

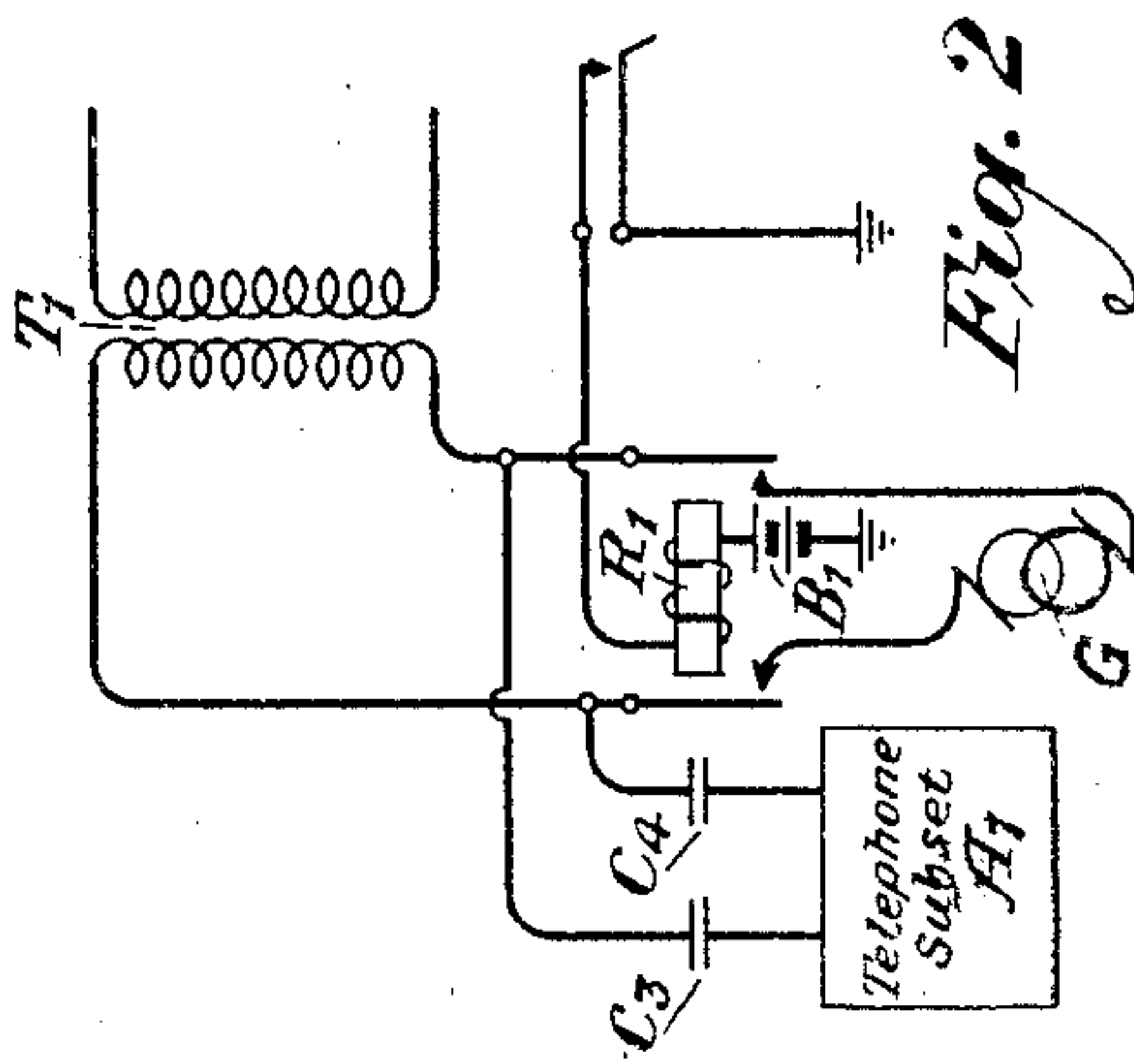
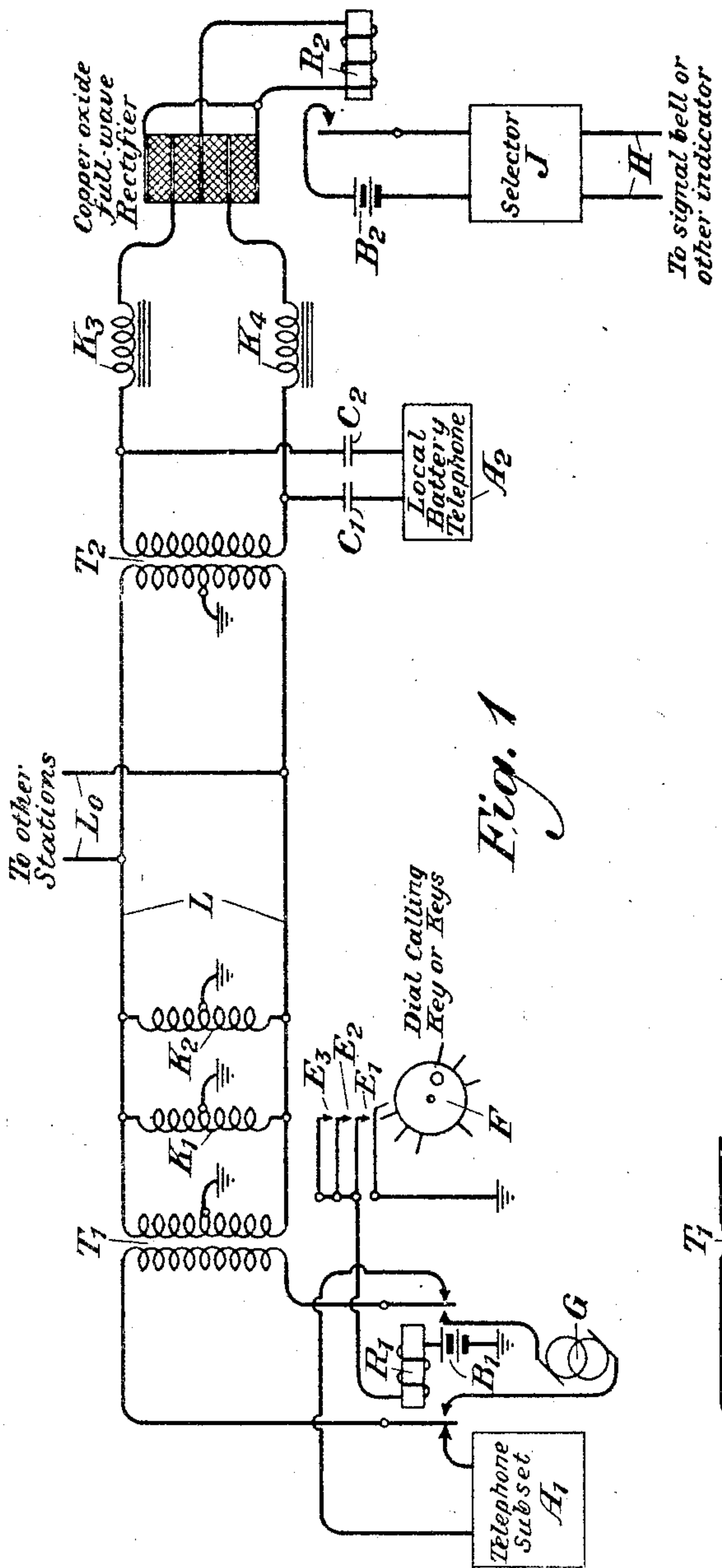
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SELECTIVE SIGNALING SYSTEM

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SELECTIVE SIGNALING SYSTEM

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This invention relates generally to signaling systems. More particularly, this invention relates to devices and apparatus to be employed in connection with signaling systems of the selective type.

It has heretofore been difficult under certain circumstances to transmit coded signals suitable to operate a commercial selector capable of closing a circuit coupled to the selector so as to energize an indicating device connected to the coupled circuit. Further difficulties were encountered as the coded signals took the form of direct current pulses occurring at low frequency and as the transmitting medium was a telephone line subject to power induction from extraneous sources. These difficulties become apparent when one realizes that ordinary telephone circuits are bridged by drainage coils which exhibit very low impedances to pulses of a few cycles per second, i. e., $3\frac{1}{2}$ to 10 cycles per second, which are the ordinary limits of operation of the commercial selector. The low impedance of the drainage coils causes practically all of the low frequency coded current to become shunted from the telephone circuit and, therefore, the selector often fails to operate.

To overcome these and other difficulties, it is the object of this invention to employ an alternating current instead of a direct current and to produce pulses of alternating current spaced in accordance with the characteristic of the commercial selector. It is another object of this invention that the frequency of the alternating current be such that the bridging leakage coils of the telephone circuit will exhibit high impedances so as not to greatly affect the level of the transmitted alternating current. Still another object of the invention is to rectify the transmitted alternating current and operate the armature of a sensitive direct current relay in accordance with the coded alternating current pulses. Thus, the selector would be operated only when the characteristic alternating current pulses have been impressed upon the telephone line, and any indicating device included in the circuit controlled by

the selector would become energized upon the operation of the selector.

These and other objects of this invention become apparent from the detailed description hereinafter following when read in connection with the accompanying drawings in which Figure 1 represents one embodiment of the invention given merely for the purpose of illustration, and Fig. 2 shows a modified arrangement of part of the apparatus shown in Fig. 1 so as to permit the simultaneous transmission of coded current and speech currents.

Referring to Fig. 1 of the drawings, the reference character L represents a telephone line capable of freely transmitting speech currents. This line is bridged by drainage coils K_1 and K_2 . The line L is terminated at its left side by the secondary winding of an insulating transformer T_1 and at its right side by the primary winding of a similar transformer T_2 . The windings of both transformers T_1 and T_2 are insulated against high voltages of the order of 25,000 or 50,000 volts or more. The midpoints of the secondary winding of transformer T_1 , the primary winding of transformer T_2 , and of the drainage coils K_1 and K_2 are all grounded, as shown.

The telephone line L may run parallel to a high voltage power circuit and, in fact, it may be so exposed as to induce substantial currents from extraneous sources. These extraneous effects will send currents through the drainage coils K_1 and K_2 and thereby reduce the voltages normally impressed upon the conductors of the line L. The high insulation of the transformers T_1 and T_2 will further prevent the extraneous voltages from reaching the circuits connected or coupled to the primary winding of transformer T_1 , as well as to the secondary winding of the transformer T_2 . These protective features render the arrangement of this invention particularly adaptable for selective signaling between stations located along an electrified railroad.

The primary winding of the transformer T_1 extends to the armatures of a relay R_1 . One terminal of the winding of the relay R_1 is connected to a grounded battery B_1 . The

other terminal of the winding of the relay R_1 is connected to a plurality of normally open contacts designated E_1 , E_2 and E_3 . The contact E_1 is associated with a dial calling key
 5 F which embodies peripherally arranged teeth spaced in some predetermined manner characteristic of a desired calling signal. The dial calling key may be manually revolved in one direction and then released so that it may
 10 revolve in the opposite direction and close the contact E_1 a number of times at certain intervals determined by the spacing of the peripheral teeth. Current will then flow from the battery B_1 through the winding of the
 15 relay R_1 during such time as the contact E_1 is closed, and this current will, of course, be interrupted while the contact E_1 is open. It will be obvious that separate dial calling keys may be associated with the contacts E_2 and
 20 E_3 and that these may be independently operated and that, moreover, a master calling key of any type well known in the art may be used to selectively close any one of the contacts E_1 , E_2 or E_3 , as found desirable.

25 The inner contacts associated with the armatures of the relay R_1 are connected to an alternating current generator which may supply current of any frequency conveniently transmitted by the line L . Current of a frequency of 60 cycles is readily available in
 30 most places and its use is preferable in the arrangement of this invention because a frequency of that order is at or slightly below the lower limit of the ordinary range of audibility. Moreover, the impedance of the
 35 drainage coils K_1 and K_2 is sufficiently high at 60 cycles so as not to by-pass an appreciable amount of the current. It will be understood, however, that current of a frequency
 40 above the range of audibility, i. e., 5,000 cycles or more, may be employed, if desired.

The outer contacts of the armatures of the relay R_1 extend to a telephone sub-set A_1 , which may be of any well known type.
 45 These outer contacts are normally closed and a telephone conversation may normally take place in opposite directions between the sub-set A_1 and another sub-set A_2 which may, if desired, be of the battery type and which is
 50 connected to the secondary winding of the transformer T_2 through a pair of condensers C_1 and C_2 . The telephone conversation will only be interrupted upon the operation of the relay R_1 as a result of the closure of any one
 55 of the contacts E_1 , E_2 or E_3 by one of the teeth of the associated dial calling key.

The secondary winding of the transformer T_2 is connected through a pair of retardation coils K_3 and K_4 to a full wave rectifying
 60 apparatus D , which may be any well known type, preferably of the copper oxide type. The rectifying apparatus D may include four copper oxide rectifiers so related as to convert the alternating current transmitted over line
 65 L by the generator G into direct current.

Each pulse of alternating current will produce a corresponding pulse of direct current. The various pulses of direct current will flow through a sensitive direct current relay R_2 , the armature of which will close its contact
 70 once for each pulse. It will be apparent that the relay R_2 will follow the relay R_1 in synchronism.

The retardation coils K_3 and K_4 exhibit low impedances for all frequencies of the
 75 order of, for example, 60 cycles. Their impedance is high for ordinary speech frequencies; hence ordinary speech currents will be unable to reach the full wave rectifying apparatus D .

The armature of the relay R_2 controls a circuit which includes a battery B_2 and a selector J . The selector receives the pulses of direct current determined by the movements of the armature of relay R_2 , and if
 80 these pulses of direct current are of the proper number and spaced in a predetermined way in accordance with the setting of the selector, the selector will operate and close the circuit
 85 H . The selector may, of course, be of any type which will operate in response to the reception of a coded signal composed of a plurality of direct current pulses spaced by predetermined intervals. One form of selector
 90 suitable for this purpose is described in a patent to J. C. Field No. 1,343,256 dated June 15, 1920. When the selector J operates, a bell will be rung or a lamp lighted, and of course, the operation of the selector may be
 95 used to continuously energize any other well known form of visible or audible indicating device connected to the circuit H .

The circuit L_0 and similar circuits may be bridged across the telephone line L . Each circuit bridging the line L may include a
 100 transformer similar to the one designated T_1 as well as all of the equipment shown in Fig. 1 of the drawings connected to the secondary winding of the transformer T_2 .

Fig. 2 shows a telephone sub-set A connected to the primary winding of the transformer T_1 through a pair of condensers C_3 and C_4 . Here a telephone conversation may be carried on continuously with any party
 110 connected to the telephone line even during code signaling operations. The relay R_1 , when it is energized by direct current pulses, connects the generator G to the primary winding of the transformer T_1 at the same time
 115 that the sub-set A is connected to that primary winding. Current supplied by the generator G will be transmitted over the telephone line simultaneously with the speech currents and the low frequency of the generated current will not affect or distort the
 120 general wave shape of the speech currents.

Thus, it will be apparent that coded pulses of alternating current are transmitted over a telephone line and that the frequency of this
 125 current does not interfere with the frequency of the speech currents.

cies ordinarily present in telephone conversations. These alternating current pulses are converted into corresponding direct current pulses which operate one or more high speed direct current relays.

As stated hereinabove, the selector J is connected to the line L through a full wave rectifying device and a sensitive direct current relay. Commercial selectors generally operate at frequencies of about $3\frac{1}{2}$ to 10 cycles; 60-cycle alternating current will hardly affect and operate these selectors. The inclusion of the full wave rectifying device and the sensitive direct current relay permit the proper use of these low frequency selectors for code signaling systems involving higher frequency currents. In connection with certain kinds of lines, a properly designed selector may be connected directly to the rectifier without the sensitive direct current relay, and the direct current pulses will then operate the magnets of the selector.

The code calling key or keys and the various selectors permit selective signaling between different stations connected with the same line. One selector will be operated to the exclusion of all of the others, and the indicating device coupled to the operated selector will be energized to the exclusion of all other indicating devices coupled to the remaining selectors.

While this invention has been shown and described in certain particular arrangements merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied forms without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a telephone line exposed to extraneous voltage effects, a plurality of telephone sub-sets connected to said line, a source of alternating current having a frequency close to or below the lower limit of the ordinary range of audibility, a toothed calling key, means responsive to the operation of said key to connect said source of alternating current to said line at intervals determined by the spacing of the teeth of said key, a full wave rectifier for converting the alternating current pulses into direct current pulses, and a selector responsive to said direct current pulses.

2. The combination of a telephone line, a plurality of telephone sub-sets connected to said line, a source of alternating current having a frequency below the ordinary range of audibility, apparatus for producing any one of a plurality of different codes, means responsive to the operation of said apparatus to connect said source of alternating current to said line at predetermined intervals corresponding to any one of said codes, a plurality of selectors each responsive to the direct cur-

rent pulses corresponding to one of said codes, a plurality of full wave rectifiers each interposed between a selector and said line, and means whereby the rectified pulses may operate only the selector responsive to its predetermined code.

In testimony whereof, I have signed my name to this specification this 24th day of February, 1931.

WILLIAM L. SHAFER.

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