Oct. 21, 1958 W. F. MARKLEY ET AL 2,857,583

MOLDED MODULAR TERMINAL BLOCK

Filed Jan. 7, 1955 3 Sheets-Sheet 1

FIG. 1

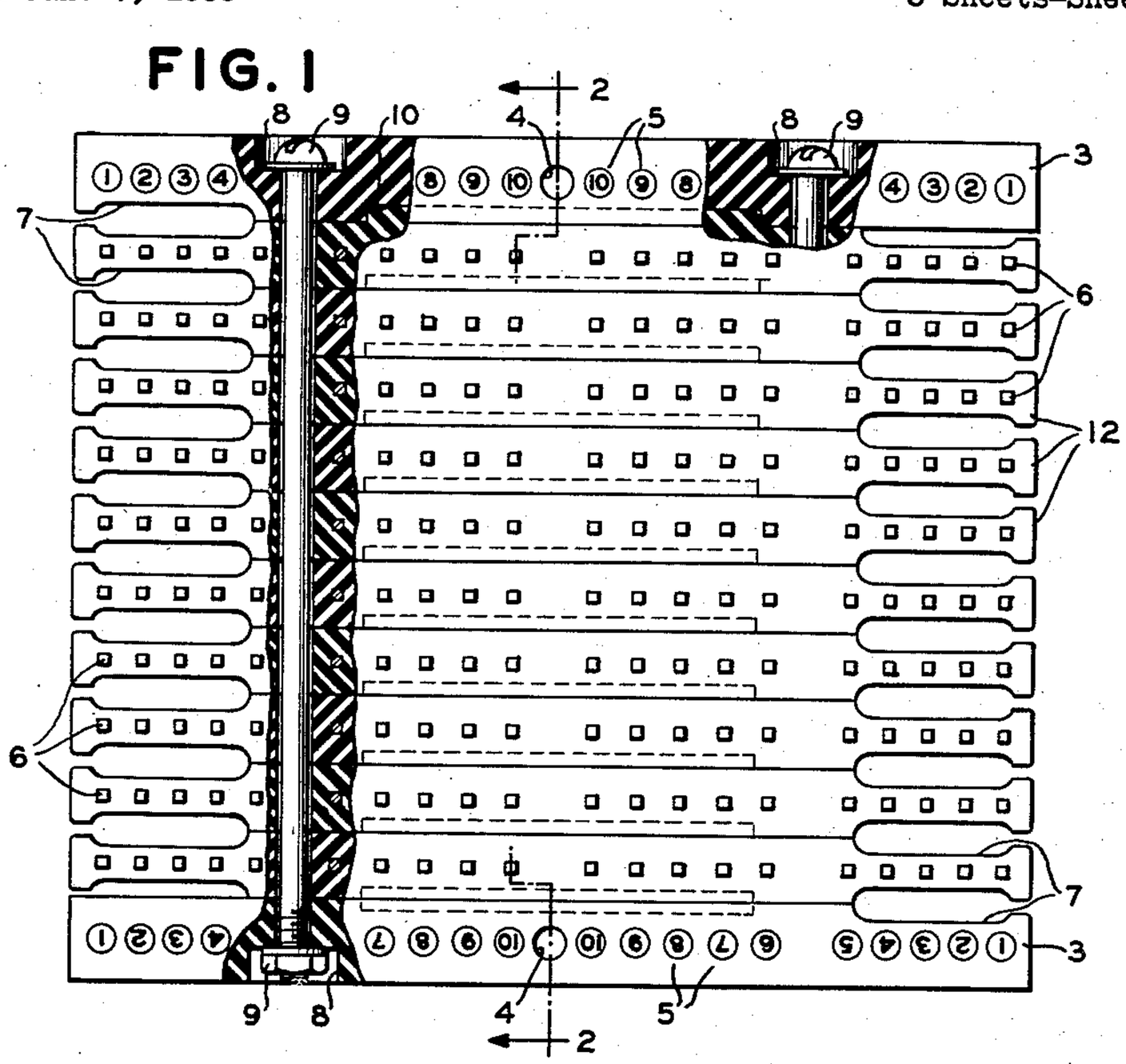
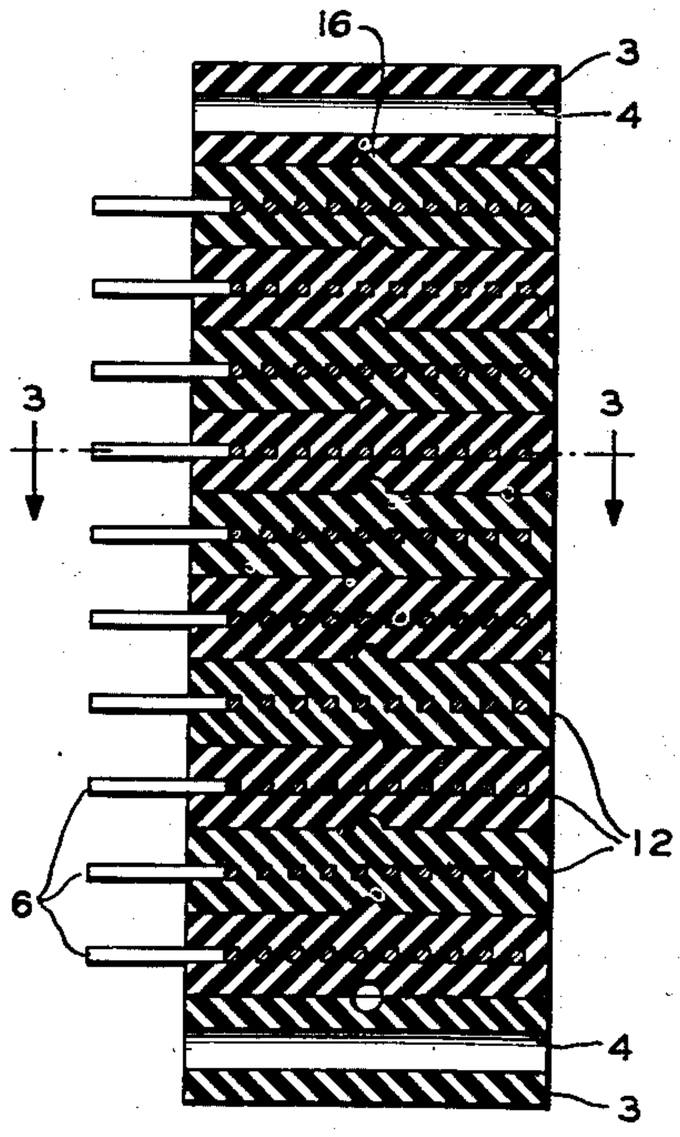


FIG. 2



INVENTORS
W. F. MARKLEY
M. HAIFTER

BY Robert B. Henderson

ATTORNEY

Oct. 21, 1958 W. F. MARKLEY ET AL 2,857,583

MOLDED MODULAR TERMINAL BLOCK

Filed Jan. 7, 1955 3 Sheets-Sheet 2

FIG. 3

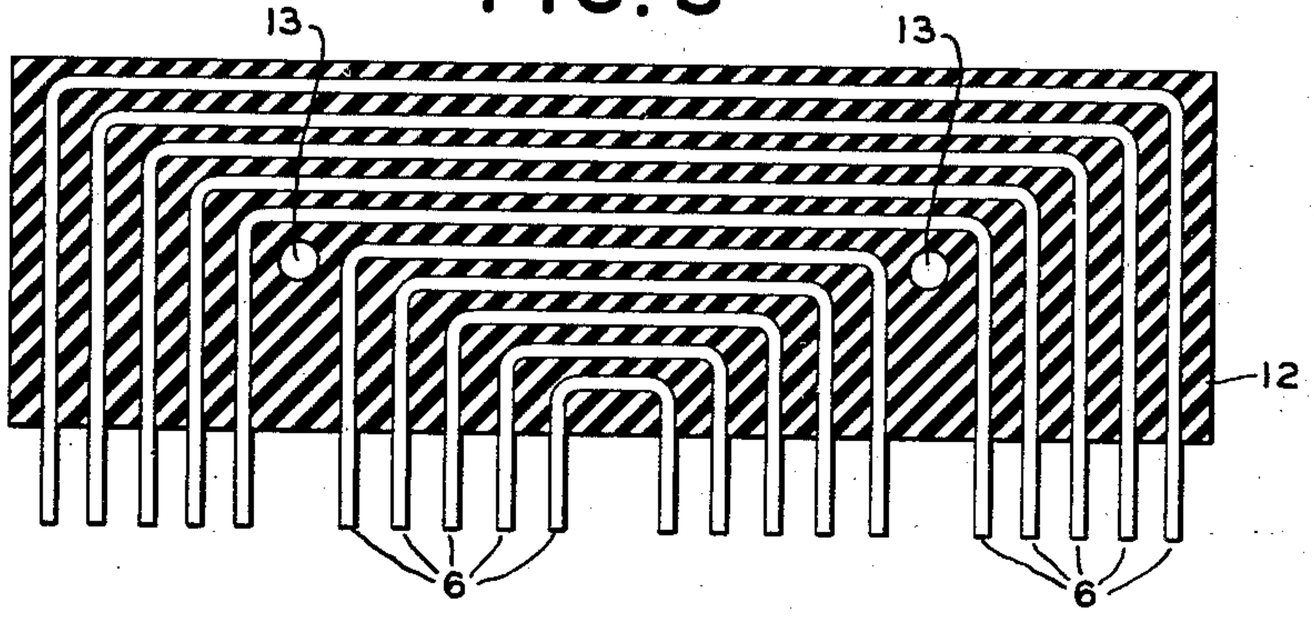


FIG. 4

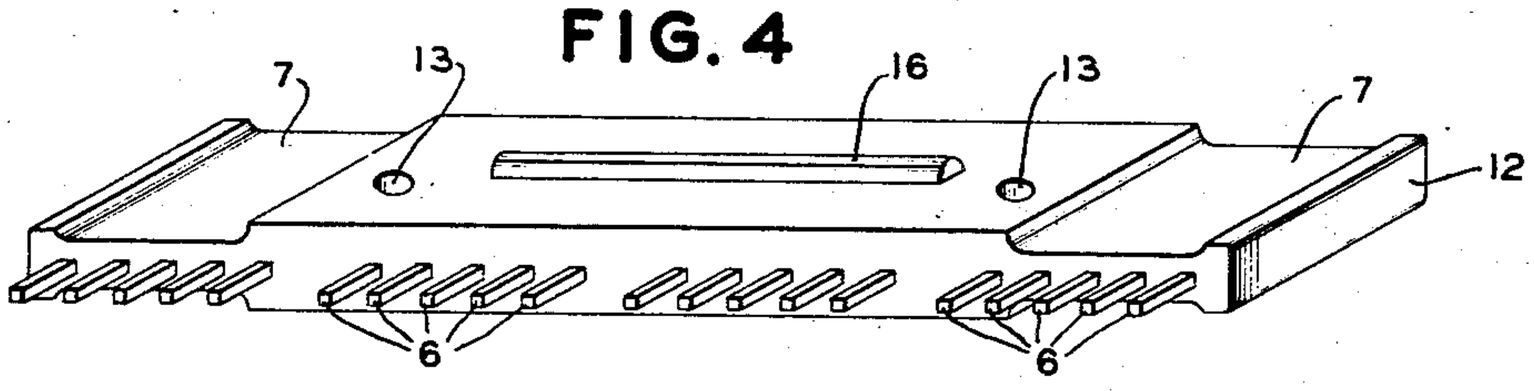


FIG. 5

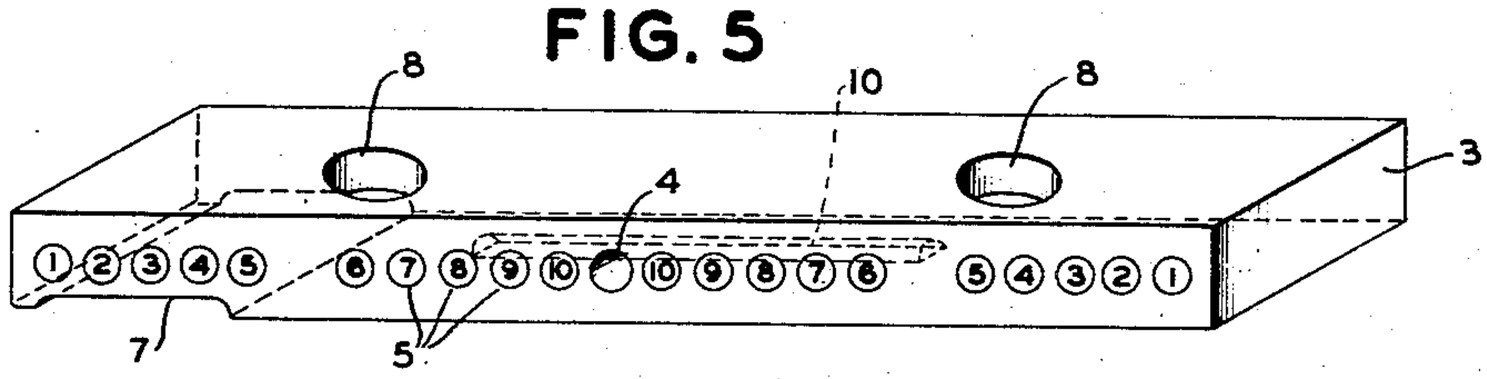


FIG. 6

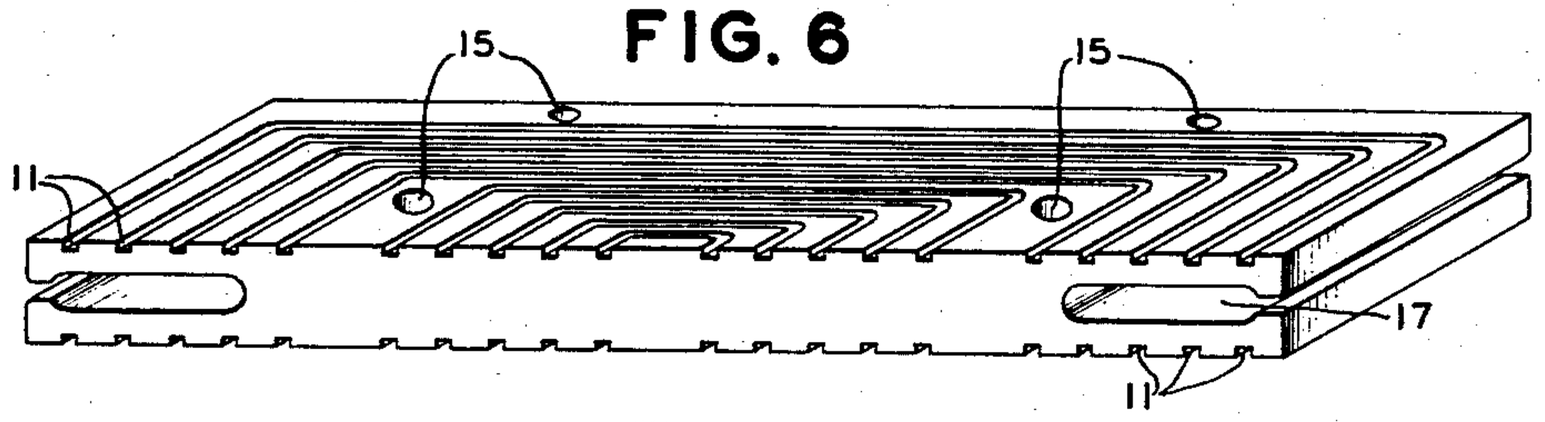
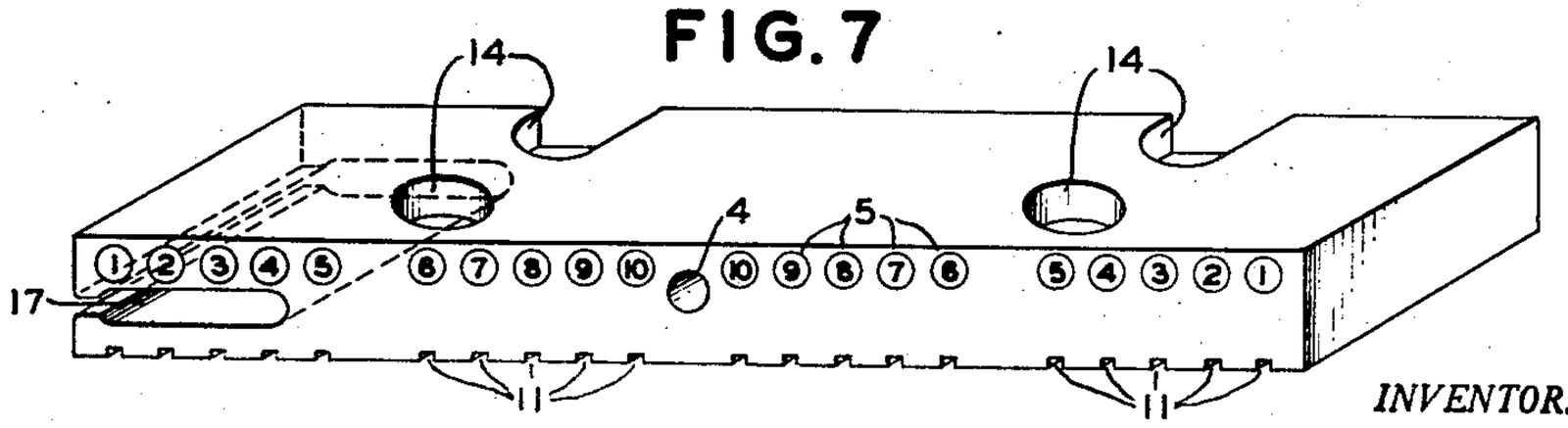


FIG. 7



INVENTORS
W. F. MARKLEY
M. HAIFTER

BY Robert B. Henderson

ATTORNEY

Oct. 21, 1958 W. F. MARKLEY ET AL 2,857,583

MOLDED MODULAR TERMINAL BLOCK

Filed Jan. 7, 1955 3 Sheets-Sheet 3

FIG. 8

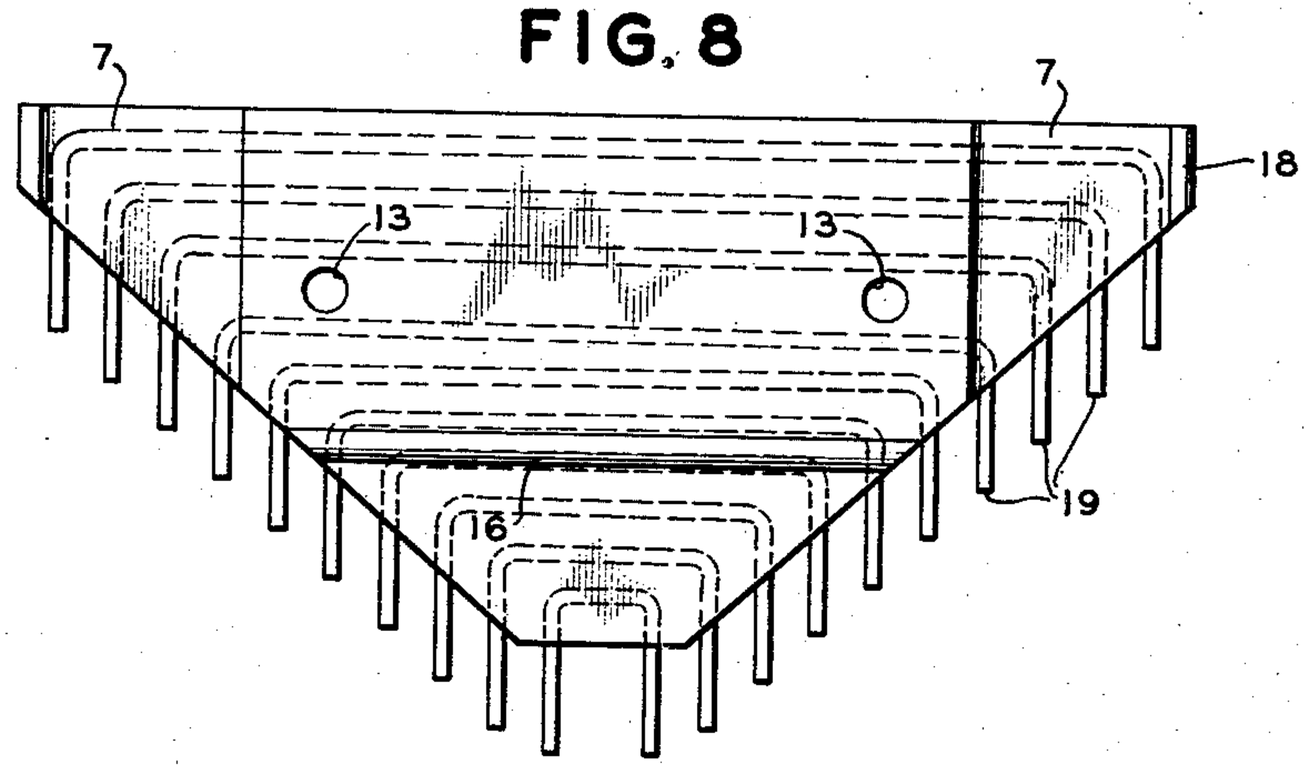


FIG. 9

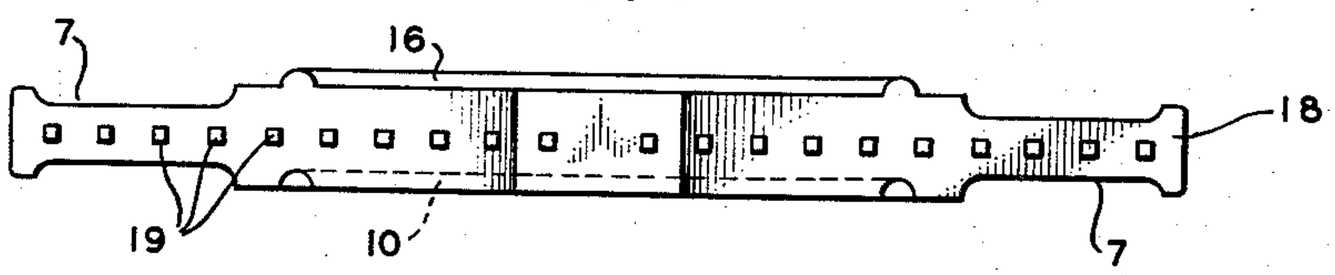


FIG. 10

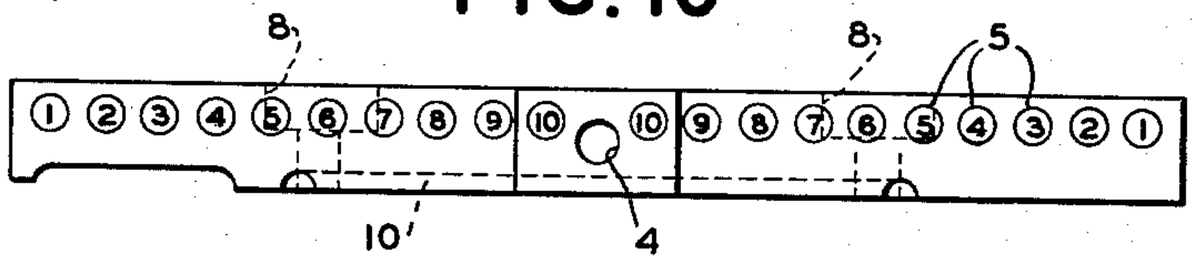
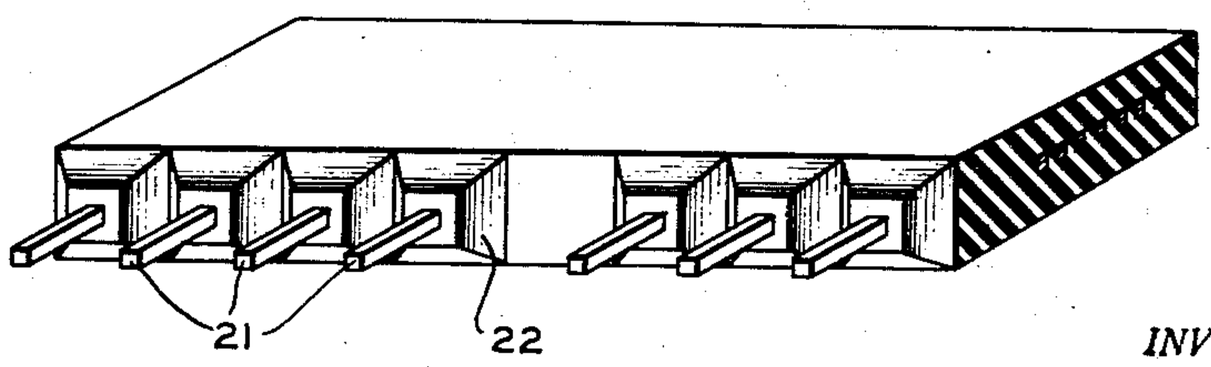


FIG. 11



INVENTORS
W. F. MARKLEY
M. HAIFTER

BY Robert B. Henderson

ATTORNEY

United States Patent Office

2,857,583

Patented Oct. 21, 1958

2,857,583

MOLDED MODULAR TERMINAL BLOCK

William F. Markley, Ridgewood, and Merines Haiffter, Rutherford, N. J., assignors to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application January 7, 1955, Serial No. 480,376

8 Claims. (Cl. 339—198)

This invention relates to electrical terminal blocks, and more particularly to such blocks intended for accommodating the large number of conductors associated with communications equipment wiring, in a relatively small space.

Multiple-lug terminal blocks have been employed for many years in the cross-connecting and distributing frame rooms of the wire communications industry to provide a convenient and orderly means of making the necessary mass wire terminations. Such terminal blocks are connected in two directions, that is, the entering cable or group of conductors is fastened to an array of terminals having a certain orientation, while the leaving or other group of conductors is fastened to terminals of the same block having a different orientation. It is thus necessary, when the conductors are to be fastened to a terminal block which is already secured in place, for separate clearance distances amounting to an adequate working space to be provided adjacent to both the entering and the leaving portions of the terminal block.

This condition is necessitated by the conventional construction of terminal blocks wherein terminals enter through one face thereof, and passing through the block, provide connection on a second opposed face on the rear side of the block.

The disadvantage of this need for excessive clearance space when using conventional terminal blocks is especially apparent when they are employed as a wiring means in equipment contained in a housing enclosure. Space in such structures as enclosed relay racks is at a premium, and since access to the wiring of the equipment is usually obtainable from only one side, by means of a door in the rear of the cabinet, large and consequently expensive clearances must be provided on each side of terminal blocks mounted in the center of the doorway.

It is therefore an object of the present invention to provide means to reduce the access space required for fastening input and output wires to the terminal arrays of a terminal block.

Another object of the present invention is to provide a terminal block which is more easily and quickly wired into a circuit because of the convenient access afforded to all terminals from a single location.

Still another object of the invention is to eliminate the production of wiring mistakes by providing a terminal block having input and output terminals always symmetrically located and simultaneously visible for instant and easy checking of connections.

A further object is to provide such a terminal block in nesting modular form for convenient assembly as a rigid unitary structure having any desired multiple of a predetermined number of terminals.

Other objects and advantages of the invention will appear from a consideration of the following description thereof, taken in conjunction with the drawings, wherein—

Fig. 1 is a front view of a terminal block constructed in accordance with the present invention;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1,

showing the construction of such a terminal block from the side;

Fig. 3 is a sectional view of one of the interior constituent decks comprising Fig. 1;

Fig. 4 is a perspective view of the deck of Fig. 3;

Fig. 5 is a perspective view of an exterior constituent deck of Fig. 1;

Fig. 6 is a perspective view of another embodiment of an interior constituent deck element of the instant invention;

Fig. 7 is a perspective view of an exterior deck element for use with the article shown in Fig. 6;

Fig. 8 is a top view of another embodiment of an interior constituent deck element of the instant invention;

Fig. 9 is a front view of the article of Fig. 8;

Fig. 10 is a front view of an exterior deck element suitable for use with the elements of Fig. 8; and

Fig. 11 is a perspective view of a portion of a terminal block deck having an extended surface between the terminals thereof.

Referring now to the drawings, Fig. 1 shows a composite terminal block comprising upper and lower end pieces **3** of identical construction, being in the form of rectangular blocks of insulating material, preferably molded to shape, as seen more clearly in Fig. 5. Consecutive numbers **5** are molded in relief across the front faces of the identical end pieces **3**, in duplicate sets of numbers, each starting from an opposite side of the block. As seen in Fig. 1, these numbers are aligned with terminals **6** later described, so that pairs of terminals on the same level and having the same number are internally connected together. A mounting hole **4** is provided at the center of each end piece, and cut away portions **7** extending to the rear of the said end pieces cooperate with corresponding portions of the remainder of the assembly to provide wireways for convenient grouping of the wires to be terminated, according to the level of the terminal deck to which they are fastened. Countersunk through holes **8** in the end pieces are aligned with holes **13** in the interior deck elements **12**, seen more clearly in Fig. 4, to retain screws such as **9**, compressing the assembly into an immovable structure, with the aid of a recess **10** which is formed in the lower surfaces of the said end pieces to engage a corresponding tongue **16** on the adjacent assembly to form a rigid structure. End pieces **3** are shown in greater detail in Fig. 5.

Fig. 4 is a perspective view of an interior deck element such as **12** of Fig. 1, and is seen to comprise a rectangular molded body of insulating material provided with holes **13** for the aforementioned bolts **9**. A shallow tongue **16** is raised in the upper surface for engagement with the mating recess of adjacent sections as indicated in Fig 2, which is a cross sectional view of Fig. 1, taken on the line **2—2**.

Terminal pins **6** are constructed in pairs, and constitute the free ends of reentrant convolutions of wires made of conductive material as seen in Fig. 3, which is a horizontal cross sectional view of Fig. 4. Square phosphor bronze wire plated with tin has been found to be a most successful material for the construction of these parts. These are arranged in nested fashion to conserve space and the said deck element molded around them, thus securing them in position. It will be observed that the shape of the said convolutions is such as to provide secure fastening of the terminals, without any need for adhesion between the material of the block and that of the terminals, and without need for other deformation of the wires, changes in their cross section or the provision of anchoring means therefor.

It is thus a feature of this construction that the internal connection between corresponding terminal pins, because of the uniform cross section of the wire employed, has

the lowest possible internal ohmic resistance for the amount of metal used in its construction.

In Fig. 6 is shown an alternative construction of the interior constituent decks, in which it is seen that the open rectangular slots **11** are formed in the upper and lower surfaces of the deck, such that when placed in juxtaposition with the similarly slotted surface of an adjacent deck or piece, a series of reentrant convolutions in the form of channels of square cross section is produced, which are capable of retaining a series of suitably formed conductors in a nested array which may be separately prepared, and assembled only at such time as the decks are fastened together into a unitary terminal block assembly. Such conductors are similar to those at **6** of Fig. 3, but as stated, are not embedded in the insulating material of the deck at the time of its manufacture, as there shown. The wireways **17** are in this case molded entire in each deck element, and identical exterior deck elements are provided for top and bottom of the terminal block, as shown in Fig. 7, in order to terminate the assembly with a suitable single set of conductor receiving grooves at each end of the block to form an integral number of levels of square grooves. By this means, it is possible to cast or mold insulating deck elements having no metallic inserts at the time of molding, which greatly increases the efficiency and rapidity of the molding operation. The reentrant convoluted shape of the conductors **6** of Fig. 3, as used, which insures their secure retention in the decks without need for adhesion or anchoring, and their constant and favorable cross sectional shape which enables molding dies for the decks to be made with sufficient draft to release the finished deck easily and quickly after molding, are seen to be important factors contributing to the feasibility of this embodiment.

Countersunk through holes **14** appropriate to this construction are provided in the end pieces of Fig. 7 for alignment with holes **15** in the interior deck elements of Fig. 6 to retain through bolts similar to **9** of Fig. 6.

A further and preferred form of the invention utilizes an assembly constructed in general accordance with the arrangement of Fig. 1, from interior deck elements **18** of the type shown in plan in Fig. 8 and in front view in Fig. 9 having reentrant wire convolutions with free ends comprising terminals **19** molded in place. These are assembled with appropriate identical external elements at top and bottom, of the kind shown in front view in Fig. 10. It is seen from Fig. 8 that the insulating deck **18** has oblique anterior surfaces, placing the terminal pins **19** in echelon, such that the forwardly extending length of each of the pins is equal and minimal. This arrangement effectively preserves the advantage of unidirectional pin orientation and consequently access to all pins from a single direction is maintained, which results in the large saving in mounting space aforementioned, and at the same time decreases the required length of the internal conductors, resulting in a substantial saving of metal required in the construction of the terminal block and also reducing the electrical resistance of the connections. In addition, the amount of insulating material required to produce a block of a given number of terminals and of given terminal spacing is thereby reduced.

An advantage of the preferred construction shown in Figs. 8 and 9 is that because of the oblique frontal surfaces of the insulating material containing the terminals, the leakage path across the insulation between terminals is lengthened. This increased length of the leakage path is proportional to the secant of the angle of frontal obliquity, and constitutes an improvement in the important property of insulation resistance of the terminal block. Since the molded-in arrangement of the terminals obviates any surface leakage elsewhere in the structure, such as the leakage experienced in other types of communications circuit terminal blocks due to the collection of dirt and moisture in crevices communicating with the conductors, the insulation resistance of the blocks is found to remain at a relatively high value, especially after aging and the consequent accumulation of airborne dirt thereon, as compared with that of prior forms of insulating blocks.

Because of the molded form of the terminal blocks, it is practical to use any of a variety of moldable plastic substances as an insulating material such as polyester, epoxy, polysilane and fluorocarbon resins, all of which have a sufficiently low electrical conductivity and moisture absorption to render these formerly critical factors unimportant in the design of the present form of terminal block.

For application elsewhere than in the interconnection of normally low impedance and low voltage communications circuits, where higher insulation resistance of the terminal block is desirable, the leakage path between terminals of the present block can be effectively extended to produce the desired increase of impedance by including appropriate provision in the dies used for forming the insulating parts, for producing bosses or collars about each terminal pin **21** in order to extend the electrical surface leakage distance therebetween, as shown at **22** in Fig. 11. Obviously, such improvement is applicable only to the form of block of the instant invention where the conductors are embedded in insulating material, and would be futile if practiced on prior forms of blocks having extensive shunt leakage paths between exposed conductors.

A further advantage of the present invention is that the wireways formed by the cut-away portions **7** of Fig. 1 and at **17** of Fig. 6 have been molded integral with the components of the terminal block. By this means it is rendered unnecessary to employ the separate "fanning strip" formerly used to group and guide the wires entering the terminal block, thus avoiding the need for the strip itself, the means for mounting the strip, and particularly the large amount of space taken up by the strip.

An important advantage of the present invention lies in its adaptability for use with wire connections made by means of the wire wrapping technique. Wrapped terminal connections are produced by a tool requiring frontal access to the terminal, and because of the considerable size of the tool employed and the need for manual support and guidance thereof, any divergence between the frontal directions of entering and leaving terminal banks increases greatly the access space required for wiring the terminal block. The saving made possible by the instant invention in space required for the wiring of terminals, which was previously adverted to, is in this instance multiplied because of the unusual requirements involved in this special method of wiring.

It has been found that the volume of the cabinet enclosing a number of the instant terminal blocks can be reduced to about 15 to 20% less than that of a cabinet enclosing corresponding terminal blocks of conventional construction, without sacrifice of convenience or accessibility. A consequent and somewhat greater saving of cost of the cabinet and of space occupied by the cabinet is thus attained.

Although here described in terms of specific illustrative examples, the concept of the present invention is capable of exemplification in other forms, and it is therefore intended that no limitations be placed thereon except such as are specifically set forth in the attached claims.

What is claimed is:

1. A terminal block comprising a plurality of keyed superposed prismatic terminal slabs of molded electrical insulating material having wireway passage portions extending rearwardly from the anterior faces thereof, a plurality of nested sets of coplanar conductor return bends having polygonal conductor cross-sections, disposed in the said slabs and having substantially parallel end portions protruding a terminal forming distance beyond the said

anterior faces, at least one said slab surrounding and retaining each said conductor set, a pair of congruent cover slabs for the said terminal slabs having on the anterior faces thereof duplicate sets of indicia for being identifyingly aligned with duplicate ends of the said conductors in columnar array, releasable means to retain the said slabs in fixed compressed relation, and means to mount the said terminal block.

2. A terminal block comprising a plurality of superposed rectangular terminal decks of molded electrical insulating material having opposite surfaces adapted for mating in superposition, a plurality of metallic conductors disposed in a nested pattern of graduated sized return bends in the midplane of each of the said terminal decks and having end portions of polygonal cross-section protruding therefrom comprising aligned terminals and otherwise completely surrounded by and embedded in the said insulating material, the said terminal decks having therein surface discontinuities of predetermined character in one mating surface and corresponding inverse discontinuities in an opposite mating surface for keyed superposition of a plurality of said decks, and having complementary wireway portions at the sides of the said surfaces for lead wire retention, upper and lower deck shaped cover plates having terminal block mounting means therein, for superposition on the said superposed terminal decks, having contiguous bi-symmetrical linear segments of indicia on the faces thereof aligned with the said terminals, and means to compress the superposed decks and cover plates into rigid keyed relationship.

3. The article of claim 2 wherein the said polygonal cross-section is square.

4. A terminal block assembly comprising a plurality of superposed rectangular prismatic terminal slabs of molded electrical insulating material each having upper and lower surfaces for abutment grooved in nested rectangular channels to form with a mating slab square passageways having extremities facing in substantially the same direction, metallic conductors of square cross-section substantially filling the said passageways and protruding therefrom a terminal forming distance, upper and lower conforming deck plates having lower and upper surfaces correspondingly grooved respectively, and having duplicate sets of conductor identifying indicia aligned with duplicate conductor connected terminal columns, and means to retain the said assembly compressed into a unitary block.

5. A terminal block comprising a plurality of superposed generally triangular right prismatic terminal decks of molded electrical insulating material having opposite surfaces adapted for mating in superposition, a plurality of metallic conductors disposed in a nested pattern of graduated sized return bends in the midplane of each of the said terminal decks and having end portions of polygonal cross-section protruding from the angular frontal surfaces thereof comprising parallel terminals and otherwise surrounded by and embedded in the said insulating material, the said terminal decks having therein surface discontinuities of predetermined character in one mating

surface and of complementary character in the opposite mating surface for keyed superposition of a plurality of said decks and having complementary wireway recess portions parallel to said terminals at the lateral extremities of said mating surfaces extending completely across said mating surfaces for lead wire retention, upper and lower deck shaped cover plates having terminal block mounting means, for superposition on the said superposed terminal decks and having contiguous bisymmetrical linear segments of indicia on the anterior faces thereof aligned with the said terminals, and means to compress the superposed decks and cover plates into rigid keyed relationship.

6. The article of claim 5 wherein the said polygonal cross-section is square.

7. A terminal block assembly comprising a plurality of superposed generally triangular right prismatic terminal decks of molded electrical insulating material each having upper and lower surfaces for abutment grooved in nested rectangular channels to form with a mating slab square passageways having parallel terminations pointing in the same direction in symmetrical frontal faces thereof, metallic conductors of square cross-section substantially filling the said passageways and protruding therefrom a terminal forming distance, upper and lower congruent deck plates of moldable insulating material having lower and upper surfacees correspondingly grooved respectively and having duplicate sets of discrete indicia on the frontal faces thereof aligned with duplicate, conductor connected terminal columns, and means to retain the said assembly compressed into a unitary block.

8. A terminal block assembly comprising a plurality of superposed prismatic terminal slabs of molded electrical insulating material each having upper and lower surfaces for abutment grooved in nested rectangular channels to form with a mating slab square passageways having parallel terminations pointing in the same direction, metallic conductors of square cross-section substantially filling the said passageways and protruding therefrom a terminal forming distance, upper and lower conforming deck plates having lower and upper surfaces correspondingly grooved respectively, and having duplicate sets of indicia aligned with duplicate conductor connected terminal columns, and means to retain the said assembly compressed into a unitary block.

References Cited in the file of this patent

UNITED STATES PATENTS

2,326,327	Brewer	Aug. 10, 1943
2,327,048	Joyce	Aug. 17, 1943
2,463,826	Thacker	Mar. 8, 1949
2,465,419	Barany	Mar. 29, 1949
2,468,785	Sealey	May 3, 1949
2,509,701	Smith	May 30, 1950
2,787,773	Potter	Apr. 2, 1957

FOREIGN PATENTS

822,184	France	Sept. 13, 1937