are bent together and soldered at **108** at the extreme end thereof. In accordance with a second and preferred technique for interconnecting the aligned terminals, a connector strip **110** is provided which is comprised of a back bar **112** and a plurality of spaced connector bars **114**. Each of the connector bars **114** is intended to be aligned with a pair of vertically spaced terminals, e.g. **116** and **118**. The connector bar **114** is then soldered to the terminals **116** and **118** to form a connection thereacross. The back bar **112** can then be broken away from the connector bars **114** along a score line **120**.

Attention is now drawn to FIGURE 11 which shows an alternative embodiment of the invention in which a comb structure **121** is provided including terminals **122** projecting from a back bar **124**. The terminals **122** are formed of two sections **126** and **128**. A score line **130** is provided in the first sections **126** which are fanned out. A second score line **132** separates sections **126** and **128**. The comb structure **121** can form part of a frame similar to frame **36** of FIGURE 4 previously discussed. When the back bar **124** is broken away along line **130** however, after the free ends of terminals **122** are adhered to the base plate, fanned out sections **126** will be exposed and be available for test purposes. After testing has been completed, the sections **126** can be broken away along score line **132** to thus leave only terminal sections **128** in the permanent installation.

From the foregoing, it should be appreciated that an apparatus and fabrication method therefor has been shown herein for mounting magnetic cores and the like so as to enable a plurality of terminals to be easily and accurately provided. Although a preferred embodiment of the invention has been shown herein, it should be appreciated that various modifications can be made thereto without departing from the spirit and intended scope of the claims. Thus, for example, it is not essential that the guide depressions and land on each terminal be oriented exactly as shown in FIGURE 6. Nor of course is it critical that the adhesive be applied in performed strips as shown in FIGURE 3. Other similar modifications should also be apparent to those skilled in the art.

What is claimed is:

**1.** A mounting device for magnetic cores and the like comprising:
- a flat base plate;
- a terminal strip including a back bar having a plurality of aligned terminals each having a first free end and a second end secured to said back bar;
- said terminals having aligned reduced cross-sectional portions defining a line along which said terminal strip can be easily severed; and
- means adhering said free ends of said terminals to said base plate.

**2.** A mounting device for magnetic cores and the like comprising:
- a flat base plate having top and bottom surfaces and a plurality of side surfaces;
- a flange extending outwardly from at least one of said side surfaces;
- a terminal strip including a back bar having a plurality of aligned terminals each having a first free end and a second end secured to said back bar;
- said terminals having aligned reduced cross-sectional portions defining a line along which said terminal strip can be easily severed; and
- adhering means adhering said free ends of said terminals to said flange.

**3.** A mounting device for magnetic cores and the like comprising:
- a flat base plate having top and bottom surfaces and a plurality of side surfaces;
- a flange having top and bottom surfaces and extending outwardly from at least one of said side surfaces;
- first and second terminal strips each including a back bar having a plurality of aligned terminals, each having a first free end and a second end secured to said back bar;
- said terminals on each of said terminal strips having aligned reduced cross-sectional portions defining a line which said terminal strip can be easily severed; and
- means respectively adhering said free ends of said terminals on said first and second terminal strips to said top and bottom surfaces of said flange.

**4.** A mounting device for magnetic cores and the like comprising:
- a flat base plate having top and bottom surfaces and a plurality of side surfaces;
- a flange having top and bottom surfaces and extending outwardly from each of said side surfaces;
- an integral terminal frame comprised of a plurality of terminal strips equal in number to said plurality of side surfaces;
- each of said terminal strips including a back bar having a plurality of aligned terminals each having a first free end and a second end secured to said back bar;
- said terminals on each of said terminal strips having aligned reduced cross-sectional portions defining a line along which said terminal strip can be easily severed; and
- means adhering the free ends of each of said terminal strips to said top surface of said flange.

**5.** The device of claim **2** wherein said base plate is formed of a material having good electrical and thermal conductivity characteristics; and wherein
- said adhering means insulate said terminals from said base plate.

**6.** The device of claim **2** wherein first and second conductor guide means are provided on each of said terminals between said line and said free ends thereof.

**7.** The device of claim **2** wherein each of said terminals includes a land and first and second conductor guide depressions extending in opposite directions therefrom between said line and said free ends.

**8.** The device of claim **2** wherein said terminal strip further includes a flat element extending from said back bar;
- said flat element having a reduced cross-sectional position aligned with said line;
- said base plate defining a guide aperture therein;
- said flat element defining an aperture therein; and
- means adhering said terminal strip to said base plate within said flat element aperture aligned within said base plate aperture.

**9.** The device of claim **8** including a spacer element disposed in said aligned apertures;
- said spacer element including a central portion having a cross-section conforming to said aligned apertures, a larger upper flange portion, and a smaller lower plug portion;

said upper flange portion defining a receptacle adapted to receive a lower plug portion and having a cross-section conforming thereto.

**10**. A mounting device for magnetic cores and the like comprising:

a flat base plate having top and bottom surfaces and a plurality of side surfaces;

a flange extending outwardly from at least one of said side surfaces;

a terminal strip including a back bar having a plurality of terminals extending therefrom, each of said terminals being comprised of a first section affixed to said back bar and a second section affixed to said first section, said second sections being substantially straight and in alignment with one another and said first sections being fanned out so as to provide a greater spacing therebetween;

said terminals having a first set of aligned reduced cross-sectional portions defining a first line between said first sections and said back bar and having a second set of aligned reduced cross-sectional portions defining a second line between said first and second sections;

each of said first sections having a free end; and

means adhering said free ends to said base plate.

**11**. A structure for supporting magnetic cores and the like comprising:

a first base plate having top and bottom surfaces and a plurality of sides, said plate being formed of a material having good electrical and thermal conductivity characteristics;

a flange having flat top and bottom surfaces formed integrally with said base plate and extending outwardly from the sides thereof;

a plurality of elongated conductive terminals; and

insulating means adhering said terminals to at least one of said flange surfaces with said terminals extending outwardly from said flange parallel to one another.



**12**. The structure of claim **11** wherein each of said terminals includes a land and first and second conductor guide depressions extending in opposite directions therefrom.

**13**. A mounting structure for magnetic cores and the like including:

a plurality of base plates arranged on top of one another, each formed of a material having good electrical and thermal conductivity characteristics;

at least one aperture defined in each of said base plates in alignment with an aperture in each of the other base plates;

a spacer element disposed in each of said apertures, each spacer element including a central portion having a cross-section conforming to each of said apertures, a larger upper flange portion, and a smaller lower plug portion;

each of said upper flange portions defining a receptacle adapted to receive the lower plug portion of a spacer element disposed in an aperture in the base plate immediately above;

each of said spacer elements defining an opening therethrough; and

a rod projecting through said spacer element openings and urging said spacer elements together.

**14**. The system of claim **13** wherein each of said spacer elements is formed of a material having good electrical and thermal conductivity characteristics and is in contact with one of said base plates.

**References Cited**

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J. R. SCOTT, *Assistant Examiner.*