

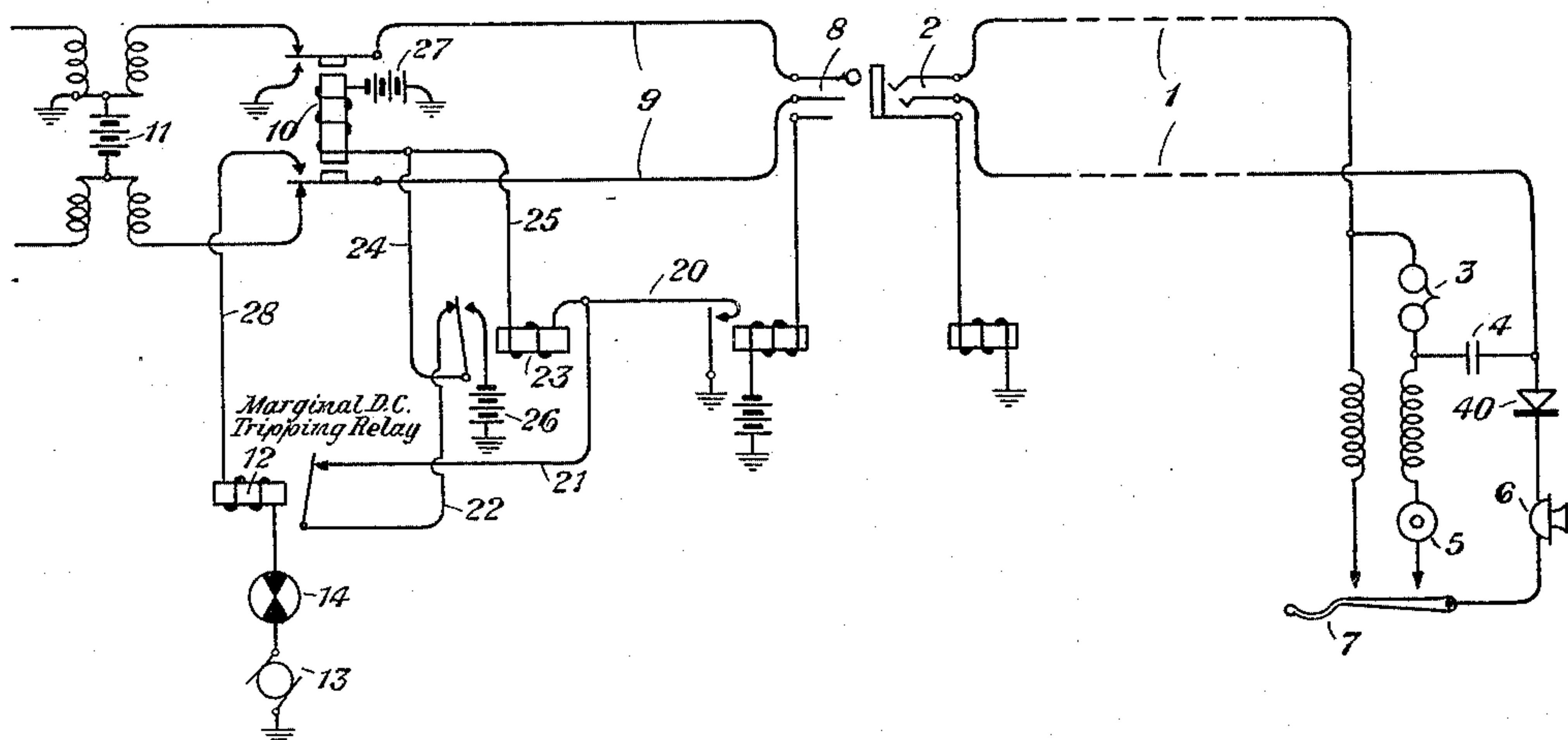
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TELEPHONE SIGNALING SYSTEM

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TELEPHONE SIGNALING SYSTEM

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This invention relates to telephone systems and more particularly to improvements in the circuits utilized for signaling purposes on such systems.

5 When it is desired to signal or ring a telephone subscriber, the subscriber's line is connected at the central office with a circuit including a source of signaling current and a tripping relay. When the subscriber answers, the tripping relay will operate and disconnect the ringing or signaling source from the line. The tripping relay is usually in series with the ringing source and the ringing current will pass through the tripping relay but will not operate it as it is adjusted so that it will not operate on this current. When the subscriber answers and takes his receiver off the hook, a lower impedance is presented to the ringing current at the station, thereby permitting a larger amount of alternating current to flow through the tripping relay. In certain types of alternating current machine ringing systems, the tripping relay will be adjusted so that it will operate on this increased amount of current, thereby stopping the application of ringing current to the line. On this type of ringing system, it is necessary that the tripping relay be adjusted so that it will not operate falsely when ringing on short loops having extension ringers. This necessitates marginal adjustment of the tripping relay on alternating currents, which limits the maximum loop and requires considerable maintenance.

Another type of ringing system heretofore utilized is the so-called alternating current-direct current type. In this type of system, there is provided a battery in series with the usual alternating current ringing source. When ringing, before the subscriber answers, there is no direct current path at the subscriber's station as the usual condenser is in the ringer circuit. However, when the party answers and completes his transmitter circuit, a path for direct current is provided. This direct current operates the tripping relay which can be designed not to operate on alternating current alone. This type of system, however, has the disadvantage that with

the total maximum instantaneous voltage at the central office restricted to a safe value, the addition of the series direct current tripping battery necessitates a reduction of the alternating current voltage, thus reducing the power available to operate the ringers at the station with a corresponding sacrifice in loop ringing range.

It is the object of the arrangements of this invention to improve the tripping of machine ringing, without introducing other disadvantages, so that maintenance will be reduced and longer loops will be permissible. A further object is to improve tripping without affecting ringing. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the figure of which is a circuit diagram illustrating a preferred embodiment of the invention.

In the drawing is shown a subscriber's line 1 terminating in the jack 2 at a central office. By means of a plug 8, connection may be established with a circuit including a source 13 of alternating ringing current with the marginal tripping relay 12 responsive to unidirectional current in series therewith. At the subscriber's station, there is shown the ringing apparatus 3 bridged across the circuit in series with the condenser 4. The receiver 5, transmitter 6 and switchhook 7, are also shown. A rectifier 40 preferably of the contact variety, such, for example, as a copper oxide rectifier, is included in the subscriber's set in the transmitter circuit. This rectifier is poled so that the direct current transmitter supply and the fluctuations imposed upon it by the transmitter during talking will be unimpeded. Regular alternating ringing current is used without the necessity of a tripping battery in series with it. During the ringing period, the transmitter circuit is open and the ringing path is as usual. However, when the called party answers, the low resistance path is completed through the rectifier. One polarity of the alternating ringing

current passes freely through the circuit and the tripping relay. The other polarity of current is blocked by the rectifier. Thus, pulsating direct current is made available to operate the tripping relay. This permits of designing the tripping relay to be very sensitive to direct current and insensitive to alternating current. Accordingly, the arrangements of the invention will provide the advantage of tripping over considerably longer subscriber's loops than heretofore.

A more detailed description of the operation of the arrangements is as follows: When the plug 8 is inserted in jack 2, the following circuit is closed; from ground connected to sleeve of jack 2, winding of the relay connected to sleeve of plug 8, to battery and ground. This will operate the sleeve relay of plug 8 and close the following circuit; from ground and contact of sleeve relay of plug 8, conductors 20 and 21, contact of tripping relay 12, conductor 22, left hand contact of relay 23, conductor 24, winding of relay 10 to battery 27 and ground. It is pointed out that when the above traced circuit is completed, a short circuit is established around the winding of relay 23 and it remains unoperated at this time. The operation of relay 10 will connect ringing current to the ring conductor of circuit 9 and thence over line 1 to the subscriber's set. Ringing current will be applied to the ring conductor of circuit 9 from the alternating current source 13, interrupter 14, winding of relay 12, conductor 28, contact and armature of relay 10 to the ring conductor of circuit 9. It is pointed out that this ringing current will not operate relay 12 at this time as it is a marginal relay adjusted to operate on unidirectional current only. This ringing current will operate the bell 3 at the subscriber's set.

When the subscriber answers in response to the bell 3 a low resistance path is completed through the rectifier 40. One polarity of the alternating ringing current passes freely through the circuit including rectifier 40 and the tripping relay 12. The other polarity of current is blocked by the rectifier. Thus pulsating direct current will transverse the circuit including the marginal relay 12. As this relay will operate on unidirectional current, such as this pulsating current, it will now operate. The operation of relay 12 will break at its armature and contact the previously traced circuit for relay 10. This will remove the short circuit around relay 23. The circuit will then be completed as follows: from ground and contact of sleeve relay of plug 8, conductor 20, winding of relay 23, conductor 25, winding of relay 10, to battery 27 and ground. This will operate relay 23 and close the following circuit; from ground and battery 26, right hand contact of relay 23, conductor 24, wind-

ing of relay 10, to battery 27 and ground. As like poles of both equal batteries 26 and 27 are connected to this circuit, the relay 10 will be de-energized. This will cut off the ringing current from the line and complete the line for talking purposes.

In systems utilizing common battery signaling and local battery talking stations, the rectifier could be placed in either side of the line so that the ringing current through the ringer is not rectified, but the ringing current through the secondary of the induction coil is rectified when the party answers.

With harmonic ringing systems the alternating current-direct current method has heretofore been used exclusively for tripping purposes inasmuch as it was not feasible to design an alternating current tripping relay with the required margins for each of the various frequencies employed. As a relatively high voltage is also required to operate the ringers in this type of system, the restriction in loop range referred to above is especially severe. The arrangements of the invention, accordingly, are especially advantageous for harmonic ringing systems, due to the high effective ringing and tripping voltages which they afford without exceeding a safe limit for the maximum instantaneous voltage.

While the invention has been disclosed as embodied in certain specific arrangements, which are deemed desirable, it is understood that it is capable of embodiment in many other forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A telephone line connecting a subscriber's set with a central office, a source of alternating ringing current at said central office, a tripping relay in series with said source responsive only to unidirectional current, and rectifying means in the talking circuit of said subscriber's set.
2. A telephone line connecting a subscriber's set with a central office, a source of alternating ringing current at said central office, a tripping relay in series with said source, said relay being responsive only to unidirectional current, means to connect said source of ringing current to said line, an alternating current path bridged across said line at said subscriber's set, signal responsive means in said path, means responsive when said subscriber answers for completing said line as a direct current circuit, and rectifying means in said line as so completed.
3. A telephone line connecting a subscriber's set with a central office, a source of alternating ringing current at said central office, a tripping relay in series with said source, said relay being responsive only to unidirectional current, means to connect said source of ringing current to said line, and means re-

sponsive when said subscriber answers for rectifying the current transmitted from said source through said relay.

5 4. A telephone line connecting a subscriber's set with a central office, a source of alternating ringing current at said central office, a tripping relay in series with said source, said relay being responsive only to unidirectional current, and a rectifier of the contact
10 variety in series in said talking circuit at said subscriber's set, said rectifier allowing the transmission therethrough of talking currents.

15 5. A telephone line connecting a subscriber's set with a central office, a source of alternating ringing current at said central office, a tripping relay in series with said source, said relay being responsive only to unidirectional current, a source of direct current for
20 signaling purposes at said central office, and a rectifier of the contact variety in series in said talking circuit at said subscriber's set, said rectifier being so poled as to allow the transmission therethrough of currents from
25 said direct current source used for signaling.

In testimony whereof, we have signed our names to this specification this 22nd day of September, 1928.

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