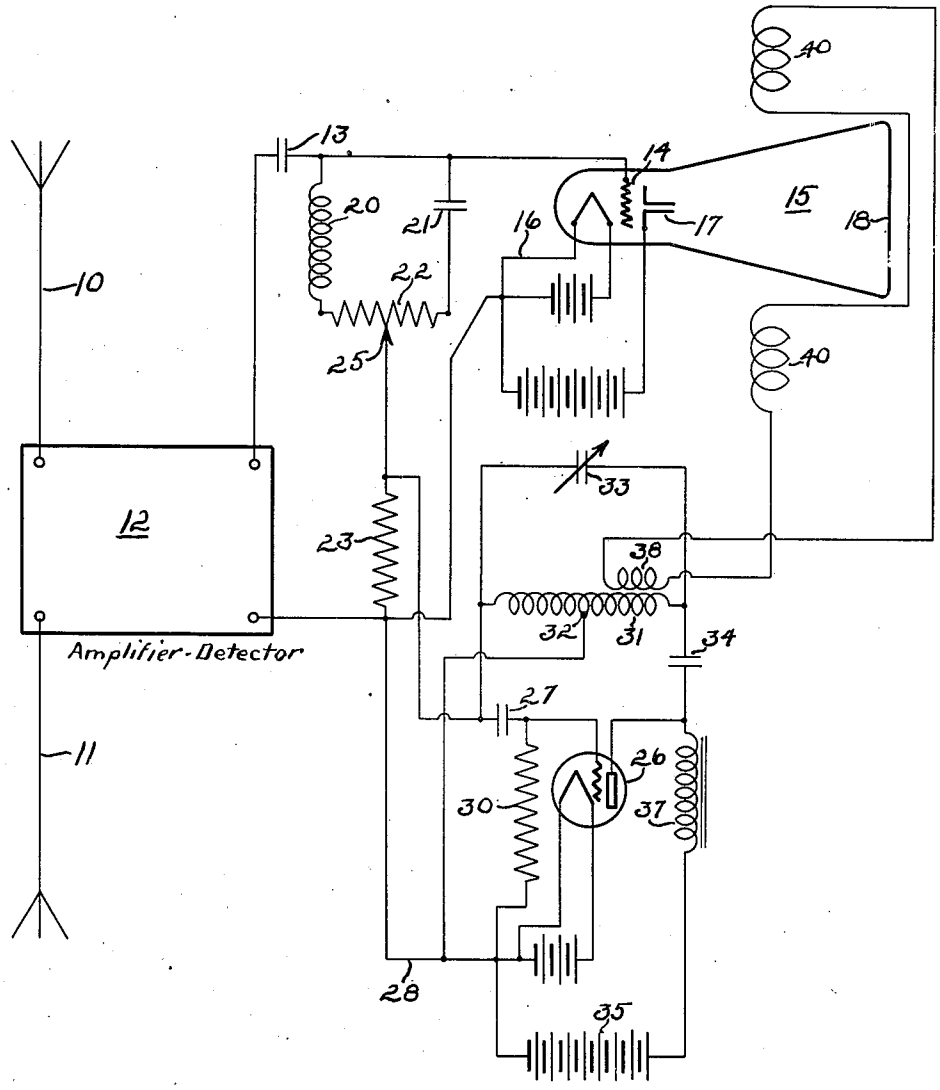
Aug. 22, 1933. A. H. BROLLY 1,923,252

PHASING DEVICE

Filed May 31, 1930




INVENTOR,
ARCHIBALD H. BROLLY.
BY Donald W. Lippincott
ATTORNEY.

Patented Aug. 22, 1933

1,923,252

# UNITED STATES PATENT OFFICE

1,923,252

## PHASING DEVICE

Archibald H. Brolly, San Francisco, Calif., assignor to Television Laboratories, Inc., San Francisco, Calif., a Corporation of California

Application May 31, 1930. Serial No. 457,879

7 Claims. (Cl. 178—44)

My invention relates to systems for providing power of variable phase as referred to a source which may be considered as fixed, and particularly to such systems as applied to phasing the current used for deflecting the cathode ray stream in cathode ray oscillograph tubes such as are used for receiving television pictures.

Among the objects of my invention are: First, to provide a phasing system which may be directly connected to the control electrode of the cathode ray tube without materially affecting the voltage thereof; second, to provide a phasing system which will give a phase rotation of substantially 180°; third, to provide a control means of the type described wherein the deflection of the rays is substantially independent of the phase; and fourth, to provide a phasing system which is simple, continuously adjustable, and of general utility for the purposes mentioned above and for other purposes where phase variation is desired.

My invention possesses numerous other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is to be understood that I do not limit myself to this disclosure of species of my invention, as I may adopt variant embodiments thereof within the scope of the claims.

The single figure of the drawing is a schematic diagram of the phasing system of my invention as applied to a television receiving system.

In general terms, my device employs a phase rotating network comprising oppositely reactive links connected to one side of the supply. A resistive link joins the free ends of the two reactive links, and is provided with a variable contact connected to a relatively low resistance, which, in turn, connects with the opposite side of the supply circuit. Movement of the adjustable contact varies the phase of the voltage drop in the resistance, and if the resistive link is made of high impedance as compared with the two reactive links, this phase rotation may be made to approach 180° as nearly as may be desired. In the preferred form of the device here shown, the supply circuit is the control electrode circuit of an oscillight or television receiving tube. The cathode ray stream of this tube is deflected by current supplied by an oscillator, and this oscillator is controlled as to its phase by the potential drop across the resistance. If the oscillator be adjusted for maximum output, the input voltage will not affect the output power, but will merely serve to regulate its phase.

In greater detail, the device of my invention is shown as applied to a receiver of television radio signals. The signals are received on an antenna system 10—11, and are fed to the amplifier-detector 12, which may employ any of a number of well known circuits. The output circuit of the amplifier-detector connects through a grid condenser 13 with the control electrode 14 of an oscillight or cathode ray oscillograph 15.

The oscillight is provided with the usual filament circuit 16, anode 17, and fluorescent screen 18.

Connected to one side of the output circuit of the detector-amplifier 12, is the phase rotating circuit, which comprises an inductive link 20, a capacitive link 21, and a resistive bridge-link 22 which joins the free ends of the two reactive links. The impedance of the two reactive links is preferably made as high as possible, and substantially the same at the scanning or synchronizing frequency which the network is desired to phase.

A resistance 23 is connected to the other side of the supply circuit. This resistance is connected by the adjustable contact 25 to the bridge-link 22.

The impedance of the bridge-link 22 is preferably high as compared to that of the links 20 and 21, while the impedance of the resistance 23 is low as compared with the impedance of these links. For this reason, the phase of the current flowing through the network is determined almost exclusively by the links 20, 21 and 22, the resistance 23 having little effect upon it, and the voltage drop across the resistance 23 is in phase with its current.

When the movable contact 25 is moved to the extreme left, the impedance bridged across the supply circuit is practically that of the link 20 and the resistor 23 in series, since the high resistance of the bridge-link 22 almost prevents the flow of current through the condensive link 21. With the movable contact at the extreme right of the bridge-link 22, the current flow is supplied almost entirely through the condenser. In the position shown, the current through the resistance 23 is supplied equally through the links 20 and 21, and current and potential drop through the resistor 23 are in phase with the supply voltage.

By making the bridge-link of high impedance and the resistor 23 of low impedance, the phase

rotation secured may be made practically 180°. Higher impedance in the resistor 23, and lower impedance in the bridge-link 22, both serve to limit the phase rotation obtainable, but increase the voltage across the bridge-link.

A practical circuit of this character, operating at a frequency of 2,000 cycles, utilized an inductive link of 30 henries inductance, a condenser of .0002 microfarads, the impedance of the two reactive links being approximately 400,000 ohms. A high resistance potentiometer of a well known type, having 1,000,000 ohms resistance, was used as a bridge-link. The resistance 23 was in this case about 20,000 ohms.

Connected across the resistance 23, is the input circuit of a vacuum tube oscillator 26. The oscillator shown in the diagram is a sine wave generator of well known type, employing the so-called "Hartley" circuit, but any suitable type of oscillating generator may be used, including a sloped-wave generator such as is described in the co-pending application of Farnsworth and Lubcke, Serial No. 449, 985, filed May 5, 1930.

As shown in the drawing, the grid of the oscillator tube 26 is connected through the condenser 27 to the adjustable contact 25. The filament of the oscillator connects through the lead 28 to the low potential side of the supply circuit, and the filament of the oscillight. The grid of the oscillating tube is biased through a grid leak 30, the resistance of which is effectively in parallel with the resistor 23 and which should be computed in establishing the value of this resistance.

The oscillating circuit comprises an inductance 31 having a center tap 32 which connects to the filament of the tube. The inductance is tuned by a condenser 33 to approximately the scanning frequency used. One end of the inductance connects to the condenser 27, and the other end connects through the condenser 34 to the plate of the tube 26. The plate current of the tube is supplied from the source 35 through the choke coil 37.

A coil 38 is coupled to the inductance 31 of the oscillating circuit, and supplies current for the deflecting coils 40—40 which move the cathode beam of the oscillight.

The oscillator shown will produce self-oscillation, and may be tuned by means of a variable condenser 33 to the scanning frequency used in connection with the television signals. There is a certain amount of instability inherent in all self-excited oscillators, and the probability is that the frequency of the oscillator will differ slightly from the scanning frequency used in transmitting the television signals. It is, however, customary to transmit synchronizing impulses concurrently with the television signals. This may be done in one of two ways. Either a series of high scanning frequency impulses may be transmitted, followed by the picture impulses comprising one entire traversal of the picture field, and this again followed by another succession of high scanning frequency impulses, or a single impulse may be sent by the transmitter between each two successive lines scanned across the picture. The first of these systems is described in detail in Patent No. 1,844,949, issued February 16, 1932, to Philo T. Farnsworth and entitled Synchronizing system. The second is described in the copending application, Serial No. 449,984, filed May 5, 1930 by Philo T. Farnsworth.

Where either of these systems is used, a carrier wave, modulated by both the picture and the synchronizing impulses, is received on the antenna system 10—11, detected by the receiver 12, and the combination of scanning and picture impulses is applied between the filament circuit 16 and grid 14 of the oscillight, and also across the network 20, 21, 22, 23. Of the received impulses only the scanning impulses come with any regularity, and the phase of these impulses, as applied across the resistor 23, is determined by the setting of a variable contact 25 of the phasing network.

The potential across the resistor 23 is applied between grid and filament of the oscillatory tube 26, and serves to hold this oscillator not only in step, but also in phase as determined by the setting of the variable contact.

If scanning impulses of a frequency corresponding to the number of pictures per second are also transmitted, a second phasing network similar to that described may be connected in parallel with the one shown, and used to synchronize a low scanning frequency oscillator. Since the elements of such a network would be identical, in a diagrammatic showing with those shown, they are omitted from the diagram, as they would only cause complication therein.

I claim:

1. In a device for providing a voltage of adjustable phase angle from a pair of conductors supplied from an alternating source, an inductive link and a capacitive link, each connected to the same one of said conductors, a resistive bridge-link connecting said first-mentioned links, and an impedance directly connected to the other conductor and adjustably connected to said bridge-link to provide a voltage drop therein of the required phase.

2. In a device for providing a voltage of adjustable phase angle from a pair of conductors supplied from an alternating source, an inductive link and a capacitive link, each having substantially the same reactive value at the frequency of the source and connected to one of said conductors, a resistive bridge-link connecting said first-mentioned links, and an impedance directly connected to the other conductor and adjustably connected to said bridge-link to provide a voltage drop therein of the required phase.

3. In a device for providing a voltage of adjustable phase angle from a pair of conductors supplied from an alternating source, an inductive link and a capacitive link, each having substantially the same reactance value at the frequency of the source and connected to one of said conductors, a resistive bridge-link connecting said first-mentioned links and having a relatively high impedance as compared thereto, and an impedance directly connected to the other conductor and adjustably connected to said bridge-link to provide a voltage drop therein of the required phase.

4. In a device for providing a voltage of adjustable phase angle from a pair of conductors supplied from an alternating source, an inductive link and a capacitive link, each connected to the same one of said conductors, a resistive bridge-link connecting said first-mentioned links, and a relatively low resistance directly connected to the other conductor and adjustably connected to said bridge-link to provide a voltage drop of the required phase.

5. A system for providing a variable phase

output from a constant phase source comprising a pair of oppositely reactive links connected to one side of said source, a resistive bridge-link connecting the free ends of said reactive links, a resistance connected to the other side of said source and adjustably connected to said bridge-link, and an oscillator controlled as to phase by the voltage across said resistance.

6. In combination with a cathode ray tube having a control electrode therein, a phase shifting network connected across the control electrode circuit, an oscillator for supplying power for deflecting the cathode ray stream, and means for applying a voltage from said network to control said oscillator.

7. In combination with a cathode ray tube having a control electrode therein, a supply circuit connecting to said control electrode, a pair of oppositely reactive links connected to one side of said supply circuit, a resistive bridge-link connected between said reactive links, a resistance connected to the other side of said circuit and adjustably connected to said bridge-link, and an oscillator for supplying power for deflecting the cathode ray stream and controlled by the voltage drop across said resistance.

ARCHIBALD H. BROLLY.