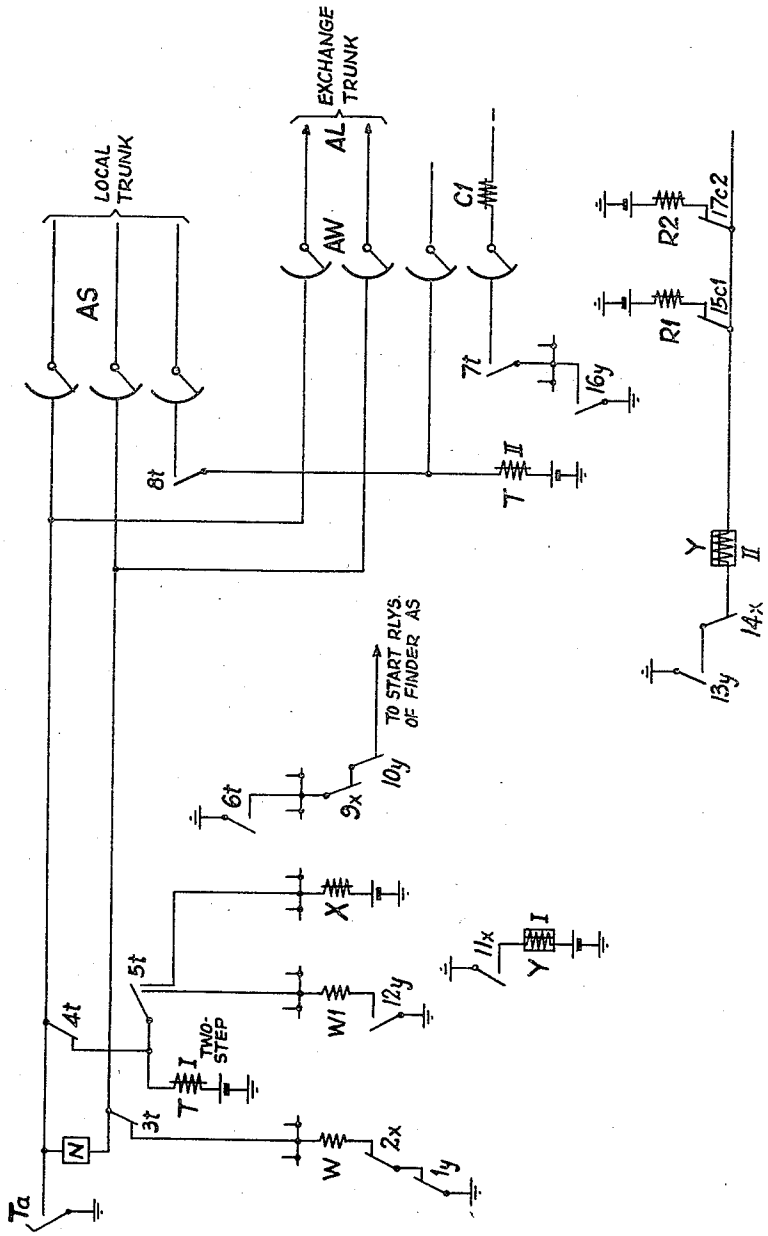
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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The present invention relates to automatic telephone systems and in particular to those systems in which the establishment of connecting paths is effected by a special switching operation, for example the operation of an earthing key at the calling station. In order to prevent the particular switching operation from causing undesired switching, as is possible in many systems, and in particular to prevent the earth connected to the subscriber's line by the depression of a key, from influencing connecting devices which have been taken into use, it has been proposed to allow the call initiating impulses to become operative only on the termination of the switching operation so that the starting relay is not energized until this moment, whereupon it effects the setting up of the connecting path.

The application of this principle, however, involves difficulties if the starting relay cannot be maintained energized over the subscriber's line, either because the subscriber has not yet taken up his receiver, or, in the case of other kinds of call initiating impulses which promote the setting up of connecting paths in other traffic directions, because neither the energizing nor the holding of the relay can depend upon the completion of the line loop. The known registering of the call initiating impulse until a connecting path has been set up between the calling subscriber and an outgoing line, is however only applicable, if, by means of specially constructed switching means, the switching operation (earthing) at the subscriber's line occupies so short a time that it is completed before the subscriber's line is switched through to the outgoing line, on account of the necessity for preventing subsequent switching devices from being influenced by the special switching operation for producing the call initiating impulse, for example the earthing of the subscriber's line. The application of specially constructed switching means, in particular earthing keys, is undesirable especially when similar switching operations (earthing) on the part of the subscriber are necessary for other purposes and the differentiation in the exchange between the various switching operations is dependent upon the duration of the operations. If keys are to be used at the subscriber's station and a special key is to be provided for the call initiating impulse it would be necessary in these systems, to provide at least two keys per station.

The use of the known call registering has moreover the disadvantage that if all the lines in the desired traffic direction are engaged, the call initiating impulse may become operative at a moment when the calling subscriber is not present to complete the call. This has the effect that connecting paths are unnecessarily withdrawn from the general traffic, including possibly urgent calls, at least for a definite period even if time switching devices are provided for the release.

All these difficulties are avoided by the present invention in that switching means are provided which, under the influence of the characteristic signal for the termination of the call initiating impulse produced by a special switching operation at the subscriber's station, effect the registering of the initiating impulse only if there is a free outlet in the desired traffic direction.

One embodiment of the invention is presented in the drawing. The arrangement under consideration is a private branch exchange system in which the removal of the receiver initiates the setting up of a local call. When the receiver is removed at telephone N relay T is partially energized over: earth, contact *1y*, *2x*, resistance W, contact *3t*, over the loop of subscriber N, contact *4t*, winding I of relay T, battery, earth. Relay T operates its contacts *5t*, *6t*, *7t*, and *8t*. Relay X is connected up in parallel to winding I of relay T, over contact *5t*. Relay X is not energized in this circuit, however, on account of the resistance W. The call initiating impulse is transmitted to the relay chain of the call finder over contact *6t* and the contacts *9x* and *10y*. The call finder AS is then set on the subscriber's connection characterized by contact *8t*. Relay T is now fully energized over its winding T*II* and breaks the call initiating circuit at contacts *3t* and *4t*.

The subscriber N can now bring about the setting of the further connecting devices reached over the call finder AS by dialing impulse trains to establish a connection with another local subscriber.

If subscriber N desires a connection with the exchange line AL over the exchange selector AW, he merely has to depress his key T*a*. The following circuit is thereby set up: earth, key T*a*, contact *4t*, winding I of relay T, battery, earth. Relay T energizes partially. The closing of contact *5t* again connects up relay X in parallel with winding I of relay T and this time relay X operates its contacts because the resistance W is not included in its circuit. Relay X opens contact *9x* and thus prevents relay T from transmitting the call initiating impulse at contact *6t* to the relay chain of the call finder AS. Relay X also closes contact *11x*, over which relay Y energizes. At contact *12y* relay Y completes the following locking circuit for relay T: earth, con-

tact 12*y*, resistance W1, contact 5*t*, winding I of relay T, battery, earth. Relays X and Y are now both energized. Accordingly, contact 13*y* is closed and contact 14*x* opens. A starting impulse therefore cannot be transmitted to the relay chain of the exchange selector AW. Relay X does not deenergize until the subscriber releases the key T*a*, this relay being still connected in parallel with winding I of relay T. With key T*a* released relay X deenergizes because it cannot hold up in series with winding I of relay T or the resistance W1. If there is an exchange line free at this time, the call initiating impulse is transmitted by contact 14*x* to one of the relays R1, R2, etc., which cause a free exchange selector such as AW to be set on the calling subscriber's line. If the first exchange selector of the series is free the following locking circuit for relay Y and energizing circuit for relay R1 is completed; earth, contacts 13*y*, 14*x*, winding II of relay Y, contact 15*c*1, relay R1, battery, earth. Relay R1 causes the stepping of the exchange selector AW. The exchange selector AW is advanced until it reaches the contact characterized by contacts 7*t* and 16*y*, when it is brought to rest by the energizing of the testing relay C1 in the known way (not represented). Contact 15*c*1 is opened by relay C so that a further starting impulse cannot be transmitted to the exchange selector AW.

If all the exchange lines are engaged, all the C-contacts (15*c*, 17*c*, etc) which are connected in parallel, are open. In this event the locking circuit for relay Y cannot be set up, when relay X releases. Relay Y therefore deenergizes, and at contact 12*y* breaks the locking circuit for relay T. Relay T returns its contacts to normal. Since relay X which effects the characterizing of an exchange call is common to several or all of the subscribers, the establishment of the starting circuit for local calls by other subscribers is prevented by the opening of contacts 1*y* and 2*x* in the case when the characteristic signal has been given for exchange calls by one subscriber so that there is no chance of the exchange selector AW being set on the connection of another subscriber who by taking up his receiver only gives the starting impulse for setting up a local call.

Since in the present arrangement the initiating impulse for setting up an exchange call is produced merely by the depression of a key T*a*, means can be provided in any well known manner whereby a signal is transmitted to the calling subscriber after the exchange selector has been set on his connecting line to inform him that he is connected with an exchange line.

If a subscriber, either intentionally or unintentionally operates his key T*a* for a prolonged period a group of the subscribers or all of them are prevented from transmitting a call initiating impulse during this period. In order to prevent this, time switching devices, thermo-relays or the like, can be provided with release the condition (relays T, X, and Y energized) produced by the prolonged depression of the key, while at the same time transmitting a signal to the subscriber or to an operator, characterizing the improper use of the system.

What is claimed is:

1. In a telephone system, a subscriber's line, a local finder and a trunk finder having access to said line, a key, a first and second relay, said first relay operated responsive to the closing of said subscriber's line for starting said local finder to find said line, said first and second relay operated responsive to the closing of said subscriber's line while said key is actuated, said second relay preventing the starting of said local finder, a third relay operated responsive to the operation of said second relay to prepare the starting circuit of said trunk finder, said second relay deenergized responsive to the restoration of said key to complete the start circuit for starting said trunk finder to find said line.

2. In a telephone system, a subscriber's substation and line therefor, a local trunk, a first finder, a toll trunk, a second finder, a key at said substation operated before the receiver is removed at said substation and released immediately thereafter when a toll call is made, a relay operated responsive to the removal of the receiver at said substation for completing the start circuit for said first finder for connecting said subscriber's line with said local trunk, means including said relay controlled by the removal of the receiver and the momentary operation of said key for opening the start circuit of said first finder and for preparing the start circuit of said second finder, and means responsive to the release of said key for completing the start circuit for said second finder for connecting said subscriber's line with said toll trunk.

3. In a telephone system, a subscriber's line, a first and a second finder having access to said line, three relays associated with said line, a first of said relays operated over a circuit including the conductors of said line to start said first finder to find said line when one call is initiated, a key for placing a ground potential on said line when the subscriber desires to extend a connection via said second finder, said first relay operated over a circuit including said key and one conductor of said line, a second of said relays operated in a multiple circuit with said first relay, means responsive to the operation of said second relay for completing an operating circuit for the third of said relays and for preventing the starting of both finders, said second relay releasing responsive to the restoration of said key immediately after the receiver of the subscriber on said line is removed for releasing said second relay to start only said second finder to find said line.

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