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TELEPHONE CIRCUIT

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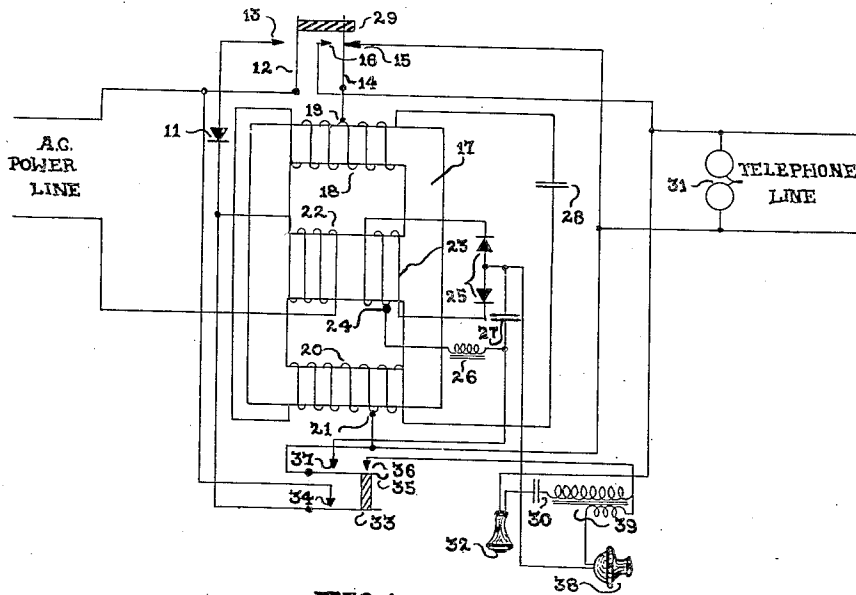


FIG. 1

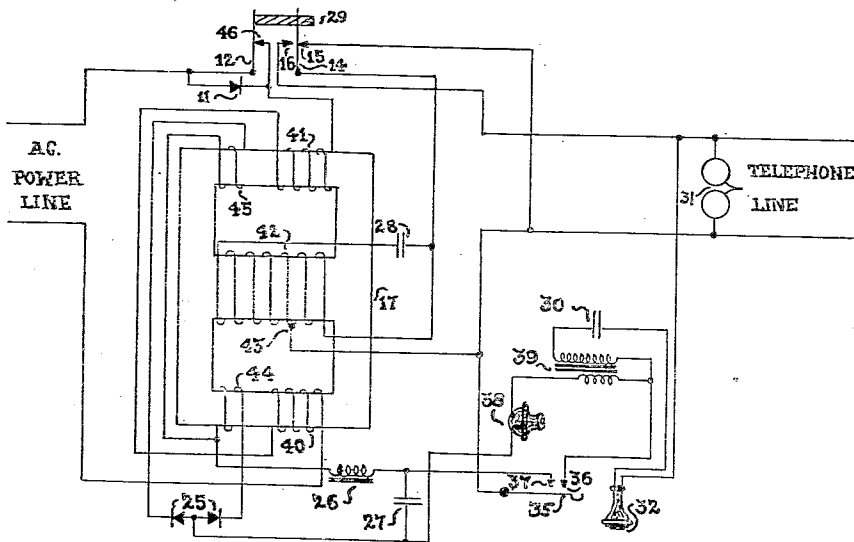


FIG. 2

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TELEPHONE CIRCUIT

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10 Claims. (Cl. 179—84)

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This invention deals with a telephone circuit of the local battery or magneto type and in particular with an A. C. operated circuit which replaces both the magneto and the batteries in a telephone of this type.

It is an object of my invention to supply a telephone with both ringing current and talking current from a single A. C.-operated unit and to provide a switching arrangement for adapting the unit to the telephone circuit.

Another object of my invention is to provide a self-starting subharmonic generator to supply telephone ringing current and to utilize the magnetic coupling unit of the subharmonic generator to energize a rectifier for supplying telephone talking current.

Other objects and a better understanding of my invention will be obtained from the following specification and claims, together with the accompanying drawings in which:

Figure 1 is the schematic diagram of one embodiment of my invention utilizing a self-starting subharmonic generator with a winding on the magnetic coupling unit supplying a talking-current rectifier and with the ringing current controlled by a push-button and the talking current controlled by the receiver hook switch; and

Figure 2 is the schematic diagram of a somewhat different form of self-starting subharmonic generator having windings supplying the talking current rectifier and having both the ringing and talking current controlled by a single push-button.

The advantages of telephone circuits of the local-battery type are well known, particularly their adaptability to extremely long or poorly maintained lines where common-battery circuits do not provide either reliable transmission or reliable signaling.

Nevertheless, there are several disadvantages connected with this type of telephone system, one being the need for the use of a hand-crank operated magneto for signaling, and another being the gradual deterioration of the dry-cell batteries at each station and the need for and expense of the periodic replacement of these batteries.

My invention eliminates both of these disadvantages and in addition provides a compact, economical unit which can be fitted in considerably less space than the equipment it replaces. It

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therefore makes possible a considerable reduction in the overall size of the telephone set.

The features of my invention will become apparent from a somewhat detailed discussion of the drawings.

In Figure 1, the three-legged saturable magnetic core structure of coupling transformer 17 carries input winding 22 on its central member and output windings 18 and 20 on its two outer members. Capacitor 28 is connected across the output winding 18 and 20 which are in series.

The output windings are substantially equal and are polarized to substantially cancel in the output circuit the voltage of the input frequency which is induced from winding 22. The input and output circuits are therefore coupled in conjugate relationship by saturable transformer means 17.

Input winding 22 may be energized from the A. C. power line through the rectifier 11 and switch members 12 and 13. When energized in this manner, the arrangement just described comprises a self-starting subharmonic generator as described in my U. S. patent application, Serial Number 662,137, filed concurrently herewith and entitled Frequency reducer.

The input branch of the circuit is energized with both direct and alternating current through the action of the half-wave rectifier 11, which produces an asymmetrical current wave through the input windings.

The output circuit through capacitor 28 oscillates at one-half the frequency supplied by the A. C. power line and the desired output voltage is obtained from the taps 19 and 21 on the output windings 18 and 20 respectively.

When push-button 29 is operated, the contact arm 12 engages contact 13 closing the normally open contacts to energize the input winding 22 from the A. C. power line through the half-wave rectifier 11. Contact arm 14 engages contact 16 and connects output tap 19 to one side of the telephone line while output tap 21 is permanently connected to the other side of the telephone line.

Thus when the push-button 29 is operated, the frequency changer supplies the subharmonic ringing frequency to the telephone line. The subharmonic oscillations start very rapidly and the push-button may be operated to code the ringing signal in any required manner. The user's own telephone ringer 31, being across the telephone line,

gives an audible indication of the code being transmitted.

Winding 23 on the central member of the core 17 is inductively coupled to the input winding 22. The full-wave rectifier 25 is energized from winding 23 to provide a talking current supply. A center-tap rectification circuit is shown, although any one of the several known rectifier circuits might be used. Filter inductance 26 is connected to the center tap 24 of winding 23 to filter the direct current output of the rectifier 25. The filter capacitor 27 is connected across the direct current output to complete the filtering of the talking current supply.

The remainder of the telephone circuit is, for the most part, a typical circuit of the local-battery type. An added element is the contact arm 33 and contact 34 operated by the receiver hook which holds the receiver 32.

When the receiver 32 is lifted from its hook, contact arm 33 engages contact 34 connecting the input winding 22 directly to the A. C. power line, and thereby energizing the rectifier 25 to supply the talking current. The core 17 is not normally saturated under this condition, because the biasing current from rectifier 11 which saturates the core for the generation of subharmonics is not supplied when the contacts 33 and 34 are closed.

The receiver-hook contact arm 35 engages contacts 36 and 37 when the receiver 32 is lifted from its hook, thereby connecting the receiver 32 across the telephone line through condenser 30, the secondary of induction coil 39 and contact 36. At the same time the direct current from rectifier 25 is fed through contacts 36 and 37, through the primary of the induction coil 39, to the transmitter 38 to complete the talking-current circuit. The telephone is thus conditioned for normal reception and transmission.

It will be noted that under this condition the ringing current supply is not connected across the telephone line, being disconnected at the normally open contact 16. Furthermore, the output taps 19 and 21 are short-circuited through the normally closed contacts 14 and 15. This arrangement assures that no undesired oscillations will be excited by capacitor 28 while push button 29 is not operated. When this feature is not required, the contact 15 may be omitted.

If the receiver 32 is lifted from its hook while the push button 29 is operated, rectifier 11 is shorted through contacts 12, 13, 33 and 34 so that no ringing power is generated and the receiver is not subjected to an abnormally high voltage.

In Figure 2 a modification of the subharmonic generator of Figure 1 is shown. The saturable core structure of the coupling transformer 17 has input windings 40 and 41 on its two outer members, and output winding 42 on its central member. Capacitor 28 is connected across output winding 42 for the excitation of subharmonic oscillations therein.

When push-button 29 is operated, the normally closed contacts 12 and 46 are opened, inserting the half-wave rectifier 11 in series with the input windings 40 and 41 which are energized from the A. C. power line. The input windings 40 and 41 are connected in series and are polarized to produce opposing fluxes in the central core member, making the input and output circuits conjugate.

The self-excited subharmonic oscillations in the output circuit are generated in essentially the

same manner as in the arrangement of Figure 1. The required subharmonic ringing voltage is obtained from winding 42 by the provision of a tap 43.

With push-button 29 operated, the ringing voltage is fed to the telephone line through contacts 14 and 16.

When push-button 29 is in the non-operated position, the normally closed contacts 12 and 46 short the rectifier 11, connecting the input windings 40 and 41 directly to the A. C. power line to energize the rectifier windings 44 and 45. The center tap full-wave rectifier 25 is energized from the windings 44 and 45 in series, and the center-tap connection for the positive direct current lead is obtained at the junction between the two windings 44 and 45.

The direct current supply is filtered by the inductance 26 and capacitor 27 as in Figure 1, and the remainder of the telephone circuit is substantially as shown in Figure 1.

The normally open contacts 33 and 34 shown in Figure 1 are omitted in Figure 2, the direct current supply being controlled by the push-button 29. Thus, the rectifier 25 is continuously energized, even when the receiver 32 is hanging on its hook.

It will be apparent that the various modifications shown in Figures 1 and 2 are interchangeable between the two figures and that other modifications which will be apparent to those skilled in the art may be employed without departing from the scope of my invention.

Although I have described my invention with a certain degree of particularity, it is to be understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

I claim as my invention:

1. In a communication circuit adapted to be energized by an alternating current source, the combination of a subharmonic generator including transformer means, first winding means on said transformer means for supplying subharmonic output voltage, ringing-current circuit means, talking-current circuit means, means for connecting the ringing-current circuit means to said first winding means, first switching means for energizing said subharmonic generator, whereby said first winding means supplies subharmonic current to said ringing-current circuit means, second winding means on said transformer, a rectifier connected to said second winding means, and second switching means for connecting said rectifier to said talking-current circuit to supply direct current thereto.

2. In a communication circuit adapted to be energized by an alternating current source, the combination of a subharmonic generator including transformer means, first winding means on said transformer means for supplying subharmonic output voltage, ringing-current circuit means, talking-current circuit means, means for connecting the ringing-current circuit means to said first winding means, first switching means for energizing said subharmonic generator, whereby said first winding means supplies subharmonic current to said ringing-current circuit means, second winding means on said transformer, a rectifier connected to said second winding means, and second switching means comprising at least first and second contact means, said

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first contact means connecting said transformer to the alternating current source and said second contact means connecting said rectifier to said talking-current circuit means to supply direct current thereto.

3. In combination, a frequency changer comprising input and output branches, saturable magnetic coupling means coupling said input and output branches in conjugate relationship, a first rectifier, subharmonic load circuit means in said output branch, a capacitor in a closed circuit in said output branch for exciting subharmonic oscillations therein, means in said input branch for energizing said coupling means through said first rectifier to produce said oscillations and energize said load circuit means, a second rectifier, winding means on said coupling means inductively coupled to said input branch and connected to said second rectifier, direct current circuit means connected to said second rectifier, and means in said input branch for energizing said coupling means independently of said first rectifier to energize said second rectifier and said direct current circuit means.

4. In a telephone circuit the combination of a subharmonic generator comprising input and output branches, saturable magnetic coupling means coupling said input and output branches in conjugate relationship, a capacitor in a closed circuit in said output branch for exciting subharmonic oscillations therein, a rectifier, winding means on said coupling means inductively coupled to said input branch, ringing-current circuit means, talking-current circuit means, first and second switching means, first circuit means controlled by said first switching means for supplying both alternating current and direct current to said input branch to produce said subharmonic oscillations and to energize said ringing-current circuit means therewith, second circuit means controlled by said second switching means for supplying alternating current to said input branch to energize said rectifier from said winding means to supply direct current to said talking-current circuit means.

5. In a telephone circuit, the combination of a ringing-current circuit, a talking-current circuit, a subharmonic generator comprising input and output branches, saturable magnetic coupling means coupling said input and output branches in conjugate relationship, a capacitor in a closed circuit in said output branch for exciting subharmonic oscillations therein, a first rectifier serially connected in said input branch, first input circuit means for supplying alternating current through said first rectifier to produce said subharmonic oscillations to energize said ringing-current circuit, winding means on said coupling means inductively coupled to said input branch, a second rectifier connected to said winding means, and second input circuit means for supplying alternating current independently of said first rectifier to energize said second rectifier to supply direct current to said talking-current circuit.

6. In a telephone circuit, the combination of a ringing-current circuit, a talking-current circuit, a subharmonic generator, a first switch for connecting said subharmonic generator to a source of alternating current and to said ringing-current circuit, said subharmonic generator including a saturable transformer, winding means on said transformer, a rectifier connected to said winding means, and a second switch for connecting said transformer to said source of alternating

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current and for connecting said rectifier to said talking-current circuit, said ringing-current circuit being energized with subharmonic current by the operation of said first switch, said talking-current circuit being energized with direct current by the operation of said second switch.

7. In a telephone circuit, the combination of a ringing-current circuit, a talking-current circuit, a subharmonic generator comprising a saturable magnetic coupling unit having input and output branches in conjugate relationship, a capacitor connected to said output branch for exciting subharmonic oscillations therein, a half-wave rectifier connected to said input branch, a first switch having normally open contacts for connecting said input branch to a source of alternating current through said half-wave rectifier and having normally open contacts for connecting said output branch to said ringing-current circuit, winding means on said coupling unit inductively related to said input branch, a full-wave rectifier connected to said winding means, and a second switch having normally open contacts for connecting said input branch to said source of alternating current independently of said half-wave rectifier and having normally open contacts for connecting said full-wave rectifier to said talking-current circuit.

8. In a telephone circuit, the combination of a ringing-current circuit, a talking-current circuit, a subharmonic generator comprising a saturable magnetic coupling unit having input and output branches in conjugate relationship, a capacitor connected to said output branch for exciting subharmonic oscillations therein, a half-wave rectifier connected to said input branch, a first switch having normally closed contacts shunting said half-wave rectifier for connecting said input branch to a source of alternating current and having normally open contacts for connecting said output branch to said ringing-current circuit, winding means on said coupling unit inductively related to said input branch, a full-wave rectifier connected to said winding means, and a second switch having normally open contacts for connecting said full-wave rectifier to said talking-current circuit.

9. In combination, a three-legged saturable magnetic core, an input winding on the central member of said core, two output windings one on each outer member of said core, said output windings being connected in series, polarized to substantially cancel voltage induced from said input winding, a half-wave rectifier, means for energizing said input winding from an alternating-current source through said half-wave rectifier, a capacitor connected to said output windings for exciting subharmonic oscillations therein when said input winding is energized through said half-wave rectifier, subharmonic load circuit means connected to said output windings, a rectifier winding on the central member of said core, a full-wave rectifier connected to said winding, direct current load circuit means connected to said full-wave rectifier, and means for energizing said input winding from said source independently of said half-wave rectifier.

10. In combination, a three-legged saturable magnetic core, an output winding on the central member of said core, two input windings, one on each outer member of said core, said input windings being connected in series and polarized to produce opposing fluxes in said central member, a half-wave rectifier, means for energizing said input windings from an alternating-current

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source through said half-wave rectifier, a capacitor connected to said output winding for exciting subharmonic oscillations therein when said input windings are energized through said half-wave rectifier, subharmonic load circuit means connected to said output winding, two rectifier windings, one on each outer member of said core, said rectifier winding being connected in series in the same polarity as the input windings, a full-wave rectifier connected to said windings, direct current load circuit means connected to said full-wave rectifier, and means for energizing said in-

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put windings from said source independently of said half-wave rectifier.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

10	Number	Name	Date
	2,323,307	Campbell	July 6, 1943