April 25, 1939. C. DE VRIENDT ET AL 2,155,933

CENTRALIZED INFORMATION SERVICE

Filed Feb. 12, 1937 4 Sheets-Sheet 1

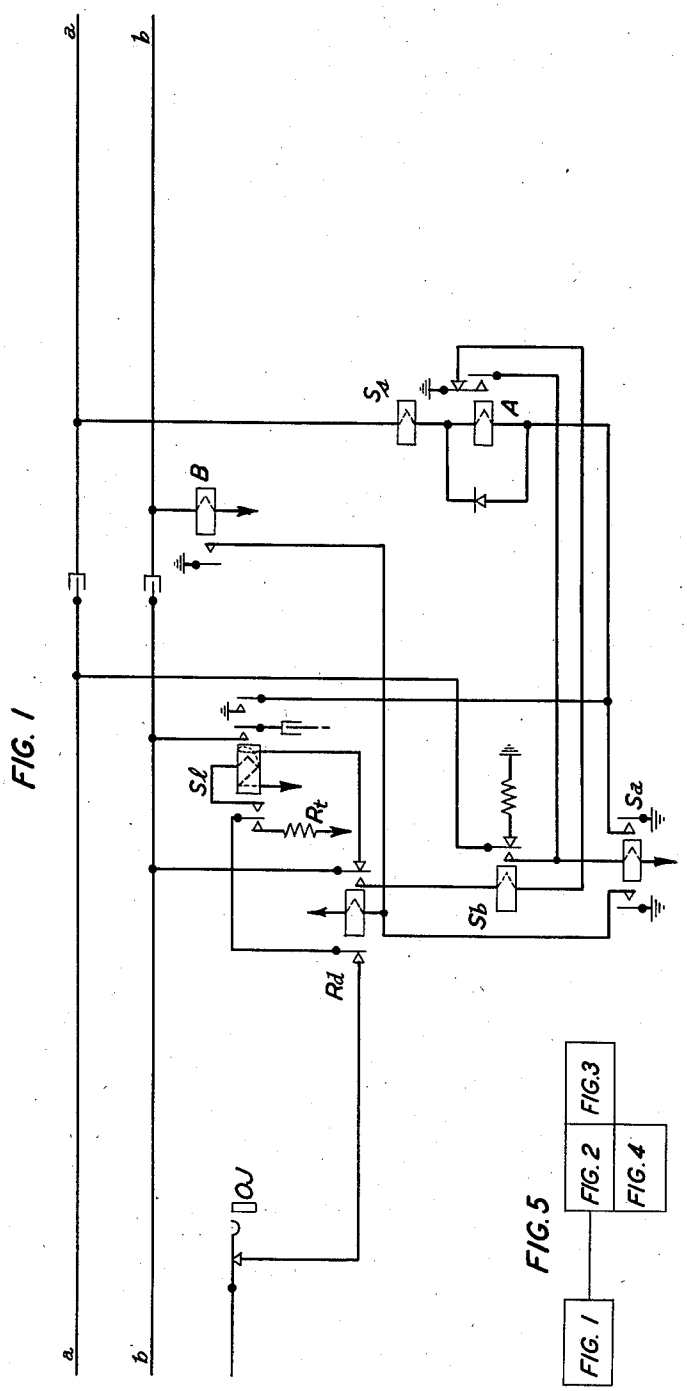

FIG. 1

FIG. 5

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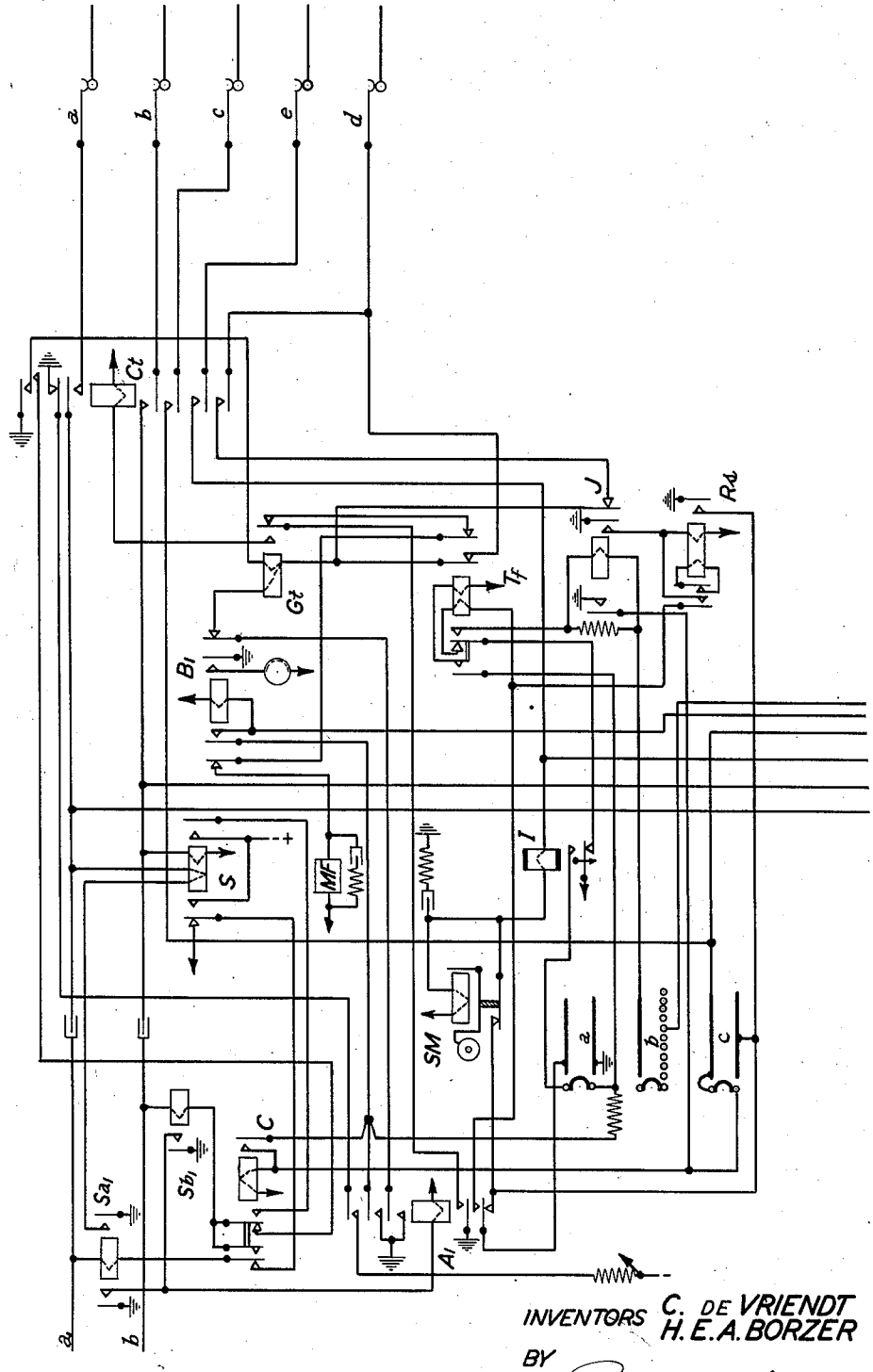

FIG. 2

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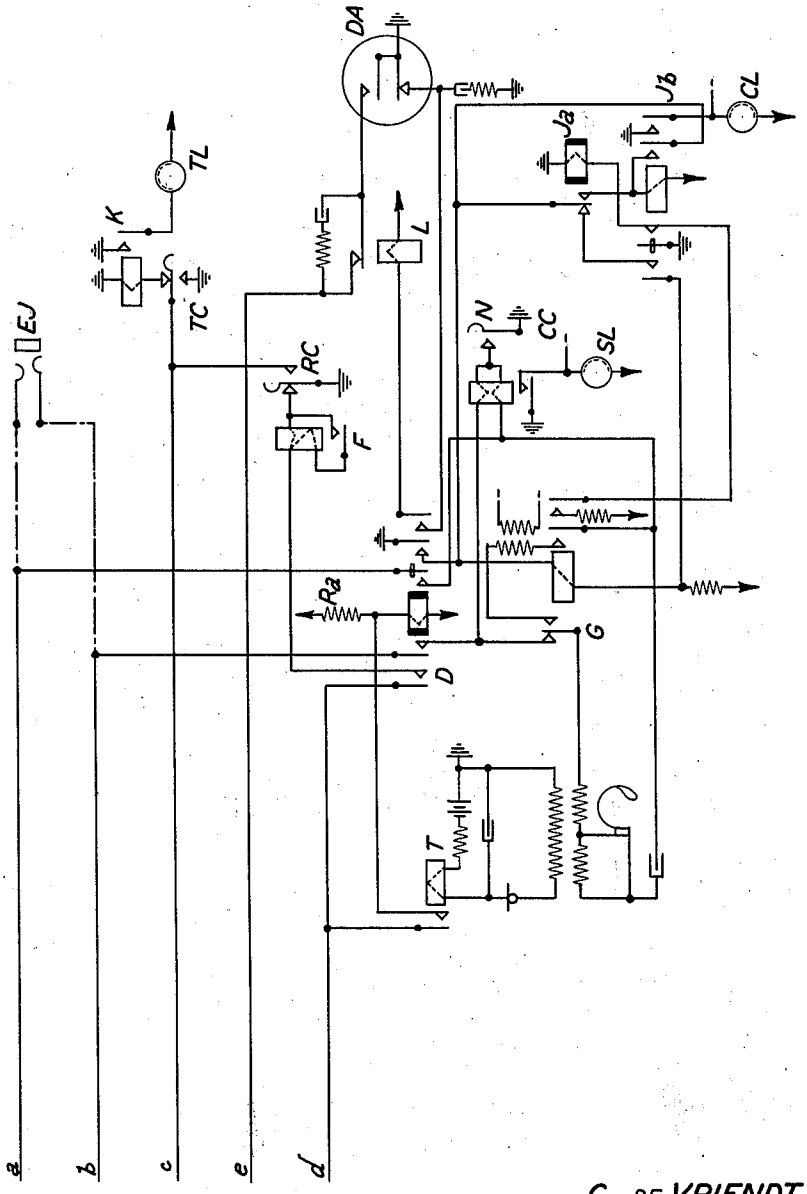

FIG. 3

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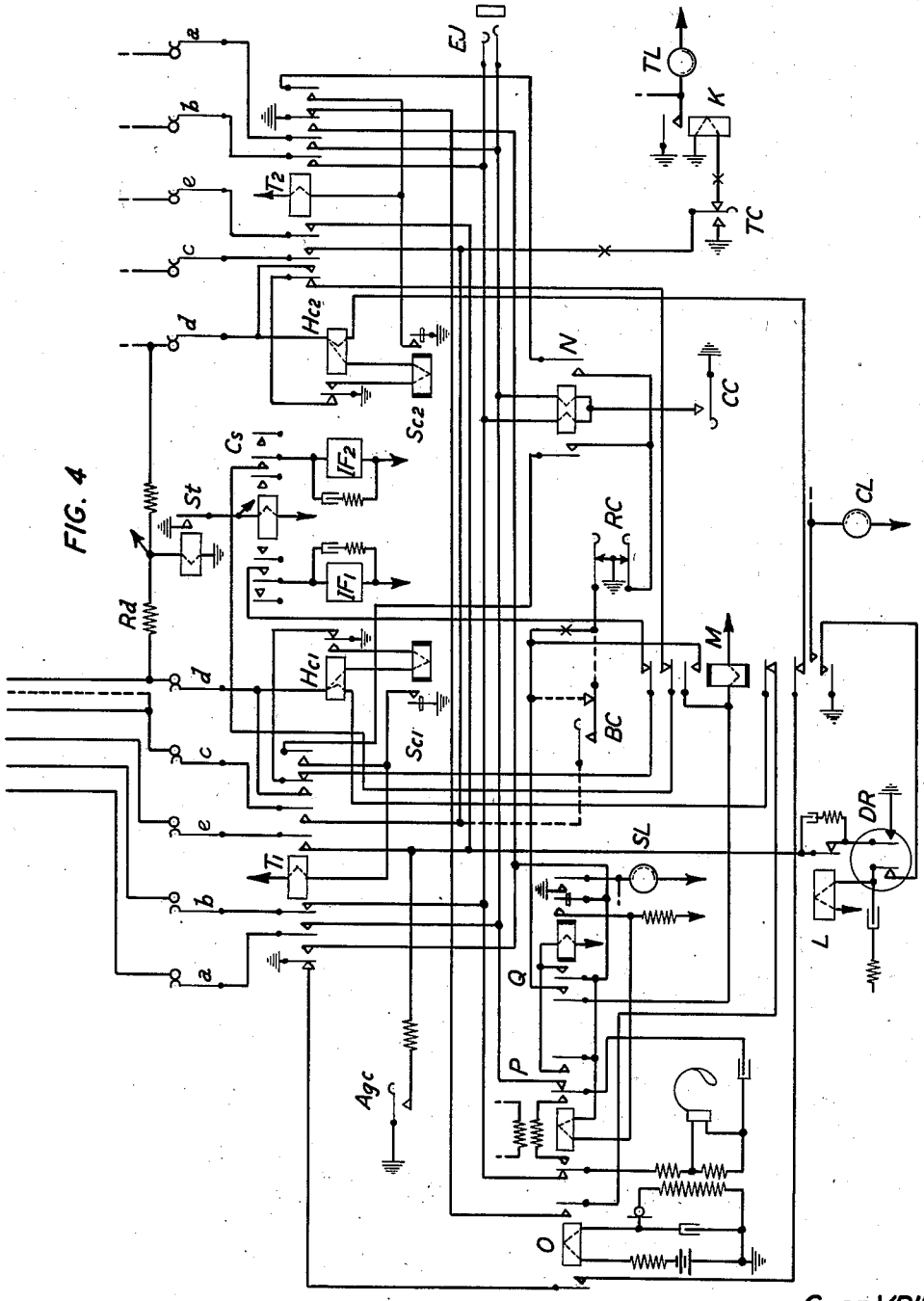
FIG. 4



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Patented Apr. 25, 1939

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UNITED STATES PATENT OFFICE

2,155,933

CENTRALIZED INFORMATION SERVICE

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Application February 12, 1937, Serial No. 125,413
In France April 25, 1936

13 Claims. (Cl. 179—27)

This invention relates to telephone exchange systems and more particularly to facilities for giving information service from a centralized center to subscribers whose lines terminate in different offices of the system.

In a large city having telephone networks with multiple offices and particularly with automatic offices, one of the difficulties consists in the organization of the information service. It is clear that in order to give an efficient and rapid service of this nature which may be of a quality comparable with that of the usual automatic service, the arrangement hitherto generally maintained, of operators allocated to this service in each office constitutes an unfavorable element not only from the point of view of the subscriber, but also from that of the utilization of the staff by reason of its great dispersion. It is obvious that a good information service would be more easily obtained by concentrating all the staff allocated to this service in a single point of the network, to which the subscriber's call could arrive in an automatic manner and to be able then to be rapidly transferred to the service capable of giving the exact information required. Such a centralized information service can be attained by methods borrowed from the art of manual telephony, or again an effort might be made to utilize methods of exploitation as automatic as possible. In the first case the subscribers' calls can arrive at the central information service at operators' receiving sets equipped with single cords on which the said calls are taken. The information operators' positions of the various services would be represented on multiple jacks permitting the receiving operators to direct the calls received to a further operator of the appropriate service. The call thus extended to a particular service would, however, have to be adapted to be transferred to another service if this appeared necessary, and finally, it would also be desirable that any call might be transferred to the supervisory position. Moreover, by reason of the nature and variety of the information that these various operators may be called upon to give to the public, they must have at their disposal varied and usually voluminous documents such as telephone directories or various works of reference whose presence on their desk accords ill with that of the numerous plugs or keys. It is consequently clear that it is highly desirable to develop a system of automatic distribution of the calls for information which while giving the desirable facilities mentioned above would also have the advantage of accommodating itself to an operator's position free of impeding switching equipment. The system which is the object of the present invention fulfils this requirement. In this system each information operator's position only contains a dial or similar device, three push buttons and three supervisory lamps, all the keys and cords required by a service employing a multiple manual switchboard being eliminated. The invention will easily be understood by means of the following description taken in connection with the attached drawings, in which:

Fig. 1 shows an output junction circuit of which a certain number are equipped in each automatic exchange and on which arrive the calls of the subscribers to any information service;

Fig. 2 shows the input junction circuit to the information center which represents the termination at this center of the outgoing junction shown in Fig. 1;

Fig. 3 shows the circuit of a receiving operator's position and control to which are connected the junction circuits according to Fig. 2;

Fig. 4 shows a circuit of an information or supervisory operator's position, which is connected to the input junction circuit of Fig. 2 after a transferring operation has been effected by the control operator serving the position circuit shown in Fig. 3; and

Fig. 5 shows the method of association of the circuit drawings of Figs. 1 to 4.

On long lines the general operation of the system is as follows:

The subscriber after having dialed the number corresponding to "information" is connected through the circuits of Figs. 1 and 2 to a receiving operator's or control position (Fig. 3). When the call arrives the operator perceives a tone in her receiver at the same time that a call lamp is lighted. The operator is then automatically connected to the calling subscriber without having to manipulate any key. The line of the calling subscriber, like all the circuits employed by the connection, is maintained under the control of the operator's position so as to maintain the connection with a view to possible transfer or even, if necessary, to permit the origin of mischievous calls to be identified. When, supposing that she has been able to do so, the operator has given the required information and the calling subscriber hangs up, she gets a supervisory signal and actuates a key to release the connection to free her own set.

If, however, the operator wishes to transfer the calling line to another service, she dials a certain number of one digit which corresponds to the

desired service. The corresponding impulses are received and marked in the input junction circuit by a step-by-step switch and all the junction finders of the circuits (Fig. 4) of the service concerned, hunt for the call thus registered. The control operator, however, remains in connection with the subscriber until the call is effectively taken by a second operator. When the operator perceives a supervisory signal informing her that a call has actually been transferred, she actuates a key in order to release her position. If the receiving operator had had to transfer the call to a supervisory position, she would have dialed a special number reserved for this position. If for any reason, such for example as a case of surcharge, the transfer is not completed, she can cancel this operation by actuating a key.

Moreover, each operator of the various services can at will retransfer a call to other information positions or to a supervisory position. It is also possible to send the call again to a receiving operator and for this purpose all the information positions and the supervisory position are provided with a special key. Finally, an operator can also as desired perform an operation which will determine the metering of the call against the calling subscriber. One of the interesting features of this system of distribution consists in the fact that the retransfer of a call is obtained by means of an impulse device, thus permitting access to a relatively large number of services and in the fact that a call can be successively transferred as often as necessary and always by means of the same key manipulation, the number dialed only depending upon the service to be obtained and not on the position from which the call is transferred.

When a call is made to the information service, it terminates at the office of origin in the circuit of Fig. 1 which is connected to the banks of primary or secondary selectors in the well-known manner. The engagement of a circuit in accordance with Fig. 1 takes place in this circuit by the energization of the relay *Sl* over the talking loop established at the secondary selector switch. The relay *Sl* in operating cuts off the potential applied through the resistance *Rt* to the third wire so as to permit the advance of the secondary selector and remains locked to the earth on the third wire. By its inner right-hand work contact it connects a return ringing tone intended for the calling subscriber and by its outer right-hand work contact it connects, through the polarized relay A and the self-inductance S_s, an earth over the wire *a* to the input junction circuit of Fig. 2. In this circuit the relay Sa_1, connected on the one hand to the wire *a* and on the other hand to the battery through rest contacts of the relays C and S, is actuated, and by its left-hand work contact closes a circuit for the relay A_1, which in turn causes the rotation of the finder MF, whose circuit is closed through the left-hand rest contact of *Bl*, the outside right-hand rest contact of *Tf*, the rest contact *Gt*, the inside lower work contact of A_1, to earth. The hunting for a control operator takes place under the control of the relay *Gt*. The potential of availability of the control operator is given by the relay D (Fig. 3) and the resistance R_a to battery, which is connected in parallel provided, however, that the relay T is energized, that is to say, that the operator is at her position. As soon as the finder MF meets an idle control operator's circuit, the relay *Gt* is actuated, cuts off the circuit of the electromagnet MF and closes the circuit for the connection relay *Ct*. The relay *Ct* on the one hand closes the wires *a* and *b* to the operator's position and on the other hand connects an earth to the low resistance winding of *Gt*, so as to prevent another finder from stopping on the control operator's position which has just been engaged. Moreover, by the upper work contact of *Ct* and a rest contact of C, the relay Sb_1 is connected to earth and consequently operates in series with the relay B of the circuit of Fig. 1. This relay B operates the relay *Rd*, which by its left-hand rest contact determines the unlocking of *Sl* and consequently the momentary retraction of the relay Sa_1, but the relay A_1 is held by the work contact of Sb_1. By its right-hand work contact *Rd* connects to the incoming wire *b*, the relay *Sb*, which operates in series with the relay of the wire *b* of the connecting circuit, thus preventing the subscriber from being able to release the connection by hanging up. Moreover, the relay *Sa* through the work contact of *Sb* is connected to the incoming wire *a* and operates in series with the self-inductance connected to earth at the connection circuit. *Sa* supplies on the one hand a holding earth to the relay *Rd* and on the other hand connects earth to the conducting wire *a* which, replacing that given by *Sl*, again determines the operation of Sa_1 (Fig. 2).

At the moment when the low resistance winding of the relay *Gt* is introduced in the test circuit, the relay D of the control operator's position is actuated. This relay connects an earth to the relay G which then operates and connects the secondary of a tone transformer to the receiver of the operator's position; at the same time, the relay G causes the actuation of the relay *Ja*, which in turn causes the actuation of *Jb*, which remains locked to the earth given by D. Relay *Jb* in actuating short-circuits *Ja*, which falls back and at this moment G also falls back short-circuited. During the period that G has been in operation, the operator will have heard the warning tone of the arrival of a call. Finally, the relay *Jb* lights the lamp CL. The relay N is actuated in the battery feed loop through the relay S of the circuit of Fig. 2, but the resistance of the two windings of N in series is such that relay S does not operate under these conditions. The relay N lights the lamp SL, which will give the subscriber's supervision.

Two cases may arise: either the control operator can give the information required by the subscriber, or else she has to transfer the call to one of the information or supervisory positions.

In the first case, when after having received the information the calling subscriber hangs up, the operator obtains the supervision of this operation in the following manner:

The hanging up of the subscriber causes the successive retraction of the relays *Sa* and Sa_1 in the circuits of Figs. 1 and 2, the latter of which opens the earth of the left-hand winding of the relay S (Fig. 2) and determines the retraction of the relay N in the controlling operator's position circuit (Fig. 3). If the operator has to cause the metering for the information given, she temporarily presses the key CC, which has the effect of actuating the relay S (Fig. 3), which connects a positive battery on the wire *a* of the junction, which causes the operation of the polarized relay A in the circuit of the office of origin (Fig. 1). The relay A gives an earth in order to hold the relay *Sa*, and opens the incoming wire *b* which determines the retraction of *Sb* and also of a relay in the wire *b* in the connection circuit which

will advance into such a position that the metering will take place at the time of the release. If the operator does not wish to meter, it is sufficient for her in order to release the subscriber, while freeing her position, to press the key RC. In effect key RC through the wire *c* connects an earth to the bank *c* of the step-by-step switch SM of the circuit of Fig. 2 and by means of normal position terminal of this bank the relay C is actuated and locked. Relay C connects the relays Sa_1 and Sb_1 in series across the wires *a* and *b*, so that relay Sb_1 having earth removed, releases and consequently also the relay A_1, and successively all the other relays operated in the two circuits.

Let us now suppose that the operator cannot give the information to the subscriber and is obliged to transfer him to an information position. In this case the operator by means of the dial on her set will dial the number of the information position which is likely to fulfill the subscriber's requirement. As soon as she begins to dial, earth is connected through the off-normal contact of the dial to the armature of the relay L. This relay being operated at this moment nothing happens, but as soon as the dial returns, the relay L operates at the rhythm of the impulse contact of the dial and during each opening sends an earth over the terminal and the brush *e* of the finder MF (Fig. 2) and by means of a work contact of relay *Ct* to the step-by-step switch SM. The latter advances by a number of steps corresponding to the digit sent and the relay I, which is in series with the electromagnet of the step-by-step switch, operates in response to the first impulse and remains operated until the end of the series. As soon as relay I has reclosed its normal contact, it connects a battery to the left-hand winding of the relay *Tf*, which is actuated and locked by its right-hand winding to the earth of a work contact of relay A_1. It will be noted that the circuit of the relay *Gt* has been paralleled by a circuit passing through a work contact of relay *Ct* and a rest contact of J, so that when *Tf* opens its rest contact the relay *Gt* is maintained and the control operator remains in communication with the calling subscriber. As soon as the relay *Tf* is operated, the battery at the rest contact of relay I is transferred to one terminal of the winding of the relay J and of a resistance in parallel, the other terminal of this relay being connected through the brush and a terminal of the bank *b* of switch SM, towards the multiple bank terminals *d* of all the finders IF_1 and IF_2 of the groups of circuits according to Fig. 4, corresponding to a given information service, and moreover, through a single resistance *Rd*, to the starting relay *St* corresponding to this group. This relay operates and in turn operates the relay *Cs*, which closes the circuits of the finders IF_1 and IF_2. When one of these finders, for example IF_1 reaches the terminal *d*, which is under potential, the relay Hc_1 operates, stopping the rotation of the finder and introducing its low resistance winding in series with the low resistance winding of relay Sc_1, which also operates. *St* is then shunted and falls back and consequently also relay *Cs* and the other finders IF are stopped.

Moreover, relay Sc_1 operates relay T_1, which connects the wires *a*, *b*, *c*, *e* of the circuit of Fig. 4 to the corresponding connections of the junction circuit Fig. 3. Relay T_1 operates relay P, which connects the operator's set to a tone induction coil. Relay P in turn operates relay Q, which is locked to the earth at relay T, and relay Q itself operates relay M, which is locked to the earth of the key RC. Relay Q also lights the ringing lamp SL and short-circuits relay P, which falls back in order to discontinue the application of tone to the operator's set and to put her in connection with the wires *a* and *b* in order to connect her with the subscriber. Through four rest contacts the relay M opens the circuits of the finders IF_1 and IF_2 as well as those of the high resistance windings of the test relays Hc_1 and Hc_2, thus preventing the operator's circuit from being able to get another call. Finally, the relay N in loop of the wires *a* and *b* operates in series with the two windings of the relay S of the circuit of Fig. 2, and maintains the operated relay T_1 locked.

Moreover, the control operator has the supervision of the transfer in the following manner:

As soon as the switch SM following the dialing impulses has left its normal position, the relay K of the control operator's position is actuated through the rest contact of the key TC, the wire and brush *c* of the finder MF, the bank *c* of SM to battery through the winding of the magnet SM and its interrupter contacts. The relay K lights the supervisory transfer lamp TL. If for any reason the transfer does not take place, this lamp remains lighted and the control operator can cancel the operation by pressing key TC. In doing this she connects a direct earth to the winding of magnet SM through its interrupter contacts and consequently the step-by-step switch returns to normal. The control operator can check the return to normal of switch SM by the fact that once the key TC is released the lamp TL should no longer light. At this moment she can again dial under the same conditions as the first time in order to obtain a new transfer.

Let us now suppose that the transfer has been completed, that is to say, that the test by the finder IF_1, for example, has taken place. The operation of the circuit of Fig. 4 takes place as has already been described above. From the time of the introduction of the low resistance winding of the relay Hc_1, the relay J of the circuit of Fig. 2 has been operated. Relay J causes at its rest contact the opening of the circuit of the relay *Gt* which falls back and releases relay *Ct*. The connection between the subscriber and the control position is cut off. At the same time the relay J actuates the relay *Rs* which is locked through a work contact of relay A_1 towards the earth of the bank *a* of the step-by-step switch SM. A third contact of relay J causes the operation of the relay C, which in turn is locked towards a work contact of relay A_1. The operation of relay C, as has already been seen above, connects the relays Sa_1 and Sb_1 in bridge of the wires *a* and *b*, which will permit the subscriber to free himself by hanging up. The relay *Rs*, which has been actuated, connects an earth to the winding of magnet SM through its interrupter contacts and thus causes the return of this step-by-step switch to normal. As soon as the relay *Ct* falls back, the lamp TL of the control operator's position is extinguished indicating to the latter that the transfer has taken place. Further, as soon as the circuit of the relay *Gt* has been cut off by the operation of relay J, the relay F of the control position, no longer being shunted, is actuated, holding this position locked and inaccessible owing to the introduction of the second low resistance winding of relay F. The control operator can thus write certain informa-

tion without being disturbed by a fresh call. The locked condition of the control position is indicated by the fact that the lamp CL is burning. As soon as she wishes to release her position, the operator presses the key RC and all the locked relays are released.

For the information operator two cases may arise, as for the control operator, according to whether she can or cannot give the information desired by the subscriber.

In the first case, when the subscriber has received the information and hung up, he causes the release of all the apparatus of the junction circuit of Fig. 2, which causes the retraction of the relay N in the circuit of the information position Fig. 4. Relay N unlocks relay T_1, which falls back, opens the wires *a*, *b*, *c*, *e* and releases the relay Q, which puts out the lamp SL. The extinction of this lamp indicates to the operator that the subscriber has hung up. The relay M remains locked, however, to the earth given by the key RC, thus the lamp CL remains alight and the relay M prevents the circuit of this operator from taking a fresh call. The operator thus remains cut off, which permits her to take notes if necessary without being disturbed. As soon as she wants to release her position, she presses the key RC, which releases the relay M and renders the circuit available for a new call.

Let us now suppose that she cannot give the information to the subscriber. Under these conditions she can, like a control operator, transfer the call to another information position or to a supervisory position, or even to a control position if this should be necessary. For the latter operation it is sufficient for her to press the key A_{SC}.

For the normal transfer she manipulates her dial which, as for the control position, sends impulses through the impulse relay L towards the step-by-step switch SM of the circuit according to Fig. 2. The transfer to any position then takes place under conditions similar to the transfer from the control position with the difference that when the transfer is effected, the connection to the information operator's position remains maintained by relay N being operated. The operator can thus assure herself of the completion of the transfer, after which she releases her position by pressing the release key RC. If a subscriber does not hang up after receiving the desired information, the information operator or the supervisor can, if the key BC is equipped, actuate the relay Bl of the circuit of Fig. 2 which has the result of rendering the subscriber's call ineffective. When this subscriber hangs up, the relays Sa_1 and Sb_1 fall back as well as the relays A_1 and B_1, and the junction circuit resumes its normal condition. If it be desired that the information operator shall be able to supervise the transfer by means of a lamp and to cancel it if it should not be completed, it is sufficient to provide in the circuit of Fig. 4 the relay K and the lamp TL as well as the key TC, then the key BC must be omitted and the possibility of blocking the subscriber by means of the relay Bl is only left to the supervisory positions. Like the control positions the information or supervisory positions have a key such as CC to control the metering if necessary. The method of operation of this key is exactly the same as that already described for the control operator's position.

It is obvious that, when employing the finders IF with six brushes instead of five, it is possible to maintain for the information operators the possibility of blocking the subscriber on the junction circuit while leaving them the supervision of the transfer.

Finally, the system has been described with the use of a dial actuating a step-by-step switch in order to mark the service to which the call must be transferred. It is clear that this step-by-step switch may be replaced by any equivalent means such as a switch of the motor-driven type well known in the art.

It is also clear that with the same number of wires in junction circuits and operators' circuits, that is, five in the example chosen, the transmission of impulses in order to indicate the service may be obtained by actuating one of the keys of a key pulsing keyboard by using in the junction circuit polarized and marginal relays and a set of marker relays, and in the operator's circuit positive and negative battery impulses.

It is finally clear that the system is not limited to a capacity of access of ten services at a maximum, and could easily be adapted to a larger number, for example, by using a step-by-step switch of greater capacity, directed by means of two sets of successive impulses, or in any other well-known manner.

The embodiment described above has been elaborated in order to operate specifically in a particular network, but it is obvious that by a few adaptations in some of the circuits, the means of realization which it embodies would immediately be applicable to any other automatic network with multiple offices and might also be further adapted to a network containing manual offices.

What is claimed is:

1. In a telephone system, a plurality of operators' positions, impulse generating means at each of said positions, means for extending a connection to one of said positions and means for transferring said connection to another one of said operators' positions by means of a single operation of the impulse generating means at said first position.

2. In a telephone system, a plurality of operators' positions, impulse generating means at each of said positions, means for extending a connection to one of said positions and means for transferring said connection from one of said positions to another by means of a single operation of the impulse generating means at the transferring position.

3. In a telephone system, a plurality of operators' positions, impulse generating means at each of said positions, means for extending a connection to one of said positions and means for repeatedly transferring said connection from position to position by means of single operations of the impulse generating means at the transferring position.

4. In a telephone system, a plurality of operators' positions, impulse generating means at each of said positions, means for extending a connection to one of said positions, means for transferring said connection to another one of said operators' positions by means of a single operation of the impulse generating means at said first position, and means to indicate to said first position that the transfer has been completed.

5. In a telephone system, a plurality of operators' positions, a dial at each of said positions, means for extending a connection to one of said positions and means for transferring said connection to another one of said operators' posi-

tions by means of a single operation of the dial at said first position.

6. In a telephone system, a plurality of operators' positions, a dial at each of said positions, means for extending a connection to one of said positions and means for transferring said connection from one of said positions to another by means of a single operation of the dial at the transferring position.

7. In a telephone system, a plurality of operators' positions, a dial at each of said positions, means for extending a connection to one of said positions and means for repeatedly transferring said connection from position to position by means of single operations of the dial at the transferring position.

8. In a telephone system, a plurality of operators' positions, a dial at each of said positions, means for extending a connection to one of said positions, means for transferring said connection to another one of said operators' positions by means of a single operation of the dial at said first position, and means to indicate to said first position that the transfer has been completed.

9. In a telephone system, an incoming trunk circuit, a plurality of control operators' positions each having a dial, means for connecting said trunk circuit with an idle one of said positions, a plurality of other operators' positions having access to said trunk circuit, and a marker switch in said trunk circuit controllable from the dial of a connected control operator's position, for directing the connection of one of said other operators' positions to said trunk circuit.

10. In a telephone system, an incoming trunk circuit, a plurality of control operators' positions each having a dial, means for connecting said trunk circuit with an idle one of said positions, a plurality of other operators' positions having access to said trunk circuit, a marker switch in said trunk circuit controllable from the dial of a connected control operator's position for directing the connection of one of said other operators' positions to said trunk circuit, and a dial at each of said other positions for controlling said marker switch to direct the transfer of the connection of said trunk circuit from one of said other positions to another of said other positions.

11. In a telephone system, an incoming trunk circuit, a plurality of control operators' positions each having a dial, means for connecting said trunk circuit with an idle one of said positions, a plurality of other operators' positions having access to said trunk circuit, a marker switch in said trunk circuit controllable from the dial of a connected control operator's position for directing the connection of one of said other operators' positions to said trunk circuit, and means thereupon operative for disconnecting said trunk circuit from said control operator's position.

12. In a telephone system, an incoming trunk circuit, a plurality of control operators' positions each having a dial, means for connecting said trunk circuit with an idle one of said positions, a plurality of other operators' positions having access to said trunk circuit, a marker switch in said trunk circuit controllable from the dial of a connected control operator's position for directing the connection of one of said other operators' positions to said trunk circuit, means operative following said transfer for disconnecting said trunk circuit from said control operators' position, and a dial at each of said other positions for controlling said marker switch to direct the transfer of the connection of said trunk circuit from one of said other positions to another of said other positions.

13. In a telephone system, an incoming trunk circuit, a plurality of control operators' positions each having an impulse generating means, means for connecting said trunk circuit with an idle one of said positions, a plurality of other operators' positions having access to said trunk circuit, and marking means in said trunk circuit controllable from the impulse generating means of a connected control operators' position for marking a desired group of said other operators' positions and for directing the connection of one of said marked operators' positions to said trunk circuit.

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