June 16, 1931. V. P. THORP 1,809,950

CARRIER TELEGRAPH SYSTEM

Filed Aug. 5, 1929

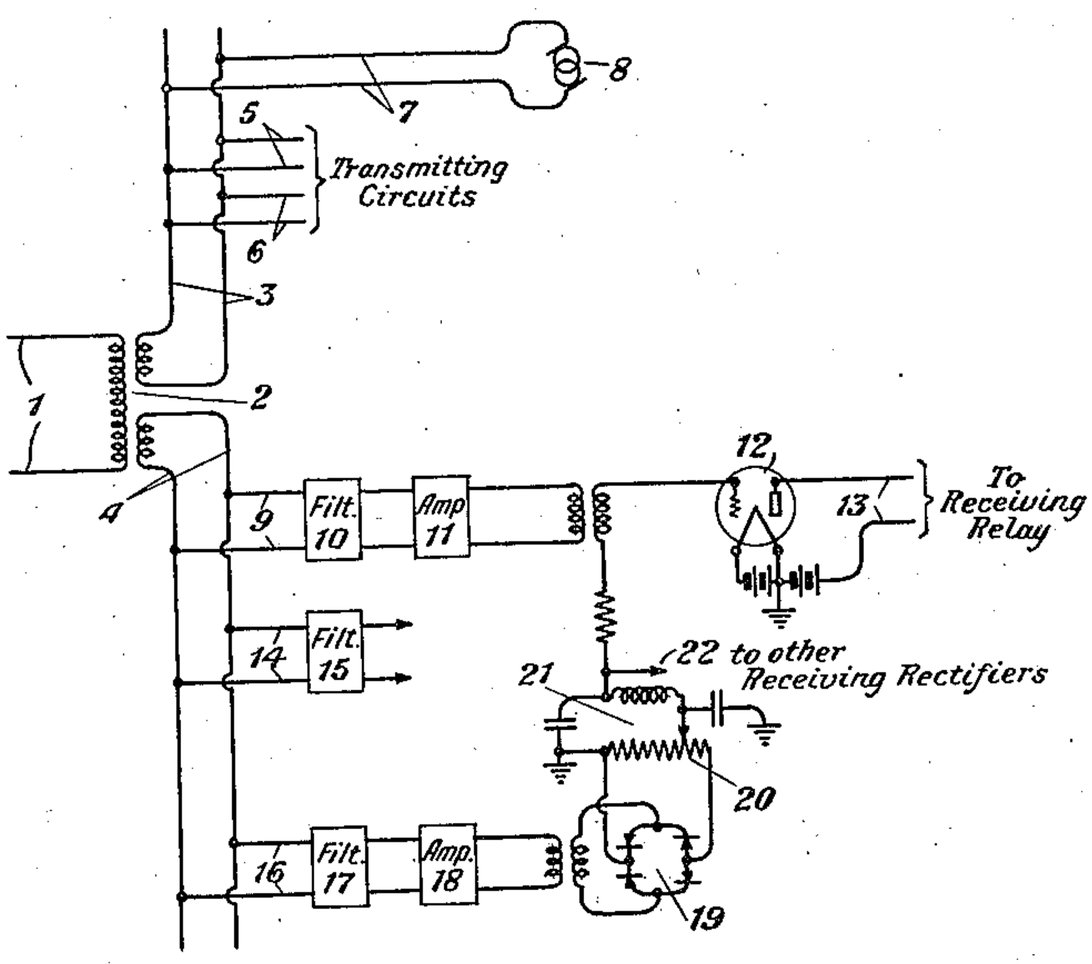

Fig. 1

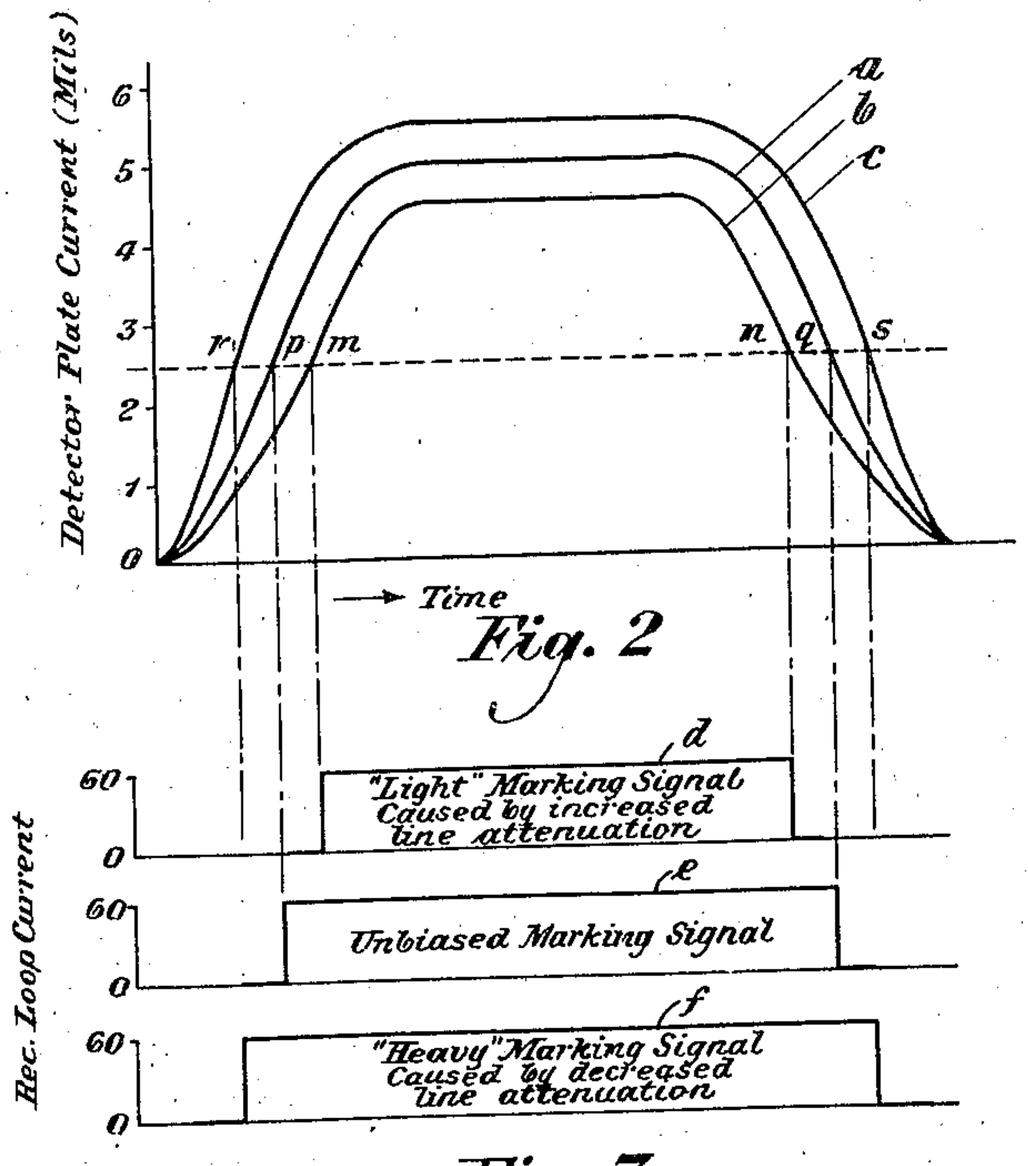

Fig. 2

Fig. 3

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UNITED STATES PATENT OFFICE

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CARRIER TELEGRAPH SYSTEM

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This invention relates to carrier telegraph systems and more particularly to arrangements for reducing the distortion of the telegraph signals received over such systems.

In carrier telegraph systems any changes in the received currents are apt to cause distortion in the telegraph signals. These changes in the received current are due primarily to variations in line attenuation with weather conditions. It is the practice in certain types of carrier telegraph systems to utilize sensitive receiving relays, which are biased to spacing by a current which has a magnetic effect on the armature of the relay of about one half that of the marking or received rectified current. This biasing current is approximately constant and is independent of the line characteristics since it is supplied from a local battery. It is evident, therefore, that any change in the received current from the distant end will cause bias or distortion in the telegraph signals in the receiving loop circuit. In certain types of service, such as high speed printing telegraph service, this may be sufficiently large to cause trouble. Accordingly it is one of the primary objects of the invention to provide arrangements whereby variations in the received currents due to changes in line attenuation or to other causes will not cause bias or distortion in the signals in the receiving loop circuit.

The arrangements of the invention utilize a separate carrier frequency which is sent over the same line with the carrier frequencies used for signaling purposes. This separate carrier is amplified and rectified at the distant end of the line. The rectified current thus obtained is passed through a resistance and the voltage drop across this resistance, after being properly filtered, is used to furnish the negative potential for the detector tubes in the telegraph channel terminals. By this means the operation of the detector tubes may be controlled in accordance with any changes in the received current and the output of the detector tubes may be substantially constant. Further objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawings in the Figs. 1, 2 and 3 of which the invention is illustrated. Fig. 1 is a circuit diagram illustrating a preferred embodiment of the invention. Figs. 2 and 3 illustrate graphically certain characteristics of the received telegraph signals under various line conditions.

In Fig. 1 is shown a transmission line 1, at each end of which would be provided terminal apparatus similar to that shown at only one end thereof in the drawing. The line 1 would be connected through a transformer 2 to a common sending circuit 3 to which might be connected a plurality of lines such as 5 and 6 whereby different carrier frequency channels might be transmitted over line 1. There would also be provided a circuit 7 connected to a source such as 8, whereby a separate carrier frequency might be continuously applied to the line and transmitted thereover with the carrier frequencies used for signaling purposes. The line 1 would also be connected to a common receiving circuit 4 to which there would be connected individual receiving circuits such as 9 and 14. Circuit 9 would include a filter 10, an amplifier 11, which would be connected to the input of a detector 12. The output of this detector would be connected to a receiving relay. Circuit 14 would be of a similar nature and only the filter 15 thereof is shown.

An additional receiving circuit such as 16 would be provided and would be connected to circuit 4. This receiving circuit will be rendered selective by the filter 17 for the separate carrier frequency transmitted over line 1 from the distant station from the generator thereat corresponding to the generator 8. Circuit 16 will also include a rectifier 19. This rectifier is shown as of the thin film or contact variety although other types may be utilized. The output of rectifier 19 is connected to a resistance 20. The voltage drop across this resistance will be filtered by

device 21 and then utilized to furnish the negative potential for the detector tube 12. By means of other connections, such as 22, this voltage drop may be used to furnish the negative potential for the detector tubes in other of the receiving circuits.

When the system is properly lined up, the negative grid potential for the detectors in the various telegraph channel terminals will be adjusted to a certain predetermined value. If the line attenuation subsequently increases, the received carrier current input to each telegraph channel terminal will be reduced. With a constant negative grid potential supplied to the detector tubes, as in former types of systems, the detector plate current will change its rate of build-up from that shown on curve *a* to that indicated on curve *b* of Fig. 2. The receiving relay would then operate at points *m* and *n* instead of at points *p* and *q* which, as shown in Fig. 3, would cause distortion in the form of spacing bias. If the line attenuation decreases the received current would build up along curve *c* instead of *a* which would cause the relay to operate at points *r* and *s*, thus causing distortion in the form of marking bias.

If, instead of maintaining a constant negative grid potential for the channel terminal detector tubes, the arrangements of the invention as shown in Fig. 1 are used, then the detector grid potentials will also be affected by changes in line attenuation in such a way as to tend to shift curves "*b*" and "*c*" to the position occupied by "*a*" which is the one necessary for unbiased signals. The circuits may be so adjusted that over a fairly wide variation of line attenuation, the detector plate current which operates the receiving relay will not only have a constant maximum value but will also build up at the same rate as before the attenuation change took place.

It is pointed out that the steady carrier used for the grid potential supply need occupy only a small portion of the frequency range available for telegraph purposes since no appreciable band width is necessary. It would be desirable probably to locate this carrier frequency midway in the frequency range used for the telegraph receiving circuits to minimize the effect of difference in attenuation changes with frequency.

In addition to compensating for line attenuation changes, the circuit arrangements of this invention takes care to some extent of the change in battery voltages at the terminal stations. At the sending station, for example, the oscillator and sending amplifier supplying the steady carrier current will vary in output with changes in battery potentials and at the receiving station the gain of the receiving amplifier will likewise vary with battery potential changes. In each case the grid potential on the detector tubes will be shifted in the proper direction to correct to some degree for these local variations in battery potentials.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In a carrier telegraph system the method of signaling which comprises transmitting a plurality of different carrier frequency currents over the system, separately detecting said received carrier currents, simultaneously transmitting over the same system a separate carrier frequency current, and utilizing said separate carrier frequency current to control said detection.

2. In a carrier telegraph system the method of signaling which comprises transmitting a plurality of different carrier frequency currents over the system, separately detecting said received carrier currents, simultaneously transmitting over the same system a separate carrier frequency current, and utilizing said separate carrier frequency current to control the negative grid potential of the tubes utilized for said detection.

3. A carrier telegraph system comprising a line interconnecting two stations, means at one of said stations for applying to said line a plurality of carrier frequency currents for signaling purposes, means at said station for applying a separate carrier frequency current to said line, means at the other of said stations for selecting and separately detecting said plurality of carrier frequency signaling currents, means at said last station for selecting said separate carrier frequency current and for utilizing said current to control the output of said detections.

4. A carrier telegraph system comprising a line interconnecting two stations, means at one of said stations for applying to said line a plurality of carrier frequency currents for signaling purposes, means at said station for applying a separate carrier frequency current to said line, a receiving circuit at the other of said stations comprising means for selecting said first named carrier frequency currents and a separate detector for each carrier frequency, a receiving circuit at said last mentioned station comprising means for selecting said separate carrier frequency, means in said circuit for rectifying said separate carrier frequency and means for controlling the output of said detectors by said rectified current.

5. A carrier telegraph system comprising a line interconnecting two stations, means at one of said stations for applying to said line a plurality of different carrier frequency currents for signaling purposes, means at said station for applying a separate carrier fre-

quency current to said line, a plurality of receiving circuits at the other of said stations each comprising means for selecting different ones of said plurality of carrier currents and each of said receiving circuits including vacuum tube detectors, a receiving circuit at said last mentioned station comprising means selective for said separate carrier frequency, a rectifier in said last mentioned receiving circuit, a resistance bridged across said rectifier output, and means for utilizing the voltage drop across said resistance to control the negative grid potential of all of said detectors.

6. A carrier telegraph system comprising a line interconnecting two stations, means at one of said stations for applying to said line a plurality of carrier frequency currents for signaling purposes and a pilot carrier frequency, a separate receiving circuit at the other station for each signaling channel and each comprising a detector, a rectifier for the pilot carrier, a resistance in the output thereof, and a condenser shunted around said resistance, the drop in E. M. F. across the resistance constituting a portion of the grid bias of each detector.

7. A carrier telegraph system comprising a line interconnecting two stations, means at one of the said stations for applying to said line a plurality of carrier frequency currents for signaling purposes, means at said station for applying a pilot carrier current to said line, a separate receiving circuit at the other station in each signaling channel each comprising a detector, a rectifier for the pilot carrier and a resistance in the output thereof, the input circuit of each detector comprising an individual transformer winding and the rectifier resistance being in series therewith and common to all the detectors.

In testimony whereof, I have signed my name to this specification this 30th day of July, 1929.

VAUGHN P. THORP.