July 22, 1947. J. W. McCLEW ET AL 2,424,281

RELAY ALLOTTER FOR FINDER SWITCHES

Filed Dec. 8, 1944 6 Sheets-Sheet 1

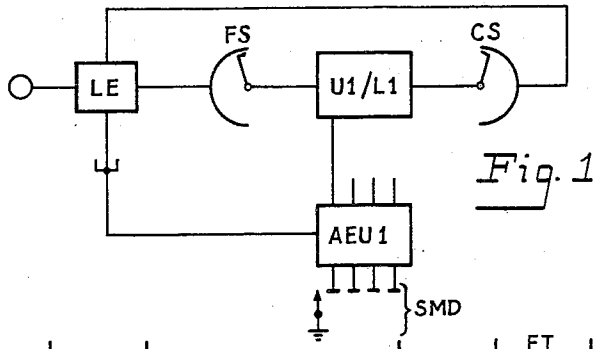

Fig. 1

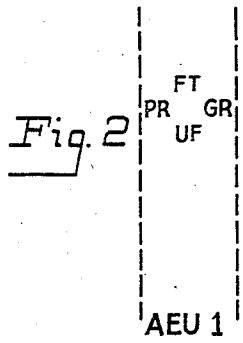

Fig. 2

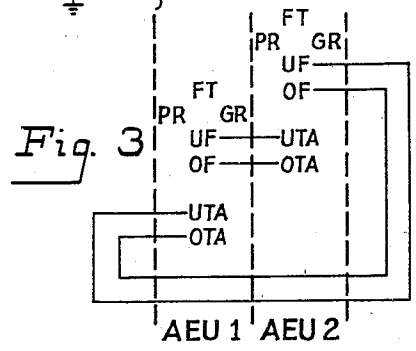

Fig. 3

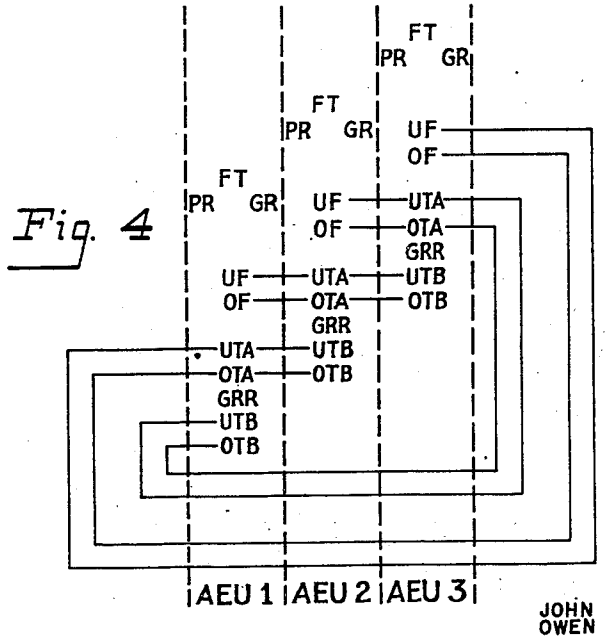

Fig. 4

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RELAY ALLOTTER FOR FINDER SWITCHES

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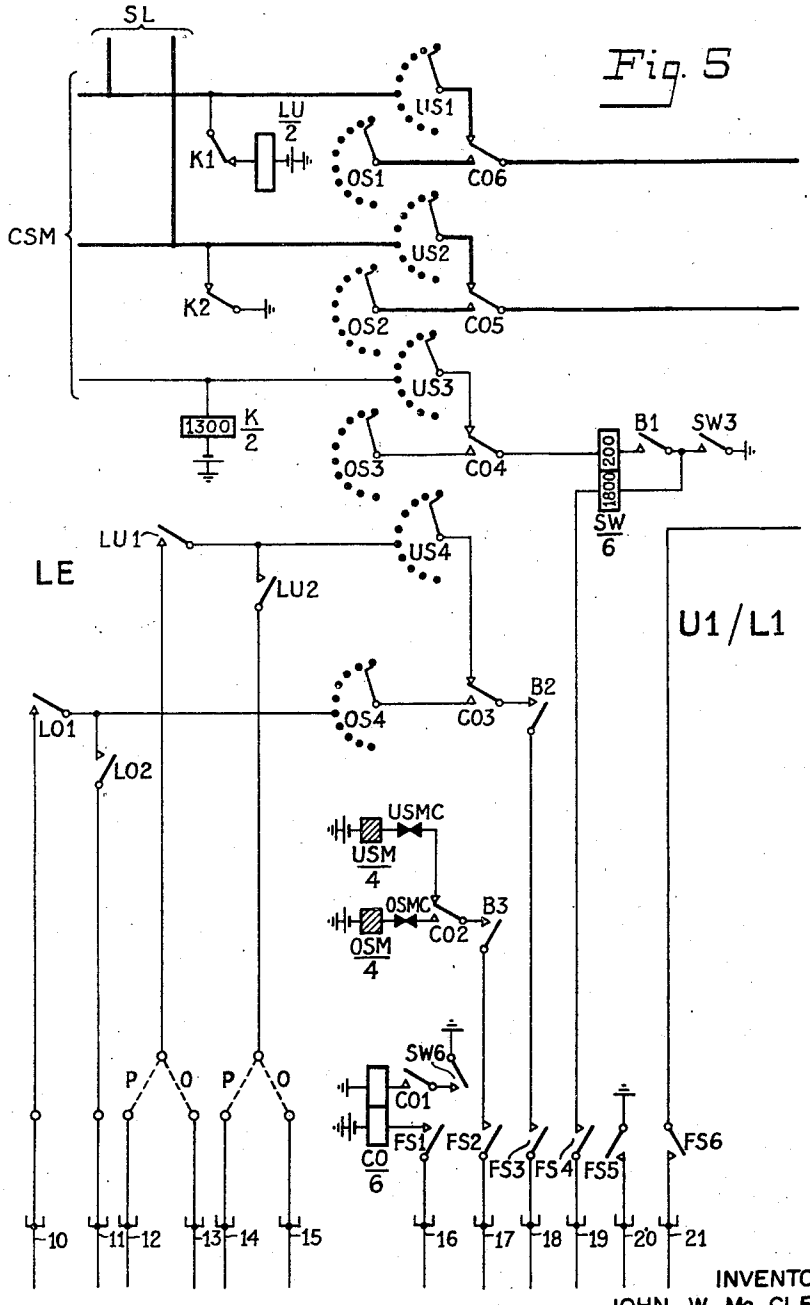

Fig. 5

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RELAY ALLOTTER FOR FINDER SWITCHES

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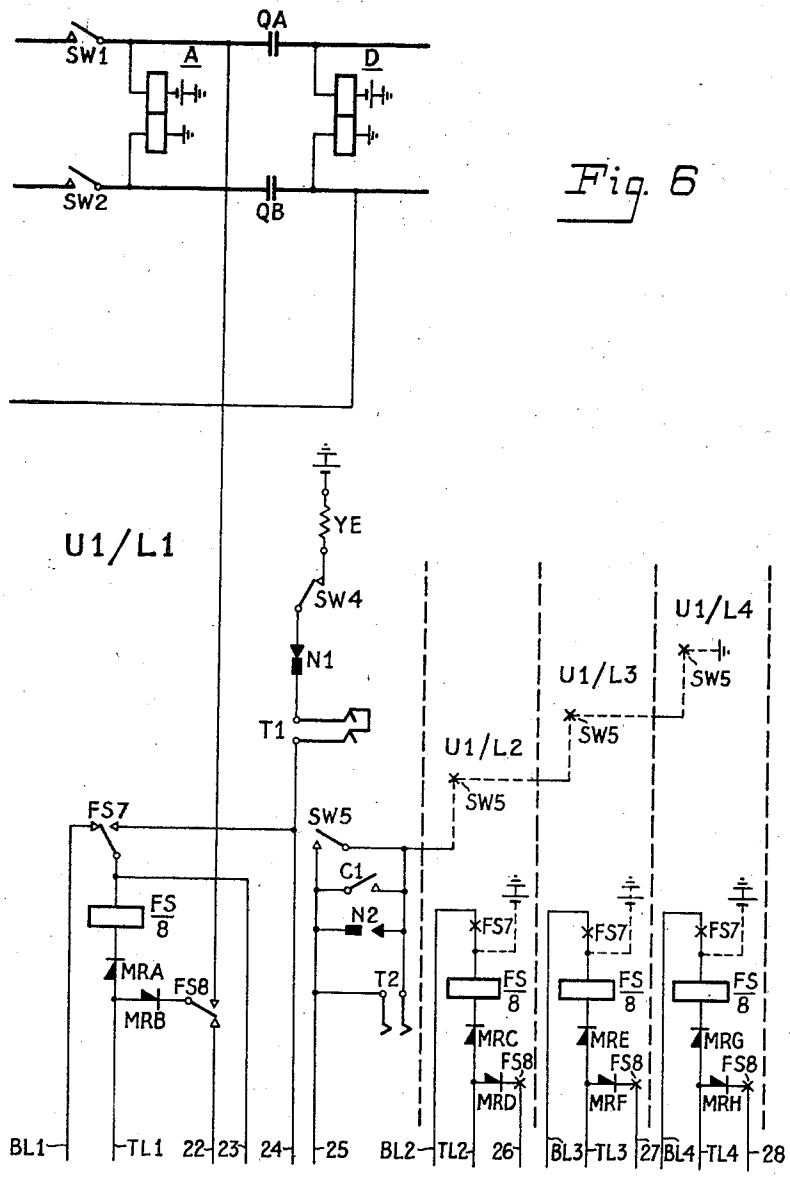

Fig. 6

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RELAY ALLOTTER FOR FINDER SWITCHES

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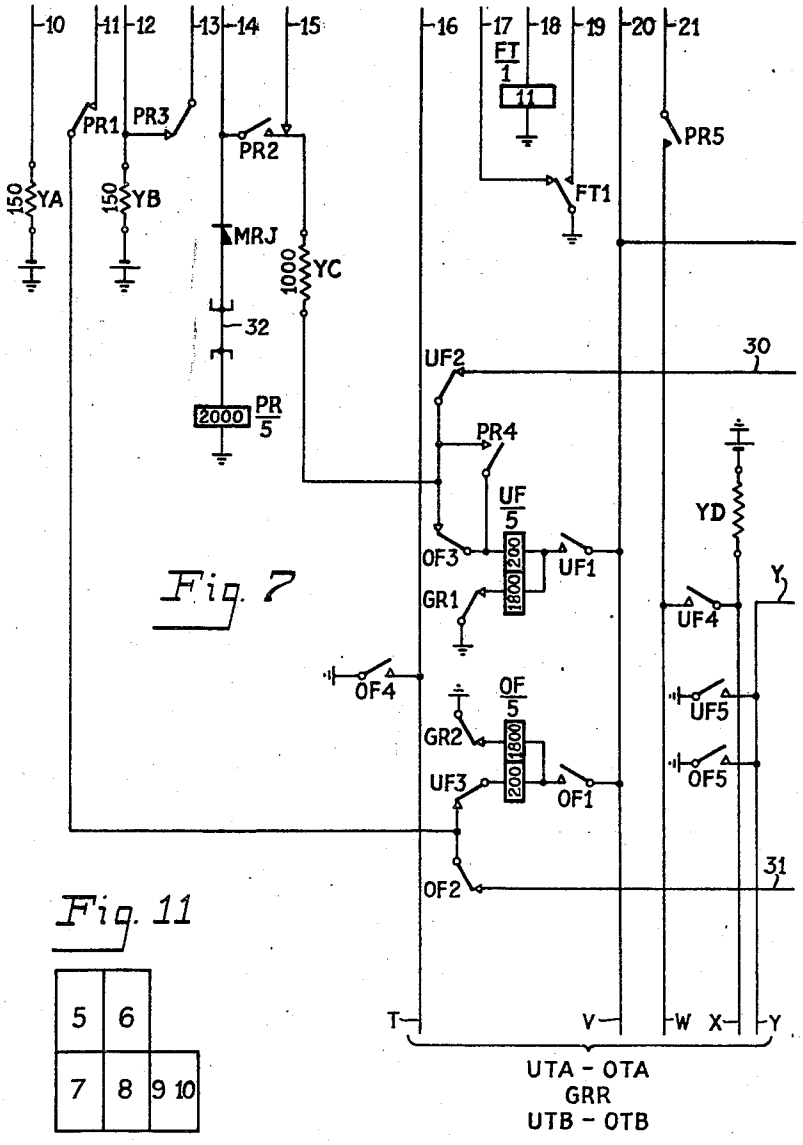

Fig. 7

Fig. 11

5	6		
7	8	9	10

AEU 1

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RELAY ALLOTTER FOR FINDER SWITCHES

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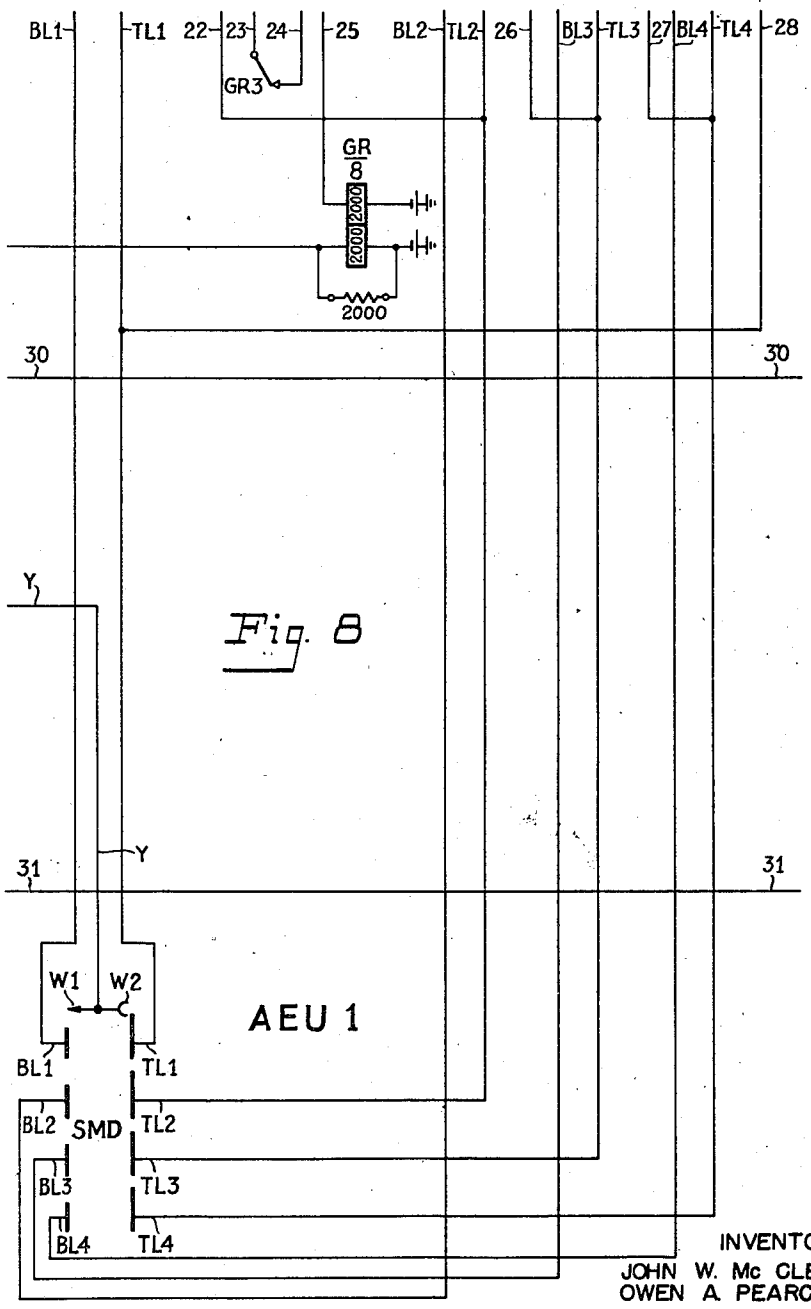

Fig. 8

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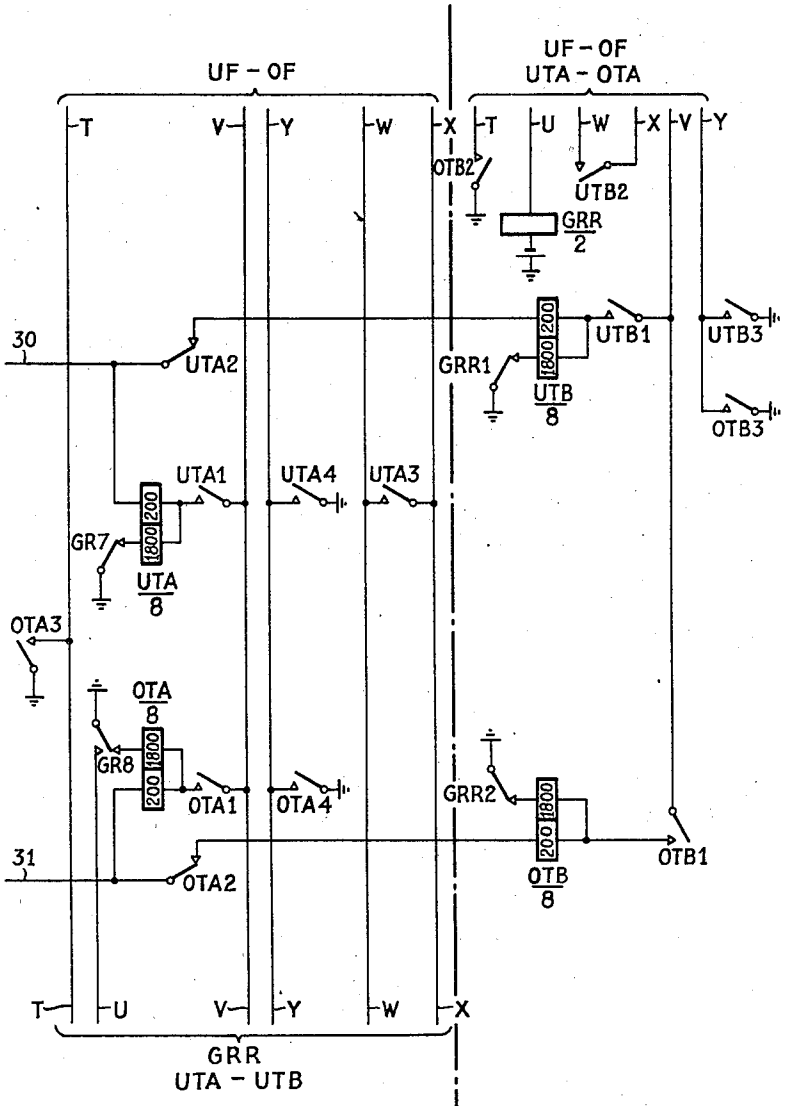
RELAY ALLOTTER FOR FINDER SWITCHES

Filed Dec. 8, 1944 6 Sheets-Sheet 6



AEU 2 AEU 3

Fig. 9 Fig. 10

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UNITED STATES PATENT OFFICE

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RELAY ALLOTTER FOR FINDER SWITCHES

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Application December 8, 1944, Serial No. 567,223
In Great Britain January 22, 1944

6 Claims. (Cl. 179—18)

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The present invention relates to telephone or like systems and is more particularly concerned with finder switch allotting arrangements such as find particular use in automatic telephone systems of the line finder type.

In finder switch main exchanges the subscribers' lines are usually divided up into 100 or 200-line groups, each such group being served by a predetermined number of two-motion line finder switches which are allotted for use by a uni-directional switch, for instance in the manner disclosed in British Patent No. 462,910, issued June 10, 1937.

In private automatic exchanges or private automatic branch exchanges of the sizes normally met with, a number of finder/connector link circuits usually serve the subscribers' lines concerned, the links being allotted for use by associated relays operating on a chain circuit basis for instance as described in British Patent No. 389,867, issued June 15, 1933.

A primary object of the present invention is to combine the cyclic allotting capabilities of the selecting switch allotter with the substantially instantaneous action of the relay type allotter.

According to one feature of the invention, in a telephone or like system having a group of lines served by a plurality of finder switches, an idle finder switch for use in handling a call is allotted under the control of a relay allotter incorporating a closed chain circuit having a relay connected thereto corresponding to each finder and a one-way conducting device in the chain between each relay connection and the next together with a switching device for applying starting potential to each relay connection in the chain in turn.

According to another feature of the invention, in a telephone or like system having a group of lines served by a plurality of finder switches certain of the lines are given calling priority by means of arrangements adapted to remove any previously existing markings from the banks when a privileged line calls so that the next succeeding operation of a finder switch will connect with the privileged line.

The invention will be better understood from the following description of one method of carrying it into effect, reference being had to the accompanying drawings comprising Figs. 1 to 10 in which it is shown applied to a P. A. X board.

Fig. 1 shows trunking arrangements of one of a number of identical units from which such a board may readily be built up, while Figs. 2, 3 and 4 respectively tabulate the relays required in

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the finder switch allotting equipment when the board comprises respectively one, two or three of the units shown in Fig. 1. It will be seen from Figs. 2–4 that the relay allotting equipment per unit comprises but four relays where one unit only is concerned, the number of relays increasing slightly with increase in the number of units. These Figures 2, 3 and 4 are similar charts indicating between the dotted lines the relays which would be used in each allotting equipment and the reference characters used therein correspond to those of the relays in Figs. 7, 8 and 9. For instance, Fig. 2 shows that for a 35 line unit, 1 allotter including relays PR, FT, GR and UF would be required. Fig. 3 shows 2 allotting equipments between the 2 sets of dotted lines and shows the reference characters of the relays which would be required for a 35–70 line unit. Fig. 3 shows by dotted lines the 3 allotters which would be required in a larger system and indicates by reference characters the additional relays which would be used.

Figs. 5–10 when arranged in the manner shown in Fig. 11, which is located on the same sheet with Fig. 7, show circuit connections of a 100-line board which is built up from three 35-line identical units each comprising the subscribers' line equipments, four finder/connector links and relay allotting equipment. In the circuits typical values of certain resistances and relay windings are shown.

Each link is assumed to employ a 50-point uniselector finder and a 100-point two-motion connector. Where the capacity of the board may exceed 50 lines, two line finders per link are provided and respectively serve subscribers in the "under 50" and "over 50" groups into which the 100 lines of the board are divided. Where the capacity of a board is not expected to need to exceed 50 lines, a 50-point finder per link will be provided.

A board for up to 35 lines will require one unit such as is shown in Fig. 1 comprising four links, such as U1/L1 with associated finder and connector switches FS and CS, the subscribers' line equipments such as LE, and also relay allotting equipment AEU1. In addition there will be a common sequence marking device or switch SMD which ensures cyclic operation of the relay allotting equipment at all times by successively marking each of the four links U1/L1—U1/L4 of the unit as the first choice link as will be fully described later.

A board with a capacity of from 35 to 70 lines will comprise two units of the type shown in

Fig. 1 and in this instance in order to ensure that all subscribers on the board have potential access to all links on the board so as to give full availability, two additional relays UTA and OTA are provided in each of the allotting equipments as shown in Fig. 3 and the two common equipments are linked together so that if all the links of one unit are busy, a free one of the links of the other unit may be taken into use. An additional relay OF is also provided in each unit. Similar remarks apply when the board involves three units when each of the three allotting equipments will comprise the relays shown in Fig. 4. The common sequence marking arrangements are retained in each case. It will be clear from what has been said above that the subscribers' lines of each unit are directly associated only with the allotter of that unit.

Where two or more units are concerned, the associated allotting equipments will normally operate independently in response to originated calls on the different units to give cyclic allotting of links. In case all links of a unit are engaged, calls from the lines of that unit will be transferred to the other unit or the next unit as the case may be, this being possible since the finders of the links of both or all units have access to all the lines of the board.

A P. A. X board employing a relay allotting circuit according to the invention is characterised by substantially instantaneous allotting of links or both units and links according to the prevailing circumstances. Moreover since the allotting equipments are on a "per unit" basis the total of allotting equipment will be proportional to the size of the board. Furthermore, as each of the allotters operates independently, simultaneous operation of two or more finder switches can take place provided they are in differing units.

As will be appreciated from the ensuing circuit description, link or unit and link preselecting facilities are provided. As regards circuit operations, the line marking serves also for finder start purposes so that unless a bank marking exists a finder cannot be started up. Under blown fuse or other major fault conditions in a link, such link is automatically busied, while arrangements are also made for maintaining service under allotter or common sequence marking equipment failure. With regard to the sequence switch control of the allotting equipments, a selected link is adapted to operate for a predetermined period within which normally switching through takes place or the calling subscriber clears. If a finder fails to switch through before the predetermined period elapses, another finder in the same or another unit is caused to take up the search.

Referring now to Figs. 5 to 10, Fig. 5 shows a subscriber's line equipment LE which, if the subscriber concerned is in the "under 50" group, employs a line relay LU, while if he is in the "over 50" group it employs a line relay LO, the contacts only of which are shown. Figs. 5 and 6 together show the finder part of the finder/connector link U1/L1, which in common with the other three links U1/L2–U1/L4 is served by the allotting equipment AEU1, part of which is shown in Figs. 7 and 8. The remaining two parts of allotter AEU1 which are connected with over leads T—Y are respectively identical with the corresponding parts of the allotters AEU2 and AEU3 which are shown in Figs. 9 and 10.

The circuit shows in Fig. 9 the particular part of allotter AEU2 to which a start signal would be transferred if a call on being initiated to allotter AEU1 found all four of the associated links busy. In Fig. 10 is shown the particular part of allotter AEU3 to which such start signal would be transferred if all the links associated with both allotters AEU1 and AEU2 are busy. Similar remarks apply where AEU2 and AEU3 are the calling allotters.

In Fig. 8 is also shown that part of the sequence marking device SMD which serves allotter AEU1, similar parts serving allotters AEU2 and AEU3. Each part comprises four sets of contacts over which wipers W1 and W2 are continuously driven, conveniently from the shaft of the ringing current generator or from any other suitable source. These wipers are adapted successively to earth for periods of the order of one second each the paired busying and testing leads such as BL1 and TL1 extending to the associated links.

Considering now the circuit operation, when the subscriber's line SL, Fig. 5, assumed to be in the "under 50" group is looped, relay LU operates. Assuming that this subscriber has no priority facilities, the strapping connections "O" individual to each line equipment will apply, in which case battery via resistance YB, Fig. 7, will extend via contacts PR3 and common lead 13 to mark the calling line in the "under 50" finder switch bank US4 of each link on the board, while it will also extend via common lead 15, contacts PR2 and resistance YC to relay UF, and also over contacts UF2 and start transfer lead 30 to the first transfer relay UTA, Fig. 9, in alloter AEU2 and over contacts UTA2 to second transfer relay UTB in allotter AEU3, Fig. 10.

Assuming that at least one of the links such as U1/L1, Figs. 5 and 6, in the calling first unit is free, the busying relay GR, Fig. 8, will be normal and relay UF will operate, thereupon at contacts UF2 opening the circuit to the second and third allotter relays UTA and UTB. At UF3 it disconnects any circuit for relay OF, at UF4 prepares the priority cut-in circuit, and at UF5 earths the Y lead extending to the wipers W1 and W2 of the sequence marking device SMD.

It will be seen that the left-hand contacts of this device are shorter than the right-hand ones so that wiper W2 will make contact before W1, the period during which wiper W2 only is making contact being of the order of 20 milli-seconds and constituting a testing period during which the FS relay in the link with which the test lead connects can be operated. After this period the link is automatically busied, as will be described, if the FS relay is not already operated, and a call coming in at this stage would be switched into the next available link. Assuming that at the time relay UF is operated the sequence switch wipers are occupying the position shown, earth will extend over test lead TL1 to relay FS in link U1/L1, via rectifier MRB and contacts FS8 to the FS relay in U1/L2 and so on for the remaining two links, the four FS relays being in effect tapped off a circular chain of rectifiers on to which chain an earth is applied at a partcular point in accordance with the position of the sequence switch wipers. Under the circumstances being considered, the earth is applied directly and not via any FS relay contacts to the FS relay in link U1/L1, and this relay will therefore have the first choice of the four FS relays in the chain circuit, even though all the links U1/L1—U1/L4 may be idle. In this case all the FS relays will be connected to resistance battery as for instances via lead 23, Fig. 6, contacts GR3, lead 24, test springs T1, connector off-

normal contacts N1, contacts SW4 and resistance YE to battery, for relay FS in link U1/L1. Relay FS will therefore operate and in so doing will disconnect any circuit to the other FS relays at contacts FS8.

In similar manner with the switch in the next position, link U1/L2 would be marked over lead TL2 as the first choice and so on, the rectifiers MRB, MRD, MRF and MRH functioning in each case to ensure that the circuit always operates in the predetermined clockwise direction.

Returning now to the operation of relay FS, at contacts FS5, Fig. 5, it locks relay UF over lead 20 to the starting and marking battery and also energises relay GR, Fig. 8, which at its contacts GR3 disconnects the initial idle resistance marking battery of the selected link but this is without effect owing to it being short-circuited by operated contacts FS7. Relay FS also at contacts FS2 prepares a self-interrupted driving circuit for the "under 50" finder switch magnet USM via the magnet interrupter contacts USMC, and at contacts FS3 extends the test lead earth to operate relay A which brings up relay B, not shown, in known manner. Relay B completes the driving circuit of magnet USM at contacts B3 and at contacts B2 connects the allotter low resistance testing relay FT to wiper US4.

The sequence switch wiper W1 will by this time have reached the first contact and both the leads BL1 and TL1 will be earthed so that relay FS would be short-circuited were it not for the fact that it has already operated and opened the short-circuiting path over the busying lead BL1 at contacts FS7. Relay FS continues to hold over the earthed test lead TL1.

When the finder switch reaches the calling line, relay FT rapidly operates in series with the line marking battery and by virtue of its low resistance provides an immediate guard on this line. At contacts FT1 it cuts the driving circuit and extends earth over common lead 19 to bring up relay SW in series with the calling subscriber's cut-off relay K. Relay SW in operating, at contacts SW1 and SW2 switches the calling line through to the A relay of the link via banks and wipers US1 and US2, at contacts SW3 extends a low resistance guarding earth through its upper low resistance winding to bring up relay K, at contacts SW4 disconnects the link idle resistance marking battery, whereupon relay FS releases, and at contacts SW5 extends the link busy indication lead 25 through to the next link U1/L2.

Relay FS in releasing releases relays FT, UF and GR and relay K in operating releases relay LU which removes the starting and marking resistance battery. The allotter AEU1 is now ready to deal with further calls from the group of subscribers which it serves.

In link U1/L1, relays A, B and SW remain operated and in response to dialled impulses the connector portion is subsequently set to effect connection with the wanted line via the connector switch multiple such as CSM in known manner.

From the foregoing description it will be seen that the whole of the finding operations described are dependent on the continued operation of the line relay LU so that if the calling subscriber hangs up his receiver at any time during finding, all apparatus will be released, the finder switch remaining in the position that it reaches when its driving circuit is cut off.

Assuming that in the circumstances described a subscriber in the "over 50" group in the first unit calls, relay OF, Fig. 7, operates from the YA resistance battery in place of relay UF from the YB resistance battery and functions in precisely the same manner as relay UF with the exception that when relay FS operates in the selected link U1/L1, relay CO is brought up over common lead 16 and at its contacts CO2 connects up the "over 50" finder switch magnet OSM and at its other contacts connects up the corresponding wipers and banks. Relay CO locks up to contacts SW6 so that it will remain held for the duration of the call.

As previously mentioned each finder is allowed a predetermined period within which to effect its switching through to a calling line, this period being governed by the sequence switch and being generally terminated when the wipers W1 and W2 leave the pair of contacts associated with the selected link. The period concerned is at least such as to allow the finder switch to perform a complete revolution and is a minimum when the selected link is the first choice link. In the instance described, where the link U1/L1 taken into use is the first choice link, if the finder switch fails to switch through by the time wipers W1 and W2 leave the contacts connecting with the associated leads BL1 and TL1, earth will be removed from lead TL1 and relay FS will thereupon release. Since wiper W2 is of the bridging type, at the same time as relay FS in the link U1/L1 is released, earth will be extended over test lead TL2 to bring up relay FS in the next link U1/L2 provided this is free or the relay FS in the next free link in the sequence. This link is started up in the same manner as described for the link U1/L1 which is released on the release of relay FS.

In case link U1/L1 with the faulty finder switch is the only available link in the first unit, then in order to ensure that this link is not repeatedly taken into use contacts C1, Fig. 6, of relay C (not shown) of the A, B and C impulse-responding relay triad in that link are provided in the link busy indication circuit. When link U1/L1 is released, relay C in operating in usual manner during the release of relay B will maintain a circuit for relay GR, Fig. 8, for sufficient time to ensure that a free link in another unit is taken into use via one of the transfer relays in a manner to be described.

Assuming that the "under 50" group subscriber calls when the sequence switch wipers W1 and W2 are connecting with leads BL1 and TL1, relay UF will operate as usual if any one of the links associated with allotter AEU1 are free, but relay FS in first choice link U1/L1 will be unable to operate since it will be short-circuited over leads BL1 and TL1. If the next link U1/L2 is free, the relay FS in this link will therefore operate and will cause the associated finder to search for the calling line. In this instance it will be seen that the finder switch of link U1/L2 will have a longer time to complete its switching since the circuit to the FS relay will not be opened by the bridging wiper W2 until such time as it leaves the contact connecting with the test lead TL2 for link U1/L2. In similar manner links U1/L3 and U1/L4 if taken into use in these circumstances would have even longer times to complete their finding operations.

Assuming now that the subscriber calls with the sequence switch in the position shown, and that link U1/L1 is busy. Under this condition the resistance battery connection to relay FS will be disconnected so that the earth over test lead

TL1 will extend via rectifier MRB to bring up relay FS in the next free link, whereupon the operations continue as before described.

Considering now the arrangements for start signal transfer under busy conditions, the "under 50" and "over 50" relays UF and OF, the first transfer relays UTA and OTA, and the second transfer relays UTB and OTB of each unit are interconnected over leads designated T—Y in each instance. Certain pairs of relays in each of the units are linked together as indicated in Fig. 3 and as shown in detail in Figs. 7–10 with particular regard to the linking between the relays UF and OF of the first unit, relays UTA and OTA of the second unit and relays UTB and OTB of the third unit.

For a call initiated on the first unit, if all the links therein are busy, the call is transferred to the second unit in the manner described below where relay UTA or relay OTA is brought in according as to the group in which the calling subscriber is situated. If all the links in the second unit are engaged, the call is transferred to the third unit where relay UTB or relay OTB is brought in. Similar remarks apply when a call is initiated on the other units. Thus each subscriber on the board has potential access to all links of the board.

Assuming now that an "under 50" group subscriber in the first unit calls when all the associated links are busy, relay GR, Fig. 8, will already be operated via the series-connected contacts SW5 in the various links and this relay will have disconnected the earth connection to relay UF at contacts GR1. Hence the starting battery will be extended over lead 30 to the second unit to operate relay UTA, Fig. 9, which functions in similar manner to relay UF of the first unit, i. e. over lead Y, Fig. 9, it earths the sequence switch wipers associated with the second unit and so brings up the FS relay in a free one of the associated links, the first choice-link being determined in usual manner by the position of the sequence switch wipers.

If all links are busy in the second unit, relay GR of this unit will be operated and will have disconnected any circuit to relay UTA at contacts GR7 so that the start battery will be effective on relay UTB, Fig. 10, in the third unit. Relay UTB in operating starts up a free link in the third unit.

In similar manner an "over 50" call in the first unit would be transferred to the second or third units under heavy calling conditions, the relay concerned being relay OTA, Fig. 9, or OTB, Fig. 10.

With regard to the function of the GR relay in each allotter this is operated as described over its upper winding under conditions where all associated links are busy, but, as mentioned earlier, it is also operated over its lower winding when any one of the four associated links is taken into use and is then held until the link completes its finding operation. If, for example, an "under 50" subscriber in the first unit has taken link U1/L1 into use, relays UF and GR will be operated in the allotter and relays FS, A and B will be operated in the link, while the finder switch will be commencing to search for a calling line. Relay GR in operating, at contacts GR4, GR5 and GR6 (not shown) corresponding to GR3 disconnects the resistance battery from the FS relays of the other links in that unit. If the link U1/L1 is not the first choice link at that time, in which case relay FS will be holding via contacts FS8 of a prior link or links and the relevant chain circuit rectifier or rectifiers, and a prior link should become free, then if such link could become operative by re-operating its FS relay, link U1/L1 in question would be broken down. Since, however, the resistance battery to the three FS relays of links U1/L2—U1/L4 is disconnected by relay GR, this cannot take place and the normal operations proceed without interference. Similar conditions exist between units, but in this case interference is prevented in well-known manner by means of a low resistance guarding earth through one winding of the switched-in relay concerned. For example, if a call on the first unit has been transferred to the second unit, in which case relay UTA or relay OTA, Fig. 9, will be operated together with the FS relay in the link taken into use, a comparatively low resistance earth will be fed back via lead V and the upper low resistance winding of relay UTA or the lower low resistance winding of relay OTA to prevent relay UF or OF, Fig. 7, from switching if a link in the first unit becomes free immediately afterwards. In this manner a finder in an early unit is prevented from taking over a call from a finder in a later unit.

Relay GR in operating also at contacts GR7 and GR8 (as shown in Fig. 9 for allotter AEU2) disconnects the earth feed to the first transfer relays UTA and OTA and at the latter contacts applies earth to lead U, which is utilised when three allotters are employed on the board, to bring up a third relay GRR (shown in Fig. 10 for allotter AEU3) and this relay at contacts GRR1 and GRR2 disconnects the earth feed from relays UTB and OTB. It will thus be seen that when a link finder is searching, the operation of relay GR busies the controlling allotter against all further calls.

In case calls are originated simultaneously by two subscribers located respectively in the "under 50" and "over 50" sections in the same unit, either relay UF or relay OF will operate first and will disconnect the other so that the transfer lead 30 or 31 as the case may be, associated with the unoperated relay remains energised and the call for the second subscriber will mature in the next free unit.

In the case where subscribers in the three units originate calls simultaneously, the UF or OF relay in each unit will be operated so that it will be seen that under these circumstances three calls can be dealt with simultaneously, one in each unit.

Considering now the priority facilities afforded to privileged subscribers, such subscribers are all located in the "under 50" group so that they always appear on the banks of the "under 50" finder switches US in the various links. The arrangements are such that a privileged subscriber on initiating a call is immediately allotted a free link and starts up the US finder switch in that link. At the same time the starting and marking condition for "under 50" ordinary subscribers is disconnected so that there will be no possibility of a link finder switch, started up by an "under 50" ordinary subscriber, connecting with the privileged line or vice versa.

Considering now the circuit operations, it will be assumed that a privileged subscriber in the first unit is calling. In the line circuits of privileged subscribers the strapping connections "P" are used so that a starting potential for such subscriber will extend to common lead 14 and thence via rectifier MRJ to lead 32 which is common both to the rectifiers of the leads 14 of the three al-

lotters of the board and to the PR relays of the three allotters of the board. In consequence the PR relays in all three allotters will operate. In the calling allotter AEU1, relay PR in operating at contacts PR1 disconnects the starting condition for all "over 50" subscribers in the first unit so that link finders already in operation to find such subscribers will be released. A link finder about to switch through to such subscriber will, however, be able to do so since the marking condition is not disconnected by relay PR. At contacts PR2 the starting battery for the privileged subscriber is extended via resistance YC to relay UF, and at contacts PR3 the starting and marking condition for all "under 50" ordinary subscribers on the first unit is disconnected. If allotter AEU1 is not already in use at this time, relay UF will operate and will start up a free link in search of the privileged party in the usual manner, all other markings on the bank of the link finder switch being disconnected in response to the operation of the PR relays in the three allotters in the manner described for relay PR of the first unit.

If an ordinary "under 50" call is already being handled by relay UF in the allotter AEU1 at the time relay PR operates, relay UF will be maintained by relay PR and the link finder in operation will thus be taken over by the privileged party.

In case an "over 50" subscriber and the privileged subscriber on the first unit originate calls simultaneously, contacts PR4 in the circuit of relay UF will give this relay priority over relay OF.

If an ordinary "under 50" call is being already handled by relay UTA or UTB in allotter AEU1, relay PR in operating will operate relay UTA in allotter AEU2 and thus start up a link in the second unit. The operated relay UTA or UTB in the first unit will be released until such time as the privileged party has been switched through to the link.

If an ordinary "over 50" call is being already handled by relay OF, OFA or OFB in allotter AEU1, relay PR will operate relay UTA in allotter AEU2 as before and relay OF, OFA or OFB in allotter AEU1 will be released.

Should priority subscribers in different units originate calls together, a finder switch will be started up in each of the units concerned, but if a plurality of priority subscribers in one unit originate calls together, only one finder switch in that unit will be started up. The rectifier such as MRJ in each of the allotters prevents the starting battery of one or more calling priority subscribers in one unit from extending through via the common lead 32 to the UF relays in the other units and so starting up a plurality of finders in search of one subscriber. The operation of the PR relays in the various units is not affected since only one rectifier in a conductive direction, rectifier MRJ in this instance, will be in circuit with the PR relays, whereas two rectifiers in conductive and non-conductive directions respectively will be in circuit with the UF relays of other units.

From further examination of all possible prevailing conditions it will be seen that a privileged subscriber on calling will receive substantially immediate priority over all other subscribers in process of being connected up to a free link.

It will be noted that when a finder is set in operation by a privileged party, battery is extended via resistance YD, Fig. 7, contacts UF4 or their equivalent on relay UTA or UTB, contacts PR5, lead 21 and contacts FS6 to operate relay D, Fig. 6, in the selected link so as to prepare the link circuit for giving a priority cut-in feature to an engaged line when subsequently the link has been set to a desired line by dialling in the usual manner. It will be understood that other special facilities may be provided in similar manner.

Although in the example described the privileged subscribers are assumed to be located in the "under 50" group, it might be desirable to arrange for them to appear in either group, one necessary circuit modification with this point in view being to arrange for the PR relays in operating to disconnect both the marking and starting condition for all ordinary subscribers on the board.

Considering now the operation of the board under fault conditions, if the two-motion connector switch in any link stays off-normal through some mechanical fault, the resistance battery to the FS relay will be disconnected at contacts N1, Fig. 6, while at contacts N2 a point will be completed in the busy indication chain circuit. Similar remarks apply if the link is receiving attention by a maintenance officer, in which case the U plug in test springs T1 is transferred to springs T2. If a fuse associated with the battery feed to a link should blow, the resistance battery to the FS relay will be ineffective and since in such circumstances the battery connection to resistance YE will be replaced at the fuse bar by the fault earth which caused the fuse to blow, such earth potential is prevented from feeding back through relay FS by means of rectifier MRA and so is prevented from upsetting the link allotting chain circuit. If the sequence marking device should stop with its wipers in a position such as that shown, every link on the board would be able to give service, but if it should stop with both its wipers connecting with contacts, one link in each unit would be out of action owing to the FS relay being short-circuited over the leads with which the sequence switch wipers are connecting. Under the latter conditions, however, arrangements might be made whereby all the busying leads BL1—BL4 would be automatically or manually disconnected whenever the sequence switch failed, and hence the whole board could be maintained in action no matter in what position the sequence switch wipers are stopped, though clearly the cyclic allotting feature would be lost.

It will be understood that the invention is not limited in application to P. A. X boards as it could also be applied to P. A. B. X boards or any other boards employing line finder arrangements including main exchange line finder arrangements with or without partial secondary working.

What we claim as new and desire to secure by Letters Patent is:

1. In a telephone system, a group of lines, a group of finder switches having access to said lines, an allotter comprising a chain of relays one for each finder, a closed chain circuit including said relays and a unidirectional current conductinng device in the circuit between each relay and the next, and a switching device operated to apply starting potential to each relay in turn when a call is initiated to allot an idle finder for use in handling the call.

2. In a telephone system, a group of lines, a group of finder switches having bank contacts connected to said lines and responsive to markings on said contacts to connect with said lines, means controlled from calling lines for placing said markings on said contacts, and means controlled from certain priority lines, when calling, for removing previously established markings

from said contacts to insure that the next operated finder will connect with the calling priority line.

3. A telephone system as claimed in claim 1 in which there are a pair of contacts of different length for each finder and the switching device comprises a continuously operated rotary switch having means for applying potential to said contacts so that for the one period potential is applied to one contact only and for another period to both contacts.

4. In a telephone system a group of finder switches having access to a group of lines, a relay allotter for allotting an idler finder to extend calls from calling lines comprising a closed chain circuit having a relay for each finder connected thereto and a one way conducting device in the chain between each relay and the next, a pair of contacts for each finder switch, a high speed rotary switch in the allotter for applying starting potential to each relay connection in turn, said switch operating at a speed such as to pass over each pair of contacts in slightly more time than that required for a finder switch to hunt over all of its contacts.

5. A telephone system as claimed in claim 4 in which the allotter relay for initiating the operation of the associated finder is connected across a pair of said contacts and is short circuited when potential is connected to both contacts by said switch.

6. A telephone system such as claimed in claim 1 in which each relay upon operation has means for cutting off the subsequent relays in the chain circuit.

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