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TELEPHONE EXCHANGE SYSTEM

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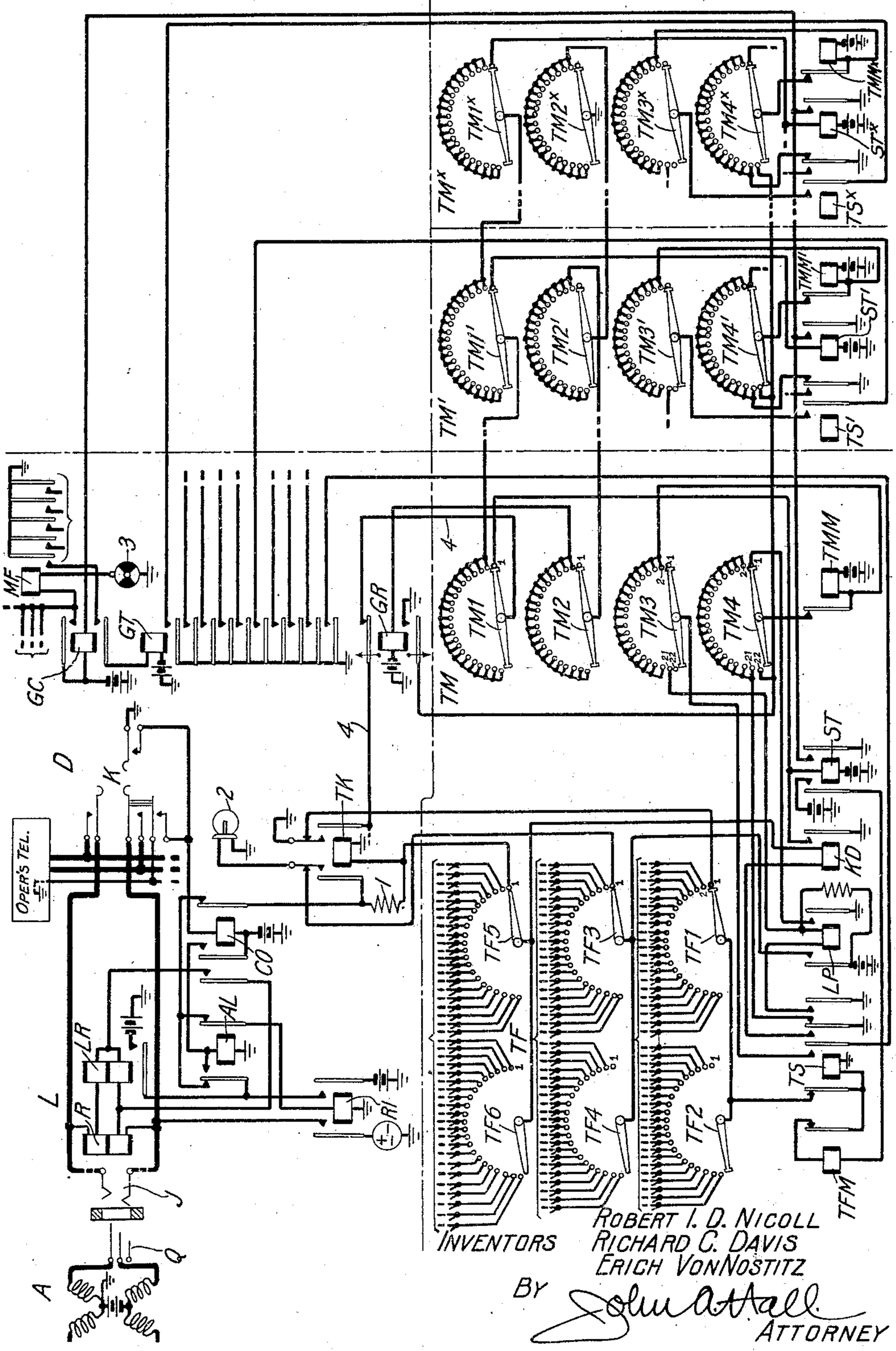

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UNITED STATES PATENT OFFICE

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TELEPHONE-EXCHANGE SYSTEM

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This invention relates to improvements in signaling systems and more particularly to improvements for controlling signal devices employed in connection with telephone lines.

In telephone exchange systems wherein a line has an associated signal device such as a lamp which is lighted, when the line is connected to at the other end, for the purpose of indicating to the operator that a call is awaiting attention, it frequently happens, especially during busy periods, that the call may remain unanswered for a longer time than is necessary or desirable.

An object of this invention is to avoid such delays in answering calls by changing the condition of the signal device, after a predetermined time interval, to indicate the oldest of the unanswered calls, in such a manner that it will be quickly noticed by the operator. A feature of the invention, by means of which the foregoing object is attained is a timing circuit arrangement, common to a plurality of lines, which arrangement comprises an automatic selector switch mechanism, whereby the line lamp is caused to flash after a predetermined interval of time.

More specifically this timing arrangement, which is automatically taken for use when a call arrives, hunts for and connects to the calling line and then, after a certain time interval determined by the time required for the selector switch to move from its starting position to a predetermined advanced position, closes a circuit to cause the line lamp to flash.

Another feature is an arrangement whereby any desired time interval may be had between the arrival of the call and the time flashing commences.

Another feature is the provision, for a plurality of lines, of a group of timing circuits less in number than said lines and arranged to be seized in sequential order by successive calling lines.

Another feature is the arrangement of said timing circuits in such a manner that any circuit after having been taken for use to time a call and subsequently released, by the call being answered, is placed in a waiting condition and not made ready for seizure by a succeeding call until all other timing circuits of the group are either in use or in a similar waiting condition.

The present invention will clearly appear from the following description when read in connection with the drawing, which illustrates one embodiment of the idea.

In the drawing L is one of a plurality of trunk lines extending from a switchboard position A to central office desk or other terminating point D. When the operator at position A desires to communicate with the desk D the calling plug Q of her cord circuit is inserted into jack J of the trunk L whereupon battery from the cord circuit traverses the conductors of the trunk, the retardation coil R and the two windings of the line relay LR in series thereby causing this relay to operate. The operation of LR causes the operation of relay TK over a circuit which may be traced from battery, contacts of relay LR, left hand normal contacts of relay AL, right hand normal contact of relay CO, resistance 1. and winding of relay TK to ground. The relay TK in operating causes the line lamp 2 to be lighted over a portion of the previously described circuit which extends from battery, at the contacts of relay LR, over the left hand normal contacts of relay A, the right hand normal contacts of relay CO and the now operated left hand alternate contacts of relay TK to ground through the lamp 2. The operation of relay TK also causes the start relay ST to be operated by closing the following circuit: battery, winding of relay ST, terminal 1 and brush TM^1 of the selector switch TM, upper normal contacts of relay GR to ground at the right hand alternate contacts of relay TK. In case the selector TM of the first timing circuit is off normal, due to another call, the relay ST′ of the next idle timing circuit will operate from the strapped contacts of arc TM^1 of the selector TM over the brush and contact 1 of the selector TM′.

In case the brushes of the trunk finder selector TF are standing in the position shown in the drawing, i. e. with brushes TF^1, TF^3 and TF^5 on terminal 1 which corresponds to the trunk L, the stepping magnet

TFM will not operate when relay ST is energized due to the fact that ground has been removed from terminal 1 of the arc associated with brush TF¹ by the operation of the relay TK of that line. If, however, selector TF is standing on an idle trunk, ground will be present on either brush TF¹ or TF² due to the non-operated condition of the TK relay of the trunk on which the selector is standing and the stepping magnet TFM will operate in a circuit which may be traced from battery, left hand alternate contacts of relay ST, winding and normal contacts of magnet TFM, left hand normal contacts of relay TS and whichever brush, TF¹ or TF² that is resting on a grounded terminal. The magnet TFM will continue to step the selector TF in the usual manner until it finds the trunk for which it is hunting, i. e. the one whose TK relay is operated. Finding no ground on this terminal of the selector TF the stepping magnet TFM will stop and the high resistance relay TS will operate, which relay has heretofore been short-circuited by the ground found by the brushes of the selector TF. Due, however, to the high resistance of the relay TS insufficient current is permitted to flow through the magnet TFM to cause it to operate further.

As it is assumed that the trunk L is calling, the operation of relay TS closes a circuit for operating the knock down relay KD. This circuit may be traced from ground, right hand middle alternate contacts of relay TS, winding of relay KD, brush TF⁵ and No. 1 terminal of selector TF, resistance 1, right hand normal contacts of relay CO, and left hand normal contacts of relay AL to battery at the operated contacts of the line relay LR. The low resistance of the winding of relay KD is now connected in parallel with the high resistance winding of the relay TK. This latter relay TK, being effectually short-circuited, releases.

Relay TS in operating also closes an obvious energizing circuit for relay LP which provides battery, at its left hand alternate contact over brush TF³ and contact 1 of its associated arc to keep the line lamp 2 lighted when relay TK releases.

Relay KD in operating provides ground at its alternate contacts for holding relay ST operated when selector TM is moved off terminal 1 by the operation of relay LP which, by closing its right hand alternate contacts, supplies ground over terminal 1 and brush TM⁴ to energize the stepping magnet TMM of the selector TM, thereby causing this selector to make one step ahead.

The release of relay TK replaces ground on its associated terminal on the No. 1 or 2 arcs of the selector TF so that the next selector hunting for a trunk will pass it by. From this it will be noted that both busy and idle trunks test the same, the only difference being when a trunk selects an idle flashing circuit and the flashing circuit hunts to find the trunk having a non-grounded terminal.

When the ST relay operated it also operated the group control relay GC, over an obvious circuit, which relay in operating closes at its upper alternate contacts a circuit for the master flashing relay MF under control of a machine interrupter 3. The MF relay which is common to all the groups of flashing circuits in turn completes an obvious circuit for the operation of the group timing relay GT under control of the GC relay. The operation of the GT relay, in step with the interrupter 3, energizes the magnet TMM of the selector TM and steps the selector ahead one terminal per interruption until the prescribed time that flashing is to start. The energizing circuit for magnet TMM is completed from ground at the lowermost alternate contact of the multi-contact relay GT, the inner right hand alternate contacts of relay TS, brush TM³ and strapped contacts of the associated arc of selector TM and the winding of TMM to battery.

In the present instance the circuit is arranged for the line lamp 2 to be continuously lighted for 20 interruptions before flashing starts and therefore terminals 2 to 20 of the TM³ arc of the selector TM are strapped together and wired direct to the stepping magnet TMM.

When the brushes of selector TMM move off terminal 20 the foregoing circuit for stepping magnet TMM is opened and the selector rests on terminal 21. Intermittent ground from the contacts of relay GT is now supplied over the brush TM³ and contact 2 of the associated bank to intermittently short-circuit the relay LP, thereby causing this relay to release in step with interrupter 3 and causing the lamp 2 to flash.

The operator in answering the call, either before or after flashing starts, operates the key K to the left or answering position, thereupon closing an obvious circuit to operate the CO relay which opens at its right hand contacts the energizing circuit for the KD relay and allows it to release.

The release of the KD relay releases the ST relay, which initiates the release of the GC, MF and GT relays. The release of the ST relay also releases relay TS which, in turn, releases relay LP to extinguish the lamp 2. The release of the TS relay also opens the ground circuit from the GT relay to the No. TM³ arc of the TM selector to facilitate the restoration of the TM selector, which now takes place due to the connection of ground, at the right middle normal contacts of relay TS, to the strapped terminals of the No. TM⁴ arc of the selector TM.

As long as the brush TM⁴ of the selector TM encounters ground, the stepping magnet TMM will continue to move the selector ahead until the brush moves on to terminal 22 in

which position it stops unless all the other timing circuits are in use, in which case the relay GR will be operated, thus grounding terminal 22, thereby causing magnet TMM to move the selector ahead one more step to terminal 1, in which position the selector TM is in condition to receive and time the next call. This feature will be considered more fully further along.

At this time all the relays of the timing circuit are released; the TF selector is resting on the terminal on which it found its last trunk and the TM selector is resting on terminal 22 waiting to be advanced to terminal 1.

If it be assumed that the foregoing describes the operation of the first timing circuit, it will be readily seen that with the TM selector standing anywhere off normal, that is, anywhere except on terminal 1, a second call on the same or another trunk is switched through brush TM^1 to the next timing circuit whose TM selector is resting on terminal 1. For example, if it be assumed that the operator at A recalls immediately over line L, relay TK will operate and ground will be connected to the brush TM^1 of the first selector TM, which selector we have just assumed is standing on terminal 22 and, as terminals 2 to 22 of the No. 1 arc are strapped together and connected to the next timing circuit selector TM', this ground will be extended until it finds a path over a No. 1 terminal to energize a start relay ST'—ST^x.

In case all the timing circuits have their TM selectors advanced beyond position 1, then a circuit is closed from ground on brush TM^{2x} through all the No. 2 arcs and brushes of the TM selectors to energize the group restore relay GR, which when operated connects ground at its bottom contacts to advance all the TM selectors, which are resting on terminal 22, to terminal 1.

As soon as any one of the TM selectors resting on terminal 22 advance to terminal 1, the series circuit through the TM^2 brushes and the GR relay is opened and this relay slowly releases. The GR relay is made slow to release to give all the idle TM selectors time to reach terminal 1.

When all the timing circuits whose TM selectors were standing on terminal 22 have been advanced to position 1 the first one of these in the sequence counting from left to right will be seized by the next call.

From the foregoing it will be seen that each timing circuit operates in turn until all have been operated after which the ones which have been released, i. e. the ones whose calls have been answered, are restored to normal (position 1) and then selected in order of their position in the sequence. As each timing circuit is released it is advanced to position 22 and there waits until all the other TM selectors of the group are either engaged in timing a call or are waiting in position 22, at which time, as before described, the group restore relay GR operates to advance these waiting circuits to position 1.

It will also be noted that although certain calls are answered more promptly than others, each timing circuit will, over a period of time, have a substantially equal amount of use for the reason that a circuit that has been seized and released is not advanced into position to be seized again until all circuits of the group, which are in their normal position (position 1), have been seized, and even then a restored circuit, although standing in position 1, cannot be seized until all circuits preceding it in the sequence, which were advanced at the same time from position 22 to position 1, are taken for use.

It will be further noted that in the extreme case if all timing circuits of the group are simultaneously engaged in timing calls and a further call arrives before a circuit is released and advanced to position 1, the call will not be lost as the line lamp 2 will light in the usual manner, the only difference being that the interval between the arrival of the call and the time flashing begins will be increased by the period that all timing circuits are held in use. Under these circumstances as soon as a timing circuit is released and advanced to position 22 and from there to position 1, ground from the operated TK relay of the calling line will energize the ST relay of the now restored timing circuit. From this point the operation will proceed in the usual manner, as previously described. It will be still further noted that the normal interval which will elapse before flashing starts is controlled by the strapping of the terminals of the TM3 arc of the TM selector and the speed of interrupter 3. If we assume interrupter 3 to operate at the rate of 60 interruptions per minute, that is 1 per second, then the TM selector is use will advance one terminal per second as long as the #3 brush encounters ground and will stop on the first ungrounded terminal, which should be connected to relay LP in such a manner as to short circuit it while relay GT is operated.

By this arrangement the time interval before flashing starts can be readily adjusted to suit any condition by merely changing the strapping of the #3 bank and connecting the first unstrapped terminal to the LP relay in the manner shown and described.

What is claimed is:

1. In a telephone system, a line, an operator's position, a signal device for said line thereat, means responsive to seizure of said line for operating said device to indicate the arrival of a call, and a timing mechanism including a selector switch which is set in motion responsive to the arrival of a call for changing the character of operation of said

signal device after a predetermined time interval.

2. In a telephone system, a line, an operator's position, a signal device thereat for said line, means responsive to seizure of said line for operating said device to indicate the arrival of a call, a timing mechanism, including a selector switch, adapted to hunt for said line in response to the arrival of a call and after a predetermined time interval following its finding said line to change the character of operation of said signal device.

3. In a telephone system, a line, an operator's position, a line lamp for said line at said position, means for lighting said lamp to indicate the arrival of a call, a selector switch adapted to hunt for said line in response to the actuation of said means, and a timing mechanism actuated in response to finding said line to cause said line lamp to flash after a predetermined time interval.

4. In a telephone system, a line, an operator's position, a line lamp for said line at said position, means for lighting said lamp to indicate the arrival of a call, a selector switch adapted to hunt for said line in response to the actuation of said means, and a timing mechanism including a second selector switch actuated in response to finding said line to cause said line lamp to flash after a predetermined time interval.

5. In a telephone system, a line, an operator's position, a line lamp for said line at said position, means for lighting said lamp to indicate the arrival of a call, a selector switch adapted to hunt for said line in response to the actuation of said means, and a timing mechanism, including a second selector switch, actuated in response to finding said line to cause said line lamp to flash after a predetermined time interval, said second selector switch being so arranged as to be readily adjusted to determine said time interval.

6. In a telephone system, a line, an operator's position, a signal device thereat for said line, means responsive to seizure of said line for operating said device to indicate the arrival of a call, and a timing mechanism including a selector switch set in motion responsive to the arrival of a call for changing the character of operation of said signal device after a predetermined time interval, said selector switch being so arranged as to be readily adjusted to determine said time interval.

7. In a telephone system, a line, an operator's position, a signal device thereat for said line, means responsive to seizure of said line for operating said device to indicate the arrival of a call, and a timing mechanism including a selector switch set in motion responsive to the arrival of a call for changing the character of operation of said signal device after a predetermined time interval, said selector switch being so arranged that said time interval is determined by the number of terminals that are connected together on one of its arcs.

8. In a telephone system, a plurality of lines, an operator's position, a signal device at said position for each line, means responsive to seizure of a line for operating its associated signal device to indicate the arrival of a call, a group of timing mechanisms less in number than said lines, each mechanism including a selector switch, and means responsive to the arrival of a call on one of said lines for seizing an idle one of said timing mechanisms for changing the character of operation of the associated signal device after a predetermined time interval.

9. In a telephone system, a plurality of lines, an operator's position, a signal device at said position for each line, means responsive to seizure of a line for operating its associated signal device to indicate the arrival of a call, a group of timing mechanisms less in number than said lines, each mechanism including a selector switch, means responsive to the arrival of a call on one of said lines for seizing an idle one of said timing mechanisms for changing the character of operation of the associated signal device after a predetermined time interval, and means responsive to said call being answered at said position for advancing said selector switch into an intermediate position where it cannot be seized for use again until all other mechanisms of the group have been seized.

10. In a telephone system, a plurality of lines, an operator's position, a signal device at said position on each line, means responsive to the seizure of a line for operating its associated signal device to indicate the arrival of a call, a sequentially operating group of timing mechanisms less in number than said lines, each including a selector switch, means responsive to the arrival of a call over one of said lines for seizing the first idle mechanism in the group for changing the character of operation of the associated signal device after a predetermined time interval, means responsive to said call being answered at said position for releasing said timing mechanism, and means responsive to seizure of the last idle mechanism in the group for restoring said released mechanism to normal in readiness for reseizure.

In witness whereof, we hereunto subscribe our names this 15th day of September A. D., 1927.

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