

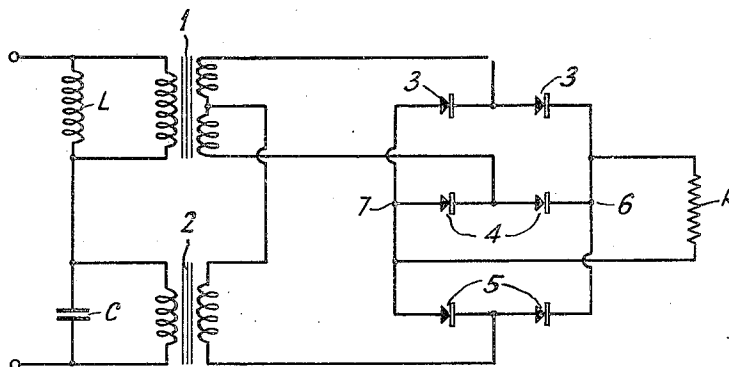
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DEMODULATOR SYSTEM

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DEMODULATOR SYSTEM

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9 Claims. (Cl. 250—30)

The invention relates to demodulator systems and is particularly useful in systems in which it is desired to separate modulation signals from a carrier the frequency of which may be of the same order as the higher modulation frequencies.

An example of such a system is a facsimile telegraph system wherein direct current impulses are required to modulate light from a light source as by being applied to a mirror galvanometer. In such a system it is frequently desired to transmit the direct current signal impulses over a telephone line or over a radio link as modulations of a carrier, either by frequency or amplitude modulation of the carrier, the frequency of which is of the same order as the highest component frequency in the modulation.

In arrangements of the above nature in which modulation signals are separated from the carrier by means of a full wave rectifier, the modulation signals remain distorted by reason of the presence therein of components due to the carrier, the frequency of the fundamental component being equal to twice the carrier frequency and being also of considerable amplitude. Separation by means of a filter will not be possible since the frequency ranges overlap. Thus, in a facsimile telegraph system, a signal corresponding to pure white at the transmitting end will be reproduced at the receiving end as a white field with superposed black dots.

This difficulty may be overcome by the use of a phase splitting arrangement so that the modulated carrier is applied to rectifiers in two phases in quadrature, four-phase rectification being effected. With this arrangement the demodulation efficiency, provided there is no loss in the conversion from a single-phase signal to a two-phase signal, remains unchanged but the unwanted frequencies are considerably reduced and the frequency of the fundamental component can, since it is four times the frequency of the carrier, if desired, be removed by means of filters.

In carrying out the present invention this phase-splitting arrangement is carried further and according to the invention separation of a modulation signal from a carrier is effected by converting the single-phase modulated signal into a three-phase signal, applying the separate phase to a six arm rectifier bridge, and taking modulation signal from the junction points of pairs of arms.

In one way of carrying out the invention as illustrated in the accompanying drawings, two transformers 1 and 2 are provided, the primary winding of one being connected in series with the

primary winding of the other and the modulated carrier signal being applied across the said series-connected primary windings. An inductance L is connected across the primary winding of transformer 1 and a condenser C is connected across that of the other transformer 2. The secondary winding of transformer 1 is center-tapped and the tapping point is connected to one end (as shown, the upper) of the secondary winding of the other transformer 2.

There are also provided rectifiers, preferably of the copper oxide type. There are three pairs of these rectifiers 3, 4 and 5, the pairs being connected together in parallel and the rectifiers of each pair being in series. The rectifiers of any pair have their pass directions facing the same way and the pairs have their pass directions facing to the same common connecting point or connection 6.

The two terminals of the center-tapped secondary winding of transformer 1 are connected to the junction points of rectifiers in two separate rectifier pairs 3 and 4 and the free end of the secondary winding of the other transformer 2 is connected to the junction point of the rectifiers 5.

The common junction points or connections 7 of the pairs of rectifiers are connected across a modulation load R.

The ratio of the primary winding to the halves of the secondary winding of the center-tapped transformer 1 is as $1:m:m$, and the ratio of the primary winding to the secondary winding of the other transformer 2 is $1:n$. The following relationships hold:

$$n = \frac{2m}{\sqrt{3}}$$

$$2\pi fL = \frac{1}{2\pi fC} = \frac{\pi^2 R}{36m^2}$$

wherein f is the carrier frequency, R is the resistance of the load and where L and C are the inductance and capacity already described as connected across the primary windings of the transformers.

Assuming that there are no losses incurred in converting from single-phase to three-phase current, the detection efficiency will be unchanged and the reduction of fundamental unwanted frequency component will be some 92% or more of that remaining with single-phase full-wave rectification.

The system is applicable to amplitude modulated signals and is particularly suitable for the detection of a phase and frequency modulated

signal such as may result from first detecting a frequency modulated signal by a filter.

The inductance may be connected across the primary winding of either transformer, or may be incorporated in that winding, and the condenser may be connected across that of the other. Again equivalent values of inductance and capacity may be connected each respectively across one and the other of the secondary windings.

I claim:

1. In a demodulator system suitable for separating modulation signals from a carrier the frequency of which may be of the same order as the higher modulation frequencies, the method of obtaining said separation which comprises converting the single-phase modulated signal into a three-phase signal, separately rectifying the positive and negative components of each phase and deriving the modulation signal from a combination of said components.

2. A system for performing the method of claim 1 comprising two transformers, the primary winding of one being connected in series with the primary winding of the other, means for applying the modulated carrier signal across the said series-connected primary windings, an inductance connected across the primary winding of one transformer and a condenser connected across that of the other transformer, the secondary winding of said one transformer being center-tapped and the tapping point being connected to one end of the secondary winding of the other transformer.

3. A demodulator system comprising means for splitting a modulated carrier wave into modulated three-phase energy, a rectifier network constituted by three pairs of one-way conductors each pair being so connected to said phase splitting means as to provide full wave rectification of each separate phase of said energy, means for interconnecting the positive output terminals of said one-way conductor pairs, means for interconnecting the negative output terminals of said one-way conductor pairs, and a load connected between the positive interconnections and the negative interconnections of said output terminals.

4. A demodulator system according to claim 3, wherein the phase-splitting means is constituted by two transformers having their primary windings connected in series, and one of said primary windings is shunted by a capacitor.

5. A demodulator system according to claim 3, wherein the phase-splitting means is constituted

by two transformers having their primary windings connected in series, and means are provided for shifting the phase of the energy at the inter-connected inner terminals of said primaries away from a quadrature relation to the energy at the outer terminals of said primaries.

6. A translating system comprising two transformers having their primaries in series, an inductive reactance in shunt with one of said primaries, a capacitor in shunt with the other of said primaries, the secondary in one of said transformers having a mid-tap connected to a terminal of the secondary in the other of said transformers, the two terminals of the mid-tapped secondary having individual connections to the input sides of two full-wave rectifiers respectively, a third full-wave rectifier having its input side connected to the free terminal of the secondary in the other of said transformers, and means for combining the output energy derived from the three said rectifiers.

7. A system according to claim 6 wherein said rectifiers are of the type which includes copper oxide rectifiers, and dry plate rectifiers.

8. A demodulator system comprising means for splitting a modulated carrier wave into three-phase components, said carrier wave and its higher modulation frequencies being of substantially the same order, means for separately rectifying the differently phased components of said modulation frequencies, said rectifying means including uni-directional conductances faced to deliver rectified energy pulses of one polarity to a common output terminal and to return the energy pulses from a second common output terminal during half-cycles of reverse polarity, and a utilization device connected across said common output terminals.

9. A demodulator system comprising means for splitting a modulated carrier wave into polyphase components, said carrier wave and its higher modulation frequencies being of substantially the same order, means for separately rectifying the differently phased components of said modulated carrier wave, a combining circuit having one terminal to which all energy pulses of one polarity are carried from said rectifying means, and another terminal from which all energy pulses of reverse polarity are returned to said rectifying means, and a utilization device connected across said terminals.

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