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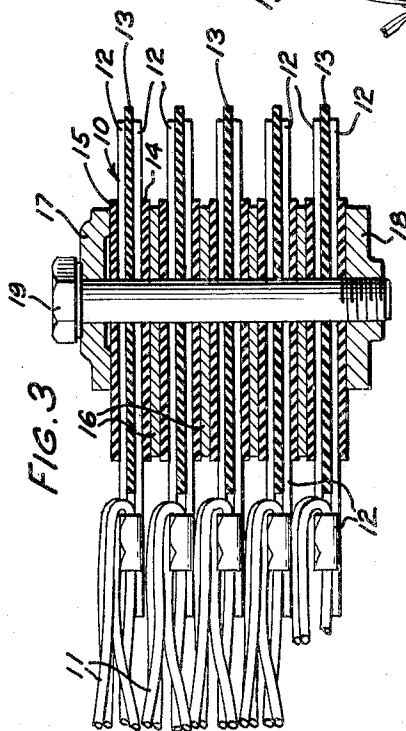
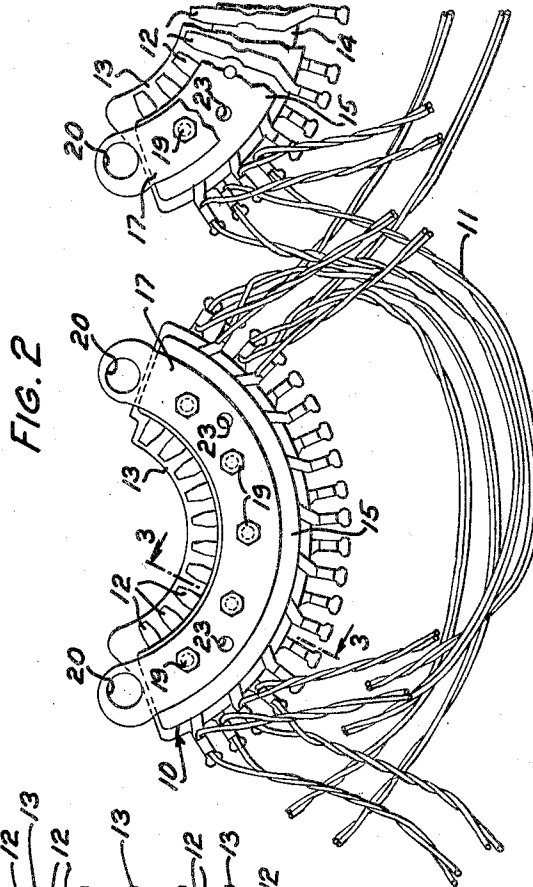
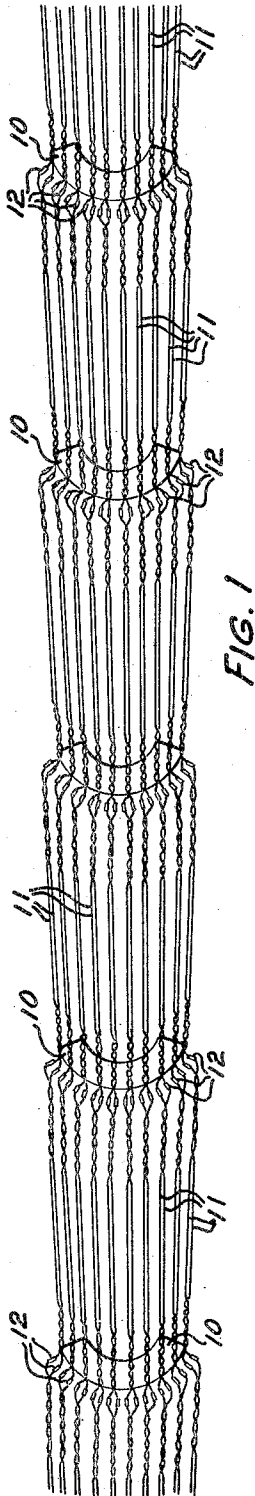
E. L. MALHIOT

2,496,949

METHOD OF ASSEMBLING SLIP MULTIPLE TERMINAL BANKS

Filed Oct. 22, 1946

3 Sheets-Sheet 1



INVENTOR.
E. L. MALHIOT
BY *E. F. Kane*
ATTORNEY

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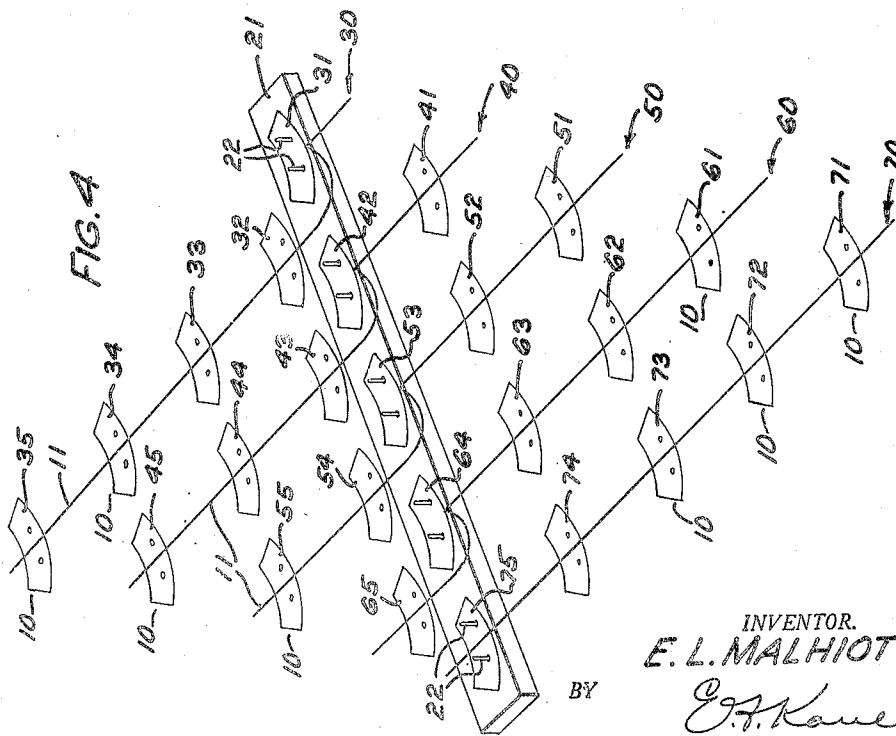
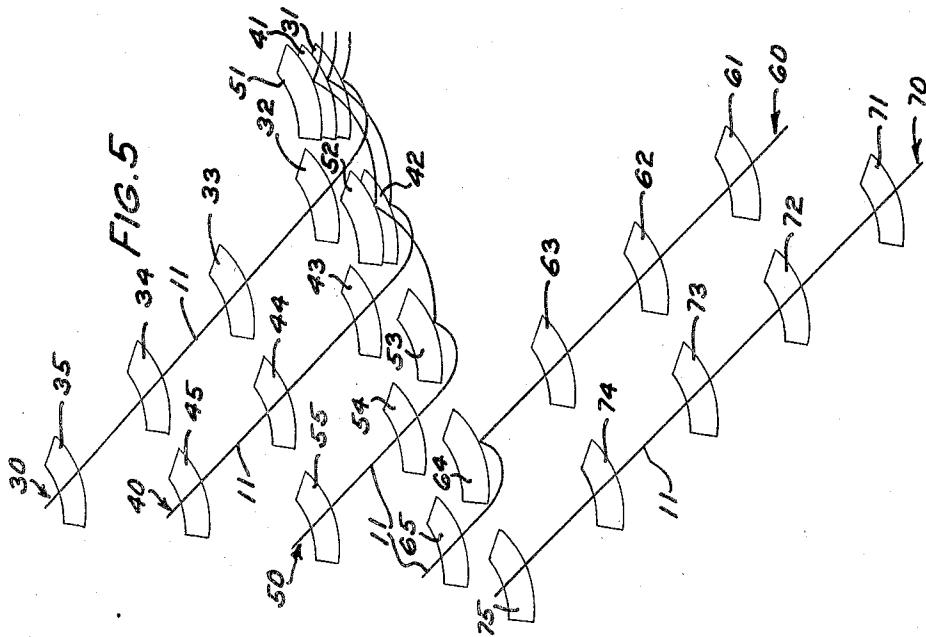
E. L. MALHIOT

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METHOD OF ASSEMBLING SLIP MULTIPLE TERMINAL BANKS

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3 Sheets-Sheet 2



INVENTOR.
E. L. MALHIOT
BY
C. F. Kane
ATTORNEY

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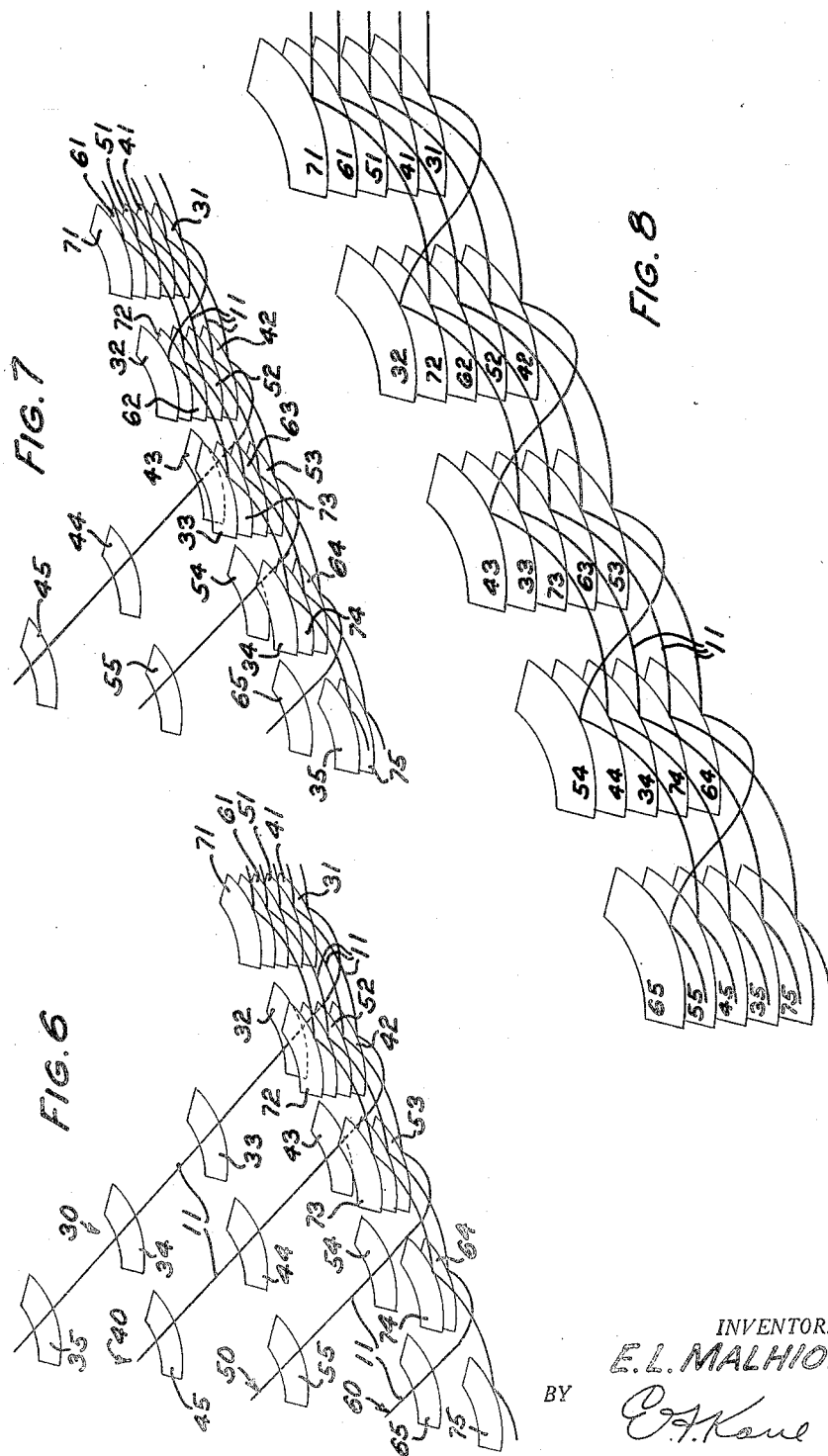
E. L. MALHIOT

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METHOD OF ASSEMBLING SLIP MULTIPLE TERMINAL BANKS

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3 Sheets-Sheet 3



INVENTOR.
E. L. MALHIOT
BY
E. J. Kane
ATTORNEY

UNITED STATES PATENT OFFICE

2,496,949

METHOD OF ASSEMBLING SLIP MULTIPLE
TERMINAL BANKSEugene L. Malhiot, Maywood, Ill., assignor to
Western Electric Company, Incorporated, New
York, N. Y., a corporation of New York

Application October 22, 1946, Serial No. 704,833

9 Claims. (Cl. 29—155.55)

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This invention relates to a method of assembling articles, and more particularly to a method of assembling slip multiple terminal banks.

In the manufacture of telephone exchange equipment, step by step multiple terminal banks have heretofore been manufactured by assembling insulator cards carrying contactor members with the terminals of the contactor members extending radially from the arcuate insulator card and stacking a plurality of these cards one upon another to carry the banks of terminals in position where the contactors may be engaged by a brush stepped vertically in alignment with a level of terminals and then stepped in an arcuate path to select a terminal at that level. These assemblies have heretofore been wired after all of the terminals have been mounted on their respective frameworks and clamped in place. New methods have been devised for expediting the assembly and wiring of these banks wherein arcuately shaped cards or insulators having contacts fixed to them are attached together in strings by continuous lengths of wires, which are automatically fixed to the terminals, and thereafter the cards or insulators are assembled to form the banks. Considerable difficulty, however, was experienced in arranging previously wired cards to form a slip multiple terminal bank wherein the bottom level of one bank must be wired to the second level of the second bank, the third level of the third bank, the fourth level of the fourth bank, etc.

It is an object of the present invention to provide a simple method of assembling slip multiple terminal banks.

In accordance with one embodiment of the invention, the terminals mounted on insulating cards are wired in multiple to correspondingly positioned terminals on other insulating cards and the wires are severed at predetermined points to form strings of terminal cards having a predetermined number of cards in each string and a plurality of strings of cards equal in number to the number of cards in each string are placed side by side on a fixture and in stepped relation to each other with each successive string after the first advanced one card with respect to the preceding string to form a complete transverse row of cards on the fixture to serve as the bottom level of the slip multiple terminal banks, and then, beginning with the shortest string and successively the next shortest throughout the series on one side of the complete row of cards, the card or cards of each string are placed on the card or cards of the preceding string so that

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the end cards of the strings are stacked in a pile and then, beginning with the longest string and in sequence the next longest string throughout the series on the other side of the complete row of cards, the card or cards of each string are placed on the cards or card of the preceding string so that the end cards of the string are stacked in a pile.

A more complete understanding of the invention may be had by reference to the following detailed description when considered in connection with the accompanying drawings, in which

Fig. 1 is a plan view of a group of arcuately shaped card units having contacts fixed to them and connected together by continuous lengths of wire to form a string of cards;

Fig. 2 is a partial plan view of a group of banks of wired-together card units prior to the mounting of the assembly on a shelf (not shown) which will align the terminals of the banks for engagement by suitable brushes;

Fig. 3 is a transverse sectional view taken substantially along the line 3—3 of Fig. 2, showing a pile up of spacers and wired-together card units assembled in a bank;

Fig. 4 is a schematic diagram of the first step of the method of assembling previously wired strings of card units to form a slip multiple;

Fig. 5 is a diagrammatic illustration of an intermediate step in the manipulation or assembling of the strings of wired card units;

Figs. 6 and 7 are diagrammatic illustrations of the condition of the strings of card units at two points in the assembling of the card units to form a slip multiple; and

Fig. 8 is a diagrammatic illustration of a completed slip multiple terminal bank.

In Fig. 1 there is illustrated a length or string of interconnected card units 10—10 having wires 11—11 interconnecting the contactors or terminals 12—12 thereon. These lengths of interconnected card units 10—10 may be formed by any suitable method, but preferably by the method disclosed in detail in the co-pending application of Leland A. Bartelheim and Maurice W. Lane, Serial No. 468,808, filed December 12, 1942, now Patent No. 2,438,959, issued April 6, 1948, wherein tip and ring contactors of a step-by-step telephone system are disposed directly opposite each other for engagement by brushes individual to them and movable across them. In the lengths of interconnected card units, the tip and ring contactors of a line are separated from each other by an insulator 13 and the contactors or terminals 12 are suitably assembled with the card

units 10 in such manner that the terminal ends thereof to which wires 11 are attached are spaced arcuately relative to each other, whereas the brush engaging portions are arranged in pairs in superposed relation. Thus each card unit designated 10 in Fig. 1 comprises, as shown in Figs. 2 and 3, a tip card 14 having contactors or terminals 12 fixed to its upper side, a ring card 15 having contactors or terminals 12 fixed to its lower side and the insulator 13 interposed between the terminals or contactors 12 on the cards 14 and 15.

An apparatus suitable for attaching contactors or terminals to cards is shown in the patent to L. A. Bartelheim et al. No. 2,394,837, patented February 12, 1946.

From the foregoing, it will be apparent that each card unit 10 of an interconnected length or string of card units has two sets of ten terminals 12 on it and that, therefore, the length or string of card units has ten pairs of wires extending along it which serve to interconnect corresponding terminals or contactors 12 on all of the cards. This arrangement provides for ten lines since the tip contactor 12 and the ring contactor 12 are necessary for each line, but are mounted on the tip cards 14 and ring cards 15. In the assembled switching apparatus, card units 10 from various strings are spaced apart by metal spacers 16 and are clamped into a stack or bank between two arcuate plates 17 and 18 by means of bolts 19 extending through suitable apertures in the card units and spacers and through the plate 17 and threaded into the plate 18. After the card units 10 have been properly arranged to provide the type of multiple desired, the banks illustrated in Figs. 2 and 3 may be tightly clamped together by means of the bolts 19, and the banks may be mounted in a row or bank multiple by means of posts extending from a shelf (not shown) and passing through apertures 20 formed in the ends of the plates 17 and 18.

With strings of interconnected card units 10 of the type described hereinbefore, an ordinary multiple may be made up by simply aligning the card units 10 and spacers 16 on assembling fixtures, maintaining a horizontal alignment between the card units of the string and superposing the desired number of strings of card units, which is usually ten, whereby one hundred lines are provided in a bank comprising ten card units, each card unit having ten tip connections and ten ring connections. In a slip multiple, it is necessary that the card unit at the bottom level of a bank at one end of the row of banks be connected to the card unit of the second level of the second bank; the third level in the third bank, etc. Ordinarily, there will be ten of these banks mounted on a shelf. However, for the purpose of illustrating the invention more clearly, only five units have been shown in those figures illustrating the various steps of the method of the present invention.

In following the method of the present invention, any suitable type of fixture may be provided on which clamping plates 18 may be mounted by means of posts extending from the fixture. One of the fixtures has been illustrated diagrammatically at 21 and the posts at 22 in Fig. 4. The apertures designated 23 in the clamping plates 17 and 18 (Fig. 2) are aligned with similar apertures in the spacers 16, insulator 13 and cards 14 and 15, to facilitate the positioning of the card units 10 to form the desired slip multiple.

Beginning with Fig. 4 and continuing through Figs. 5, 6, 7 and 8, the method is illustrated diagrammatically as pointed out hereinbefore and only one of the wires 11 of the group of wires is shown. This wire is shown as though it were connected to the mid point of the card unit 10. In practicing the invention, the interconnected string of card units may be cut to the desired length, for example, to a length such that there are five card units 10 interconnected by wires 11 in each string. The card units 10 in Figs. 4 to 8, inclusive, have been assigned reference numerals 31 to 35, 41 to 45, 51 to 55, 61 to 65, and 71 to 75, and the strings of interconnected units have been designated 30, 40, 50, 60 and 70, respectively, so that the method of assembling them will be more readily understood.

After this cutting operation has been performed and the desired length of a string of interconnected units has been formed, the units may be placed successively on the assembling fixture 21, as shown in Fig. 4, wherein the first or right hand string 30 of interconnected card units 10 is placed in position with the end or first one of the card units 10 (designated 31) on the assembling fixture at the right hand end of the fixture 21; second string 40 is placed on the fixture with the second card unit (designated 42) on the fixture; the third string 50 is placed with the third card unit 10 (designated 53) on the fixture; the fourth string 60 has the fourth card unit (designated 64) on the fixture, and the fifth string 70 has the fifth card unit (designated 75) placed on the fixture. Since there are only five card units in each of the strings, as selected for illustration, this means that the last card unit 75 of the last string 70 is placed on the fixture 21, as shown in Fig. 4. Thus the cards on the fixture 21 form a complete transverse row of card units which are placed on the fixture in the proper order desired for the bottom level of the slip multiple banks and in the embodiment shown are arranged in ascending consecutive numerical order beginning with the card in the first string, and each card in the row bears the same numerical relation to the others in its string as it does to the others in the transverse row.

To prevent the wires 11 of the strings of cards from interfering with the laying of the second level of cards, the wires 11 of the strings of cards on one side of the fixture 21 are displaced laterally to the sides of the cards on the fixture to which they are connected, as indicated diagrammatically in Figs. 4 to 7. The strings of cards may be allowed to hang down on opposite sides of the fixture 21, if desired, or they may be supported in any convenient manner.

After the first step of the assembling method, the arranging of the strings of card units as shown in Fig. 4, the steps illustrated in Fig. 5 may be followed, wherein the first card unit 41 of string 40 is placed on top of the first unit 31 of string 30; the second card unit 52 of string 50 is placed on top of the second card unit 42 of string 40, and the first card unit 51 of string 50 is placed on top of the first card unit 41 of string 40. This operation is continued until, as shown in Fig. 6, all of the card units which had been shown on the near side of the fixture 21 have been assembled on the fixture, and thus there will be assembled at the right hand position of the fixture the first card units 31, 41, 51, 61 and 71 of all five strings 30, 40, 50, 60 and

70, superposed one on the other in ascending sequence.

After the card units have been placed as shown in Fig. 6, card units 32, 33, 34 and 35 are placed on top card units 12, 13, 14 and 15, as shown in Fig. 7. Thereafter, card units 43, 44 and 45 are placed on top of card units 33, 34 and 35; card units 54 and 55 are placed on top of card units 44 and 45, and card unit 65 is placed on top of card unit 55 to provide the arrangement of card units as shown in Fig. 8, which constitutes a slip multiple formed from previously interconnected card units aligned in such order that the contactors or terminals 12 will be connected in multiple at a different level in every bank.

It will be understood that while a slip multiple of five banks each having five levels has been shown for illustration in the drawings, in the ordinary slip multiple there are ten banks of ten levels each, but the method of assembling these banks would follow the sequence described hereinbefore.

What is claimed is:

1. A method of assembling slip multiple terminal banks which comprises cutting strings of interconnected card units having terminals thereon interconnected by wires into predetermined lengths having a predetermined number of cards in each length, placing a plurality of said lengths of interconnected cards equal to the number of cards in each length in position parallel one to another with the cards progressively aligned in an echelon arrangement whereby the first card of the first length is in a transverse row with the last card of the last length, placing the first card of the second length on top of the first card of the first length, placing the second card of the third length on top of the second card of the second length, placing the first card of the third length on top of the first card of the second length, continuing the placing of the cards one on top of the other in the order just mentioned for all succeeding lengths until all except the last of the cards of the last length have been placed upon cards of the other lengths, placing the second card of the first length on top of the second card of the last length, placing the third card of the first length on the third card of the last length, and continuing the just-mentioned sequence with all of the remaining cards of all of the lengths in sequence with the cards of each length being placed upon corresponding cards of the lengths then on top of the bank.

2. A method of assembling a slip multiple from interconnected lengths of card units which comprises arranging a plurality of lengths of interconnected card units having a predetermined number of cards in each length in an echelon formation with the lengths parallel one to another and the cards progressively aligned so that the first card of the first length lies parallel to the last card of the last length in a line at right angles to the direction of extent of the lengths, said lengths being equal in number to the number of cards in each length, in sequence placing the first card of the second length on top of the first card of the first length, placing the second card of the third length on top of the second card of the second length, placing the first card of the third length on top of the first card of the second length, continuing this sequence of operations in order with succeeding lengths until all of the cards of the last length with the exception of the last card thereof have been placed above correspondingly numbered cards of all of the other

lengths, then in sequence placing the second card of the first length on top of the second card of the last length, placing the third card of the first length on top of the third card of the last length, continuing this sequence until all of the cards of the first length with the exception of the first card thereof have been placed above correspondingly numbered cards of all of the other lengths, repeating this sequence of operations for all of the remaining cards of all succeeding lengths in order until all of the cards have been piled on top of one another in rows.

3. A method of assembling slip multiple terminal banks utilizing lengths comprising a predetermined number of interconnected card units having terminal contactors arranged in each unit and the contactors of one unit serially connected with corresponding contactors in all of the other units in a length which comprises, arranging a plurality of such lengths of interconnected cards equal to the number of cards in each length parallel one to another but in stepped relation whereby a card unit displaced from an end of one length is directly opposite a card unit of the next succeeding length displaced from the corresponding end of its length one card distance greater than the previously mentioned card unit, whereby the first card unit of the first length will be parallel to the last card unit of the last length and the cards will be in staggered relation with the lengths extending parallel, and then sequentially placing the first card unit of the second length on top of the first card unit of the first length, placing the second card unit of the third length on top of the second card unit of the second length and continuing this sequence for all remaining lengths in order until all of the first card units of all of the lengths are stacked one on top of the other, then placing the second, third, fourth, etc. card units of the first and sequentially the succeeding lengths on top of the second, third, fourth, etc. card units of preceding lengths of cards then constituting the tops of the banks until all of the card units have been stacked in piles corresponding to the number of lengths of interconnected card units.

4. A method of assembling slip multiple terminal banks which comprises forming strings of terminal cards having a predetermined number of cards with the corresponding terminals on the cards connected in multiple, arranging a plurality of strings of cards equal to the number of cards in each string side by side and in stepped relation with each succeeding string after the first advanced one card with respect to the preceding string to form a complete transverse row of cards for the bottom level of the slip multiple terminal banks, then beginning with the shortest string and successively the next shortest throughout the series on one side of said complete row of cards, placing the card or cards of each string on the correspondingly numbered card or cards of the preceding string which forms a part of or is positioned on top of the transverse row of cards so that some of the correspondingly numbered cards of the strings are stacked in banks, and then beginning with the longest string and in sequence the next longest string throughout the series on the other side of the complete row of cards, placing the cards or card of each string on the correspondingly numbered cards or card of the preceding strings then forming the top of the banks so that the remainder of the correspondingly numbered cards of the strings are stacked in banks.

5. A method of assembling slip multiple terminal banks which comprises wiring a predetermined number of terminal cards in multiple to form strings, arranging a plurality of strings of cards equal to the number of cards in each string side by side in stepped relation to each other to form a complete transverse row of cards with the cards in the transverse row numbered consecutively and with each card having the same numbered relation in its string as it has in the row, then beginning with the shortest string and in sequence the next shortest throughout the plurality of strings on one side of said complete transverse row of cards, placing the card or cards of each string above the correspondingly numbered card or cards of said complete transverse row of cards and then beginning with the longest string and successively the next longest throughout the plurality of strings on the other side of said complete transverse row of cards, placing the card or cards of each string above the correspondingly numbered card or cards of the complete transverse row of cards.

6. A method of assembling slip multiple terminal banks which comprises forming strings of interconnected terminal cards having a predetermined number of cards in each string, arranging a plurality of strings of cards equal to the number of cards in each string side by side with each succeeding string after the first advanced from the preceding string to form a complete transverse row of cards for the bottom level of the slip multiple terminal banks, then beginning with the shortest string and successively the next shortest throughout the series on one side of said complete row of cards, placing the card or cards of each string above correspondingly numbered successive cards of the said complete transverse row of cards at a progressively changing level from that of the preceding card of the same string, and then beginning with the longest string and successively the next longest throughout the series on the other side of said complete transverse row of cards, placing the card or cards of each string above correspondingly numbered successive cards of the said complete transverse row of cards at a progressively changing level from that of the preceding card of the same string.

7. A method of assembling slip multiple terminal banks which comprises providing a plurality of strings of terminal cards having the similarly positioned terminals of the cards connected in multiple and each string having the same number of cards, arranging a plurality of strings of cards equal in number to the number of cards of each string in a row in stepped relation to each other with the first card of the first string, the second card of the second string, the third card of the third string and the next higher numbered card than that of the preceding string for each successive string arranged in a complete transverse row to serve as the bottom level of cards for the slip multiple terminal banks, then starting with the second string and in sequence

the successive strings on one side of the complete row of cards, placing the card or cards of each of the strings on the correspondingly numbered card or cards in the previous string with the first cards of the strings in a stack or bank, and then starting with the first string and in sequence the successive strings on the other side of the complete row of cards, placing the card or cards of each of the strings on the correspondingly numbered card or cards of the previous string then lying on top of the banks with the last cards of the strings in a stack or bank.

8. A method of assembling slip multiple terminal banks which comprises forming strings of interconnected terminal cards having a predetermined number of cards in each string, arranging a plurality of strings of cards equal to the number of cards in each string side by side in a series in stepped relation to each other and with the first card of the first string, the second card of the second string, the third card of the third string and the correspondingly numbered card of each additional consecutively numbered string throughout the series forming a complete transverse row of cards for the bottom level of the slip multiple terminal banks, then beginning with the shortest string and in sequence the next shortest throughout the series on one side of said bottom level row of cards, placing the card or cards of each string above the correspondingly numbered card or cards of said bottom level row of cards, and then beginning with the longest string and successively the next longest throughout the series on the other side of said bottom level row of cards, placing the cards or card of each string above the correspondingly numbered cards or card of said bottom level row of cards.

9. A method of assembling slip multiple terminal banks which comprises forming strings of interconnected cards with the number of strings and the number of cards in each string equal to the number of banks to be assembled, assembling the cards in a row of banks with correspondingly numbered cards of each string in correspondingly numbered banks and with the cards in each string at different levels from the other cards in the same string and with the cards in the bottom level of the row of banks arranged in consecutive order by arranging the first card of the first string in the first bank, the first two cards of the second string in their correspondingly numbered banks, the first three cards of the third string in their correspondingly numbered banks, the first four cards of the fourth string in their correspondingly numbered banks and so on with the remaining strings, and then beginning with the first string, arranging the remaining cards therein on the correspondingly numbered banks and arranging the remaining cards in each successive string in sequence on the correspondingly numbered banks.

EUGENE L. MALHIOT.

No references cited.