

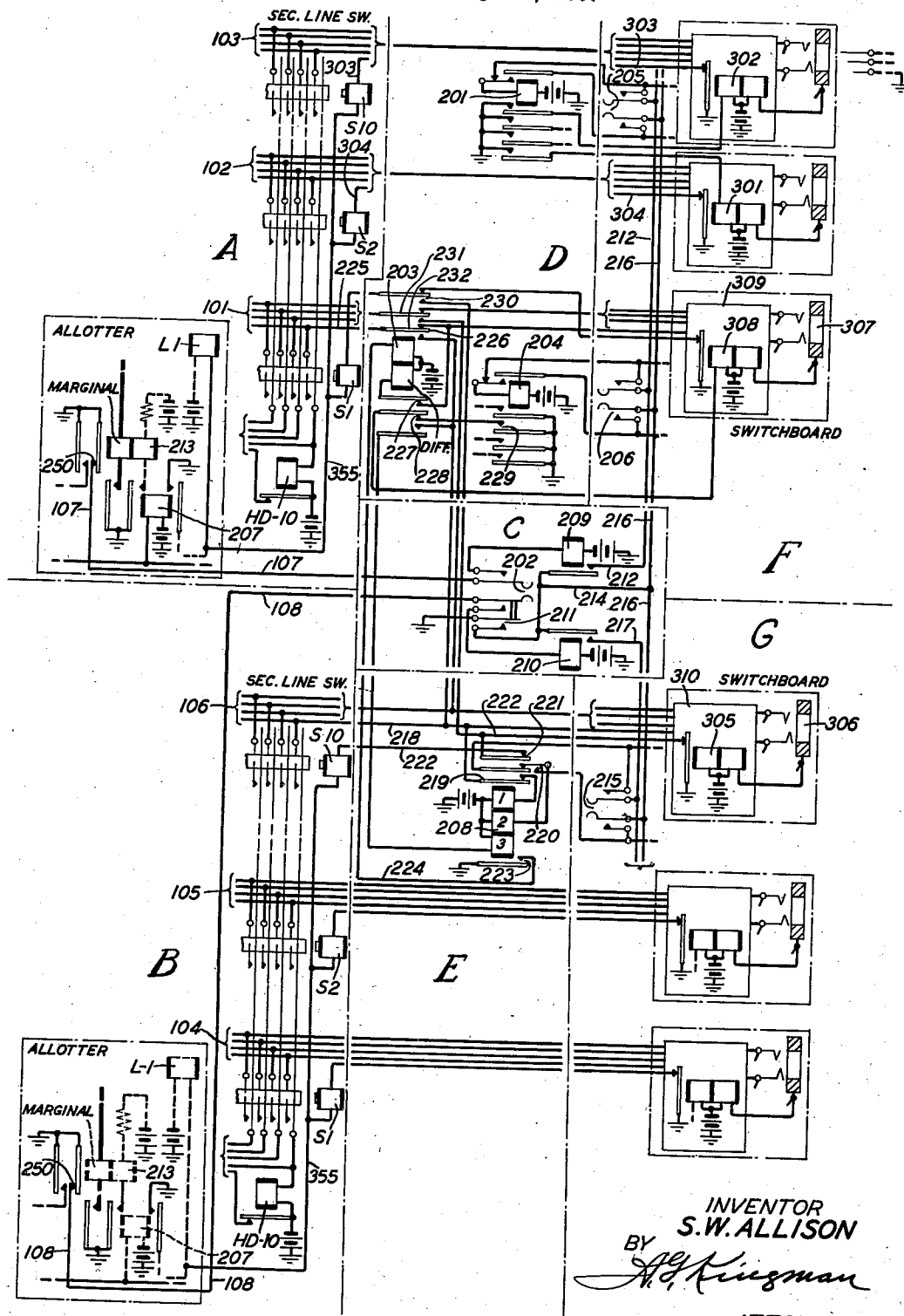
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S. W. ALLISON

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TELEPHONE SYSTEM

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INVENTOR
S. W. ALLISON
BY
H. Kingman
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Sewell W. Allison, West Orange, N. J., assignor to
Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

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This invention relates to telephone systems and more particularly to arrangements for transferring, at the will of the operating force, lines normally terminating at one switchboard to another or second switchboard.

In large toll centers having two or more inward switchboards and in connection with which call concentration is employed it frequently happens that lines or trunks terminating at one or more of these switchboards carry very light traffic during the night, on Sundays, holidays and other periods which traffic is insufficient to justify maintaining a force of operators on duty at these switchboards during such periods. Under this condition it is desirable to concentrate all the traffic, during such light load periods, in a single switchboard where operators are on duty.

An object of the present invention is, therefore, to concentrate, at a single switchboard, for periods of light traffic or other reasons, the answering or incoming ends of lines or trunks normally terminating at two or more switchboards.

A feature of the invention whereby the foregoing object is attained resides in means, comprising a switching relay for each line to be transferred, and manually controlled by means of concentrating keys, usually from the switchboard to be vacated, whereby all or a portion of the lines may be cut off from the vacated switchboard and connected to suitable terminal or line circuit apparatus in the concentrating or night board.

Another feature resides in means for preventing the transfer of any one line becoming effective until the line to be transferred and the terminal to which it is to be transferred are both idle.

A related feature resides in an arrangement whereby if an idle line cannot be immediately transferred, due to a busy condition of the line circuit apparatus at the concentrating switchboard to which it is to be connected, the line to be transferred will be made busy at its outward end until such time as the line circuit apparatus at the concentrating switchboard becomes idle, whereupon the line busy condition will be removed and the transfer effected.

A further feature resides in means, effective when only a certain portion of a group of lines are transferred, for removing from service (i. e., making busy at their outgoing end) all the remaining lines of the group terminating at the vacated switchboard.

Still another feature resides in an arrange-

ment for preventing the retransfer of a transferred line back to its normal switchboard circuit while the line is busy.

Another feature resides in an arrangement for removing from service (made busy) lines terminating in switchboard circuits at the concentrating board, which are to receive transferred lines, as fast as these concentrating board lines become idle.

The invention will be understood by reference to the accompanying drawing which has been divided by broken lines into Figs. A, B, C, D, E, F and G, respectively for sake of clarity.

In the drawing two separate groups of incoming trunks are shown, one group extending from secondary line switches of the cross-bar type, Fig. A, to jacks in a first answering switchboard, Fig. F, and the other group extending from secondary line switches, Fig. B, to jacks in a second answering switchboard G.

It will be understood that these trunks are reached by calling subscribers through primary line switches of the cross-bar type (not shown) which are directed and controlled by associated allotter circuits, small portions of which are shown in Figs. A and B.

The manner in which calls are directed through these primary and secondary switches is fully described in U. S. Patent 2,059,596 issued November 3, 1936 in the name of J. Meszar and the reference characters applied to the secondary line switches and the allotters of the present application correspond to like parts of the drawing of the above referred to Meszar patent.

For the purpose of illustration, the invention has been shown as applied to a trunk concentration system which is identical in most respects to the system of the above referred to Meszar application which, although described as a call distributing system, is so designed as to function as a concentration system by terminating the trunks in multiple jacks instead of in plugs, as shown.

In the drawing, Figs. C, D and E show the equipment of the present invention required to transfer calls normally incoming to the switchboard at the upper right of the drawing (Fig. F) to the switchboard at the lower right of the drawing (Fig. G).

The operation of the present system, in general, involves the use of a group of primary and secondary switches and a link allotter circuit, previously referred to, for concentrating incoming calls in switchboard jacks. The allotter circuits start functioning the moment a call origi-

nates, as fully described in the before-mentioned Meszar patent and a relay in this circuit, identified by the reference numeral 213, operates and remains operated until the allotter has performed its function and is dismissed. For the purpose of the present invention an additional break contact, 250, has been added to the relay 213 and connected to ground for supplying the master transfer key 202 of Fig. C with ground whenever the allotter is not engaged. In transferring calls this prevents interrupting a call that may be in process of completion as will be later described. Only such a portion of the secondary switches are shown in Figs. A and B as are necessary to a proper explanation of the features of this invention, it being assumed that reference will be made to the above-noted Meszar patent, if a detailed description is desired.

The secondary switches shown in Fig. A represent the complete switching equipment nominally required to handle calls for a 22 position switchboard as represented by Fig. F. Similarly, the switches of Fig. B represent another complete switching equipment for the switchboard shown in Fig. G. These two switching units under busy hour conditions feed calls to their respective switchboards which may or may not be in the same building. Under these conditions the transfer features of this invention are not required to function. In hours of light load traffic, however, one switchboard is capable of handling all the calls from both units. The switchboard represented in Fig. G, in the arrangement here shown, is assumed to be the one that handles all calls during hours of light traffic when the switchboard of Fig. F is closed down. It is obvious under these conditions that only a portion of the total trunks available in Fig. A will be required to carry calls to the switchboard of Fig. G. Therefore, it has been elected to designate as 102 and 103 those trunks that are not to be transferred, and those trunks that may be transferred to the switchboard of Fig. G by the designation 101. Relay 201, associated with trunks 102 and 103, therefore functions to make these trunks test busy when the master key 202 and individual group key 205 are operated. Relays 203 and 204 associated with trunk 101 function to cause the trunk to be transferred if and when idle.

It will also be obvious that not all trunks of Fig. B will be required at this time for carrying the light traffic of this unit. It has, therefore, been elected to represent by the numerals 106 those trunks which are to be removed from service between the switches of Fig. B and the switchboard jacks of Fig. G and used to terminate the transferred trunks 101 in the switchboard of Fig. G. The balance of the trunks of Fig. B on which the calls from the lower unit continue to be carried are represented by the numerals 104 and 105 and are not affected by the transfer equipment. Relay 208 associated with trunk 106 functions to prepare this trunk and switchboard jack to receive a call from trunk 101 when master key 202 and individual keys 206 and 215 are operated. If trunk 106 is busy at this time, the existing connection will not be disturbed but will automatically receive the transferred trunk when the trunk becomes idle.

Having given a general description of the apparatus involved in the system it will now be described how certain trunks are transferred and other trunks are made busy when the master and individual transfer keys are operated which

keys are usually located in the operating room available to the supervisor or chief operator.

When the rate of calling on the switchboard of Fig. F has diminished to a point where the calls can be handled at the switchboard of Fig. G, all further calls incoming to the upper switching unit can be terminated on the lower switchboard (Fig. G) by throwing first the individual transfer keys 205, 206 and 215 and then the common transfer key 202. Key 205 controls relay 201 which in turn controls four trunk relays 301, 302, etc. which are associated with trunks 102, 103, etc., which, as before stated are to be put out of service during the period the upper switchboard (Fig. F) is shut down. These relays 301, etc., when operated, remove ground from conductors 304, 303, etc., respectively, and prevent operation of the selecting magnets S2, S10, etc., of the secondary switch of Fig. A. Other relays may be connected in parallel with relay 201 and more keys may be added and in this manner provision is made for any number of trunks which it is desired to remove from service, according as they are not required by incoming traffic when the other trunks of the unit are transferred. Key 206 controls relay 204 which in turn controls four trunk sleeve relays 308, etc., which are associated with trunks 101, etc., which trunks are to be transferred, by relay such as 203, to the lower switchboard (Fig. G). It will be understood that it is necessary to hold these trunks busy to incoming calls until transfer is complete as indicated by the operation of relay 203. Additional keys and relays for this group are provided according to the number of trunks to be transferred. Key 215 controls individual trunk relay 208 which serves to determine whether trunk 106, to which calls on trunk 101 are to be transferred, is busy and which also serves to control the actual transfer itself when both trunks are free. Trunks 104 and 105 are shown as carrying traffic at all times to the switchboard of Fig. G and therefore do not require any transfer features.

Assuming that the individual keys mentioned above have been operated, the chief operator then throws master key 202 which prepares a path for relays 209 and 210. If no calls are in process of being connected over an idle link between the primary and secondary cross-bar switches, then the associated allotter circuits are idle and ground is connected to leads 107 and 108. Thus relays 209 and 210 operate directly upon throwing key 202. If, however, a call is in progress in either or both groups then the transfer will not take place until the call in progress has been connected to a switchboard jack. Assuming both allotter circuits are idle when key 202 is operated, then relays 209 and 210 operate immediately from ground over leads 107 and 108 and back contact 250 on relay 213 of the allotter circuits. Three different actions follow at once, first all relays such as 201 associated with the trunks of the transferred unit which are to be removed from service, are operated from ground at contact 211 on key 202, through bottom contact relay 209, lead 212, upper contact on key 205 to battery through relay 201 and its own break contact. Relay 201 and associated relays when operated connect ground at their lower armatures to the left-hand windings of the trunk sleeve relays such as 301 and 302, the operation of which removes ground from the individual trunk leads 303 and 304, respectively. This action prevents selecting magnets S1 and S2 of Fig. A from having a chance to operate, thereby disabling

these trunks. Relay 201 being once operated is held over lower contact on key 205, leads 216 and 214 to ground at contact 211 on common key 202. If any of these trunks are already busy, nothing happens until the trunk starts to come free, that is, relays 301 and 302 start to release. The left winding, however, being held by ground from one of the bottom contacts of relay 201, is not permitted to release and the trunk thereby cannot extend another call.

The second action that takes place is to make all those trunks of the second unit, 106 for example, test busy to which the corresponding trunks of the first unit are to be transferred. Relay 208 associated with trunk 106 performs this function. When, therefore, relay 210 operates after key 202 is operated, a circuit is closed for operating relay 208 traced from ground at contact 211 on key 202, through make contact relay 210, lead 217, top make contact key 215, to top armature relay 208 and its break contact to winding 2 to battery. Biasing winding 1 of relay 208 is differentially connected with respect to winding 2 and has only sufficient turns to act as a biasing winding so that when the circuit just traced through winding 2 is first closed, the relay will not operate if winding 1 is energized. Said biasing winding 1 is energized, whenever the trunk 106 is busy, over a path traced from the trunk control lead 218, armature 219 and winding 1 of relay 208 to battery. Under this condition winding 1 prevents winding 2 from operating the relay. If, however, the trunk is idle as is assumed at this time, then winding 2 causes relay 208 to operate and at contact 220 lock to lower contact key 215, leads 216 and 214 to ground at contact 211 on key 202. At contact 221 this relay opens lead 222 and makes trunk 106 test busy to calls incoming from the switches of the lower unit, i. e., prevents switch magnets S10 from operating and at contact 223 connects ground to lead 224 for operating relay 203.

Connecting ground to lead 224 for energizing the top winding of relay 203 is the final step in transferring calls incoming from the cross-bar switches of the top unit to the switchboard jacks of the lower switchboard unit. If the trunk 101 is still busy on a previous call when transfer key 202 is operated, ground will be present on lead 225 which prevents relay 203 from operating. This is due to ground setting up a biasing current flow in the lower winding relay 203 traced through contacts 226 and 227 on relay 203 to battery through its lower winding, said ground path when connected alone not being sufficiently powerful to operate relay 203. The circuit remains in this condition until ground is removed from lead 225 allowing relay 203 to operate. Thus the operation of relay 208 means the jack 306 and its multiples are ready to receive calls from trunk 101 and the operation of relay 203 means that trunk 101 is idle and in condition to be transferred. Contact 228 on relay 203 in combination with contact 229 on relay 204 provides a path from ground through the left winding relay 308 to battery so that when key 206 is operated, in turn operating relay 204, trunk 101 is immediately disabled for incoming calls by the removal of ground from the lead to selecting magnet S1 until the transfer is effected. Upon operation of relay 203 to complete the transfer, this lead from selecting magnet S1 is connected through contact 230 to lead 222 so that trunk 101 will thereafter be disabled only by relay 305. Armature 231 of relay 203 is representative of three armatures on

this relay, only one being shown for simplicity, one armature for each of the three upper bracketed conductors of trunk 101, which armatures effect the transfer of these three trunk conductors from multiple jack 307 of the upper switchboard of the multiple jack 306 of the lower switchboard when relay 203 operates. Armature 232 of relay 203 likewise transfers lead 225 from the relay circuit 309 associated with switchboard jacks 307 to the relay circuit 310 associated with switchboard jacks 306. In this manner calls from the upper group of trunks are transferred to a corresponding group of relay circuits and associated switchboard jacks of the lower unit.

A feature of this invention also relates to the restoration of these trunks to their normal channels without interfering with any calls that may be in process of completion or the trunks that may be busy when the retransfer takes place. Releasing group keys 205, 206 and 215 and master key 202 for restoring the incoming calls to the switchboard of Fig. F will permit associated relays 201, 204, 209 and 210 to release at once. If, however, a call is connected over the trunk 101 at this time to jack 306, then relay 208 is prevented from releasing by the trunk holding ground on lead 218, traced through bottom contact and armature of relay 203 to battery through winding 3 of relay 208. When the trunk is no longer busy, ground is removed from lead 218 allowing relay 208 to release, which in turn, at contact 223 releases relay 203, thus returning the conductor of trunk 101 from switchboard jacks 306 to switchboard jacks 307. Contact 221 on relay 208 again closes the selective magnet circuit of the magnet S10 for trunk 106, thus permitting it to connect with switchboard jack 306. The release of relay 201 automatically permits relays like 301 and 302 to release, thus restoring ground to selecting magnet leads 303 and 304 for making trunks 102 and 103 available to receive calls for the switchboard of Fig. F.

What is claimed is:

1. In a telephone system, first and second manual switchboards, a first line incoming to the first switchboard and a second line incoming to the second switchboard, manually controlled switching means for disconnecting the first line from the first switchboard and connecting it to the second line, and relay means automatically responsive to a busy condition of either line to prevent operation of said switching means.

2. In a telephone system, first and second manual switchboards, a first line incoming to the first switchboard and terminating in a jack thereat, a second incoming line terminating in a jack at the second switchboard, manually controlled switching means for disconnecting the first line from the first switchboard jack making the originating end of the second line test busy, and for connecting the first line to the second line.

3. In a telephone system, first and second manual switchboards, first and second groups of incoming lines, each group terminating in automatic switches, first and second relays, a trunk line extending from one of the first group switches over normal contacts of said first relay to and terminating in a jack at the first switchboard, a second trunk line extending from one of the second group switches to and terminating in a jack at the second switchboard, said second relay being associated with the second line and having its contacts so arranged and connected that when the relay is operated said second group switch is prevented from making connection to

the second trunk line, said first relay having its contacts so arranged that when operated it disconnects the first switch from the first jack and connects said first switch to the second jack,
5 manual means at one of said switchboards for operating said relays, and means for preventing operation of said relays while their associated lines are busy.

4. In a telephone system, first and second manual switchboards, first and second groups of in-
10 coming lines, an automatic switch terminating

each group of lines, a first trunk line extending from the first group switch to the first switchboard and a second trunk line extending from the second group switch to the second switchboard, manually controlled switching means for
5 disconnecting the first trunk line from the first switchboard and for connecting it to the second trunk line, and means for preventing the operation of said switching means while either of said trunk lines is engaged.

SEWELL W. ALLISON.