

March 19, 1935.

H. L. SKLAR

1,994,967

METHOD OF FORMING RESISTORS

Filed April 17, 1933

2 Sheets-Sheet 1

Fig. 1.

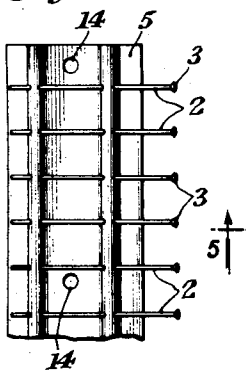


Fig. 3.

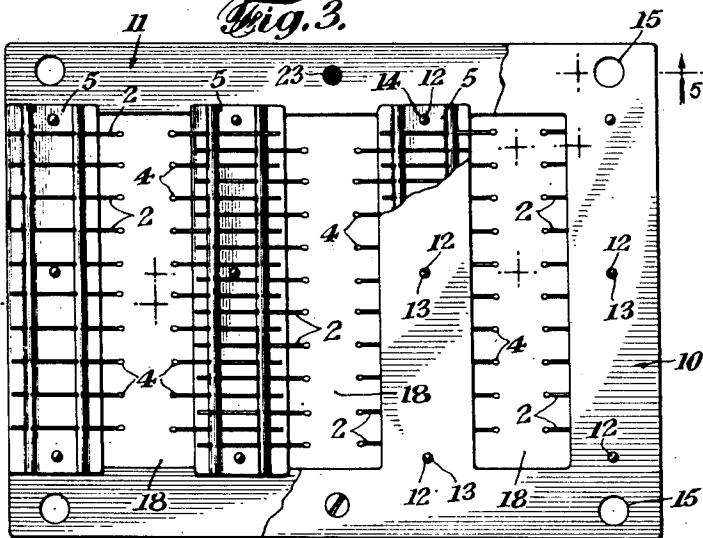


Fig. 2.

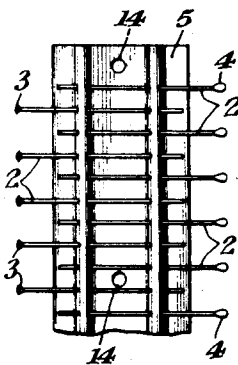


Fig. 4.

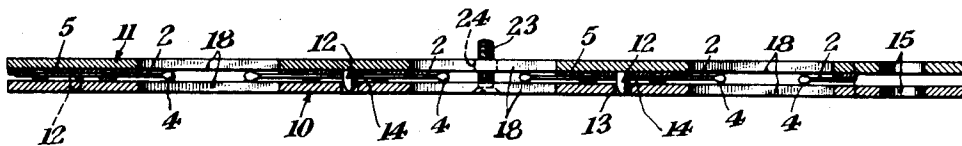
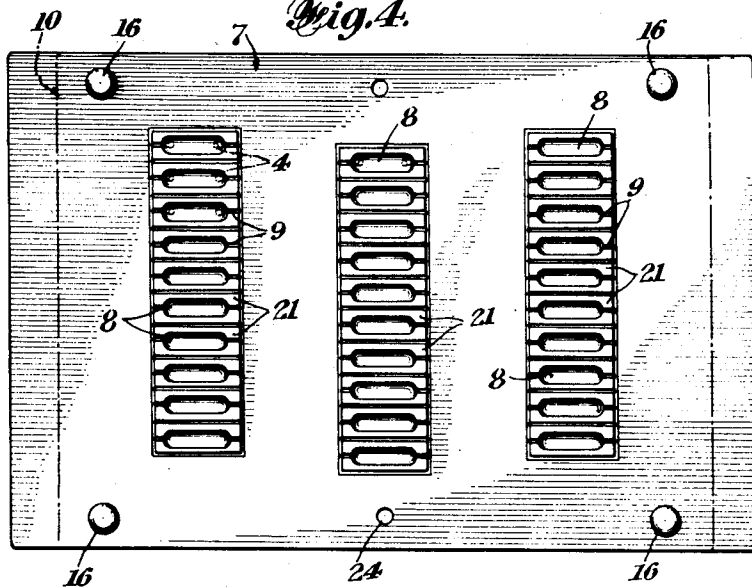


Fig. 5.

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2 Sheets-Sheet 2

Fig. 6.

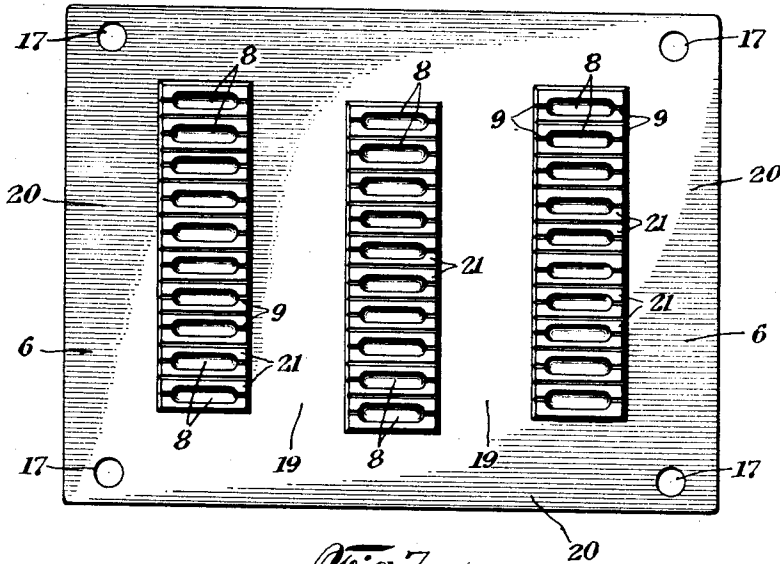


Fig. 7.

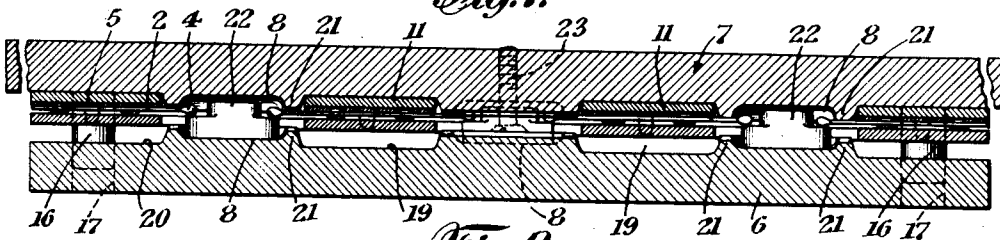


Fig. 8.

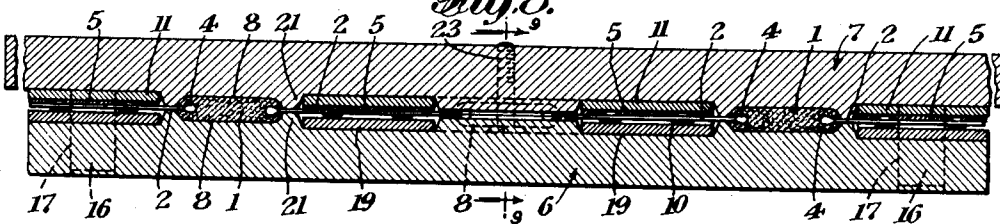


Fig. 9.

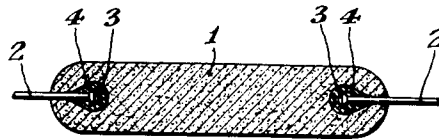
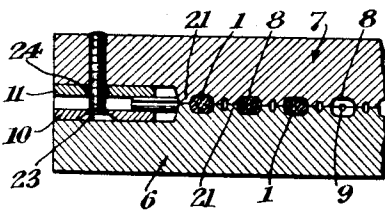


Fig. 10.

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METHOD OF FORMING RESISTORS

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Application April 17, 1933, Serial No. 666,415

4 Claims. (Cl. 201—63)

The invention relates to the manufacture of electrical resistors wherein the terminals of the resistor are embedded within a mass of resistance material, and aims primarily to provide methods by which resistors of the above character may be economically and rapidly produced in large quantities. Certain of the features of the invention are particularly applicable to hot molded resistors, while others are also applicable to cold molding processes, as hereinafter explained in greater detail in the following specification which, taken in conjunction with the accompanying drawings, illustrates an apparatus adapted to be used in forming resistors in accordance with the invention, and certain steps or stages in such manufacture. In the drawings—

Fig. 1 shows a plurality of resistor terminals carried by a supporting and positioning strip adapted to be used as a part of the present invention.

Fig. 2 is a view similar to Fig. 1 but showing the terminals projecting toward the right of the figure coated with a low resistance material, which may be used to facilitate good electrical contact between the terminals and the resistance material proper.

Fig. 3 is a plan view of a resistor terminal supporting frame adapted to be used in carrying out the present invention, to support terminal holding strips of the character shown in Figs. 1 and 2, a portion of one of the plates forming part of such frame being cut away.

Fig. 4 is a bottom plan view of an upper main molding die adapted to be used in carrying out the invention, and indicating in dotted lines the operative position of the above mentioned frame in respect to such die.

Fig. 5 is a sectional view through said frame taken on the broken line 5—5 of Fig. 3, looking in the direction of the arrows.

Fig. 6 is a plan view of a main molding die adapted to be used in carrying out the invention.

Fig. 7 is a sectional view through a pair of main molding dies, with the resistor terminal carrying frame in operative position therebetween, and illustrating the position of the parts at the beginning of the molding operation.

Fig. 8 is a view similar to Fig. 7 but showing the position of the parts at the completion of the molding operation.

Fig. 9 is a fragmentary sectional view taken on line 9—9 of Fig. 8 looking in the direction of the arrows.

Fig. 10 is a longitudinal sectional view of a completed resistor unit.

The invention is illustrated as applied to the manufacture of electrical resistor units of the type illustrated in Fig. 10, having a main body portion of suitable resistance material 1 which may be of any suitable composition, for example, such as is known in the art having graphite, carbon black and iron oxide serving as conducting material, with a small percentage of high melting point wax, together with a binder consisting of phenol formaldehyde, resin and asbestos or other suitable inert filler. Various compositions suitable for the above purposes are well known in the art.

Wire terminals 2 are embedded within the resistance material 1 and usually project from the opposite ends thereof as shown in Fig. 10; preferably the terminals 2 are provided with enlarged heads 3 and I prefer also to provide the embedded ends of the terminals with a low resistance coating 4 in order to insure a noiseless contact between the terminal 2 and the main body 1 of the resistor. The low resistance coating 4 may be, for example, of a composition similar to the main body portion 1 of the resistor, but with an increased percentage of conducting material therein, or an alloy of low melting point may be employed, or a composition containing graphite and a suitable binder.

In forming resistors according to the invention in its preferred form, a series of resistor terminals 2 are placed in properly positioned aligned recesses in a supporting strip 5 of tape-like character as indicated in Fig. 1, the heads 3 of the terminals projecting out sideways from the strip. This strip 5 if desired may be of paper and may support the terminals in a manner similar to that employed for supporting pointed pins in common use, or a metal strip may be employed where a terminal support suitable for repeated use is desired.

Tape-like strips of the above character, carrying the terminals in proper position, may readily be obtained or produced in long lengths, usually in coil or roll form from which the desired lengths of strip may be cut off.

While the resistor terminals are supported as above described, their ends 3 may be readily coated to form the low resisting coating 4, as indicated at the right of Fig. 2, for example by dipping the ends of the terminals in a low resistance composition while properly supported by strip 5, or spraying the composition thereon. With a large number of terminals so accurately

positioned and supported, the coating may be applied much more rapidly and accurately.

A suitable number of strips 5 carrying the terminals as aforesaid, are then ready to be placed in operative position between main molding dies 6 and 7, of the character shown in Figs. 6 to 9. These dies are provided with opposed walls defining series of resistor shaped recesses 8, three parallel rows of such recesses being shown in Fig. 6, and at opposite ends of each recess 8 are provided grooves 9 adapted to receive the terminals 2, when the strips 5 are placed in proper position between dies 6 and 7.

I prefer to employ in connection with the strips 5 a holding frame of the character shown in Figs. 3 to 5, which is interposed between the main dies 6 and 7 during the molding operation. This holding frame may consist of a pair of plate-like members 10 and 11 detachably fitting together in definite relationship, dowel pins 12 in plate 11 being shown in Fig. 5 for this purpose, and fitting in holes 13 in plate 10. The strips 5 may also be provided with holes 14 engaging pins 12, which locate the resistor terminals 2 accurately in respect to the holding frame, and the holding frame in turn may be accurately located in respect to the main dies 6 and 7, as by means of the holes 15 in the plates 10 and 11, which engage with the dowel pins 16 shown in Fig. 7 as mounted on the main die 7 and passing into dowel holes 17 in the lower main die 6.

In the illustrated form of the invention the plates 10 and 11 of the terminal holding frame are provided with openings 18, which line up with the resistor shaped recesses 8 when the holding frame is placed in operative position, the walls of the plates adjacent said openings 18 serving to hold the terminals 2 and their supporting strips 5 securely in position. The opposed walls of the main dies 6 and 7 are provided with interior depressed portions 19 and marginal depressed portions 20 adapted to receive the holding frame constituted by the plates 10 and 11, when the dies are forced together into the position shown in Fig. 8. This construction of the dies 6 and 7 leaves lands 21 surrounding the resistor shaped recesses 8, and the terminal receiving grooves 9 are formed in these lands.

Preferably the holding frame comprised of plates 10 and 11, and the terminal supporting strip 5 are used in conjunction as above described, for the purpose of properly and securely positioning the resistor terminals in the mold, but it should be noted that the strips 5 may be employed alone for the above purposes, although when used conjointly with the frame they will better insure that the terminal strands are properly held and afford greater facility in handling.

In forming resistors according to the present invention a plurality of "pills" or blocks 22 (Fig. 8) of suitable resistance material may be first placed in recesses 8 of main die 6, suitable means for rapidly performing such an operation being known in the art and accordingly not described in detail herein. A suitable number of terminal supporting strips 5 (the heads 3 thereof being preferably first coated with a suitable material 4), will then be placed in engagement with the dowels 12 of plate 11 of the holding frame. In the use of the illustrated forms of main dies 6 and 7, it will be noted that the terminal strip 5 shown in Fig. 1, containing only a single series of terminals projecting from one side thereof, is suitable for use at the opposite side edges of the main dies, while the supporting strip 5 shown

in Fig. 2, which is provided with two series of resistor terminals in staggered relation and with their ends projecting from opposite sides of the strip, is suitable for positioning in the intermediate recessed portions 19 of the main dies, one such strip 5 thereby serving both rows of resistor shaped recesses which are located on opposite sides thereof.

After the strips 5 have been properly positioned on plate 11 as above described, the plate 10 may be placed in proper relation to the plate 11 and the resistor terminal holding frame thereby constituted may be placed in proper position relative to the main dies 6 and 7, by engagement of holes 15 in the holding frame with dowels 16 of main die 7. In the illustrated form of the invention screws 23 (Figs. 3, 5 and 9) pass through the plate 10 of the holding frame and holes 24 in plate 11 into the main die 7 thereby detachably connecting the terminal holding frame to main die 7.

The illustrated die construction is adapted to be used in a hot molding process, the dies 6 and 7 being heated in such manner that the pills or blocks 22 of resistance material are quickly softened when placed in position, the result being that when pressure is applied to force the dies together from the position shown in Fig. 7 to that of Fig. 8, the resistance material 1 readily flows in recess 8 in such manner as to completely surround the heads 3 of terminals 2, and embed the latter therein. It should be understood, however, that many of the features of the invention are also applicable to cold molding processes. The hot molding process, however, produces a resistor having a glaze which affords a substantially moisture impervious surface.

After the molding operation has been completed and main dies 6 and 7 separated, the holding frame constituted by plates 10 and 11 carrying the completed resistor units may be detached from die 7, and plates 10 and 11 separated to allow removal therefrom of the completed resistor units, which are then supported by the strips 5. Subsequent handling of the resistors is much facilitated by having a large number of them supported in the above manner, and yet the individual resistors are easily separable from the strips 5 whenever desired.

While a specific apparatus and mode of procedure have been described above, it should be understood that many changes may be made therein without departing from the essentials of the invention as set forth in the appended claims.

I claim:

1. A process of the character described for forming resistors which includes penetrating a plurality of resistor terminal strands laterally into a tape-like strip so that such strands project outwardly from a side edge of said strip, placing the strip, so carrying said strands, adjacent a plurality of blocks of moldable resistance material to position the projecting ends of such terminal strands alongside of such blocks, and applying heat and pressure to embed projecting portions of said strands in the resistance material and thereby form a plurality of resistor units having terminals detachably connected together by said strip.

2. A process of the character described for forming resistors which includes penetrating a plurality of resistor terminal strands laterally into a tape-like strip so that such strands project outwardly from a side edge of said strip

and molding bodies of resistance material respectively about projecting portions of said terminal strands, thereby to form a plurality of resistor units having terminals which are connected together by said tape-like strip.

5 3. In combination, a plurality of electrical resistor units each including a resistor body having terminal strands projecting respectively from the opposite ends thereof, and tape-like strips
10 also located respectively adjacent the opposite ends of said units, the said terminal strands of said units detachably penetrating and being connected together by the aforesaid strips which are respectively adjacent thereto.

4. A process of the character described for forming resistors which includes positioning a plurality of resistor terminal strands projecting laterally therefrom, between mating dies having a series of resistor-shaped recesses, in such manner that said terminal strands project respectively
5 into such recesses, molding resistance material about the portions of said terminal strands which are so positioned in said recesses, and then stripping said strips carrying the resistor units
10 thereby formed, from the molding recesses.

HERMAN L. SKLAR.

CERTIFICATE OF CORRECTION.

Patent No. 1,994,967.

March 19, 1935.

HERMAN L. SKLAR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 2, after "a" insert the words plurality of tape-like strips each carrying a; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of May, A. D. 1935.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.

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