

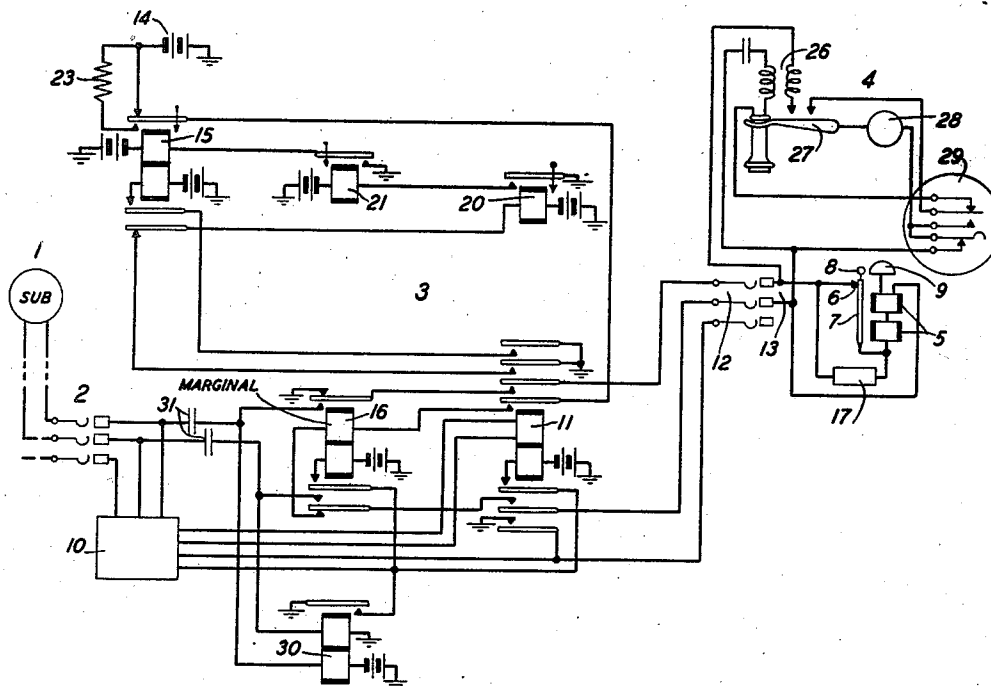
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O. A. SHANN

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RINGER CIRCUIT

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INVENTOR
O.A. SHANN
BY
C. D. M. Guthe.
ATTORNEY

UNITED STATES PATENT OFFICE

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RINGER CIRCUIT

Oscar A. Shann, Short Hills, N. J., assignor to
Bell Telephone Laboratories, Incorporated, New
York, N. Y., a corporation of New York

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This invention relates to telephone systems and particularly to arrangements for calling subscribers' lines.

An object is to improve the method and apparatus for calling subscribers' lines.

Heretofore various systems have been used in which a subscriber is called by operating the called subscriber's bell in different manners. For example, the bell may be operated with a gradually increasing sound intensity either by mechanical damping means applied to the bell or by arrangements for gradually increasing the frequency of the operating intervals of the bell.

It is a feature of the applicant's invention to provide a ringer at a substation having tap gongs and automatic switching means at the central office operative on the seizure of the called subscriber's line for actuating the ringer to tap the gong once and if the subscriber does not answer this call within a certain interval thereafter, for actuating the ringer to tap the gong repeatedly at shorter intervals.

The invention has been illustrated in the accompanying drawing.

Referring now to the drawing, the invention is shown applied to an automatic telephone system. A calling subscriber's station is shown at 1, with a connection through a switch 2 illustrated merely by brushes and contacts to a connector, or line connection initiating, circuit 3 having access to a called subscriber's station 4. The connector circuit 3 is merely shown with such parts of the circuit as are of particular interest in connection with the applicant's invention as applied thereto. At subscriber's station 4 is shown a ringer 5 having a self-interrupting contact 6 and an armature 7 to which is connected a clapper 8 for tapping the gong 9.

The operation of this system is as follows: If a calling subscriber 1 establishes a connection through switch 2 to connector circuit 3, the connector circuit which may be of any well-known type establishes through equipment indicated merely by box 10, a connection for the operation of relay 11 through its upper winding. This operation takes place as is well known in connector circuit practice, when the brushes 12 have been actuated by a series of impulses to establish a connection to the terminals 13 of the line leading to the called subscriber's station 4. Thus when relay 11 operates a locking circuit for maintaining itself operated is established from battery, through the lower winding, the lower inner armature and front contact of relay 11 to a ground (not shown) in the circuit arrangement 10, and

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a connection to ground is also established through the lower outer armature and front contact to the sleeve terminal of the line 12 to make this called line busy. An immediate other effect of the operation of relay 11 is that a circuit is established for the operation of ringer 5 in a circuit traceable from battery 14, contacts of relays 15 and 11, upper winding and contacts of relay 16, contacts of relay 11, the ring brush and terminal of the called line, windings of ringer 5, armature 7, contact 6, tip terminal and brush, contacts of relays 11 and 16 to ground. This circuit, upon closing, does not operate marginal relay 16 when the circuit first closes but does cause the windings of ringer 5 to attract the armature 7. Armature 7, upon operating, (1) causes clapper 8 to tap the gong 9 once, (2) interrupts this circuit and (3) permits current from battery 14 to flow through the element 17 which is of the type having a negative temperature coefficient of resistance. The voltage of battery 14 now causes a decrease in resistance of element 17 due to these characteristics and thus increases the current to maintain the ringer operated with armature 7 attracted. Thus clapper 8 will only tap gong 9 once to call the called subscriber.

If the called subscriber does not answer this signal within a certain period of time, the following operations will take place. It should be noted that upon the operation of relay 11, a circuit was completed for operation of the slow-to-operate relay 20 which circuit is traceable from battery, through the winding of relay 20, contacts of relays 15 and 11, to ground. Relay 20, in operating, closes an obvious circuit for slow-to-operate relay 21 and this relay, in operating, closes an obvious circuit for slow-to-operate relay 15. When relay 15 finally operates depending on the time it takes to operate relays 20, 21 and 15, the direct connection from battery 14, through the upper armature and back contact of relay 15 maintaining ringer 5 operated, is opened and a connection is established from battery 14, through a resistance 23 and the upper armature and front contact of relay 15 over the circuit hereinbefore traced through element 17 and ringer 5. The presence of resistance 23 in this circuit causes element 17 to be subjected to a lower voltage and hence to increase its resistance sufficient to permit ringer 5 to release the armature 7 to close a circuit through its back contact 6. When this takes place element 17 will be shunted and the ringer will again operate and open the connection through armature 7 and its back contact 6 and these operations will be repeated as in any

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self-interrupting or buzzing circuit for a relay independent of element 17. Relay 15 serves to switch resistance 23 into the terminating connector circuit at a predetermined interval of time after the single tap on the gong. Thus clapper 8 will repeatedly tap gong 9 at a corresponding frequency or rate and thus this continued tapping of the gong will urge the subscriber to answer the call. Then when the subscriber at the called station 4 answers, a shunt circuit for ringer 5 is established across the tip and ring conductors and the telephone set, from the tip terminal, the right-hand winding of repeating coil 26, switch-hook 27, a transmitter 28, contacts of dial 29, the ring terminals and across the tip and ring brushes 12. This circuit will now extend from battery 14, resistance 23, contacts of relays 15 and 11, the upper winding of marginal relay 16, the lower outer armature and back contact of this relay, contacts of relay 11, to the ring conductor and through the above-mentioned circuit at the calling subscriber's substation 4, contacts of relays 11 and 16 to ground. When ringer 5 and element 17 are shunted by the circuit just traced, marginal relay 16 operates to extend the connection from the called subscriber's line over the tip and ring conductors through contacts of relays 11 and 16, to the battery and ground through the respective windings of relay 30 which operates. Relay 30, upon operating, closes a holding circuit for relay 16 which, in its operated position, completes the talking circuit between the called subscriber's line and the calling subscriber's line over condensers 31 as is usual in connector circuits of this kind. In a similar manner relay 30, upon operating, provides a holding circuit for relay 11 which is locked operated from ground (not shown) in circuit arrangement 10. It should be noted that upon the operation of relay 15, a locking circuit was provided for this relay, extending from battery, through the lower winding and its lower inner armature and front contact, to ground at contacts of relay 11 so that this relay is maintained operated as long as relay 11 is operated. When relay 15 operated, relay 20 was released, and this in turn caused the release of relay 21. Now, therefore, as long as relay 11 is operated relay 15 is maintained actuated. However, the circuit extending from battery 14 and resistance 23 to the upper armature and front contact of relay 15 is broken upon the operation of relay 16 at the lower outer armature and back contact of relay 15 but relay 16 is held operated, as hereinbefore stated, in a circuit extending from battery, through its lower winding, lower inner armature and front contact to ground at contacts of relay 30. When the called subscriber disconnects, relay 30 releases to thereby release relay 16 and when the calling subscriber disconnects, relay 11 releases to thereby release, in turn, relays 30 and 16, relay 30 releasing, if it has not already been released. When the calling subscriber disconnects, connector 3 is released to normal. The release of relay 11 causes release of relay 15.

What is claimed is:

1. In a telephone system, lines, subscriber's station apparatus connected thereto and including ringers having tap gongs, automatic switching means for establishing a connection from a calling station to a called station, impedance means effectively cooperative upon the seizure of one of said lines in operating the associated ringer to tap the gong once, and other impedance means effectively cooperative if the subscriber at the station of the called line does not answer within a

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certain interval thereafter in causing the first-mentioned impedance means to automatically change its resistance value whereby the ringer is actuated to tap the gong repeatedly at shorter intervals.

2. In a telephone system, lines, subscriber's station apparatus connected thereto and including ringers having tap gongs, automatic switching means for establishing a connection from a calling subscriber's station to a called subscriber's line, impedance means effectively cooperative upon the seizure of said called subscriber's line in operating the associated ringer to tap the gong once, and other impedance means effectively cooperative, a predetermined interval thereafter, in causing the first-mentioned impedance means to automatically increase its resistance value whereby the ringer is actuated to tap the gong repeatedly at shorter intervals.

3. In a ringer operating system, a ringer having self-interrupting contacts, a negative resistance element shunting the self-interrupting contacts of said ringer and circuit means for establishing a connection through the ringer and said element to affect said element so as to cause said ringer to operate once only and another circuit means for establishing a definite interval after said operation of the ringer, a connection through the ringer and said element to effect repeated operations of the ringer under control of the self-interrupting contacts and to prevent the element from interfering with said repeated operations.

4. A ringer operating system comprising a ringer having gongs and an armature having a clapper for tapping said gongs when the ringer is actuated to attract said armature, a circuit for said ringer, an element having negative resistance characteristics in said circuit, a resistance, means for including in said circuit said resistance to prevent said negative resistance element from interfering with the continuous operation and release of said armature to permit said clapper to repeatedly tap on said gongs, and means for excluding from said circuit said resistance to permit said negative resistance element to function in said circuit to operate the armature once to cause said clapper to tap said gongs with a single stroke.

5. A ringer operating system comprising a ringer having a gong, an armature for actuating said gong each time the armature is attracted on the energization of the winding of said ringer, normally closed contacts opened by said armature when attracted, an element having negative resistance characteristics connected in shunt with said contacts, a source of current, a resistance, a circuit through said winding and contacts, a switch for closing said circuit through said winding, said contacts and source of current to energize said winding to attract the armature to operate the gong and to open said contacts, the resistance of said element being of such value as to permit said winding to remain sufficiently energized to maintain the armature attracted and said contacts opened after the armature has operated the gong once only, and another switch for closing said circuit through said winding, said contacts, source of current and resistance to energize said winding to attract the armature to operate the gong and to open said contacts, said resistance and said element being of such value as to permit the repeated operation and release of said armature and the opening and closing of said contacts for the actuation of said gong on each attraction of said armature.

6. A ringer operating system comprising a

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ringer having self-interrupting contacts, an element having negative resistance characteristics shunted across said contacts, a resistance, a source of current, switching means and circuit connections to first establish a connection through said element, and said self-interrupting contacts and winding of said ringer from said source of current and after an interval to include in said circuit connection said resistance in series with the source of current, said source of current being so adjusted that on the first operation of said switching means a resulting high voltage in said circuit connection permits said element to decrease its resistance to cause said ringer to operate once only and said resistance being so adjusted in relation to said source of current that on the subsequent operation of said switching means a resulting low voltage in said circuit connection permits the element to remain at a high resistance and thus cause said ringer to alternately operate and release under control of the self-interrupting contacts.

7. A ringer operating system comprising a line connection initiating circuit, a ringer having a gong, an armature provided with a clapper for striking the gong on the operation of the armature, self-interrupting contacts controlled by the armature, an element having negative resistance characteristics, terminals, a circuit extending from one terminal to said contacts and said element, in parallel, through the winding of said ringer to the other terminal, a connector switch circuit having brushes for establishing connections to said terminals upon the operation of said connector switch, a relay in said connector switch circuit having an armature, a back contact normally connected to said armature and a front contact normally disconnected from said armature, a source of current in said connector switch circuit connected to said back contact, a resistance connected between said source of current and said front contact, means controlled by said line

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connection initiating circuit responsive to the operation thereof for connecting said source of current at said contacts and said armature of said relay, in a path extending through said brushes and terminals and through said element and self-interrupting contacts of said ringer, in parallel, through the winding of said ringer to ground for the operation of said ringer to attract its armature to strike said gong with said clapper and to open said self-interrupting contacts controlled by the ringer armature and thereby cause said element to reduce its resistance to permit the ringer to remain operated, and further means controlled by said line connection initiating circuit for thereafter operating said relay after an interval of relatively long duration to open the connection at said back contact and close the connection at said front contact for the connection of the resistance, in series, with the source of current in a circuit extending through said relay armature, through the winding of said ringer and through said element, in series, to permit said element to increase the resistance accordingly so that said ringer will thereafter alternately release and operate under control of said self-interrupting contacts for the repeated striking of the gong by the clapper at a speed depending on the magnetic characteristics of said ringer and the impedance characteristics of said element.

OSCAR A. SHANN.

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