July 14, 1942. E. LABIN 2,289,788

CARRIER WAVE SIGNALING SYSTEM

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Fig. 1.

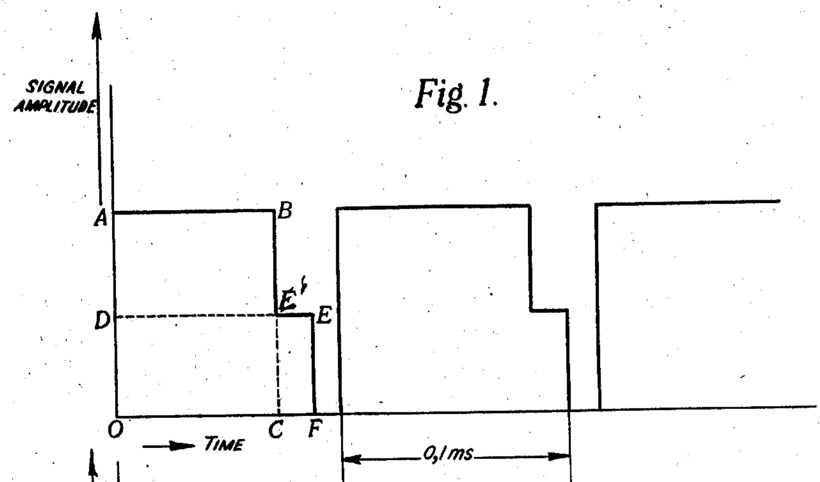

Fig. 2.

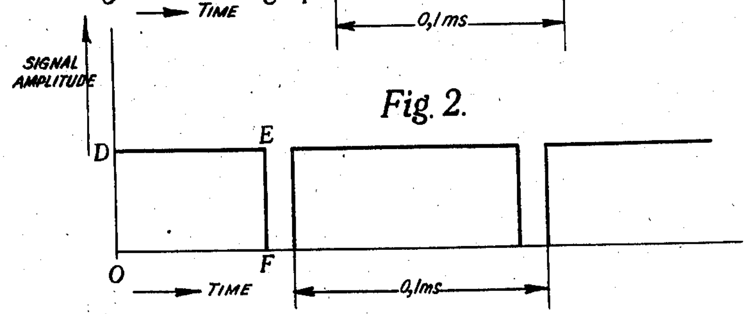

Fig. 3.

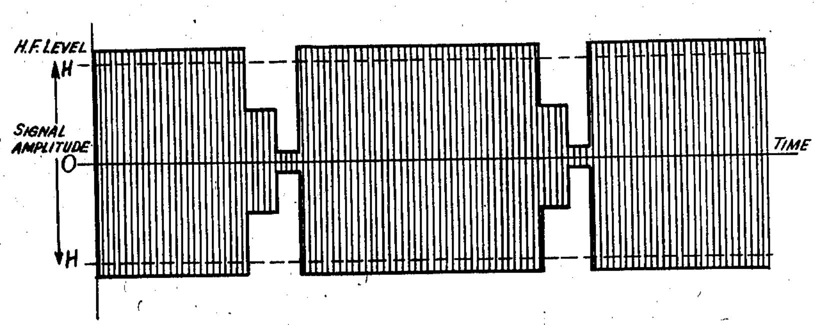

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Fig. 4.

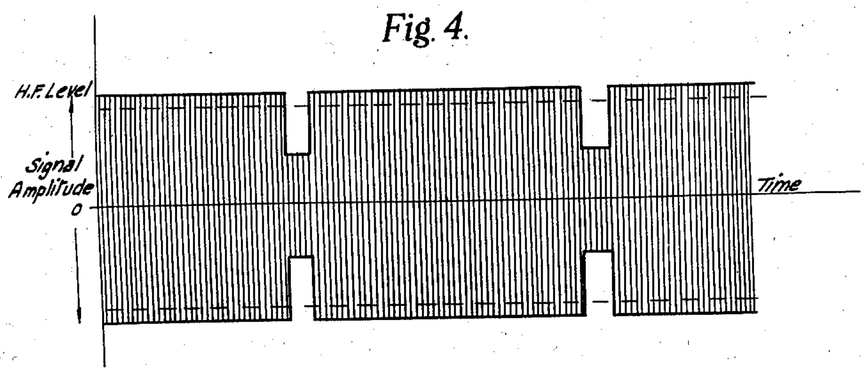
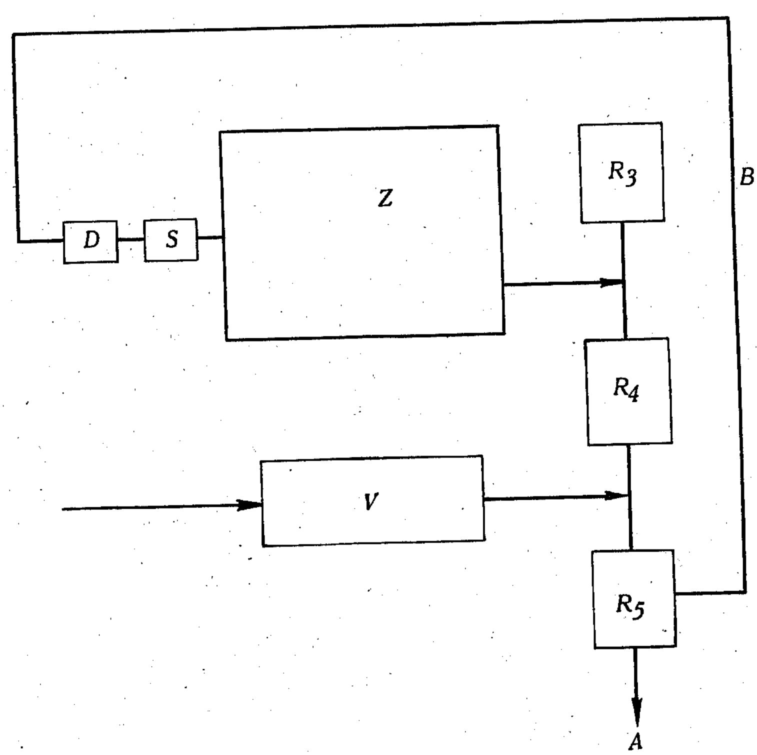


Fig. 5.



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Patented July 14, 1942

2,289,788

UNITED STATES PATENT OFFICE

2,289,788

CARRIER WAVE SIGNALING SYSTEM

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Application September 22, 1938, Serial No. 231,195
In France September 25, 1937

8 Claims. (Cl. 178—7.1)

The present invention relates to carrier wave communication systems and more particularly to radio-electric transmitters and one of its objects is to facilitate the transmission of a broad band of frequencies by means of a relatively simple apparatus.

Another object of the invention is to reduce the detrimental distortions which may be produced in such systems.

In a radio-electric transmitter working with a variable carrier wave, or, as it is sometimes called, a "floating carrier," the amplitude of the carrier wave is controlled according to a recurrent function of the signals to be transmitted, for example, in accordance with the amplitude of the crests or the hollows of the curve representing the modulating wave.

According to the invention in a "floating carrier" system the amplitude of said carrier is controlled by one or more negative feedback systems arranged to control the amplitude of the carrier wave in accordance with a predetermined law, which may be either a linear function depending upon a characteristic of the modulating wave, or else in accordance with a further feature of the invention, the amplitude of the carrier is controlled according to a law which is a function taking into account the distortion introduced by the stages of the transmitter preceding and/or following the modulator. In the event of the use of a plurality of negative feedback systems it is possible ordinarily to provide in each such circuit a device (commutator, or preferably an electronic commutator, limiting device, or the like), such that the different negative feedback systems are made successively effective.

In accordance with a further feature of the invention, the band of frequencies to be transmitted is divided into a plurality of sub-bands, for example into two bands, and in that case, the components of the signal of frequency lower than a certain frequency F_0 are amplified by the carrier current amplifier, and, after detection at a suitable level, they modulate the penultimate stage of the transmitter, while the components of frequency higher than F_0 are amplified separately by an independent amplifier and modulate the last stage of the transmitter.

In the case of a system of transmission of television signals, the frequency F_0 is made substantially equal to half the frequency of the exploration lines and the modulators chosen for each band of frequencies are adapted to compensate one another, that is to say, the distortions introduced by the first modulator are substantially equal and in an opposite direction to that introduced by the second modulator.

Although the invention may be applied in a very general way to wireless systems, either of the simplex or multiplex type or of the successive modulation type, the invention, together with its objects and features, will be clearly understood with the aid of the following description of an embodiment in the case of a television system, which description is given in relation to the drawings attached, in which:

Figs. 1, 2, 3 and 4 give a diagrammatic representation of a television signal such as is habitually employed. Amplitudes of signals being measured as ordinates and time as abscissae.

Fig. 1 represents at OABE'EF a modulating signal, composed of a picture signal DABE' (which represents an entirely white image having a black border) superposed on a synchronising signal ODEF which persists longer than the image signal due to a scanning line by the time CF.

Fig. 2 represents at ODEF a modulating signal composed of a zero amplitude picture signal (which represents a black image) with the synchronising signals ODEF superimposed thereon;

Fig. 3 represents the carrier wave of amplitude OH modulated by the signal of Fig. 1;

Fig. 4 represents the carrier wave modulated by the signal of Fig. 2, the modulating signals having traversed amplifiers which do not reproduce their direct current component; and

Fig. 5 represents schematically a system of variable carrier modulation employing features of the invention.

In television transmitting systems the signal supplied by the exploring apparatus usually comprises impulses in a single fixed amplitude direction which serve for the synchronisation between the receiver and the transmitter.

In such systems the modulating signal supplied by the exploring apparatus is preferably a signal having a variable mean value (corresponding to the mean brilliance of the image transmitted), so that by reason of the fact that such modulation signal traverses modulation amplifiers which do not amplify the direct current component of the signal, these modulating signals become distorted and consequently the resulting modulated wave does not faithfully reproduce the original signal.

The deformation that is thus imposed on the signal is doubly detrimental, because:

(1) The variable modulation depth of the

crests of the synchronising signal renders the synchronisation delicate.

(2) The mean brilliance is not transmitted.

In order to remedy these shortcomings, the invention, according to one of its features, provides for the control of the amplitude of the carrier wave (the amplitude of the synchronising impulses remaining constant) in such a manner that the depth of modulation on the crests of the synchronising signals shall remain constant. In other words, the amplitude of the carrier wave is determined by the depth of the hollows of the modulation if the transmission is carried out as shown in Figs. 3 and 4 in "positive," or by the depth of the crests of the modulation if it is carried out in "negative."

In Fig. 5, R3, R4, R5 represent the successive high frequency stages of the transmitter, R3 being a carrier wave source and R4 and R5 being amplifier stages.

The final amplifier stage R5 feeds the aerial A and it is modulated, for example by applying to its grid the output from the modulation amplifiers V which do not transmit the continuous current component. Through the negative feed-back connection B the modulated high frequency is applied to the detector D. The detected signal is applied in a suitable direction (depending on whether it is desired to measure the crest or the hollow) to a crest or peak voltmeter, i. e. to a biased second detector. The second detector S supplies a polarising or biasing potential varying in accordance with the depth of the crests or hollows of the high frequency wave, to a direct current amplifier Z which applies polarising potential in turn to the penultimate amplifier stage R4 of the transmitter and varies the amplitude of the carrier wave until the desired maximum depth of modulation is obtained. Said depth of modulation is adjustable by the action of a potentiometer (not shown) which varies the level of the signals on the second detector S. The time constant with which the negative feed-back circuit acts may be regulated by the time constant of the voltmeter S. The foregoing description supposes a grid modulation of the stages R4 and R5, but it is obvious that other modes of modulation may be employed.

If, for example, the stage R5 is modulated on the plate, it will often be preferable to apply the output of the amplifier Z to the grids of the modulator stage. The fundamental principle of the system described by way of example may be summed up by saying:

The modulation potentials required for varying the amplitude of the carrier so as to maintain constant the depth of modulation is obtained by double detection of the carrier itself so as to measure the height or depth of the crests or hollows of the modulation. It is thus possible to make a sensitive system possessing the advantage over other known systems of being inherently stable.

A variation of the carrier wave as a result of variations of amplification causes, in fact, a variation of the depth of modulation which is automatically compensated in the system described, so that it does not risk simulating an undesirable signal.

For television, the system described is particularly flexible, in that by merely reversing the direction of the signal at the output of the detector D and the direction of the action at the output of S, the system may be applied to a "positive" or "negative" transmission. Furthermore, the presence of the amplifier Z enables the action of the system B—D—S to be suppressed, if desired, and a signal representing the mean illumination of the image to be applied directly on the amplifier Z, if said signal were separately supplied by the exploration apparatus.

In addition, the time constant of the detector voltmeter S, or more exactly the time required for establishing current and the time during which it keeps a constant value may be readily adapted to the characteristics of the modulation amplifier V. If the amplifier V is faithful down to 25 cycles per second, the time constants of S will be regulated in such a manner as to ensure that the current supplied by S will follow the variations slower than 1/25 sec., but will not follow quicker variations. The amplifier Z must be faithful up to frequencies of the order of about 400 cycles. But—and this is a considerable practical advantage—it is also possible to use in television a modulation amplifier V the passing band of which starts at a frequency much higher than 25 cycles per second. A frequency equal to half the frequency of the scanning lines will preferably be chosen, for example 3 or 4 kilocycles, because it is known that the energy existing in this range of frequencies is necessarily very low or nil. In this case, the time constants of S must not be greater than 0.5 milli-second and the passing band of Z must extend up to 6 or 8 kilocycles.

The suppression of the frequencies lower than 3 kilocycles in the output of modulation amplifier V, represents a very important structural economy which is not equalised by the increase in price of the amplifiers Z.

The invention is obviously not restricted to the embodiment described, on the contrary, it may be used in all spheres of wireless transmissions and in certain cases it may be applied not only to transmission but also to reception, or even in repeating stations, for example in the case of transmission on coaxial cables or other transmission system.

What is claimed is:

1. A floating carrier wave system comprising a transmitter having a plurality of high frequency stages including a source of carrier waves, an intermediate high frequency stage, and a final output stage, a source of signals comprising recurring portions of a predetermined extreme amplitude and including frequencies above and below a frequency F_0, amplifier means for applying said signals to said final stage to modulate said carrier waves, said amplifier means being at least partially ineffective to apply to said final stage frequency components below F_0 whereby the modulated output of said final stage is distorted so that the extreme carrier amplitudes corresponding to said recurring portions vary at a frequency rate lower than F_0, detector means for detecting a portion of the output of said final stage including waves of frequencies below F_0 and means for deriving from the output of said detector means a direct current substantially corresponding to said variation of said extreme carrier amplitudes and retaining all variations below the frequency F_0, and means for applying said direct current to said intermediate stage to vary the carrier waves delivered from said intermediate stage to said final stage whereby the carrier waves in the output of said final stage are compensatorily varied in amplitude to reduce said distortion.

2. A floating carrier wave television system ac-

cording to claim 1, in which said signal source comprises scanning apparatus and the frequency F_0 is equal to one half the frequency of the exploring lines of the scanning apparatus.

3. In a floating carrier wave communication system, a transmitter having a plurality of high frequency stages including an intermediate high frequency stage and a high frequency final output stage, a negative feedback circuit feeding rectified potentials from said final output stage of the transmitter to said intermediate high frequency stage for the purpose of controlling the carrier wave amplitude in accordance with the amplitudes of the signals to be transmitted, said feedback circuit comprising first detector means for detecting the high frequency currents from the said final stage, and biased second detector means for producing a direct current potential substantially corresponding to the extreme amplitudes of the detected wave form from the first detector, an amplifier to amplify the direct current potentials from the second detector and means to apply the amplified potentials to bias suitably one of the high frequency carrier stages.

4. A floating carrier wave communication system comprising a source of modulating signals comprising recurring portions of a predetermined extreme amplitude, amplifier means for amplifying the alternating current components but not the direct current components of said modulating signals, a source of carrier waves, modulating means for modulating the carrier waves from said source in accordance with the output of said amplifier means, means for deriving from said modulated carrier waves a direct current potential primarily dependent upon the extreme carrier wave amplitude of said modulated carrier waves, and means for varying the amplitude of the carrier waves in accordance with said direct current potential.

5. A floating carrier wave television transmission system comprising a source of modulating signals including video signals and synchronization signals, said synchronization signals including pulses whose amplitudes are substantially constant and lie outside the extreme limits of amplitude of said video signals, amplifier means for amplifying the alternating current components but not the direct current components of said modulating signals, a source of carrier waves, modulating means for modulating the carrier waves from said source in accordance with the output of said amplifier means, means for deriving from said modulated carrier waves a direct current potential primarily dependent upon the extreme carrier wave amplitude of said modulated carrier waves which corresponds to said synchronization pulses, and means for varying the amplitude of the carrier waves in accordance with said direct current potential.

6. A system according to claim 5, wherein said means for deriving from said modulated carrier waves a direct current potential primarily dependent upon the extreme carrier wave amplitude of said modulated carrier waves which corresponds to said synchronization pulses comprises first detecting means for detecting said modulated carrier waves to yield detected currents corresponding to the envelope thereof, and additional means for deriving a direct current potential primarily dependent upon the peak amplitudes of said detected waves.

7. A system according to claim 5, wherein said means for deriving the amplitude of the carrier waves in accordance with said direct current potential is connected in such sense as to constitute a negative feedback circuit.

8. A system according to claim 5, wherein said means for deriving from said modulated carrier waves a direct current potential primarily dependent upon the extreme carrier wave amplitude of said modulated carrier waves which corresponds to said synchronization pulses is connected in such sense as to yield a direct current potential primarily dependent upon the minimum amplitude of said modulated carrier waves.

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