

June 29, 1948.

L. A. BARTELHEIM ET AL

2,444,026

METHOD OF MAKING SELECTIVE SWITCH BANKS

Filed July 24, 1943

3 Sheets-Sheet 1

FIG. 1.

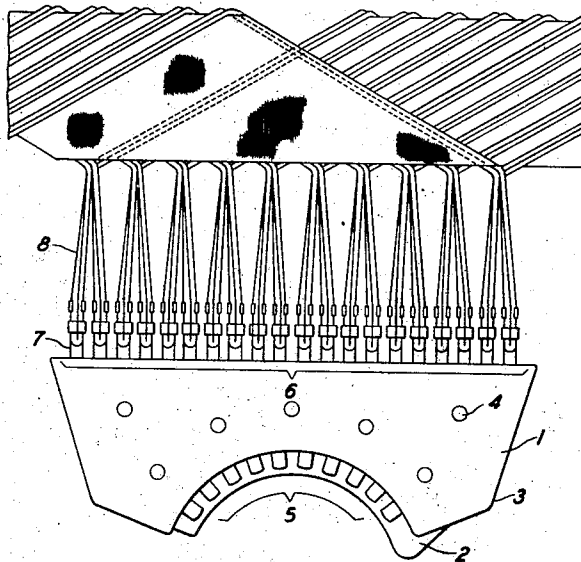


FIG. 2.

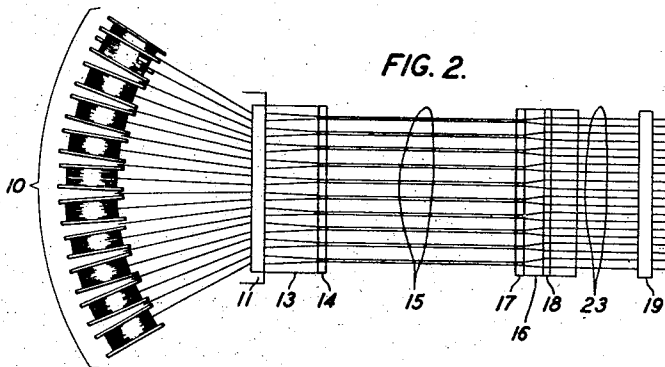
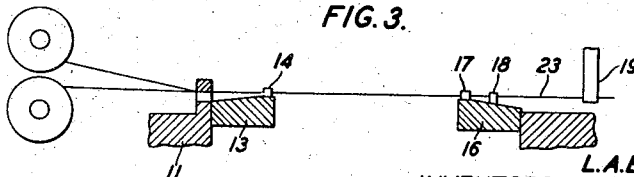


FIG. 3.



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3 Sheets-Sheet 2

FIG. 4.

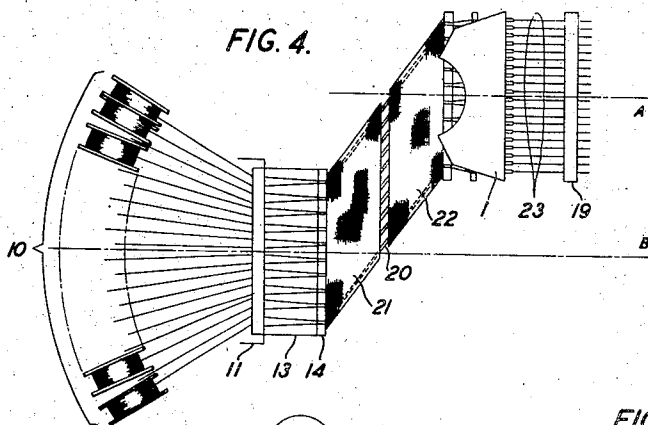


FIG. 5.

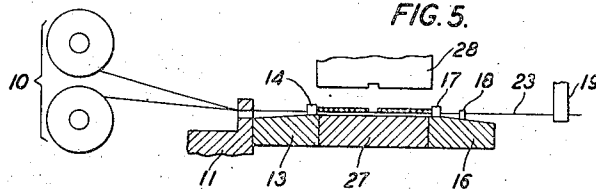


FIG. 6.

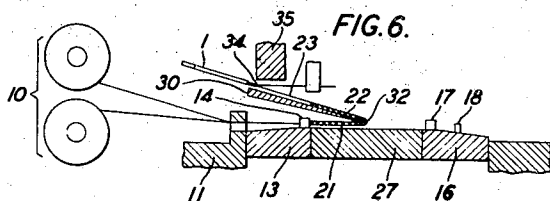


FIG. 7.

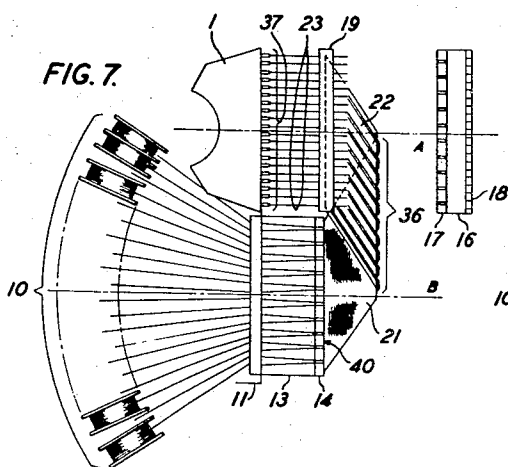
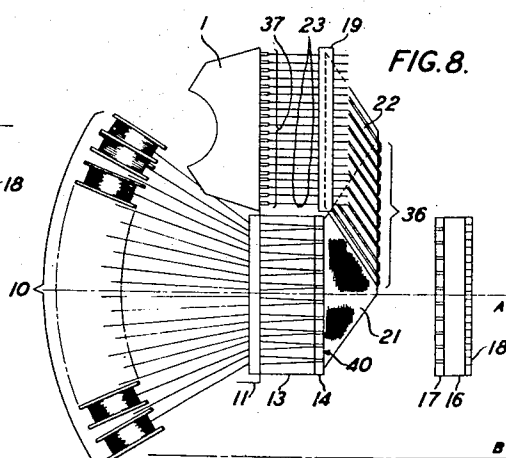


FIG. 8.



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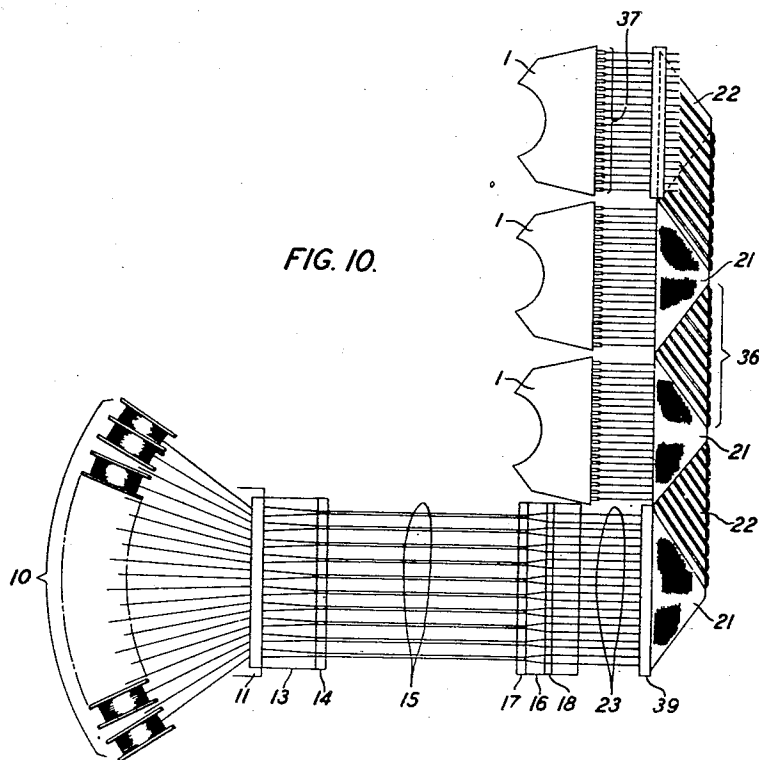
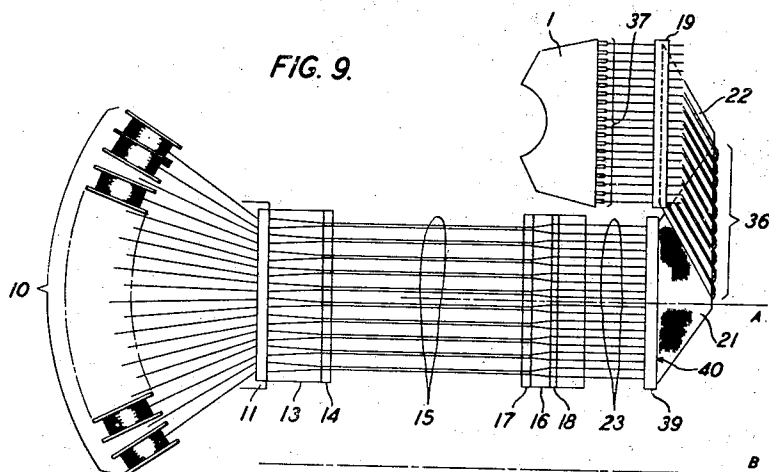
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,444,026

METHOD OF MAKING SELECTIVE SWITCH BANKS

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Application July 24, 1943, Serial No. 495,990

8 Claims. (Cl. 29—155.5)

1

This invention relates to switching devices and particularly to improvements in the manufacture of series of interconnected switching banks for use in establishment of connections in telephone systems.

An object is to simplify the method of fabricating such series of banks and the interconnecting multiple cables.

Heretofore switching banks have been individually completed, arranged in series and interconnected with conducting wires sometimes in the form of prefabricated cables. Such wires or cables were placed in the rear of the bank and the individual wires were soldered or otherwise secured to corresponding terminals in succeeding banks of the series.

The present invention relates to a method of manufacturing a series of switching banks with interconnecting conducting wires, and a feature thereof is the method which consists in securing a plurality of terminals to each of a plurality of insulation cards, forming from a group of continuous wires a cable section, connecting corresponding terminals of a card to the wires in said cable section, repeating these operations to form a continuous string of connected cards, cutting this string of cards in sections, each containing a predetermined number of cards, and assembling a desired number of sections of cards into a series of interconnecting switching banks.

This method may be carried out in its preferred form by securing the terminals to a plurality of insulation cards, forming a flat layer of equally spaced wires in a first flat rectangular section followed by a flat rhomboidally-shaped section, securing two equal rhomboidally-shaped segments of fabric to the rhomboidal section, securing the terminals of a card to the wires in the rectangular section perpendicularly across the center of said section, simultaneously folding the rhomboidal section between the fabric segments in one direction and the rectangular section across the center in the opposite direction so that the terminals in the card extend away from and in line with the loops formed by the wires in the rectangular section and repeating these operations of forming rectangular and rhomboidally-shaped sections from the spaced wires, applying the fabric segments, connecting the terminals of a succeeding card and folding the two sections to

2

form a series of cards having their corresponding terminals connected to the continuous wires formed into a flat ribbon cable, then cutting said cable in sections containing a predetermined number of cards, and finally assembling said sections into switching banks corresponding to the number of cards in the sections and having their corresponding terminals interconnected by the wires in the cable sections.

This invention has been illustrated in the accompanying drawings in which:

Fig. 1 shows a layer of terminals of one switching bank of a series connected to a cable and manufactured in accordance with applicants' invention;

Figs. 2 to 10 illustrate the various steps taken in manufacturing a series of switching banks in accordance with the applicants' invention.

Referring now to Fig. 1 the terminals of an individual layer or terminal assembly generally referred to by the numeral 1 may consist, as shown in this figure, of a group of ten tip terminals on top of a group of ten ring terminals separated by an insulation card 2 and insulated from adjacent layers by means of insulation cards such as the card 3 on top and a corresponding card on the bottom (not shown) and held together in any suitable manner by rivets or eyelets indicated at 4. These two groups of ten terminals each may be arranged at their contacting inner ends in a semicircle as shown at 5 at the outer ends in a straight single row of twenty terminals as shown at 6. Each terminal at its outer end is connected to an individual loop of a continuous conducting wire such as terminal 7 connected to loop 8. These loops of wires are formed into a continuous ribbon that connects one layer from each succeeding switching bank in a series.

Referring now particularly to Figs. 2 to 10, the method of manufacturing a series of switching banks may be as follows: For example, twenty spools of insulated wire may be placed as shown in Fig. 2 at 10 in an arrangement of ten spools in one semicircular row above another semicircular row of ten spools. From these twenty spools the wires are passed through a single row of holes in a stationary die member 11 to evenly space these twenty wires in a single flat layer. Adjacent the die member 11 is another member 13 having a row of pins 14 that guide the twenty

3

wires into ten pairs, as shown at 15, and some distance away from this member 13 is a similar member 16 having two rows of pins 17 and 18. Pins 17 maintain the wires in pairs and pins 18 to distribute the wires evenly.

The first step in manufacturing in accordance with the present method is to grip the wires by means of a gripping member 19 after they have been pulled through the holes in the die 11 and then pass them over the pins of the members 13 and 16 and some little distance beyond the pins 18 to the position shown in Figs. 2 and 3. The next step is to shift the member 16 to the position as shown in Fig. 4 to form a rhomboidally-shaped section of wires indicated at 20. To this section are then secured two equal rhomboidally-shaped segments of fabric marked 21 and 22, respectively. The securing of these fabric segments 21, 22 to the rhomboidally-shaped section of the wires at 20 may be accomplished by having a die 27 placed between the members 13 and 16 below the wires and another die 28 pressed down from the top over the fabric sections which have been put in place. These dies may be heated to melt an adhesive on the fabric segments to make them adhere to the wires. This arrangement is illustrated in Fig. 5. Then the terminal assembly 1 such as is shown in Fig. 1, a number of which have previously been made, is placed on the rectangular section 23 of the wires formed between the pins 18 and the gripper 19 with the outer ends of the terminals located approximately in the center of and perpendicularly across this rectangular section 23. These terminal ends are then secured each to a wire in any suitable manner such as soldering, crimping or welding to make electrical connections. This assembly 1 is shown in its proper position secured to the wires in Fig. 4.

The next operation is illustrated in Fig. 6 in which a wedge or plate 30 is passed over the section 21 and engages the part of the wires between the two segments 21 and 22 at 32 and immediately thereafter the assembly 1 and the section 22 are pulled towards the left off the pins 17 and 18 to bend the wires between these two segments 21 and 22 to fold section 22 over section 21 while at the same time the gripper 19 holds the wires of the rectangular section 23 taut beyond the connecting points 34 of the terminals to the wires so that the wires will fold back on themselves at these connecting points 34. A tool such as 35 is then pressed down from the top at the connecting points 34 to smooth out the folds. This arrangement is illustrated in Fig. 6 in a cross-section. Fig. 7 illustrates from the top how after these tools 30 and 35 have been removed, the wires have been formed and the assembly 1 has been positioned. That is the rhomboidal section 20 is now folded back in the middle over itself so that the fabric sections 21 and 22 overlap each other, as shown at 36, and the rectangular section 23 is folded approximately through its center to form loops, the ends of which are connected respectively to the terminals of assembly 1 with the loops of wires and terminals located in a straight line as shown at 37. Now, as shown in Fig. 8, the member 16 is returned to its former position in the line with member 13 and then, as shown in Fig. 9, moved back to its original position. A gripper 39 similar to gripper 19 is then attached at the edge 40 of section 21, and the formed cable section and assembly 1 are then shifted towards the right so that the wires are again placed in position in between the pins 17 and 18 to form a new

4

section 15 and a required distance beyond to form a new section 23. This new arrangement is shown in Fig. 9. The above-mentioned operations of forming a new rhomboidal section such as 20 and applying new fabric sections 21 and 22 and again connecting another assembly 1 to the new section 23 and folding the new rhomboidal section 20 and the new rectangular section 23 as shown in Figs. 2 to 7 are then repeated as shown in Fig. 10.

This process of forming cable sections and connecting assemblies to each section may be continued for some time until a considerable string of such units is produced. Then if it is desired to build up, for example, groups of switching banks consisting of ten banks having ten layers of assemblies each, the string is cut in ten lengths each containing ten interconnected assemblies. These ten lengths may then be placed one on top of the other to make ten complete banks having ten levels of assemblies, the corresponding levels in the corresponding switching banks being connected with flat ribbon cables formed by this method. The assemblies in each switching bank are then held together in any suitable manner, for example, by means of bolts and end plates. A similar method of building cables of this kind has been illustrated in the copending application of R. F. Mallina, Serial No. 447,729, filed June 19, 1942. In common with the Mallina method, the present method makes for an easy assembly of switching banks. It should be understood that longer or more suitable lengths may be manufactured for storage for use later in the manufacture of complete switching banks, that is, such lengths may later be cut off into smaller sections for assembling in desired groups of banks. Also in common with the above-mentioned method of Mallina, these flat ribbon cables do not occupy much space in a vertical direction so that there will be no interference between cables in the assembled switching banks.

It should be understood that while the invention has been illustrated in connection with groups of twenty terminals connected in single layers, other groups of terminals may be arranged, for example, ten terminals in a row may be connected to ten wires and the cables made and folded in the same manner as hereinbefore and from such single rows of assemblies corresponding series of switching banks may be manufactured.

What is claimed is:

1. The method of making a series of interconnected switching banks which comprises attaching a plurality of terminals to each of a plurality of insulation cards, forming from a group of continuous wires a cable section, electrically connecting corresponding terminals of a card to the wires in said cable section, repeating these operations of forming a cable section and connecting the terminals of a card thereto to produce a continuous string of electrically connected cards with intermediate formed cable sections, cutting the string of cards into predetermined lengths, then assembling a desired number of such lengths of interconnected cards into a series of interconnected switching banks.

2. The method of making a series of interconnected contact banks which comprises attaching a plurality of contacts to each of a plurality of insulation cards, arranging said cards of contacts in pairs with the contact cards of each pair arranged one above the other, forming from a group of continuous wires a cable section, electrically connecting corresponding contacts of a pair of

5

cards to the wires in said cable section, repeating these operations of forming a cable section and connecting the terminals of a card thereto to produce a continuous string of electrically connected pairs of cards with intermediate formed cable sections, cutting the string of pairs of cards into predetermined lengths, and then assembling a predetermined number of such lengths of interconnected pairs of cards into a series of interconnected contact banks.

3. The method of manufacturing a series of switching banks in which insulated groups of terminals in corresponding levels of succeeding switching banks are connected by wires formed into ribbon cables, comprising fabricating a portion of the ribbon cable forming a flat layer of equally spaced wires into a flat rectangular section followed by a flat rhomboidal section, securing fabric covering to the rhomboidal section, securing the terminals of one group to the wires across the center of the rectangular section, one terminal to each wire, folding the rectangular section across its center in one direction so that the terminals of the connected group extend away from and in line with the loops formed by the folded wires, folding the rhomboidal section in the opposite direction, repeating these operations of fabricating succeeding portions of the ribbon cable into sections each containing a predetermined number of groups of terminals, and assembling these sections one on top of the other to form succeeding layers of succeeding switching banks, each switching bank containing a group of terminals from each section connected to a corresponding group in a succeeding switching bank.

4. The method of making a series of contact banks interconnected with continuous conductors comprising attaching a plurality of contact members to each of a plurality of insulation cards, forming from said conductors a cable section, simultaneously electrically connecting the conductors at said cable section to the contact members in one card, folding said cable section over itself, subsequently and successively building individual cable sections with the contact members of succeeding cards connected thereto and with the cable sections folded in the same manner to form one level of interconnected cards for said series of banks, repeating the building of a number of such levels and then assembling said number of levels into said series of banks.

5. The method of making a series of contact banks interconnected with continuous conductors comprising attaching a plurality of contact members to each of a plurality of insulation cards, forming from said conductors a cable section, simultaneously electrically connecting the conductors at said cable section to the contact members of one card, folding said cable section over itself, subsequently and successively building identical cable sections with the contact members of succeeding cards connected thereto and with the cable sections folded in the same manner to form one level of interconnected cards for said series of banks, said folding of the succeeding cable sections of a level being such as to place the cards in a straight line side by side, repeating the building of a number of such levels and then assembling a certain number of levels into said series of banks.

6. The method of making a series of contact banks interconnected with continuous insulated conductors comprising attaching a plurality of contact members to each of a plurality of insula-

6

tion cards, forming from said conductors a cable section, attaching two flat fabric pieces to said cable section, simultaneously electrically connecting the conductors at said cable section to the contact members of one card, folding said cable section in two places so that said two fabric pieces overlap each other, subsequently and successively building identical cable sections with the contact members of succeeding cards connected thereto and with the cable sections folded in the same manner to form one level of interconnected cards for said series of banks, said folding of the succeeding cable sections of the level being such as to form from said cable sections and from said cards a continuous flat layer, repeating the building of a plurality of such levels and then assembling said plurality of levels into said series of banks.

7. The method of manufacturing a series of switching banks in which insulated groups of terminals in corresponding levels of succeeding switching banks are connected by continuous wires formed in cables with each wire connected to corresponding terminals in each group in a corresponding level, comprising prefabricating a series of individually insulated groups of terminals, with one end of the terminals in each group arranged in a straight line, fabricating a portion of the cable by forming from a flat layer of equally spaced parallel wires a flat rectangular section followed by a flat rhomboidal section, securing two equal rhomboidally-shaped fabric pieces adjacent each other to said rhomboidal section, securing the terminals of one group at the straight line formation to the wires perpendicularly across the center of the rectangular section, one terminal to each wire, folding the rectangular section perpendicularly across its center over itself in one direction so that the terminals of the connected group extend away from and in line with the loops formed by the folded wires, simultaneously folding the rhomboidal section diagonally across at the space between the two adjacent rhomboidal fabric pieces over itself in the opposite direction, repeating the operations of fabricating from succeeding lengths of said wires succeeding groups of sections comprising a rectangular and a rhomboidal section with the succeeding groups of terminals attached to the rectangular sections of wires in the same manner until a predetermined number of such groups are made, repeating said building of groups of sections with attached terminals, assembling such groups of sections one on top of the other to form succeeding straight layers of succeeding switching banks with each switching bank containing a group of terminals from each group of sections and securing the groups of terminals in each bank together.

8. The method of making a series of multi-level, multiple terminal banks which comprises attaching a plurality of terminals to each of a plurality of insulation members, one for each level in each of said banks, bringing a plurality of conductors together and forming them into a cable first at one point along their length and then in progression at each of a series of regularly spaced points along the length thereof, connecting said conductors when brought together at each of said points and formed into a cable to the respective terminals of a separate one of said insulation members to form a continuous combined terminal and multiple cable structure for one level of said series of banks, similarly forming a continuous combined terminal and multiple

cable structure for each of the remaining levels of said series of banks and assembling said combined terminal and cable structures one on another and securing them together to form a completed series of multiple terminal banks.

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