

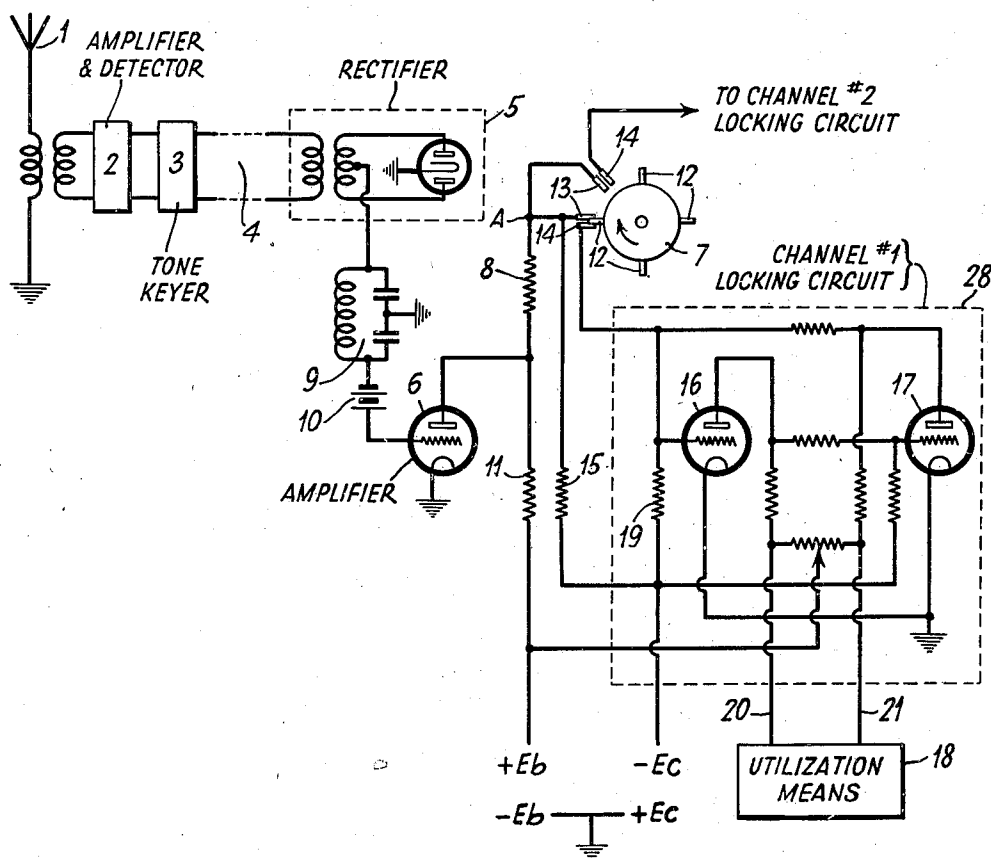
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MULTIPLEX RECEIVING CIRCUIT ARRANGEMENT

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MULTIPLEX RECEIVING CIRCUIT
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This invention relates to multiplex telegraph receiving systems and more particularly to a circuit arrangement adapted to feed into a locking circuit. It is a principal object of my invention to provide a resistance coupled input circuit interconnecting the input lines of a telegraph receiver with a so-called locking circuit and utilization means by which multiplex telegraph signals of short duration are caused to be prolonged sufficiently for the operation of conventional receiving devices.

A further object of my invention is to provide a method of and apparatus for easily and efficiently assigning the received signals to the different channels.

A still further object of my invention is to provide circuit arrangements in a receiving system such as shall be simple in construction, easy to maintain and made of the fewest possible elements in combination.

The present invention is an improvement upon and an outgrowth from the invention covered by my Patent 1,995,181, which was issued March 19, 1935, and entitled "Multiplex receiving apparatus."

The present invention, although not limited thereto, finds particular application to multiplex systems of the time division type, and for this reason the invention will be described with special regard thereto. In multiplex systems of the time division type the successive basic units of each channel are divided into equal portions of like number as the several channels, and the transmitting circuit is assigned consecutively to successive channels for a time interval equal at most to one of these portions, the remaining portion of each basic unit of each channel being discarded and subsequently restored at the receiving end of the circuit. Such a multiplex arrangement is described in United States Patent No. 1,979,484, granted November 6, 1934, to R. E. Mathes.

In brief, the present invention comprises a coupling system for assigning the received incoming signals to their respective channels, and for enabling the received signals to be rebuilt to their original form as at the transmitting station, whereby the suppressed portions of the transmitted signals are restored. For effecting this purpose, use is made of a coupling electron discharge device whose normal condition of electrical stability is changed upon the flow of signal currents in the input circuit of the receiving arrangement.

Referring to the single drawing accompanying this specification, there is shown a receiving cir-

cuit arrangement for a multiplex system in accordance with the present invention. This arrangement comprises, essentially, an energy collector or antenna 1, an amplifier and detector circuit 2 adapted to receive radio frequency energy from the antenna and to detect same in a manner well known in the art, a tone keyer 3 under control of apparatus 2 for transmitting over a land line 4 to the receiving station audible frequency tone which is interrupted in accordance with received signal energy, an amplifier and rectifier circuit 5 for producing the envelope of the keyed tone, coupling tube 6 and so-called kicker arrangement 7 with associated apparatus for assigning the incoming signals to their respective channels, each of the channels having a locking circuit 8 for rebuilding the received signal and transmitting the restored signal to a suitable utilization circuit 10.

Amplifier-detector apparatus 2 and tone keyer have been shown merely in conventional form since the manner of receiving signals over an antenna and subsequently amplifying and detecting the signals to operate a tone keyer is well known in the art. For a more detailed description, however, of the operation of the tone keyer circuit reference is made to United States Patent No. 1,874,866, granted to H. H. Beverage et al., particularly that portion which relates to Figure 2 thereof.

Similarly, amplifier-detector apparatus 5, which also is of a well known type, has been indicated in box form, the output or full wave rectifier part only being shown in order to illustrate its manner of connection to the coupling tube 6. Only the negative pulses of the rectified signal are applied to the grid of tube 6 since the positive end of the rectifier is tied down to the filament which is at ground or zero potential. A low pass filter 9 consisting of series inductance and shunt capacitance is utilized for smoothing out whatever tone components remain in the rectified signal.

In the circuit diagram shown, coupling tube 6 is biased by means of a grid battery 10 to pass current normally, in which condition there exists a positive potential on its anode which is lower in value than the potential of the anode supply $+E_b$, due to the IR drop in resistance 11. The receipt of a signal pulse on the grid of tube 6, however, is arranged to bias the grid so negatively as to make the tube block, that is, cease passing current, at which time the voltage on the anode of tube 6 will rise to the maximum value of $+E_b$.

since at this time substantially no current flows in the resistance 11.

Although this particular manner of operating tube 6 has been described, it will readily be understood that the invention is not limited thereto, since the desired coupling effect can be obtained in other ways, for example, by biasing tube 6 to cut-off at all times except when a signal is impressed on its grid, merely by the use of a reversing tube, or else by permitting tube 6 to draw current at all times and changing the magnitude thereof in accordance with the incoming signals.

When the incoming signals are applied to the grid of the tube 6 they, of course, vary the impedance of the tube in such a way as to produce changes in the voltage of the anode with respect to the cathode. These voltage changes are reflected in corresponding variations of voltage drop across a resistor 8 to a point A and further across a resistor 15 to a source of direct current potential the negative pole $-E_c$ of which is shown on the drawing to indicate a potential more negative than that of the cathode of the tube 6. The cathode is shown grounded but is not necessarily grounded. The circuit point A is connected to certain terminals 13 of a distributor or kicker arrangement. The distributor as shown in the drawing is provided with a kicker disc 7 which may consist of any suitable system of devices for conductively closing an electrical circuit between different pairs of contact terminals or segments 13 and 14. In a conventional type of distributor, for example, the segments 13 and 14 may be positioned on a common radius about the center of rotation of the element 7 and one or more brushes 12 may be caused to wipe over the stationary segments 13, 14 so as to bridge the same. Each of the segments 14 is connected to an appropriate channel leading to a so-called locking circuit. The locking circuit for channel #1 has been shown in detail, while that of channel #2 has been indicated by a legend. The operation of the distributor is such as to close a circuit conductively to the locking circuits for the different channels in succession. It will be understood that the distributor, although it is shown arranged for only two channels, may be adapted for any desired number of channels. This distributor is usually driven by a motor, not shown, which is maintained in synchronism by the incoming signals. The synchronizing means are, however, no part of the present invention.

In each receiving channel and in circuit with one of the contact segments 14 of the distributor is a biasing resistor 19 leading to the negative biasing source $-E_c$. The locking circuit includes two electron discharge devices 16 and 17. The grid of tube 16 is directly connected to an appropriate distributor segment 14. Between this connection and the anode of tube 17 is a suitable resistor. A cross connection is also provided between the grid of tube 17 and the anode of tube 16 through a similar resistor. Other resistors are provided as shown in the drawing for biasing purposes and for causing the locking circuit to possess two alternative states of electrical stability. These tubes are unstable when both are drawing current, but stable when one tube is passing current and the other blocking. The changing from one condition of stable equilibrium, such as when tube 16 is blocking and tube 17 is passing, to the other condition, when tube 16 is passing and tube 17 blocking, or the reverse, is caused by the presence of a suitable potential

on the grid of tube 16 which is due, in this case, to the polarity applied to segment 14 of the distributor, and when it is bridged in contact with segment 13 to receive either a positive or negative charge which for the moment appears at the point A due to the operation of the tube 6 and the consequent variation in the flow of current across resistor 8. This locking circuit is more adequately described in United States Patent 1,844,950 granted February 16, 1932 to J. L. Finch, to which reference is made for a more detailed explanation of the operation thereof.

Coupled to the output terminals of the locking circuit 28 may be any type of utilization circuit 18, such as a relay, an ink recorder, a printer, or local tone oscillator. This utilization circuit responds to the changes of polarity occurring in the output of 28 for marking and spacing conditions which, in turn, are due to the unbalance of the locking circuit under its two degrees of stability.

The operation of the circuit is as follows:

The respective values of the resistors 11, 8 and 15 forming a potentiometer between the terminals $+E_b$ and $-E_c$ of the direct current source are suitably chosen for shifting the voltage of the point A above and below ground potential, depending upon the blocking condition or conductance of the tube 6. If this tube is passing current the voltage at the point A is sufficiently negative with respect to ground so as to block the tube 16 when the distributor brush 12 applies this voltage to the grid of tube 16. This condition having been established momentarily, the tube 17 will be excited to pass current and will continue to do so until a pulse of opposite polarity is introduced on the grid of the tube 16. This change of polarity is occasioned by blocking tube 6 at the moment when a succeeding circuit is closed through the distributor to channel #1. Point A will now be positive with respect to ground so that the applied potential on the grid of tube 16 will be positive and will cause this tube to draw current, thereby cutting off the current flow in tube 17.

It will be understood that various changes may be made in the resistance network such as will provide proper variations in the polarities at the point A with respect to ground so as to control each of the locking circuits in the multiplex system in the manner described. The essential feature of the system as shown is the provision of resistors having suitable values in relation to the biasing sources such that each locking circuit when connected through the distributor will be dependably controlled.

It will be noted that the particular circuit arrangement herein shown and described differs considerably from that of my earlier invention as disclosed in United States Patent 1,995,181 since capacitive coupling means were there provided in place of resistive coupling means as herein shown. Furthermore, in the earlier invention of the patent the anode of tube 6 was directly connected to the segments of the distributor and the coupling means were interposed between the distributor and the locking circuit. In the present case, however, the coupling means are interposed between the output circuit of the tube 6 and the distributor, and the distributor segments are directly connected to their respective locking circuits. These changes have been found to provide improved results and the novelty of the system is set forth in the appended claims.

1. A multiplex telegraph receiving system comprising an electronic circuit arrangement for de-

5 tecting and amplifying incoming signals, a multi-
plex distributor, means including a resistor for
feeding said signals from said circuit arrange-
ment to said distributor, means including a bias-
10 ing source connected negatively through another
resistor to the junction between the first said re-
sistor and said distributor and positively through
a third resistor to the signal input end of the first
said resistor for causing said signals to vary the
15 potential at said junction, a locking circuit hav-
ing two states of electrical stability under alter-
native control of said signals when such are
transferred thereto by said distributor, and a
utilization circuit operable by changes from one
20 to the other of said states.

2. A multiplex telegraph receiving system com-
prising an electron discharge tube under con-
trol of incoming signals, said tube having an out-
put circuit connected from its anode through a
25 resistor and a direct current source to its cathode,
a multiplex distributor operative to connect said
anode periodically to different channels, a second
resistor interposed between said anode and said
distributor, a third resistor connecting the end
25 of the second resistor adjacent the distributor to
the negative pole of a direct current source whose
positive pole is connected to said cathode, a signal
storage device in each of said channels, and a
utilization device connected to each said storage
30 device and operative therefrom.

3. In a system for receiving telegraph signals
by means of a multiplex channel distributor, a

plurality of locking circuits and a corresponding
plurality of utilization devices, the method of
transferring said signals through the aforesaid
apparatus units which comprises detecting and
5 amplifying the signals, generating from said sig-
nals direct current impulses of different poten-
tials, causing said impulses to be conductively
transferred to and through said distributor and
thence to each of said locking circuits in succes-
10 sion, and causing said locking circuits to prolong
the effects of said impulses, thereby to control
said utilization devices.

4. A multiplex telegraph receiving system com-
prising a signal responsive discharge tube, a di-
rect current source and a resistor series connected
15 across the discharge path of said tube, a plurality
of locking circuits each appropriate to a com-
munication channel in said system, a distributor
having a plurality of channel segments each suc-
cessively closeable to render said locking circuits
20 individually responsive to signals applied to said
discharge tube, a resistor connected between an
output electrode of said discharge tube and a por-
tion of said distributor common to the several
channels, and means for producing a potential
25 drop across the last said resistor which varies in
dependence upon the conductive and non-con-
ductive states of said tube, thereby to transfer
said signals through said distributor to said lock-
30 ing circuits.

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