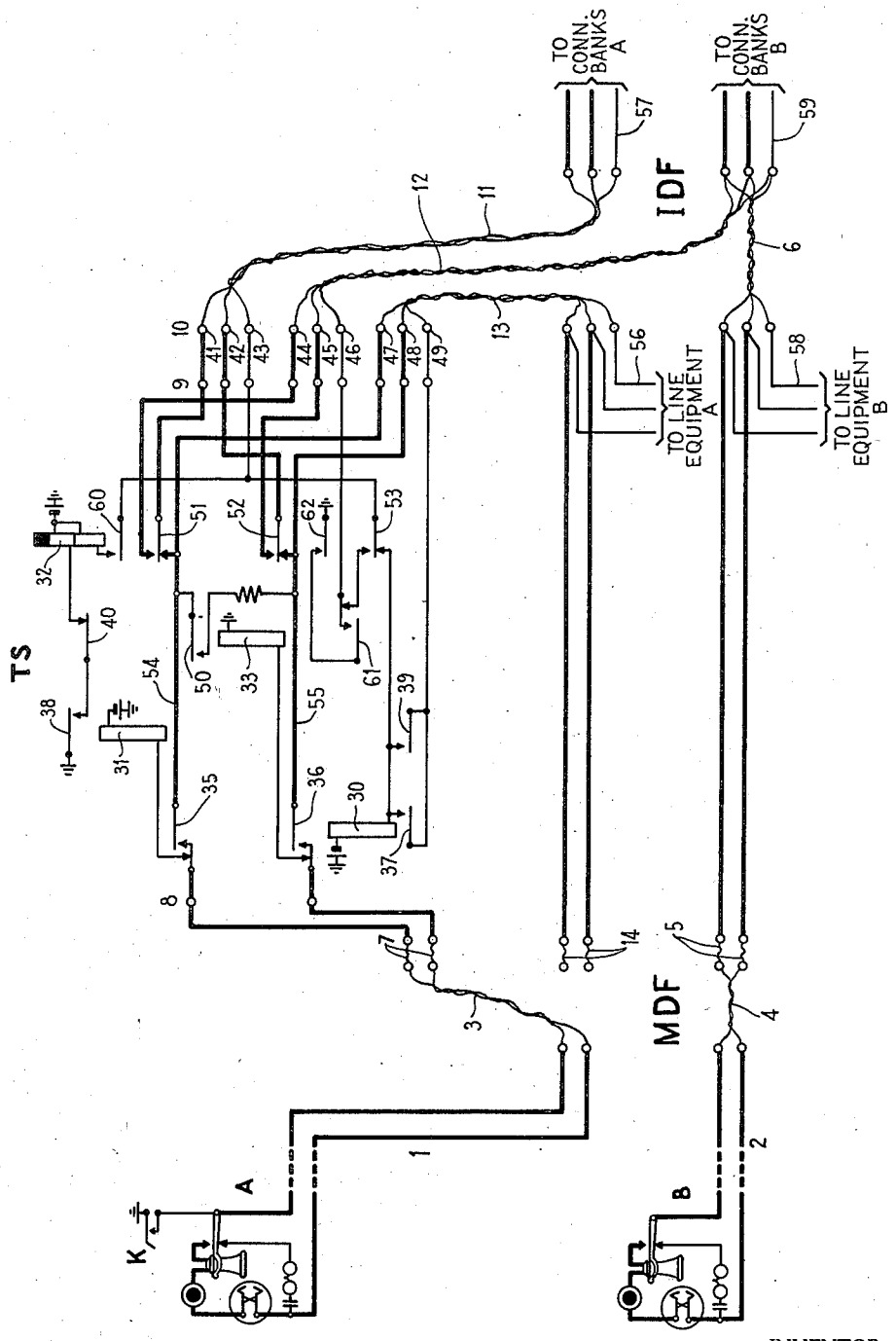
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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The present invention relates in general to telephone systems, but more in particular to an arrangement for giving a telephone subscriber a special type of service which will be referred to hereinafter as "transfer service". A subscriber having this service is able to bring about a switching operation at the exchange, in effect for any desired period, which causes all calls intended for his telephone to be diverted to another telephone. The object of the invention is a new and improved arrangement of the foregoing character.

The invention is especially useful for doctors, lawyers, and other professional people who are frequently absent from their offices and who do not wish to incur the expense of employing a secretary to answer telephone calls. It is also useful in the case of a doctor, for example, who has a secretary or attendant to answer calls during the day time, but desires to keep himself accessible to his patients at nights, when the office is unattended. In these and other cases the subscribers concerned, by contracting for the transfer service, are able to use their residence telephones for answering office calls and thus secure the equivalent of 24-hour service in connection with their office telephone numbers.

The invention will be described more in detail with reference to the accompanying drawing, which is a diagrammatic circuit drawing showing the apparatus involved and the manner in which it is installed in a typical telephone system.

Referring to the drawing, the reference letter A represents an automatic telephone station assumed to be at the office of a subscriber having the transfer service. B is the residence telephone, or any other telephone to which calls are to be transferred. The main distributing frame is indicated by reference letters MDF, and the intermediate distributing frame by the reference letters IDF. A transfer equipment, comprising four relays 30—33, is indicated at TS.

The usual connections for a subscriber's line are shown in the case of the line of substation B. The line 2 is cross-connected by means of a duplex jumper 4 at the MDF to a pair of protectors 5, indicated for convenience as fuses. From the protectors a cable pair leads to the line side of the IDF, where the line equipment is permanently connected. The foregoing are the connections required for outgoing service. The line is connected up for incoming service by running a jumper 6 from the terminal set on the line side of the IDF to the set of terminals on the connector bank side which corresponds to the assigned telephone number. This jumper has three conductors (triplex) so as to connect through the third wire, used for testing and busying purposes. The foregoing is common practice and is well understood.

The transfer equipment, comprising a plurality of units such as TS, is preferably mounted as part of the automatic switchboard, on regular switch or repeater shelves, or on separate uprights. It is advisable to provide for jack mounting, using the ordinary male and female jacks such as are used for automatic switches, although this is not essential. Assuming that jack mounting is used, each unit will require eleven jack connections, those for unit TS being indicated at 8 and 9. All the female jacks of jack connections such as 8 are permanently connected by cable to an extra group of protectors on the MDF, one pair of this group being indicated at 7. All the female jacks of jack connections such as 9 are permanently connected by cable to an extra group of terminals such as 10 on the IDF. This extra group of terminals may be either on the line side, as shown, or on the connector bank side.

Station A is connected up for transfer service in the manner shown in the drawing. The old jumper on the MDF which connected line 1 to protector pair 14 has been removed and a new jumper 3 has been run, connecting line 1 to the pair of protectors 7 which is associated with the transfer unit TS. At the IDF the old jumper, corresponding to 6, has been removed also, and three new jumpers 11, 12, and 13, have been run from the particular nine terminals of group 10 which are associated with transfer unit TS. Jumper 11 serves to connect the terminals 41—43 with the terminals on the connector bank side of the IDF which are associated with the office telephone number. Jumper 12 connects the terminals 44—46 with the residence line, that is, the line of telephone station B. This jumper may pick up the line of station B at the connector bank side of the IDF as shown, or at the line side. Jumper 13 connects the terminals 47—49 with the line equipment associated with station A.

It will be assumed now that the key at station A is normal, as will be the case if the subscriber or attendant is present. If the receiver is removed to make an outgoing call the transmitter and receiver are bridged across line 1, closing a circuit for relays 31 and 33 in series. Both these relays operate. At 39 relay 31 connects terminal 49 with terminal 43 via 53, thus connecting

through the third wire 56 associated with the line equipment to the third wire 57 extending to the connector bank contact sets of station A. At 38 relay 31 attempts to close a circuit for relay 32, but fails to do so because relay 33 opens the circuit of relay 32 at 40. At 50 relay 33 places a bridge across the line conductors 54 and 55, extending via 47 and 48 to the line equipment of station A, thus placing the line in calling condition.

The system may use either line switches or finders to extend calling lines to idle trunk lines. In any case as soon as an idle trunk is connected with ground is extended back over the third wire 56, making the line busy to the connectors, and operating relay 30. Relay 30 shunts contacts 39 at 37, and at 35 and 36 disconnects line 1 from relays 31 and 33 and extends it through to line conductors 54 and 55. Relays 31 and 33 now fall back, but without effect. The automatic equipment taken into use for handling the call by the temporary closure of the bridge at 50 is maintained operated over line 1, and maintains ground on the third wire 56 to hold relay 30 in operated position. The call is completed by dialling in the usual manner. The connection is released by hanging up the receiver at station A, which permits the automatic switches to restore. This removes ground from the third wire 56 and allows relay 30 to fall back.

When station A is called, the connector in use places ground on the third wire 57, thereby closing a circuit over the third strand of jumper 11, 43, 53, and winding of relay 30 to battery. Relay 30 accordingly energizes and connects conductors 54 and 55 through to the called line, disconnecting relays 31 and 33 at the same time. Relay 30 also connects the third wire 57 through to third wire 56 at 37, and ground is thus extended to the line equipment of station A, where the cut-off relay is operated in the usual manner. Ringing current is now transmitted over line 1 from the connector to operate the bell at telephone A, and the call is answered in the usual manner. When the connector is released, ground is removed from third wire 57, and relay 30 and the cut-off relay fall back.

It will now be assumed that the telephone station A is left unattended for a while. Before leaving the premises the subscriber or attendant will operate the key K, which may be in the base of the telephone or at any convenient place. The key is of the type which stays in operated position. If desired the receiver may be removed and left off after the key has been operated, as an aid to the subscriber in reminding him to restore the key when he returns.

When key K is operated it grounds the negative side of line 1 and operates relay 31. Relay 33 remains deenergized, whether the receiver is removed or not. On energizing, relay 31 closes a circuit at 38 for relay 32. The latter relay, on energizing, operates contacts 51, 52, and 53, thereby disconnecting the three terminals 41, 42, and 43 from their normal association with line 1 and connecting them instead with terminals 44, 45, and 46, which are associated with line 2 over the triplex jumper 12. Relays 31 and 32 remain energized while key K remains actuated, or while the telephone station A is left unattended.

If telephone A is called during this period, the connector in use places a ground on third wire 57, which is now connected with third wires 58 and 59 at 53. The grounding of third wire 58 operates the cut-off relay of the line equipment associated with line 2, the line of telephone station B, and the grounding of 59 guards the line against intrusion by another call. Ringing current is now transmitted from the connector via the bank contacts of station A, the jumper 11, contacts 51 and 52 of relay 32, and jumpers 12, 6, and 4 to line 2, operating the bell at telephone B. The call is answered at that telephone in the appropriate manner, and so far as the calling party is concerned the service is the same as if the call had been answered at telephone 2.

It will be evident that while the transfer relay 32 is in operated position an office call will make the residence line busy, while a call to the residence line will make the office line busy. This limitation is inherent from the nature of the system and is not a particular drawback from the standpoint of selling the service. As regards the possible loss of a residence call due to a call on the office line, the subscriber is willing to subordinate his residence service to the maintaining of continuous service on the office line; and as regards the possible blocking of an office call by reason of the residence line being in use the subscriber can give instructions suitably restricting the use of the residence phone while the transfer unit is in transferring condition.

It will be assumed now that the subscriber returns to his office. The receiver is replaced at telephone A, if it was left off, and key K is restored. Relay 31 accordingly falls back and breaks the initial energizing circuit of relay 32, which falls back also unless the residence telephone B is engaged in a call. In the latter event relay 32 is locked up to the third wire through contacts 60, and remains energized until the call is over with. This provision is made because the call in which telephone B is engaged may be a call intended for telephone A, being answered at telephone B, and if relay 32 were permitted to fall back while conversation was going on the call would be interrupted.

If the receiver is removed at telephone A to make an outgoing call while relay 32 is locked up, relays 31 and 33 energize and the latter relay initiates the call by placing a bridge across conductors 54 and 55 at 50 as previously described. This operates the calling equipment, line switch or finder, and ground is applied to third wire 56, operating relay 30 by way of 39. Relay 30 locks itself to the third wire at 37 and disconnects relays 31 and 33. During the short interval in which relay 33 is operated it makes a test to ascertain if relay 32 is locked up due to a call intended for telephone A, or due to a regular outgoing or incoming call involving telephone B.

Explaining this operation, when relay 33 energizes it opens the multiple connection between the third wires of lines 1 and 2 at the springs controlled by armature 61, and at the same time by means of armature 61 and its working contact it grounds the third wire 58 of line 2. There are two cases to be considered now. In the first case relay 32 is locked to ground on the third wire 58 or 59 of line 2, and accordingly when the multiple connection to the third wire 57 is broken relay 32 at once falls back and breaks its own locking circuit at 60. The ground applied to the third wire of line 2 by the operation of relay 33 does no harm, and it is taken off at 62 as soon as relay 32 falls back. In the second case relay 32 is locked to ground on the third wire 57 and of course stays locked. The ground applied to third wire 58 by way of 62 and 61 holds the cut-off relay of line 2 energized, and this same ground

connection on 59 maintains line 2 in busy condition to prevent intrusion by another call. When relay 33 falls back due to the operation of relay 30 the third wires 58 and 59 are again joined to third wire 57 and the temporary ground connection through 61 and 62 removed. The circuit remains in this condition, with relay 32 locked up, until the connector maintaining ground on 57 is released.

The arrangement just described is not essential but it is a desirable feature, as it provides for automatically unlocking relay 32 responsive to an outgoing call from station A if the relay is locked up due to a regular call on line 2, a call in which the transfer service is not involved. The subscriber at station A can make use of this feature if he desires by always momentarily removing his receiver after restoring the key K, which will insure the immediate reestablishment of incoming service to station A, unless a transferred call is actually in progress.

If the feature of selectively unlocking relay 32 is to be left out, the springs 61 and 62 are omitted and the front contact of spring 53 is wired direct through a jack connection 9 to terminal 46. Or in a unit like the one shown in the drawing the armature spring 61 can be easily adjusted so that it will not engage its working contact. Relay 32 will then remain locked up after the key K is restored provided there is a call on line 2, and it cannot be unlocked until the call is released.

Another modification involves the omission of the locking contacts 60, and may be used if the subscriber desires to definitely insure the immediate restoration of incoming service at telephone A upon restoration of key K, even though it may result in the interruption of an office call being answered at telephone B. If this modification is used, however, the subscriber should be instructed to promptly remove his receiver and challenge on the line after the key K is restored, so that if a transferred call was in progress he can take it over. Explaining this a little further, it will be seen that when relay 32 falls back on restoration of the key, the third wire 57, which is grounded if a transferred call is in progress at the time, will be switched back at 53 to its normal connection with relay 30, operating this relay. Relay 30 closes the talking circuit at 35 and 36 and when the subscriber at station A comes on the line he can pick up the call.

The transfer equipment is adapted for use in connection with other types of telephone systems than the one specifically referred to herein. One system in extensive use is similar to the one described, except that the connector bank cables and the line equipment cables have their positions interchanged at the IDF. Obviously the transfer units can be used in this type of system by merely reversing the jumpers such as 11 and 13 at one end or the other. Other systems are known in which no IDF is used and the calling and called branches of the lines are permanently connected. These permanent connections, of course, have to be opened up, by unsoldering at the cable terminals, in order to insert the transfer units. In any case the units will work in manual systems as well as in automatic systems. In manual systems, however, the arrangement is generally such that the third wire of an engaged line is connected to battery instead of ground to make the line busy and to operate the cut-off relay. In order to accommodate the transfer units to this arrangement the relays such as 30 are connected to ground instead of to battery.

The invention having been described, that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

What is claimed is:

1. In a telephone system, an office line, a residence line, a device at the station on the office line adapted for sustained operation to modify the line circuit to indicate an unattended condition so long as said device remains operated, and means at the exchange sensitive to the modified line circuit and effective in response thereto to divert calls intended for the office line to the residence line.

2. In a telephone system, a subscriber's line extending to the exchange, a branch over which the line is called, a transfer relay for switching said branch into multiple connection with the corresponding branch of another line, and controlling means for said relay effective to operate it if one side of the line is grounded at the subscriber's station and not operate it when the receiver is removed.

3. In a telephone system, a subscriber's line extending to the exchange, calling and called branches normally disconnected from the line, a transfer relay for switching the called branch into association with another line, means for operating said relay responsive to grounding the line at the subscriber's station, means responsive to the removal of the receiver when the line is ungrounded for initiating a call over the calling branch, and means responsive to the initiation of the call for extending the line through to the calling branch.

4. In a telephone system, a subscriber's line extending to the exchange, a branch of the line over which the line is called, a transfer relay for switching said branch into multiple connection with the corresponding branch of another line, means for energizing said relay from the subscriber's station, and means for holding said relay independent of said energizing means providing the latter is released by the subscriber at a time when the said first branch is in use.

5. In a telephone system, a subscriber's line extending to the exchange, a branch over which the line is called, a transfer relay for switching said branch into multiple connection with the corresponding branch of another line, means at the subscriber's station for energizing said relay, means for holding said relay after the said energizing means is released provided either of said branches is in use, and means responsive to the removal of the receiver at the subscriber's station for testing to ascertain which branch is in use and for rendering said holding means ineffective if the branch in use is the branch associated with the other line.

6. In a telephone system, a plurality of transfer units, each unit including a relay for directly switching the conductors over which access is had to a line when called into multiple connection with the corresponding conductors of another line, permanent cable connections between said units and the main and intermediate distributing frames, whereby any subscriber's line may be equipped with one of said units by running jumpers at said frames, and means at the station on each line so equipped for maintaining the relay in the associated unit energized while the subscriber is absent from the station.

7. In a telephone system, a subscriber's line,

calling and called branches of said line normally disconnected from the line, each branch including two line conductors and a test conductor, said test conductors being normally disconnected, a relay normally bridged across the subscriber's line and responsive to the removal of the receiver at the subscriber's station for initiating a call over the calling branch, a second relay operated as a result of the grounding of the test conductor of the calling branch responsive to initiation of the call, and contacts on said second relay for disconnecting said first relay, for connecting the subscriber's line to the line conductors of the calling and called branches, and for connecting said test conductors together.

8. In a telephone system, a subscriber's line, a branch of said line accessible to connector switches, a second branch extending to line equipment, test conductors included in said branches normally disconnected from each other, a relay energized over the test conductor of the connector branch when the line is called, and contacts on said relay for connecting said test conductors together.

9. In a telephone system, a subscriber's line, a normally disconnected calling branch extending to line equipment for initiating outgoing calls, two relays normally bridged across said line and responsive to the removal of the receiver, contacts on one line relay for initiating the operation of said line equipment, a third relay connected to the test conductor of said calling branch by the other of said line relays, said third relay being energized over said test conductor responsive to the operation of said line equipment, and contacts on said third relay for locking itself to said test conductor, for disconnecting said line relays, and for connecting the subscriber's line with said calling branch.

10. In a telephone system, a subscriber's line, a called branch for said line normally disconnected from said line, a relay energized when the line is called to connect said called branch to the line, a transfer relay controlled over said line from the subscriber's station, and contacts on said transfer relay effective when the relay is in energized condition for maintaining said called branch connected in multiple to another subscriber's line and for preventing the energization of said first relay when the said first line is called.

11. In a telephone system, a subscriber's line, a transfer relay for diverting calls intended for said line to another line, two line relays normally bridged across said line, one relay being responsive to grounding the line at the station and both relays being responsive to bridging the line at the station, and a circuit for said transfer relay controlled jointly by said relays.

12. In a telephone system, a subscriber's line, a key at the station on said line, a relay at the exchange held energized over one side of the line while said key is in operated position, a transfer relay for diverting calls intended for said line to another line, a circuit for said transfer relay closed by said first relay, another relay energized over said first line responsive to the removal of the receiver, and contacts on said last mentioned relay for disabling said circuit to deenergize said transfer relay.

13. In a telephone system, a main frame on which subscribers' lines are terminated, an intermediate frame on which calling and called line branches are terminated, a transfer unit comprising a transfer relay and a plurality of controlling relays, connections from said unit to a set of terminals on said main frame and to three sets of terminals on said intermediate frame, a jumper connecting said first set of terminals to a subscriber's line, and three jumpers connecting said three sets of terminals, respectively, with the called branch of said subscriber's line, the calling branch of said subscriber's line, and another subscriber's line, the said unit and connections including said jumpers constituting means whereby the station on said first line can extend and receive calls and whereby incoming calls can be diverted to said other line at times when the station is unattended.

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