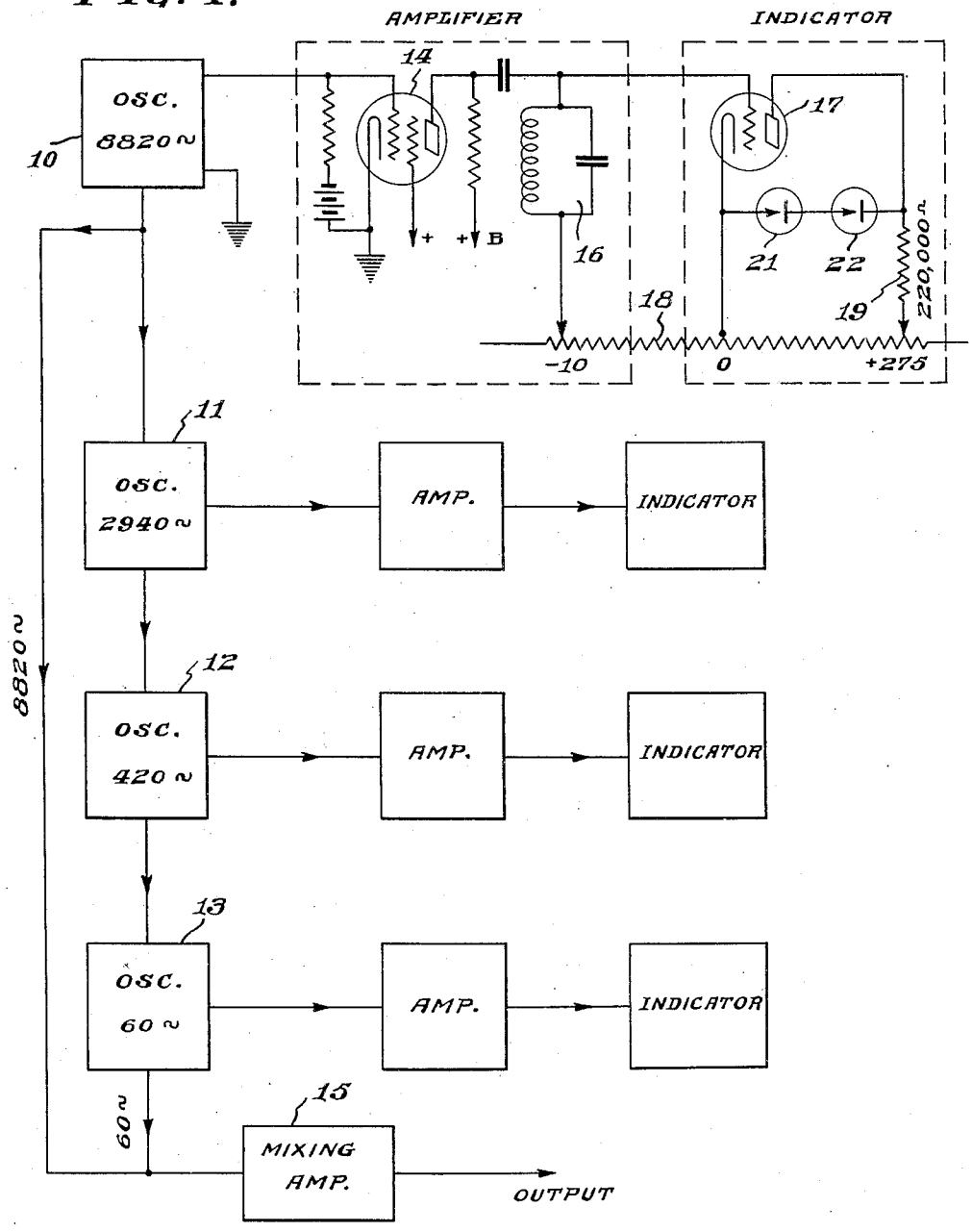
March 7, 1939. G. L. BEERS 2,149,829

INDICATING AND SWITCHING APPARATUS

Filed Aug. 31, 1937 2 Sheets-Sheet 1

FIG. 1.



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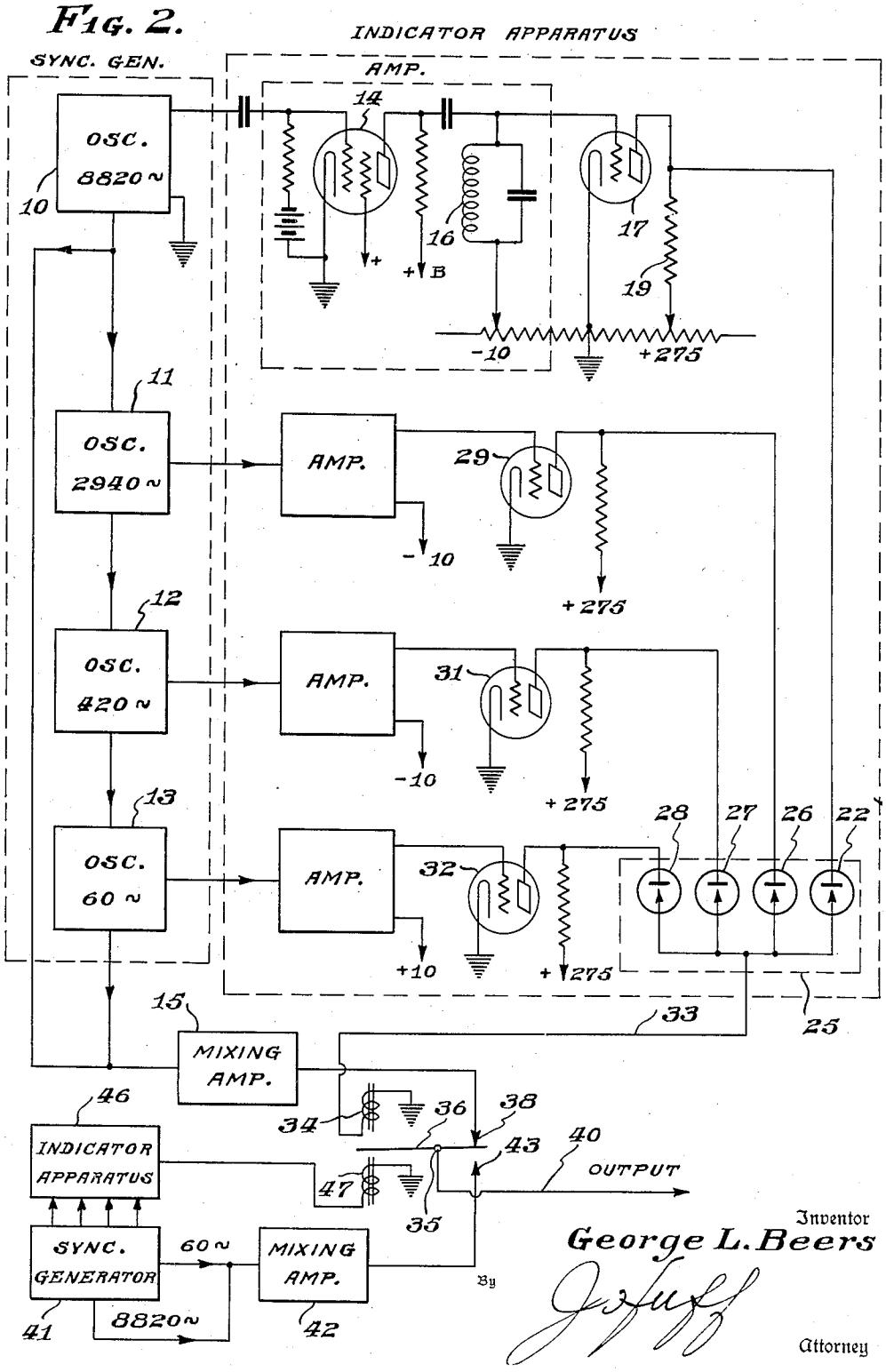
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INDICATING AND SWITCHING APPARATUS

Filed Aug. 31, 1937 2 Sheets-Sheet 2

FIG. 2.



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Patented Mar. 7, 1939

2,149,829

UNITED STATES PATENT OFFICE

2,149,829

INDICATING AND SWITCHING APPARATUS

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Application August 31, 1937, Serial No. 161,757

5 Claims. (Cl. 250—36)

My invention relates to indicating and control apparatus and particularly to apparatus for indicating whether an oscillator is operating properly and/or for switching automatically into a circuit a spare oscillation generator in the event of failure of the main generator.

In television transmitters, it is general practice to employ a synchronizing impulse generator comprising a chain of oscillators which function as frequency dividers for obtaining vertical synchronizing impulses that are locked in with the horizontal synchronizing impulses. If one of these oscillators fails to operate, it is difficult to identify this particular oscillator unless each oscillator is provided with means for indicating that it is operating at the correct frequency. Also, if one of the oscillators fails, another "sync" generator must be substituted immediately in order to keep the television program on the air.

It is, accordingly, an object of my invention to provide an improved indicator for oscillators.

It is a further object of my invention to provide an improved indicator of the above-mentioned type which may be actuated at a remote point from the oscillator.

It is a still further object of my invention to provide means for switching automatically into a transmitter circuit a spare impulse generator in the event of failure of the generator in use.

In a preferred embodiment of my invention, an amplifier having a tuned circuit is connected to the oscillator which is to be provided with an indicator, the tuned circuit being tuned to the frequency at which it is desired to operate the oscillator. An electric discharge tube rectifier is connected across the tuned circuit whereby the rectifier output current is comparatively large so long as the oscillator output is of the correct frequency and magnitude.

A neon lamp or other suitable indicating device is so connected in the rectifier output circuit that a substantial decrease in the rectifier output current will cause a voltage rise across the lamp, thereby lighting it and indicating that the oscillator output has changed.

In the embodiment of my invention where a spare "sync" generator is switched automatically into a transmitter circuit in response to failure of the main generator, a relay is so connected to the main generator that the relay is energized in response to failure of any oscillator of the main generator. This automatically disconnects the main generator from the transmitter and substitutes the spare generator.

The invention will be better understood from the following description taken in connection with the accompanying drawings in which

Figure 1 is a circuit and block diagram of a portion of a television transmitter embodying my invention, and

Figure 2 is a circuit and block diagram of another embodiment of my invention.

Referring to Fig. 1, I have shown a chain of oscillators 10, 11, 12 and 13, each of which may be a multivibrator, for example, and each of which, preferably, is self-oscillatory. The frequency of the main oscillator 10 (which in the example shown is the horizontal deflection frequency) is divided in a series of steps to produce the desired 60-cycle framing frequency. The outputs of oscillators 10 and 13 are supplied to a mixing amplifier 15 where they are added or mixed before being supplied to the output circuit.

Each oscillator is provided with indicating apparatus which may conveniently be considered as comprising an amplifier section and an indicator section as indicated.

Referring to the circuit diagram of the indicator apparatus connected to oscillator 10, it comprises an amplifier tube 14 which may be of the screen grid type. The plate circuit of this tube includes a tuned circuit 16 which is tuned to the frequency at which oscillator 10 is to operate, this being 8820 cycles in the example illustrated.

The input circuit of a rectifier tube 17 is connected across the tuned circuit 16. Rectifier 17 may be a triode which has its grid so negatively biased that it functions as a rectifier. The grid bias and the plate voltage preferably are obtained from a voltage divider resistor 18.

The plate voltage is supplied to the plate of the tube 17 through a high resistance resistor 19 whereby a flow of plate current produces a substantial voltage drop at the plate.

One or more indicating devices, such as neon lamps, are connected between the cathode of tube 17 and the plate end of resistor 19. In the example shown, two neon lamps 21 and 22 in series are utilized, one of them being located on the local control panel of the multivibrator and the other being located at a remote control point.

The operation of the indicator is as follows: So long as oscillator 10 is supplying a voltage at the desired frequency and amplitude, there is a voltage of considerable magnitude appearing across tuned circuit 16. This causes a substantial current flow through plate resistor 19, whereby the plate end of this resistor is at a substantially lower potential than the point on the voltage divider 18, to which it is connected. Therefore,

the voltage impressed across the neon lamps 21 and 22 is insufficient to light them.

If the frequency of oscillator 10 changes, or if its voltage output drops substantially in magnitude, the voltage across tuned circuit 16 becomes less, the current flow through plate resistor 19 is reduced, and the voltage across lamps 21 and 22 rises to a value which causes them to light up, thus indicating trouble at this particular oscillator.

The indicating apparatus for each of the other oscillators in the frequency divider chain preferably is the same as the indicating apparatus described above.

On the circuit diagram of the indicator for oscillator 10, the biasing voltage and plate voltage of the rectifier tube and the value of the rectifier plate resistor are indicated merely by way of example.

It will be noted that the voltage applied across the lamps 21 and 22 is a direct current voltage whereby it may be supplied through conductors of considerable length without difficulty. For this reason, my improved indicating apparatus is especially adapted for actuating a neon lamp or other suitable indicating device at a remote point.

Referring to Fig. 2, like parts in Figs. 1 and 2 are indicated by the same reference numerals. It will be seen that in the circuit of Fig. 2 the indicator lamp 22 on the control panel 25 is lighted in response to the failure of oscillator 10 in the same manner as previously described. Only one indicator lamp is shown for oscillator 10. Likewise, a single indicator lamp is shown for each of the oscillators 11, 12 and 13, these lamps being 26, 27 and 28, respectively.

In Fig. 2 the indicator lamps are shown connected to the grounded cathodes of the indicator rectifier tubes 17, 29, 31 and 32 through a common conductor 33. It will be apparent that current flows through conductor 33 only when one of the oscillators in the "sync" generator fails to operate properly.

In order to switch a second "sync" generator into the transmitter circuit in the event of such failure, a relay winding 34 is connected in series with the conductor 33. The armature 36 pivoted at the point 35 and associated with the winding 34 is held in contact with a contact point 38 so long as winding 34 is not energized. Thus, the first "sync" generator is connected through mixing amplifier 15 to the output conductor 40 so long as all oscillator units of the first generator are operating to supply voltage at the correct frequency and amplitude.

In case of failure of any oscillator in the frequency divider chain 10, 11, 12, 13, a second "sync" generator 41 is connected through a mixing amplifier 42 to the output conductor 40 as a result of the winding 34 being energized and pulling armature 36 into contact with the contact point 43.

It will be seen that at the same time the second generator 41 is connected into the circuit, a lamp lights on the panel 25 to show which oscillator of the first generator has fallen out of step or otherwise failed.

Preferably the second "sync" generator 41 is also provided with indicating apparatus 46 which may be identical with the indicating apparatus for the first "sync" generator. Also, it is desirable to provide automatic switching means for switching in the first generator in the event of failure of the second generator. Such switching means may comprise a relay winding 47 associated with the relay armature 36 and connected to be energized when an indicator lamp of the indicating apparatus 46 lights up.

If generator 41 fails while connected to the output line 40, the winding 47 pulls the armature 36 to the position illustrated, thus connecting the first generator to the line. It will be understood that the armature 38 remains on one side or the other of the center position and in contact with one of the contact points depending upon which relay winding is energized, a momentary energization of a winding being sufficient to switch in a different generator. For example, if current flows through winding 47 for an instant and then stops, the armature 36 remains in the position illustrated until current next flows through the winding 34.

It is not necessary, of course, that indicating devices such as neon lamp 22 be employed in combination with the automatic switching apparatus, although they are desirable. Therefore, any suitable device, such as a vacuum tube biased beyond cut-off, may be substituted for a neon lamp. Such a vacuum tube would be so biased that it would pass current only after a voltage exceeding a predetermined value was applied to its control grid.

I claim as my invention:

1. Indicating apparatus for an oscillator, said apparatus comprising an amplifier tube connected to said oscillator, said tube having an output circuit which is tuned to the frequency at which it is desired that said oscillator operate, an electric discharge tube having a grid, a cathode, and a plate, said grid and said cathode being connected across said tuned circuit, means for so biasing said electric discharge tube that it functions as a rectifier, a plate resistor having one end connected to said plate, a voltage source connected between said cathode and the other end of said plate resistor for applying a positive potential to said plate, and a voltage-operated indicating device connected across at least a portion of said plate resistor and across at least a portion of said voltage source.

2. Indicating apparatus for an oscillator, said apparatus comprising an amplifier tube connected to said oscillator, said tube having an output circuit which is tuned to the frequency at which it is desired that said oscillator operate, an electric discharge tube having a grid, a cathode, and a plate, said grid and said cathode being connected across said tuned circuit, means for so biasing said electric discharge tube that it functions as a rectifier, a comparatively high resistance plate resistor, means for applying a positive voltage to said plate through said plate resistor, and a voltage-operated indicating device connected between said cathode and the plate end of said plate resistor.

3. In combination, a generator of synchronizing impulses, said generator comprising a chain of oscillators, each of said oscillators operating at a different frequency and each one being locked in step with the next preceding oscillator, a relay including a switch normally connecting said generator to an output conductor, a second generator of synchronizing impulses, means for actuating said relay in response to any one of said oscillators failing to supply a voltage at a predetermined frequency or amplitude and thereby disconnecting said first generator from said output conductor and connecting said second generator to said output conductor.

4. In combination, a generator of synchronizing impulses comprising a chain of oscillators connected to function as frequency dividers, a second generator of synchronizing impulses, means for normally keeping said first generator connected to an output conductor, and means for disconnecting said first generator from said conductor and connecting said second generator to said conductor in response to any one of said oscillators failing to supply a voltage at a predetermined frequency.

5. In combination, a pair of synchronizing impulse generators each comprising a chain of oscillators connected to function as frequency dividers, means for normally keeping one of said generators connected to an output conductor, means for disconnecting said one generator from said conductor and connecting the other of said generators to said conductor in response to any one of the oscillators in said one generator failing to supply a voltage at a predetermined frequency, and means for disconnecting said other generator from said conductor and connecting said one generator to said conductor in response to any one of the oscillators in said other generator failing to supply a voltage at a predetermined frequency.

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