

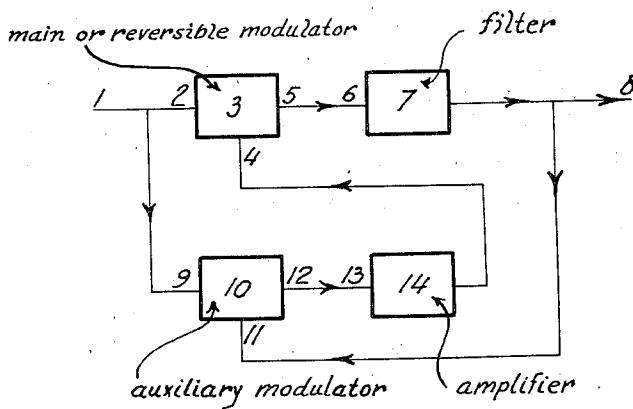
Feb. 15, 1938.

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2,108,117

SIGNALING SYSTEM

Filed Jan. 24, 1936



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UNITED STATES PATENT OFFICE

2,108,117

SIGNALING SYSTEM

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Application January 24, 1936, Serial No. 60,607
In France June 6, 1935

2 Claims. (Cl. 250—20)

This invention relates to signaling systems of the kind wherein signaling is effected by modulation of an alternating (carrier) current (which may be of high or low frequency) and more particularly to such systems wherein unmodulated current is not transmitted, i. e. to what are sometimes referred to as carrier suppression signaling systems.

As is well known in a carrier suppression signaling system, reconstitution of the signal modulation at the receiver necessitates the provision of means for resupplying a local unmodulated alternating current in synchronism with the suppressed carrier, this unmodulated current which may be represented by the expression $a \sin pt$ being fed together with the modulated received signal current $f(t) \sin pt$, in which expression $f(t)$ represents the signal modulation and $\sin pt$ the carrier current, to a modulating device in the output from which appears a new current, the expression for which is the product of the expressions representing the applied currents, viz:—

$$f(t) \sin pt \cdot a \sin pt = \frac{a}{2} f(t) - \frac{a}{2} f(t) \cos 2pt$$

The first term represents of course the original signal; as for the second term which is periodic, this may be eliminated in known manner by means of a suitable filter.

The present invention has for its object to provide a method and apparatus enabling a local alternating unmodulated current $a \sin pt$ to be obtained from the received current even although the latter may in general not contain the frequency of the current desired.

For this purpose the method envisaged by the invention consists essentially in applying a portion of the received signal current to a filter device adapted to select currents of periodicity p and to amplify them, the component of periodicity p in the modulated current $f(t) \sin pt$ being obtained as the result of intercalating between the point of arrival of the received currents and the filter-amplifier device an auxiliary modulator fed in addition directly or indirectly by a portion of the signal current $f(t)$ derived from the output from the main modulator.

The auxiliary modulator is thus fed by two currents represented respectively by the expressions $f(t) \sin pt$ and $f(t)$ and provides a current for which the expression is a product of the preceding expressions and is of the form $f(t)^2 \sin pt$. Now it is clear that the function $f(t)^2$ cannot have a mean value equal to zero. This function

may therefore be represented by an expression of the form $f(t)^2 = c + g(t)$ in which c represents a constant. There immediately results from this that the expression for the above modulated current may be written:

$$f(t)^2 \sin pt = c \sin pt + g(t) \sin pt$$

The first part of this new expression represents of course an alternating current of pulsation p .

The device according to the invention comprises therefore in combination with the main modulator fed directly or indirectly by the received current and by the demodulated signal current re-established in the output circuit of the main modulator and an amplifying and filtering device tuned to the periodicity of the unmodulated (carrier) current, said device receiving the modulated current in the output from the auxiliary modulator and providing at the main modulator the auxiliary (carrier frequency) current.

There are preferably employed as modulators symmetrical modulators such as those described in French Patent No. 739,103 of the 25th June 1932.

One embodiment of the invention is illustrated by way of example only in the accompanying schematic drawing: In this example it is assumed, in order to facilitate description, that the signal by which the alternating carrier current of frequency F has been modulated is a telegraphic signal. In this case the received current is an alternating current of frequency F but which undergoes sudden and successive inversions in accordance with the telegraphic signals. This particular case lends itself to an explanation of the functioning of the device which relies upon physical principles which are very well known.

Signal currents received at 1 are applied at 2 to a symmetrical modulator 3 also fed at 4 by the local current which is obtained in the manner indicated above; the modulated current issuing at 5 from the modulator 3 is applied at 6 to a low pass filter 7; the currents having traversed the filter 7 arrive at 8 and are applied to any suitable signal recording or reproducing apparatus.

A portion of the currents received at 1 is applied at 9 to an auxiliary symmetrical modulator 10 fed in addition at 11 by a portion of the currents obtained at 8; the modulated currents issuing at 12 from the modulator 10 are applied at 13 to a selective amplifier 14 which itself feeds the modulator 3 at 4.

This arrangement functions in the following manner:

Let F be the frequency of the current received at 1 which current undergoes sudden and successive inversions.

The symmetrical modulator 3 fed at 2 and at 4 by two alternating currents of frequency F gives at 5 a current composed of a continuous current which traverses the low pass filter 7 and arrives at 8 and of periodic currents stopped by the filter 7. The auxiliary modulator 10 fed at 9 by alternating current of frequency F and at 11 by continuous current gives at 12 a current composed of an alternating current of frequency F which is amplified by a selective amplifier 14 tuned to the frequency F and currents of harmonic frequency which are stopped by said amplifier.

When the current received at 1 undergoes an inversion, the current applied at 2 to the modulator 3 immediately undergoes this inversion, while the current applied at 4 undergoes no sudden modification as a result of the time constant of the selective amplifier 14. There results from this that the continuous current at 5 and at 8 is suddenly inverted. This inversion applies equally at 11 and the output current at 12 from the modulator is itself also inverted; the current applied at 13 to the selective amplifier 14 is therefore inverted only during a time which is very short with respect to the time constant of this apparatus and the current at 4 remains practically an alternating current.

The successive inversions of the current at 1000 periods for example received at 1 are therefore translated by concomitant inversions of a continuous current at 8.

What we claim is:

1. In a signaling system wherein signals are transmitted as modulations of the alternating carrier current and wherein there is utilized at the receiver for demodulation of the received signal energy a local unmodulated current of carrier frequency which is fed together with the received signal energy to a main modulator, the method of obtaining said local unmodulated current from the received modulated current, which consists in dividing the received current in two parts, sending one of said parts to a receiver through the main modulator and through a filtering device, providing an auxiliary modulator, sending the other part of the received current to the said auxiliary modulator, sending to said latter modulator a part of the filtered current, and supplying the current modulated in the auxiliary modulator to the main modulator through an amplifying device.

2. Apparatus for carrying out the method claimed in claim 1, comprising in combination a main modulator for demodulating the received current, an inlet circuit for feeding the received current to this main modulator, an auxiliary modulator, a derivation circuit from the inlet of the main modulator to the auxiliary modulator, an output circuit from the main modulator, a filter device in said output circuit, a circuit from the output of the filter device to the auxiliary modulator, a circuit from the output of said auxiliary modulator to the main modulator, and an amplifier in said latter circuit, said amplifier being tuned to the unmodulated carrier current.

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