

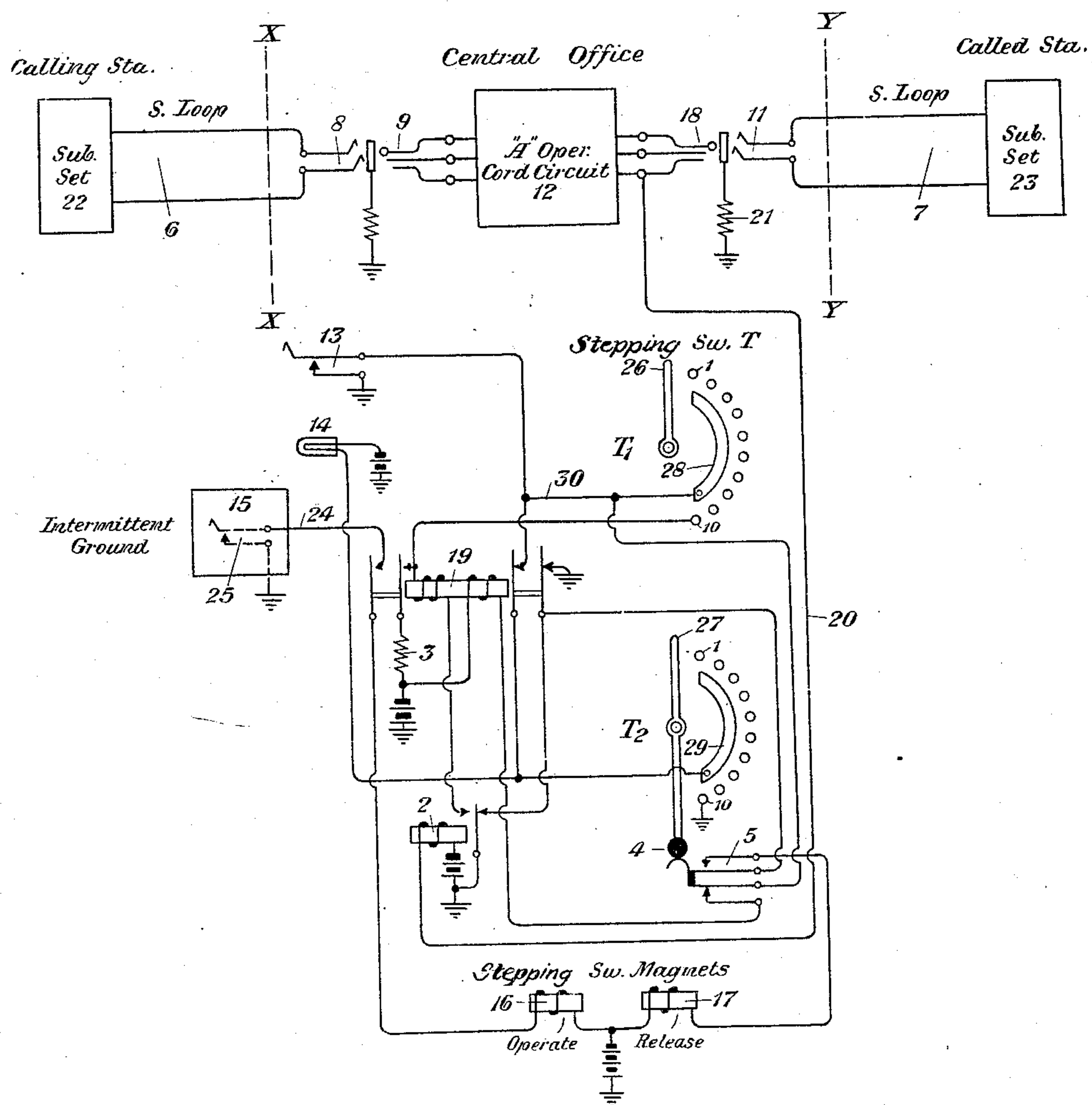
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TIMING CIRCUIT FOR TELEPHONE CALLS

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TIMING CIRCUIT FOR TELEPHONE CALLS

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This invention relates to the art of telephony and discloses a novel circuit arrangement for timing telephone calls. The circuit does not measure the exact length of the call, but operates signaling means when the call has continued for a certain length of time. Upon restoration of the circuit to normal, thereafter, it will again operate the signal when a like period of time has again elapsed. This cycle of operations may be repeated indefinitely while the call continues. The circuit is started in operation by the manual depression of a key switch, and is restored to normal and started anew by a second depression of the key switch. The circuit is controlled over the sleeve of an "A" operator's cord circuit, and will function only while the front cord thereof is connected to a telephone trunk or subscriber's circuit. The timing circuit employs a clock operated mechanism or other means for periodically completing an electrical circuit. With a connection completed from the "A" cord circuit to a called subscriber, the depression of a "start" key connects the operating magnet of a stepping switch in the circuit controlled by the timing mechanism. Each time this circuit is completed by the timing pulses, the arms of the stepping switch are rotated one step. At the last step the switch arms complete a circuit to operate a signal, indicating that a certain period of time has elapsed since the key was first depressed. Upon again depressing the start key the signal is extinguished and the stepping switch quickly restored to normal, whereupon the timing pulses will again cause the switch arms to be rotated to the final position, once more operating the signals. This procedure may be continued indefinitely while the connection is established. Upon failure to depress the start key at the end of such a cycle, the timing signal will remain steadily operated until the "A" cord circuit is disconnected, at which time the circuit is restored to normal. At any intermediate point in the cycle, the circuit is restored to normal upon disconnection of the "A" cord circuit.

The detailed operation of the circuit will now be explained with reference to the draw-

ing, which shows a wiring diagram of the timing circuit associated with an "A" operator's manual cord circuit, which latter is shown schematically. Calling and called subscribers' stations are also shown on the drawing in schematic form.

Referring to the drawing, the calling subscriber's set 22 is connected over loop 6 to a central office. Called subscriber's set 23 is connected over loop 7 to the same central office. The manual "A" operator's cord circuit 12 serves to interconnect the two subscribers' loops. Associated with the cord circuit 12 is the timing circuit which constitutes the remainder of the drawing. All of the timing equipment is located at the central office in question.

The connection is established between subscribers in the usual fashion by removal of the receiver of subset 22 from the switchhook to operate a line signal at the central office, whereupon the operator there connects the back cord plug 9 of the "A" cord circuit 12 to jack 8 of the calling subscriber's loop. Upon receiving the called number the operator proceeds to complete the connection by connecting the front cord plug 18 of cord circuit 12 to jack 11 associated with the called subscriber's loop 7. The operator then rings on subscriber's line 7.

Associated with the sleeve circuit of the plug 18 is lead 20 which connects with the timing mechanism. When plug 18 is connected to jack 11, relay 2 of the timing circuit is operated, the circuit being traced from battery through the winding of relay 2, over lead 20 and the sleeve circuit of plug 18 to ground through resistance 21 connected to the sleeve of jack 11. The operation of relay 2 prepares the timing circuit for operation under control of the manually operated "start" key 13.

The "A" operator having established the connection as explained above, supervises on the connection until the called party answers. When the front cord supervisory lamp is extinguished indicating such to be the case, the "A" operator momentarily depresses key 13 to start timing of the call. The depression of key 13 connects ground to operate relay 19

on a circuit from battery, through the right winding of relay 19, through the lower normally closed contacts of switch 5 to ground at key 13. Relay 19, upon operating, immediately locks to ground on a circuit from battery, through resistance 3, left inner front contact and left winding of relay 19, to ground at the front contact of relay 2 which latter, as was explained above, is operated to ground over the sleeve circuit of the called station.

The operation of relay 19 connects the timing means to the stepping switch and starts the timing of the call as follows. The rectangle 15 represents some sort of timing device for periodically connecting ground to lead 24. Any suitable device may be used for this purpose, such as a clock operating a cog which closes switch 25 momentarily at periodic intervals, or a slow operating relay or switching arrangement might be used which required an appreciable time between successive operations. In the present case it will be assumed that the device 15 closes switch 25 once every 36 seconds. The operation of switch 25 controls the operation of the stepping switch.

The stepping switch is shown at T. Two arcs T_1 and T_2 are required for the switch, having associated therewith rotatable arms 26 and 27, respectively. The arms are mounted on a common shaft which latter is controlled by an "operate" magnet 16 and a "release" magnet 17. For each operation of magnet 16, the switch arms are rotated one step in a clockwise direction. Upon the first operation of magnet 16, the arms are rotated from the normal position as shown on the drawing to contacts 1 on the stepping switch arcs. For successive operations the arms pass successively over steps 2, 3, etc. up to 10, after which no further rotation occurs. Upon a single operation of the release magnet 17, the arms are quickly rotated under spring tension in a counter-clockwise direction to the non-operated or normal position as shown.

The operation of switch 5 is controlled by arm 27 of the stepping switch. With the stepping switch in its normal position as shown, insulating segment 4 affixed to arm 27 depresses the movable contacts of switch 5 in the manner indicated, causing the closure of the lower contacts. As soon as arm 27 rotates one step in a clockwise direction, segment 4 moves off the movable contacts of switch 5, and the latter, being under spring tension, immediately move upward causing the closure of the upper contacts. Thus with the stepping switch normal, the lower or "normal" contact of switch 5 is closed and with the arms of the stepping switch off normal, the upper or "off-normal" contacts are closed.

Returning now to the operation of the

timing circuit, each time ground is connected to lead 24, magnet 16 operates advancing the arms of stepping switch T one step. The circuit is traced from battery, through the winding of magnet 16, left outer front contact of relay 19, over lead 24, through contacts of switch 25 to ground. With 36-second intervals between successive steps, a period of about 6 minutes will have elapsed when the arms are rotated to step 10. When the arms make contact with step 10, a circuit is closed to light lamp 14. This circuit is traced from battery, through lamp 14 to conducting segment 29 of arc T_2 , through arm 27 to ground associated with contact 10 of arc T_2 . Lamp 14 remains lighted until extinguished by the operator. No further circuit operation will occur until then. The operator, upon noting the lighted lamp will make note of this fact and restore the circuit to normal by again depressing key 13. The depression of key 13 shorts circuit relay 19 causing its release. The circuit for accomplishing this is traced from battery, through resistance 3, left inner front contact of relay 19, contact 10, arm 26, and conducting segment 28 of arc T_1 and over lead 30 to ground at key 13. It will be seen that this direct path to ground shunts the left or holding winding of relay 19 causing its release. Resistance 3 is merely a current limiting device in this operation.

The release of relay 19 closes a circuit to operate the release magnet 17 to restore the stepping switch to normal. The circuit is traced from battery through the winding of magnet 17, "off-normal" contacts of switch 5, to ground at the right outer back contact of relay 19. During the restoration of the stepping switch to normal, lamp 14 remains lighted over the circuit from battery, through lamp 14, right inner back contact of relay 19, to ground at key 13, assuming, of course, that the operator holds the key depressed while the stepping switch is being restored.

As soon as the stepping switch returns to normal, relay 19 reoperates over the circuit from battery, through the right winding of relay 19, "normal" contacts of switch 5, to ground at key 13 assuming the key still depressed. When relay 19 operates, it again immediately locks through its left winding to ground at relay 2 as explained above. The operation of relay 19 opens at its right inner contacts the circuit described above for maintaining lamp 14 lighted. The extinguishment of lamp 14 furnishes a signal to the operator that the stepping switch has restored to normal, whereupon she releases key 13. It should be pointed out here, of course, that key 13 need only be depressed a brief interval of time for the above operations to be accomplished as the stepping switch is restored very quickly.

The reoperation of relay 19 starts anew

the cycle of operations which terminates in the lighting of lamp 14. This will occur at the lapse of an additional 6-minute period, or about 12 minutes from the commencement of the call. Each time lamp 14 lights, the cycle of operations may be repeated by depressing key 13, provided, of course, plug 18 is left connected to jack 11.

When the subscribers hang up, the lighting of the supervisory lamps associated with the front and back cords of the "A" cord circuit will apprise the "A" operator that the call is complete. The "A" operator will thereupon disconnect plugs 9 and 18 from jacks 8 and 11, respectively. The disconnection of plug 18 will restore the timing circuit to normal if the stepping switch is in any off-normal position at the moment of such disconnection. The disconnection of plug 18 removes the ground from lead 20, thereby opening the operating circuit for relay 2, causing its release. The release of relay 2 completes a circuit from battery through the winding of release magnet 17, "off-normal" contacts of switch 5, which are closed in any off-normal position, to ground through the back contact of relay 2. The stepping switch is thus restored to normal. The release of relay 2 in turn releases relay 19, by opening at the front contact of relay 2, the holding circuit through the left winding of relay 19. The release of relay 19 disconnects the intermittent ground at 15 from the operating magnet 16 and thus all circuits are restored to normal.

The timing circuit described does not in general commence timing the call from the moment the start key 13 is depressed. This is due to the intermittent grounding of lead 24 through the clock mechanism. In the present instance it was assumed that a ground is connected to lead 24 once every 36 seconds. If the start key 13 happens to be depressed immediately after lead 24 has been grounded, approximately 36 seconds must elapse before this lead will again be grounded to step the stepping switch T around to the first step, and 6 minutes will elapse before the arms of the stepping switch arrive at step 10 to operate lamp 14. On the other hand, if key 13 is depressed just before lead 24 is grounded, the stepping switch will be immediately rotated to step 1, and only 5 minutes and 24 seconds will elapse until the switch arms arrive at step 10 to operate lamp 14. Thus there is a spread of 36 seconds which represents the possible error in timing. This spread may, of course, be cut in half by grounding lead 24 once every 18 seconds and providing 20 contacts on the stepping switch instead of 10. Or the timing may be made as accurate as desired by similar methods.

The above discussion thus brings out the purposes of the stepping switch, which are to provide accurate timing while at the same

time causing lamp 14 to light only at the termination of a fairly long interval. Thus if lamp 14 were connected directly to the timing device 15 through operation of the start key 13, the other apparatus being assumed for the moment omitted, the lamp would flash every 36 seconds. On the other hand, if under the same assumptions, the clock mechanism 15 were adjusted to operate once every 6 minutes, a call would be timed at 6 minutes which was anywhere from 0 to 6 minutes in length, depending on how soon key 13 happened to be depressed after the last operation of mechanism 15.

What is claimed is:

1. Means for timing telephone calls comprising in combination, means for producing electrical pulses periodically, a stepping switch operable one step by each said pulse, a telephone circuit, a cord circuit for connection thereto, relay means adapted to be operated by the connection of said cord to said telephone circuit and to be released by the disconnection thereof, means controlled by said relay means to maintain said stepping switch in its non-operated position while said relay means is released and to permit the operation of said stepping switch during operation of said relay means, means for connecting said stepping switch to said pulse source for operation thereby, and signaling means associated with the final step of said stepping switch operable while said switch is connected thereto.
2. Means for timing telephone calls comprising in combination, means for producing electrical pulses periodically, a stepping switch operable one step by each said pulse, a telephone circuit, a cord circuit for connection thereto, relay means associated with said cord and adapted to be operated by the connection of said cord to said telephone circuit and to be released by the disconnection thereof, means controlled by said relay means to maintain said stepping switch in its non-operated position while said relay means is released and to permit the operation of said stepping switch during operation of said relay means, means for connecting said stepping switch to said pulse source for operation thereby, signaling means associated with the final step of said stepping switch operable while said switch is connected thereto, and means for restoring said stepping switch to its non-operated position to start anew its operation to light said signaling means.
3. In a telephone system consisting of subscribers' lines and a link circuit for interconnecting the same, means for timing calls over said lines comprising in combination, means for producing electrical pulses periodically, a stepping switch operable by said pulses, relay means associated with said link circuit operable while the link circuit is connected to a called subscriber's line, means con-

trolled by said relay means to place the stepping switch in its non-operated position while said relay means is released, switching means controlled by the operator for connecting said stepping switch to said pulse source for operation thereby one step for each pulse, signaling means associated with the final step of said stepping switch and operable while said switch is connected thereto.

4. In a telephone system consisting of subscribers' lines and a link circuit for interconnecting the same, means for timing calls over said lines comprising in combination, means for producing electrical pulses periodically, a stepping switch operable by said pulses, relay means associated with said link circuit operable while the link circuit is connected to a called subscriber's line, means controlled by said relay means to place the stepping switch in its non-operated position while the said relay means is released, switching means controlled by the operator for connecting said stepping switch to said pulse source for operation thereby one step for each pulse, signaling means associated with the final step of said stepping switch and operable while said switch is connected thereto, means controlled by the operator to restore said stepping switch to its non-operated position to start anew its operation by said pulses.

5. In a telephone system consisting of subscribers' lines connected to a central office and a link circuit thereat for interconnecting said lines, means associated with said link circuit for timing calls over said lines, comprising in combination, means for producing electrical pulses periodically, switching means adapted to be operated from a first to a second position by application of a predetermined number of said pulses thereto, means controlled by said link circuit to maintain said switching means in said first position while said link circuit is disconnected from a called subscriber's line, means controlled by the operator subsequently to such a connection to connect said switching means to said pulse source for operation thereby from said first to said second position, and signaling means operable while said switching means is operated to said second position.

6. In a telephone system consisting of subscribers' lines connected to a central office and a link circuit thereat for interconnecting said lines, means associated with said link circuit for timing calls over said lines, comprising in combination, means for producing electrical pulses periodically, switching means adapted to be operated from a first to a second position by application of a predetermined number of said pulses thereto, means controlled by said link circuit to maintain said switching means in said first position while said link circuit is disconnected from a called subscriber's line, means controlled by the operator subsequently to such a connection to

connect said switching means to said pulse source for operation thereby from said first to said second position, signaling means operable while said switching means is operated to said second position, and means while said link circuit is thus connected to restore said switching means from the second to the first position to start anew its operation to the second position.

7. In a telephone system including subscribers' lines and a link circuit for interconnecting the same, means for timing calls over said lines comprising in combination, means for producing electrical pulses periodically, a stepping switch operable step by step by said pulses, relay means adapted to associate said stepping switch with said pulse source for operation thereby, a switch adapted to be closed by the operator for closing a circuit controlled by said stepping switch to operate said relay means, means operable while said link circuit is connected to a called subscriber's line for holding said relay means in its operated position, signaling means associated with the final step of said stepping switch and operable thereby while said stepping switch is operated upon said last step, and means controlled by said stepping switch and said relay means and operable when said operator-controlled switch is closed a second time for successively and automatically releasing said relay means, restoring said stepping switch to its non-operated position, opening the circuit of said signaling means and starting anew the operation of said stepping switch.

8. In a telephone system including subscribers' lines and a link circuit for interconnecting the same, means for producing electrical pulses periodically, a stepping switch operable step by step by said pulses, relay means adapted to associate said stepping switch with said pulse source for operation thereby, means controlled jointly by the operator and by said stepping switch for operating said relay means, means operable while said link circuit is connected to a called subscriber's line for holding said relay means in its operated position, signaling means associated with the final step of said stepping switch and operable thereby while said stepping switch is operated upon said last step, means controlled jointly by the operator and by said stepping switch for releasing said relay means, and means controlled jointly by said stepping switch and the release of said relay means for restoring said stepping switch to its non-operated position, said means for operating said relay means being also adapted to reoperate said relay means after its release to open the circuit of said signaling means and to start anew the operation of said stepping switch.

9. In a telephone system consisting of subscribers' lines and a link circuit for intercon-

necting the same, means for timing calls
over said lines, comprising, in combination,
means for producing electrical pulses peri-
odically, a stepping switch operable by said
5 pulses, one step for each pulse, means for nor-
mally maintaining said stepping switch non-
operated, means for connecting said stepping
switch to said pulse source for operation
thereby, signaling means associated with the
10 final step of said stepping switch and oper-
able thereby while said stepping switch is op-
erated upon said last step, and means for
automatically restoring said stepping switch
from any off-normal position to its normal
15 position when said interconnecting link is
disconnected from a called subscriber's line.

10. In a telephone system including sub-
scribers' lines and a link circuit for intercon-
necting said lines, means for timing calls over
20 said lines, comprising, in combination, means
for producing electrical pulses periodically,
a stepping switch operable by said pulses,
one step for each pulse, means for normally
maintaining said stepping switch non-oper-
25 ated, means for associating said stepping
switch with said pulse source for operation
thereby, signaling means associated with the
final step of said stepping switch and oper-
able thereby while said stepping switch is
30 operated upon said last step, means for re-
storing said stepping switch to its non-op-
erated position, and means for indicating
whether said stepping switch has returned
to its non-operated position.

35 In testimony whereof, I have signed my
name to this specification this 14th day of
August, 1928.

GEORGE H. PETERSON.

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