April 24, 1928. 1,666,988

W. G. BLAUVELT

TRUNKING SYSTEM

Filed April 27, 1927 2 Sheets-Sheet 1

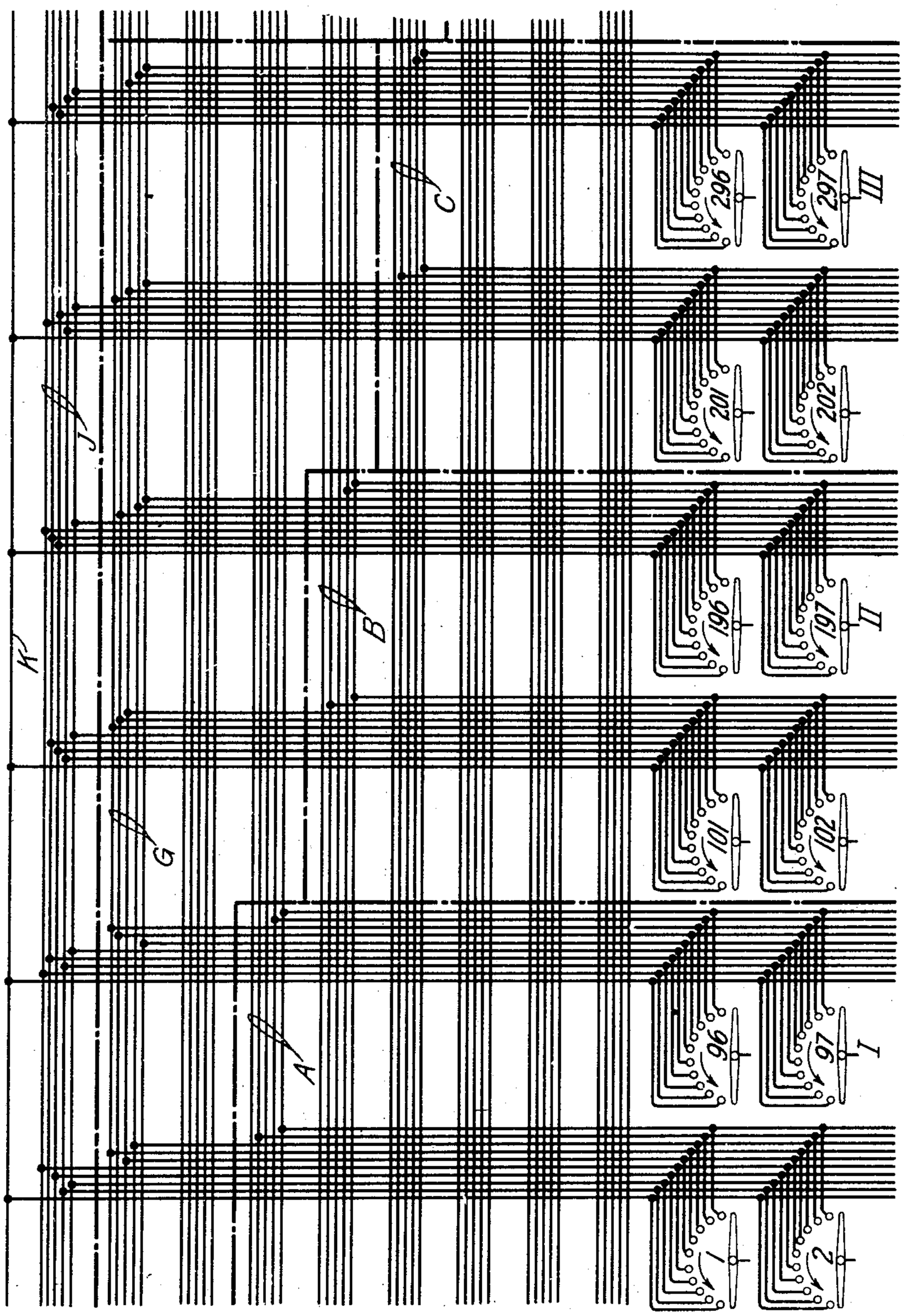

Fig. 1.

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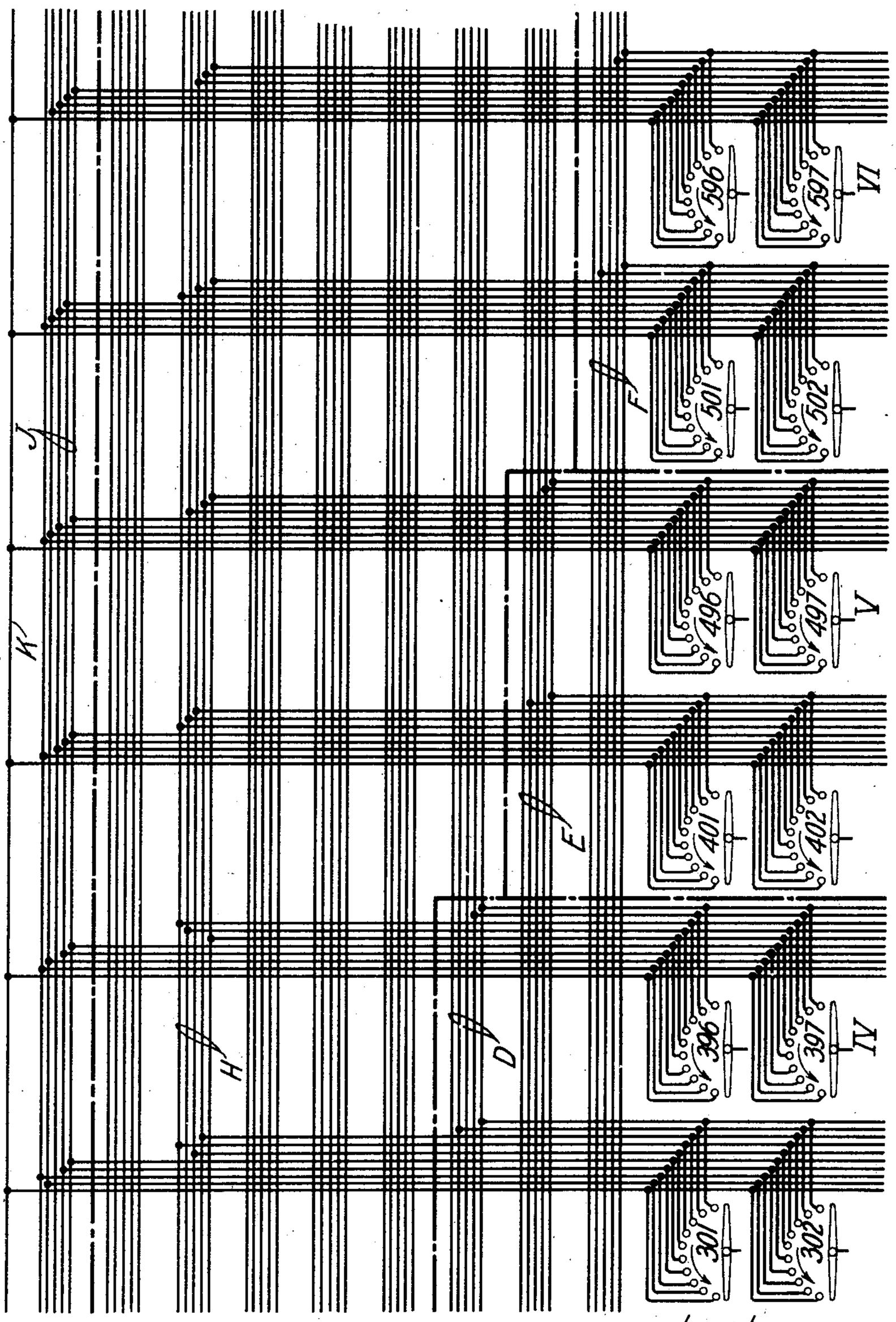

Fig. 2.

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Patented Apr. 24, 1928. 1,666,988

UNITED STATES PATENT OFFICE.

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TRUNKING SYSTEM.

Application filed April 27, 1927. Serial No. 186,998.

This invention relates to telephone exchange systems and more particularly to trunking arrangements therefor, and has for its object to increase the efficiency with which trunks and switching means may be employed without impairing the service rendered.

It is not possible in a large machine switching system to give all selector switches of one switching stage access to all of the trunks extending to the next switching stage. Two general methods have heretofore been devised to distribute the trunks of a trunk group before selector switches in such a way as to equalize the traffic over all of the trunks and to provide as nearly as possible that there may be idle trunks available at all time for the use of the selectors. According to the first of these methods, known as the graded multiple, the selectors and the trunks of each switching stage are divided into groups. A different group of trunks serves as first choice for each group of selectors. Other additional groups of trunks serve as second choice for a plurality of groups of selectors and still other groups of trunks may serve as third choice for all of the groups of selectors. According to the other of these methods, known as the random slipped multiple, the trunks and selectors are divided into groups which are individual to each other, but each group of trunks is larger than the number to which each selector has access. The trunks are then multipled according to an arbitrary random arrangement before the selectors of this group, so that each selector will have access to only a portion of the total number of trunks.

The present invention is an improvement on the above methods in that it employs a graded multiple, the trunks of each group being interchanged within their respective groups so that the groups of lines having access thereto overlap each other and the order of selection of the trunks and the overlapping of the groups of lines give rise to at least an approximately random arrangement.

One specific embodiment of the invention is set forth in the drawings. Figures 1 and 2, when arranged with Fig. 2 at the right of Fig. 1, show portions of a group of 600 selectors having access to 46 trunks.

The requirements for a perfectly random arrangement of trunks is that if any particular number of them are known to be busy, the probability of one set of trunks of that number being busy is the same as the probability that any other set of equal number will be busy. This condition would be arrived at if every possible arrangement of a group of trunks could be used. However, in the case of a group of ten trunks, which is the size group most commonly employed, the arrangements or permutations would number over 3,500,000. While it would be possible to select from these a suitable number of permutations which would approximately answer the requirement for random distribution, there would still be only ten trunks, which would be insufficient to carry the traffic of any switching stage. However, if a multiple be built up from smaller trunk groups and each selector be caused to choose between only a portion of the trunks, we arrive at figures which are more practical.

Referring now to the drawings, a plurality of incoming lines are shown, each terminating in a switch. These switches are divided into six groups I to VI, each group comprising 20 sub-groups of five switches each, or one hundred switches. Switches 1 and 2 represent two of a group of five switches each having ten terminals. Each switch may be considered to represent one level of a step-by-step switch or any other suitable switching arrangement. Switches 1, 2, 96 and 97 are four of a group of 100 switches, namely, group I. Switches 1 and 2 represent the first of 20 sub-groups of switches, and switches 96 and 97 represent the last or 20th sub-group. The first two terminals of switches 1, 2, etc., of the first sub-group are connected in parallel to the first and fourth trunks of trunk group A, while the first two terminals of switches 96 and 97 are connected in parallel to the first and second trunks of the same trunk group and the remaining sub-groups of switches have their first two terminals connected to different combinations of two trunks from group A. Similarly, the first two terminals of the swiches of group II are connected to the trunks of group B, two at a time, and those of group III to the trunks of group C, two at a time. Similarly, the first two terminals of the switches of groups IV, V and VI are connected, respectively, to trunks of the groups D, E and F.

The next three terminals of switches 1, 2, etc., are connected in parallel to three of

the trunks of group G, which is also true of all the sub-groups of groups I, II and III. The sub-groups of groups IV, V and VI have their third, fourth and fifth terminals connected to combinations of three trunks in group H.

The sixth, seventh, eighth and ninth terminals of all the sub-groups are then connected to combinations of four trunks from group J and the tenth terminals of all switches are connected to trunk K.

It is apparent from inspection that this is a graded multiple, since there is a group of trunks individual to each of the groups I, II, III, etc., a subsequent group which is common to groups I, II and III and one which is common to groups IV, V and VI, while a still additional group is common to all of the groups.

The switches as hereinbefore stated, are divided into six groups of 100 each, which are again subdivided into twenty sub-groups of five each. The switches of each sub-group choose two out of the five trunks serving as first choice for the group. The possible orders of selection of five things taken two at a time is 20, so that the selection by the sub-group of five switches is perfectly random among the first choice trunks. In addition, each switch chooses three out of its five second choice trunks. The total possible combination of five things taken three at a time is 60. So again, each one of the 60 subgroups of switches comprising either the groups I, II, III or the groups IV, V, VI can hunt over a group of second choice trunks in a different order, and again the random condition is fulfilled. Similarly, the possible permutations of five things taken four at a time are 120, and the 120 subgroups of switches comprising groups I to VI inclusive, have a perfectly random access to their third choice trunks. Since the tenth trunk is selected last by each of the switches, the selection of this trunk is obviously on a straight multipling basis. Thus, the multiple illustrated provides a truly random selection within each of the various choices or graded subdivisions.

This multiple represents one possible embodiment of the invention, it being obvious that other arrangements would carry out the spirit of the invention where the premises, such as size of switching unit, etc., differ from those assumed in the present illustration.

What is claimed is:

1. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of groups, certain of said groups of trunks being assigned as first choice trunks to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines and another group of trunks being assigned as third choice trunks in common to all of said groups of lines, the numbers of the trunks of each group assigned to any group of lines and the order in which the trunks are selected being such that when a given number of the total number of trunks are busy the probability of one set of trunks of a given number being busy will be at least appoximately the same as the probability that any other set of equal number will be busy.

2. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of groups, certain of said groups of trunks being assigned as first choice trunks respectively to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines and other groups of trunks being assigned as third choice trunks in common to all of said groups of lines, the trunks of the several groups of trunks so assigned being interchanged within their respective groups so that the groups of lines having access thereto overlap each other and the order of the selection of the trunks in the various groups of lines and the overlapping of the groups of lines being such that when a given number of the total number of trunks are busy the busy trunks are at least approximately as likely to be one set of trunks of the given number as any other set of trunks of equal number.

3. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of groups, certain of said groups of trunks being assigned as first choice trunks respectively to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines and another group of trunks being assigned as third choice trunks in common to all of said groups of lines, the trunks of the several groups of trunks so assigned being interchanged within their respective groups according to a perfectly random arrangement.

4. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups and subgroups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of

groups, certain of said groups of trunks being assigned as first choice trunks respectively to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines and other groups of trunks being assigned as third choice trunks in common to all of said groups of lines, the trunks of the several groups of trunks so assigned being so arranged that each sub-group of lines has access to a different permutation of said trunks.

5. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups and sub-groups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of groups, certain of said groups of trunks being assigned as first choice trunks respectively to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines and other groups of trunks being assigned as third choice trunks in common to all of said groups of lines, the trunks of the several groups of trunks so assigned being so arranged that each subgroup of lines has access to less than the total number of trunks in each of the groups assigned thereto.

6. A trunking system in which a plurality of trunks gives service to a plurality of lines, the lines being divided into groups and subgroups each having access to a number of trunks less than the total number provided, the trunks being divided into a plurality of groups, certain of said groups of trunks being assigned as first choice trunks respectively to certain of said groups of lines, certain other of said groups of trunks being assigned as second choice trunks to certain pluralities of said groups of lines, and other groups of trunks being assigned as third choice trunks in common to all of said groups of lines, each subgroup of lines having access to less than the total number of trunks in each group assigned thereto and the trunks of the several groups of trunks so assigned being so arranged that every possible permutation of the trunks of each group is used.

In testimony whereof, I have signed my name to this specification this 25th day of April, 1927.

WILLIAM G. BLAUVELT.