

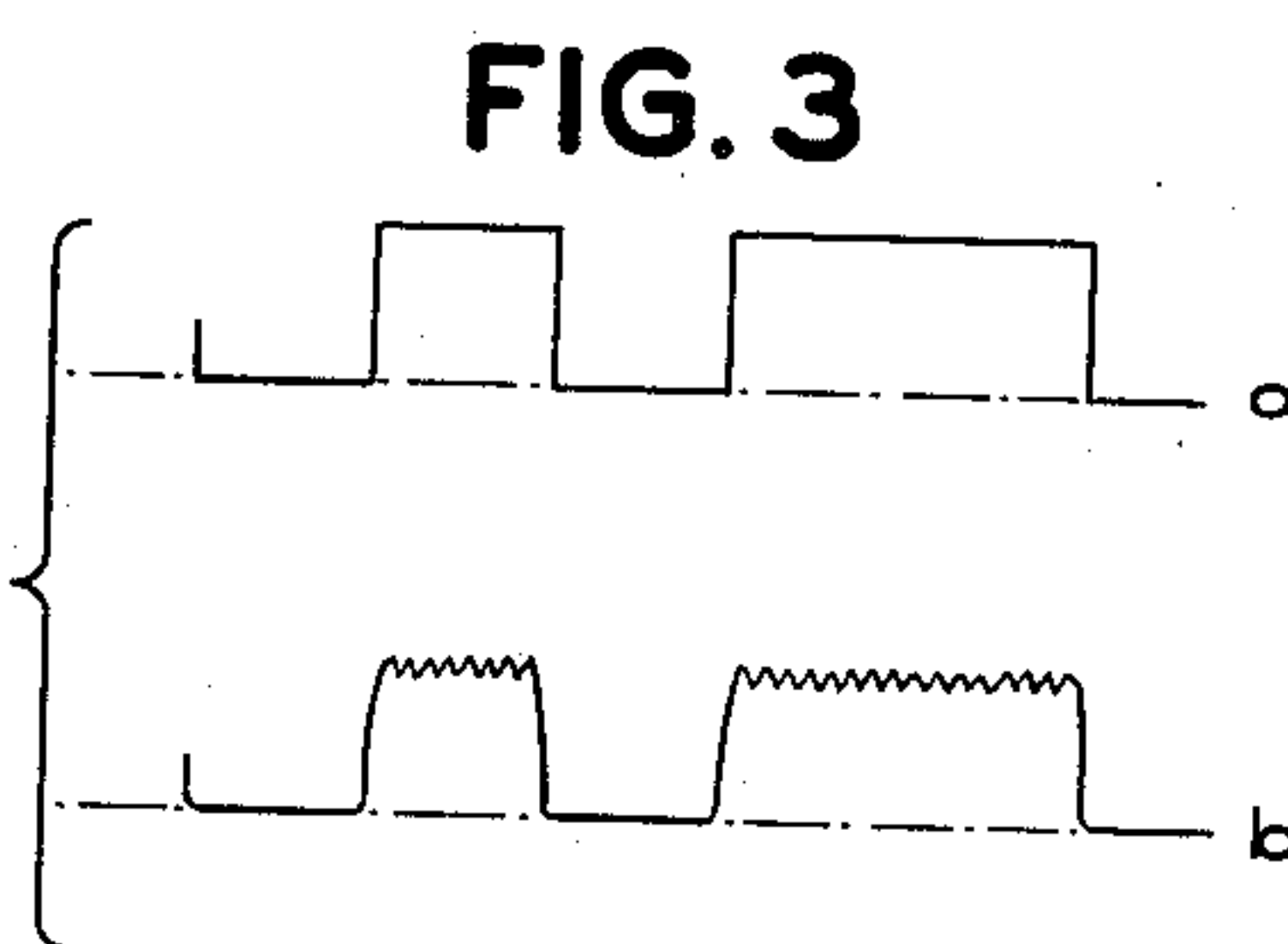
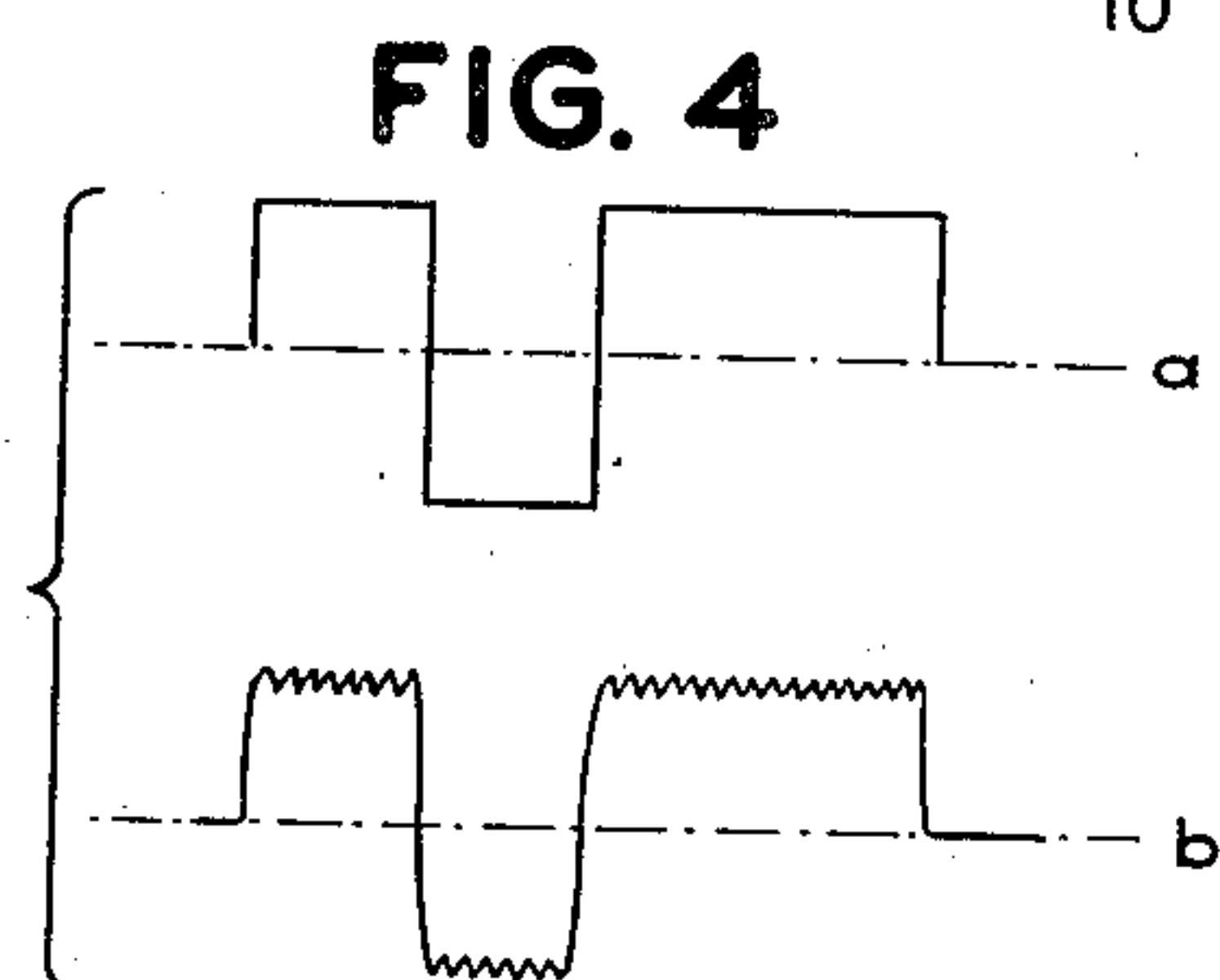
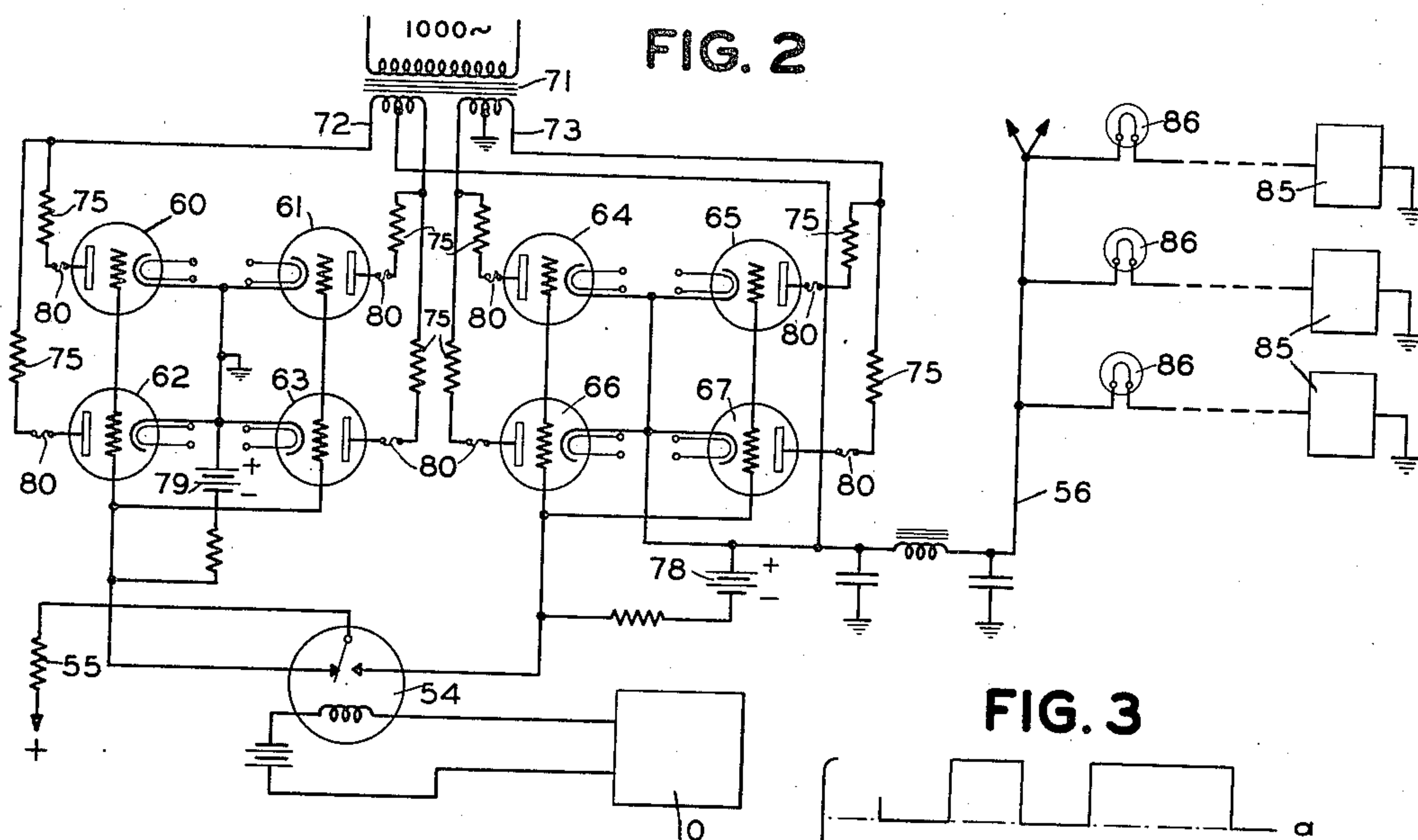
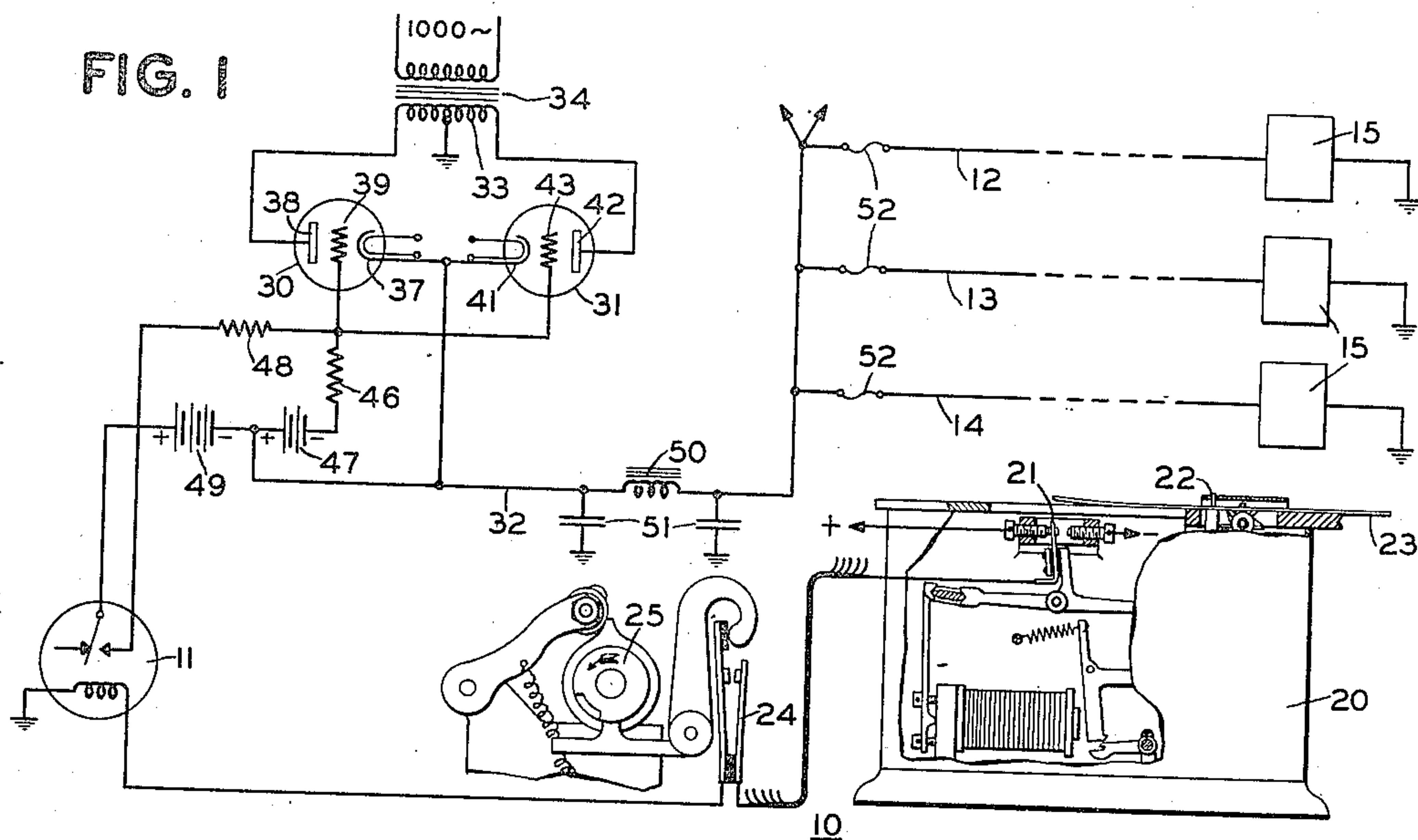
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2,216,772

TELEGRAPH TRANSMITTING SYSTEM

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TELEGRAPH TRANSMITTING SYSTEM

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8 Claims. (Cl. 178—66)

This invention relates to telegraph transmit-
ting or keying systems and more particularly to
high speed signalling systems requiring relatively
large currents, as for example systems employing
a large number of receiving instruments operated
by a single transmitting device.

An important application of the invention is
in quotation systems where a large number of
tickers are controlled from a single point. The
current consumption of each receiving ticker is
relatively high and in practise, where electro-
magnetic relays are employed for transmitting
quotation signals to a number of such tickers, a
series of parallel relays must be utilized in order
to avoid destructive arcing at the contacts of the
relays. The maintenance of the transmitting
relays in proper operating condition in order to
avoid loss or mutilation of signals presents a
problem which becomes increasingly difficult as
the number of tickers in the system increases
since the relays must be connected in cascade
relation, a group of relays being connected to the
contacts of each relay of the preceding group.
Obviously, it is desirable to reduce or eliminate
the maintenance required in operating systems
of this kind, as well as to minimize loss or dis-
tortion of signals as a result of contact troubles,
et cetera. Furthermore, the relays suitable for
this service are expensive, requiring a large ini-
tial investment in addition to the maintenance
charges, and take up considerable floor or rack
space.

In general terms, it is the object of the present
invention to provide a keying system that over-
comes these disadvantages and limitations of the
relay system, and is adapted to transmit signals
to any desired number of receiving instruments
at a high rate of speed without substantial dis-
tortion.

A further object of the invention is to provide
an improved keying system employing electric
discharge devices or valves, such as gaseous or
vapor tubes of the discontinuous control type.

A further object of the invention is to provide
a signalling system employing electric discharge
devices for keying or repeating signals and in
which the number of receiving instruments may
be increased as the system is extended by the
installation of additional parallel discharge de-
vices to take care of the additional load on the
system without substantial change in the initial
installation.

A still further object of the invention is to pro-
vide a system of the character described which is
not damaged by the grounding of a line circuit

and remains operative even though one of the
discharge devices or tubes fails or is worn out.

Other objects and advantages of the invention
will become apparent from the following de-
scription of the preferred embodiments thereof
shown in the accompanying drawing.

The invention is illustrated as applied to a
quotation system in which a number of receiving
instruments, such as tickers, are controlled by
a single transmitter although the invention is not
limited to such systems. In systems of this char-
acter, the tickers may be high-speed printer units
responsive to six-unit permutation code signals
similar in construction to that shown in Letters
Patent #1,916,168 to Dirkes and Wheeler, dated
June 27, 1933, and assigned to The Western Union
Telegraph Company. The transmitting equip-
ment embodying the invention may be arranged
to send marking and spacing signals of opposite
polarity or signals consisting of current and no-
current intervals.

In accordance with a preferred embodiment
of the invention, a source of alternating current
is employed having a frequency at least three or
four times the signal frequency, i. e., 500 or 1000
cycles a second or more. The alternating-cur-
rent source is connected to the transmitting cir-
cuit or circuits through gaseous or vapor electric
discharge devices or valves controlled by a tape
transmitter or other suitable code transmitter.
The discharge devices employed are commonly
termed discontinuous control tubes since they
are rendered conductive by the application of po-
tential to a grid or igniter electrode which is
thereafter incapable of affecting the discharge as
in the case of vacuum or low pressure discharge
tubes in which negligible gas ionization occurs.
The use of gaseous tubes, however, has the ad-
vantage that relatively large currents may be
passed through the tubes with a small voltage
drop and consequently a low power consumption.
The construction and operating characteristics
of such gaseous discharge tubes are well known
to those skilled in the art.

The discharge devices or valves are thus op-
erative to key the circuits to a large number of
tickers in response to control currents of small
magnitude derived from the tape transmitter.
Each valve is so connected to the alternating-
current source that the anode thereof alternately
becomes positive and negative with respect to
the cathode and, since the device becomes non-
conducting when the anode is negative, the dis-
charge current ceases during each alternate half-
cycle and is not re-established unless the control

electrode is maintained at such potential that the device breaks down upon the next half-cycle. In this manner the signalling current impressed upon the line, the magnitude of which may be increased to any desired extent by merely increasing the size of the discharge devices, is stopped and started in accordance with the operation of the tape transmitter. If desired, a plurality of discharge devices may be operated in parallel so that if one tube fails, the load current is divided between the remaining tubes and the system continues to function properly. As the number of tickers connected to the system increases as new subscribers are obtained, additional tubes may be added without alteration of the existing apparatus.

Two modifications of the invention are illustrated by way of example in the accompanying drawing, in which—

Fig. 1 is a circuit diagram of a quotation system employing signals consisting of current impulses separated by no-current intervals;

Fig. 2 is a circuit diagram of a similar system employing signalling impulses of opposite polarity; and

Figs. 3 and 4 are diagrams illustrating the signals transmitted in the systems shown in Figs. 1 and 2, respectively.

Referring to Fig. 1 of the drawings, I have shown a permutation code transmitter 10 arranged to control a transmitting relay 11 in accordance with code combinations to be transmitted over line circuits 12, 13 and 14 extending to a plurality of tickers 15. Any desired number of receiving instruments may be connected to the transmitting apparatus and each line circuit may include two or more tickers in series relation. Furthermore, the invention may be employed in connection with various types of controlling and receiving apparatus in electrical signalling systems known in the art although it is of particular value in connection with high speed code telegraph systems employing short current impulses transmitted in rapid succession. As shown, the transmitter 10 is similar to that disclosed in Letters Patent #1,805,374 granted to Rothermel, May 12, 1931, and assigned to The Western Union Telegraph Company. The transmitter comprises a tape transmitter unit 20 having a plurality of selectively operable contacts 21 connected to a series of feeler pins 22 to be positioned in accordance with the perforations in a tape 23; and a distributor having contacts 24 connected to the respective contacts of the tape transmitter 20 and an operating cam 25 for closing the contacts of the distributor in succession to transmit to the relay 11 the signal combination set up in the tape 23. The tape may be prepared in the usual manner and the detailed construction and operation of the distributor transmitter is fully set forth in the above-mentioned Rothermel patent.

The relay 11 is arranged to key the output currents of two gas- or vapor-filled discharge devices 30 and 31 connected in the transmitting circuit 32. Each of the discharge devices is of the discontinuous control type and, when conductive, the devices are adapted to apply signalling currents of the desired magnitude to the transmitting circuit 32 from alternating-current sources represented by the two halves of the secondary winding 33 of a transformer 34. The transformer 34 is connected to an alternating-current source of suitable frequency, for example, 1000 cycles per second. The sources of cur-

rent connected to the discharge devices 30 and 31 may be of any desired character, 180° out of phase and of a frequency at least three or four times the signal frequency.

The discharge device 30 comprises a cathode 37, anode 38 and control electrode 39 adapted to control the conductivity of the discharge device. For example, the control electrode may maintain the device 30 non-conductive at a certain potential whereas when the control electrode becomes less negative or more positive, a discharge occurs between the cathode 37 and anode 38 during each half-cycle of the voltage impressed thereon by the transformer 34 when the anode is positive with respect to the cathode. The discharge device 31 is similar to the discharge device 30 and comprises a cathode 41, anode 42 and control electrode 43 sealed in an envelope containing a filling of gas, mercury vapor or the like.

The cathodes 37 and 41 are connected to the transmitting circuit 32 and the anodes 38 and 42 are connected to the terminals of the secondary winding 33 of the transformer 34, the midpoint of which is grounded. The control electrodes 39 and 43 are connected through a resistor 46 and battery 47 to the cathodes of the discharge devices 30 and 31; and when the contacts of relay 11 are closed, said control electrodes are connected through a resistor 48, the contacts of relay 11 and battery 49 to said cathodes 37 and 41. As shown, the polarities of the batteries 47 and 49 are such that when the contacts of relay 11 are open, the potential impressed upon the control electrodes 39 and 43 maintains the discharge devices or valves 30 and 31 non-conductive whereas the control electrodes become positive or less negative when the contacts of relay 11 close and the discharge devices become conductive. Thus when the relay 11 closes its contacts, signalling current is impressed upon the transmitting circuit 32 from the transformer 34. Since the discharge devices 30 and 31 only conduct current when the anode of either device is positive with respect to its cathode, it will be apparent that each device is conductive during alternate half-cycles during the periods when the contacts of relay 11 are closed, and when the contacts of relay 11 open, the discharge current through the valve that happens to be conducting current ceases as the voltage wave passes through zero and is prevented from re-striking during the next cycle by the potential of the control electrode derived from the battery 47.

Thus although the discharge devices or valves 30 and 31 are of the discontinuous control type in which the potential of the control electrode is not effective to alter the discharge current through the device after it becomes conductive, by the use of an alternating current of a frequency of 1000 cycles per second or more, the signalling impulses impressed upon the line circuit correspond closely in shape to those generated by the transmitter 10. In certain applications and particularly where the signalling frequency is low, a power source of a lower frequency, such as 500 cycles per second, may be employed.

The signalling impulses obtained in a high speed ticker system employing a 1000-cycle power source are shown in Fig. 3, Fig. 3a representing the square-topped printer signals impressed upon the relay 11 and Fig. 3b representing the corresponding line signals. In order to decrease the

amplitude of the current variation resulting from the use of an alternating-current source, a low-pass filter comprising a series inductance 50 and shunt condensers 51 may be connected in the transmitting circuit 32, as shown in Fig. 1. Fuses 52 may also be connected in each branch of the transmission circuits to disconnect any branch circuit that accidentally becomes grounded.

Instead of employing spacing signals consisting of no-current intervals, the system may be arranged to transmit marking signals of one polarity and spacing signals of the opposite polarity. This modification is illustrated in Fig. 2 and, as shown, the system comprises a transmitter 10 of the type shown in Fig. 1 arranged to control a transmitting relay 54. The armature of the relay 54 is connected through a resistor 55 to positive battery and the respective contacts co-operating with said armature are connected to two groups of discharge devices arranged to impress signalling impulses of opposite polarity upon the line circuit 56. The discharge devices 60, 61, 62 and 63 of one group have their control electrodes connected in parallel relation to one contact of the relay 54 and the other contact of said relay is connected to the control electrodes of the other group of discharge devices 64, 65, 66 and 67. Alternating-current means including a transformer 71 having two secondary windings 72 and 73 are provided for energizing the line circuit 56 through one or the other of said groups of discharge devices depending upon the position of the armature of relay 54. The windings 72 and 73 may be similar and the peak voltage across one-half of one of said windings should be smaller than the positive voltage impressed on the resistor 55.

The discharge devices or valves 60—67 may be similar in construction and operating characteristics to the devices 30 and 31 described above in connection with the system shown in Fig. 1. The anodes of valves 60 and 62 are connected to one terminal of the secondary winding 72 of transformer 71 and the anodes of valves 61 and 63 are connected to the other terminal of said winding. The anodes of valves 64, 65, 66 and 67 are similarly connected to the terminals of the secondary winding 73 of transformer 71. The valves 62, 63, 66 and 67 may be omitted if desired, being connected in parallel to the valves 60, 61, 64 and 65, respectively, or additional valves may be employed in similar relation to increase the capacity of the system as the load increases. If the valves are operated in parallel, as shown, resistors 75 are preferably connected in series relation with the anode circuit of each valve to insure proper division of the load current.

The control electrodes of the discharge devices 60—63 connected to the left hand contact of relay 54 and the control electrodes of the discharge devices 64—67 are connected to the right hand contact of said relay whereby the two valve groups are alternately rendered conductive as the relay armature engages first one and then the other contact. When the relay armature is in engagement with the left hand contact, as shown, the control electrodes of valves 64—67 are biased to such a potential by a battery 78 that the valves are non-conducting. A battery 79 associated with the first group of valves is provided to maintain said valves non-conducting while the relay armature of relay 54 is in engagement with its right hand contact. Thus the line circuit 56 is energized through one group of valves while the armature of relay 54 is in engagement

with its marking contact and said circuit is energized through the other group while the armature of said relay is in engagement with its spacing contact.

In order to reverse the signalling current in the line as the groups of valves are alternately rendered conductive, the valve groups are oppositely connected between the transformer windings and the line circuit. The midpoint of the winding 72 is connected to the line circuit and the cathodes of the associated valve group 60—63 are grounded whereas the cathodes of the other valve group are connected to the line circuit and the midpoint of the winding 73 is grounded. The discharge current through the conductive group of valves is interrupted as the armature of relay 54 moves from one contact to the other since the potential impressed upon each valve of each group drops to zero during each cycle of the alternating voltage derived from transformer 71. In order to protect the valves against excessive current flow, fuses 80 may be connected in series relation with each valve. If one of the fuses 80 or the associated valve becomes burnt out, the load will be assumed by the parallel valve and the system will remain operative.

In this manner, current impulses of opposite polarity corresponding to the marking and spacing impulses received by relay 54 are impressed upon the line circuit. Fig. 4a represents the transmitter signals and Fig. 4b the signals impressed upon the line to operate receiving instruments or tickers 85. A lamp 86 may be connected in series relation with each branch conductor or circuit whereby the excessive current drawn by a circuit which accidentally becomes grounded will light the lamp in series with the grounded circuit to indicate the abnormal circuit condition. The resistance of each lamp 86 also prevents a defective branch circuit from grounding the entire system so that the remaining circuits are not affected by the accidental grounding of one branch line.

It is obvious that various modifications of the systems shown and described in detail for the purpose of explaining the invention will occur to those skilled in the art and consequently I desire that the invention shall not be limited in scope except as indicated in the appended claims.

I claim:

1. A signalling system comprising a line circuit, a plurality of recorders responsive to current impulses connected to said line circuit, means including a discharge device of the discontinuous control type in said circuit for transmitting signals consisting of successive current impulses over the circuit, said discharge device embodying a control electrode, means for normally maintaining the potential of said control electrode at a predetermined value, an alternating-current source in series with said discharge device and the line circuit, the frequency of said source being relatively high compared with the maximum signal frequency, and means including a source of periodic signals for varying the potential of said control electrode of the discharge device to control the conductivity of said device and thereby produce current impulses in the line circuit to operate said recorders.

2. A signalling system comprising a plurality of line circuits, means including a discharge device of the discontinuous control type in said circuits for transmitting signals consisting of successive current impulses over the circuits, an alternating-current source in series with said

discharge device and line circuits, the frequency of said source being relatively high compared with the signal frequency and means including a source of periodic signals for rendering said discharge device conductive, whereby said series-connected alternating current source and discharge device impress rectified current signals on said line circuit corresponding to the signals generated by said source of periodic signals.

3. A signalling system comprising a line circuit, a plurality of recorders responsive to periodic current impulses connected to said line circuit, two oppositely connected discharge devices of the discontinuous control type in said circuit, said discharge device embodying control electrodes, a transmitting contact device, means including said contact device for varying the potentials of said control electrodes for controlling the conductivity of said devices in accordance with periodic signals to be impressed upon the line circuit and alternating-current means in series with the discharge devices for energizing said line circuit through said discharge devices, the frequency of said alternating-current means being relatively high compared with the signal frequency.

4. A signalling system for operating a number of high speed telegraph recorders comprising a line circuit, two oppositely connected discharge devices of the discontinuous control type in said circuit, means for controlling the conductivity of said devices in accordance with periodic signals to be impressed upon the line circuit and alternating-current means of a frequency of the order of 1000 cycles per second in series with said discharge devices for energizing the line circuit alternately through one or the other of said discharge devices.

5. A signalling system comprising a plurality of parallel line circuits, a discharge device of the discontinuous control type, said device including a cathode, anode and control electrode, alternating-current means for energizing the line circuits through said discharge device when the latter is conductive, means including a source of periodic signals connected to vary the potential of the control electrode of said discharge device for rendering the discharge device conductive in pre-

determined relation to said signals and a source of potential connected to said control electrode to maintain said discharge device non-conductive except upon the occurrence of said signals.

6. A signalling system comprising a plurality of telegraph recorders, a line circuit thereto, a plurality of discharge devices of the discontinuous control type connected in parallel relation in said circuit, a plurality of other discharge devices of the discontinuous control type connected in parallel relation in said circuit and adapted to conduct current in the opposite direction, a resistor in series relation with each of said discharge devices, alternating-current means for energizing the line circuit through said discharge devices and means for controlling the conductivity of said discharge devices in accordance with signals to be impressed upon the line circuit.

7. A signalling system comprising a plurality of telegraph recorders, a line circuit thereto, a plurality of discharge devices of the discontinuous control type connected in parallel relation in said circuit, a plurality of other discharge devices of the discontinuous control type connected in parallel relation in said circuit and adapted to conduct current in the opposite direction, a resistor in series relation with each of said discharge devices, means for controlling the conductivity of said discharge devices in accordance with signals to be impressed upon the line circuit and separate alternating-current sources of opposite phase connected to the line circuit through the respective groups of discharge devices.

8. A signalling system comprising a line circuit, an alternating-current transformer provided with two secondary windings, electric valve means of the discontinuous control type for impressing signalling current of one polarity from one of said windings upon the line circuit and signalling current of the opposite polarity from the other of said windings upon the line circuit, means for controlling said valve means in accordance with predetermined code signals to generate current impulses of opposite polarity in the line circuit and telegraph receivers connected to said line circuit.

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