PUBLISHED

MAY 18, 1943.

BY A. P. C.

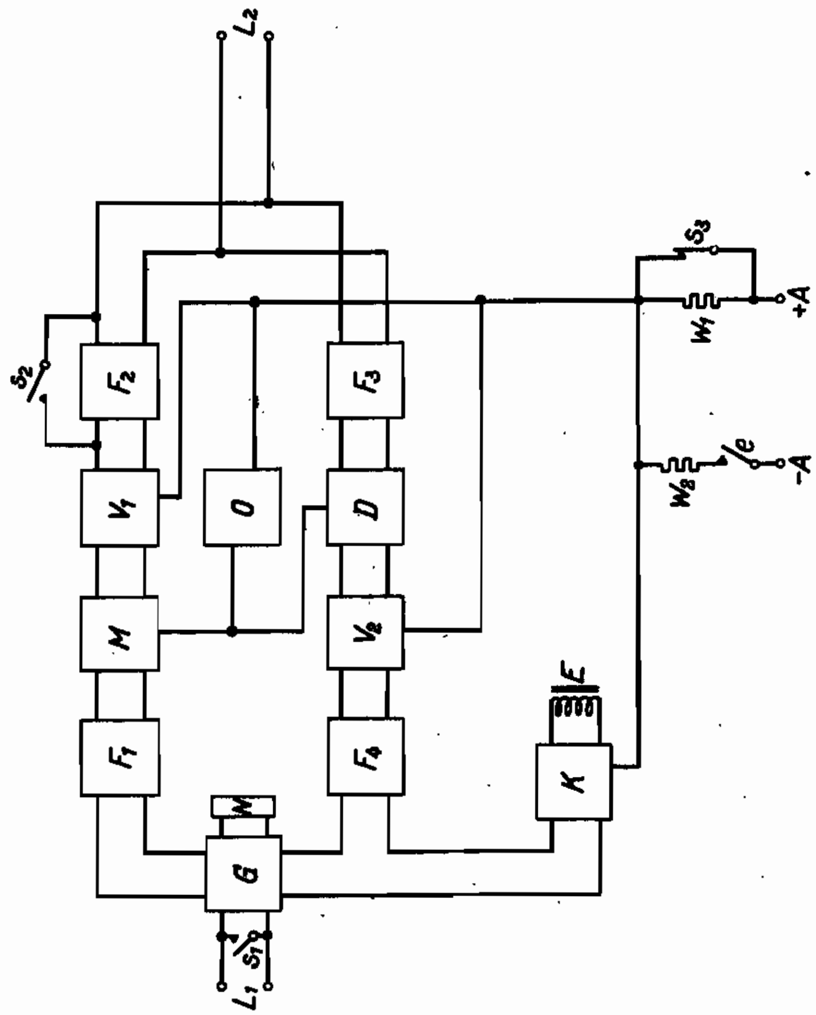
W. HAGEN

CARRIER FREQUENCY SYSTEMS

Filed Jan. 6, 1940

Serial No.

312,644



Inventor:
Wolfgang Hagen
by [signature]
Attorney.

Published May 18, 1943

Serial No. 312,644

ALIEN PROPERTY CUSTODIAN

CARRIER FREQUENCY SYSTEMS

Wolfgang Hagen, Berlin, Germany; vested in the Alien Property Custodian

Application filed January 6, 1940

This invention relates to carrier frequency systems, and more particularly to circuit arrangements for testing the operability of carrier frequency apparatus.

Each terminal equipment of carrier frequency systems comprises a number of conversational links, each of which includes a number of thermionic valves serving different purposes. It is frequently desirable to provide possibilities for testing such terminal equipment in a possibly simple manner with respect to its operability and to effect such test without necessitating cooperation with terminal equipment at the remote end of a carrier telephone line.

It is the object of this invention to provide simple means for internally testing the terminal station of a carrier frequency line. This is accomplished according to the main feature of this invention by artificially unbalancing the electric symmetry of the four-pole termination in order to provide a superposing frequency which is then utilized for testing the operative condition of each and every thermionic valve stage forming part of a terminal station.

My invention will be more readily understood from the following description taken in conjunction with the accompanying drawing, the single figure of which diagrammatically shows one embodiment of this invention.

The circuit arrangement shown in this drawing operates in the following manner. Low frequency signals resulting from a conversational connection incoming over the subscriber's line L1 pass through the four-pole terminal G, which is cooperatively connected to a balancing network N, and the low-pass filter F1 to a modulator M, where these signals serve to modulate a carrier frequency emanating from a carrier frequency generator O. The resulting two sidebands are then amplified in an amplifier V2 but the following filter F2 only passes the lower of these sidebands for further transmission to the outgoing subscriber line L2.

Conversational calls incoming from the line L2 at the frequency of the upper sideband are impressed upon a filter F3, which is designed to pass this sideband to a demodulator D, in which it is demodulated by means of the same carrier frequency from the generator O. After demodulation the resulting low frequency message currents are amplified in a low frequency amplifier V2 and then applied to the outgoing line L1 through the four-pole terminal G. Ringing signals occurring at the output circuit of amplifier V2 as a mixture of voice frequency and a ringing frequency of 20 cycles per second operate a signal-responsive device K which is caused to transmit the 20 cycles ringing current to the subscriber's line L1.

When it is desirable to test this terminal station, the operator actuates a particular switch (not shown). The contact s1 of this switch unbalances the symmetry of the four-pole terminal G, e. g. by establishing a short-circuit across the wires of the line L1, while the filter F2 is short-circuited with respect to one sideband by a contact s2, so that the second sideband is allowed directly to pass from the amplifier V1 of the transmitting branch to the filter F3 of the receiving branch. Since the low frequency blocking action of the four-pole terminal is upset, the whole carrier frequency transmitting branch is caused to oscillate at two frequencies, that is at the low frequency incoming through the filters F1 and F4 and at the frequency of the one sideband incoming through filter F3 as a result of the modulation of the carrier frequency with the low frequency in the modulator M. The sideband frequency is again demodulated in the device D.

This oscillating or singing condition of the receiving branch ceases when the generator O is rendered ineffective, since the filter F3 does not pass low frequency oscillations. On the other hand, this singing condition will be interrupted as soon as any failure occurs in the overall circuit, e. g. in response to a break-down of any element, such as the thermionic valves of the amplifiers V1 and V2. It is thus obvious that the oscillating or singing condition means that the system is fully operable, while a silent condition indicates that some fault has brought the system out of order. The singing frequency causes the signal-responsive device to respond and to actuate a relay E which reverts its contact *e*, thus connecting a resistor W2 to the negative pole —A of an anode voltage source, so as to cause a current flow through the resistors W1 and W2. The front contact s3 of the aforementioned switch is open during the testing procedure. The current from the anode voltage source is of such magnitude that the potential drop across the resistor W1 is sufficient to so reduce the anode voltage of the various thermionic valves that the oscillating or singing condition ceases, with the result that the relay E releases, whereupon the oscillating or singing condition recommences. It is thus obvious that the signal-responsive device K acts as a self-interrupter for the overall circuit and that this device is concurrently tested with respect to its readiness of operation together with the other members of the system. It is also possible to employ this signal-responsive device as a self-interrupter for partial circuits or even as an independent self-interrupter.

The heterodyning frequency may also be indicated on a direct reading instrument.

WOLFGANG HAGEN.