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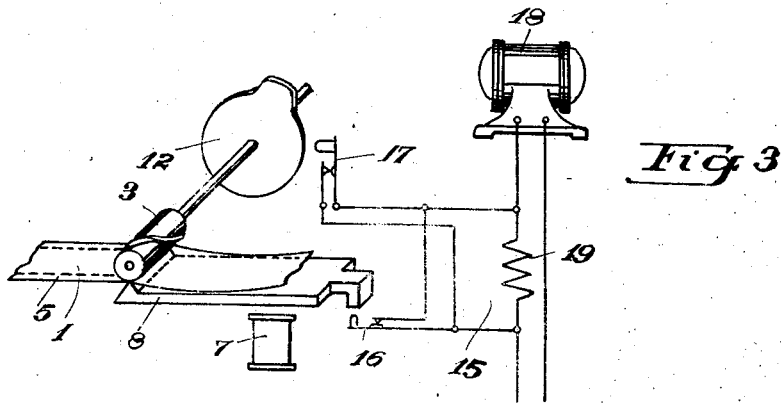
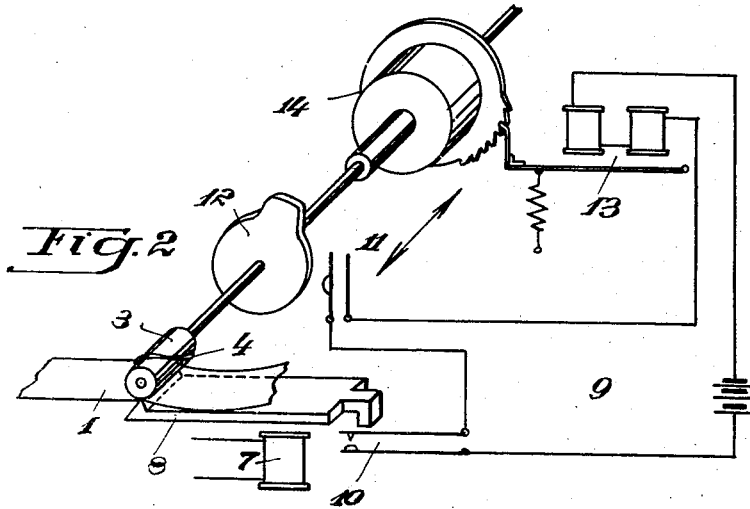
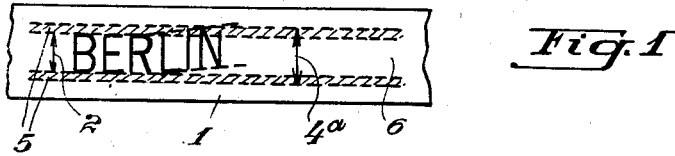
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2,113,429

ARRANGEMENT FOR SYNCHRONIZING OF TELEGRAPH APPARATUS

Filed Aug. 11, 1934

2 Sheets-Sheet 1



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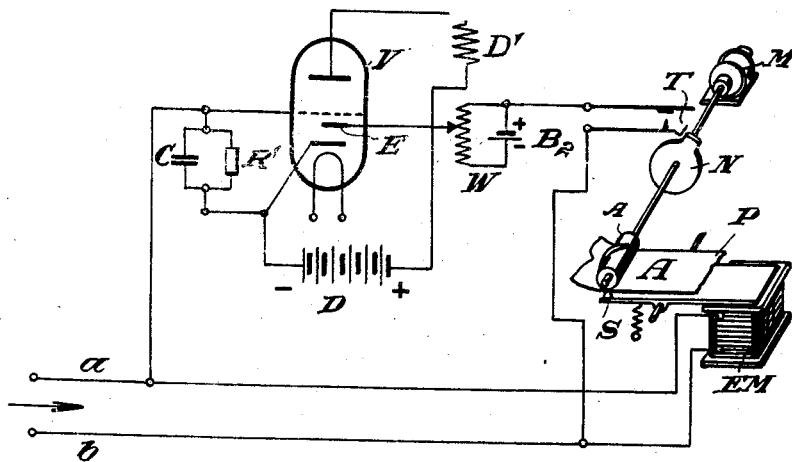
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Fig. 4



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ARRANGEMENT FOR SYNCHRONIZING OF TELEGRAPH APPARATUS

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This invention concerns improvements in and relating to synchronizing systems for telegraph apparatus which transmits and records letter signals as symbols analyzed into a succession of constituent elemental areas or picture lines.

In the well-known telegraph apparatus which records received letter signals analyzed into a succession of constituent elemental areas or picture lines, for the purpose of allowing for faults due to an inexact phase relationship between the transmitter and the receiver, a double record of the letter in two parallel lines is effected in such a manner that at least one of the letters is always recorded legibly. In such arrangements no special adjustment of the phase relationship is necessary, but the recordings are not easy to read and sheet printing is not possible.

In apparatus for picture transmission start-stop-synchronizing arrangements are well-known, in which the transmitter transmits synchronizing signals controlled by a tape on the picture drum of the transmitter which are utilized to effect an adjustment of the relationship between transmitter and receiver if the transmitted signals are recorded on a special tape on the receiver drum.

The present invention provides a synchronizing system for telegraph apparatus the receiver of which is arranged to record letter signals analyzed into picture lines by a magnet system and a rotatable recording member, in which the recording member is arranged to scan at least one limiting surface of a normal recording base or area and means are provided responsive to an encroachment of the recorded letters on to a limiting surface, and operable upon such response to effect an adjustment of the phase relationship between the transmitter and the receiver to restore synchronism therebetween. It can be so arranged that the degree of adjustment of the phase relationship is either independent of or dependent upon the number of picture points which are recorded on the limiting surface. The circuit for the adjustment of the phase relationship is dependent upon one contact controlled by a receiving magnet system and a second contact which is arranged to be closed by the rotatable recording member when the limiting surfaces are scanned. The adjustment of the phase relationship can be controlled by a relay dependent for its action upon the picture points which are recorded on the limiting surface.

The control of the adjustment of the phase relationship can be effected in a well-known manner by photoelectric means in dependence upon

the picture-points which are recorded on the limiting surface. The adjustment of phase relationship can be effected by means of a short-circuiting device in the circuit of the field winding of the driving motor of the receiver. It is also possible to adjust the phase relationship by rotation of the stator of the driving motor or by a differential gear arranged between the driving motor and the rotatable recording member. In a further arrangement it is possible to provide a coupling element with a controllable degree of slip between the driving motor and the rotatable recording member to effect the phase adjustment.

The necessary adjustment of the phase relationship can also be effected by displacing the recording member which produces the record in picture lines, in the axial direction of the spindle thereof relatively to the second strip. According to a feature of the invention the adjustment of the number of revolutions of the receiver motor is controlled by a displacement of the grid potential of an electric discharge tube, in dependence upon the received letter signals and upon a contact which is closed by the rotatable recording member. The rectification for generating the displacement potential is effected in one electrode system, the cathode of which is common with the cathode of the electrode system of which the grid potential is displaced for adjusting the number of revolutions of the receiver motor. This electrode system is well-known under the signification "binode". The binodes are a combination of a grid-amplifier-electrode-system with a two-electrode-rectifier of which one electrode is common with the cathode of the grid-amplifier-electrode-system. The time constant of the grid circuit is, for instance, made equal to the period for recording one picture line by switching in a condenser and resistance combination of suitable values. The adjustment of the number of revolutions of the receiver motor is controlled by a relay which is switched in the anode circuit of the discharge tube, or can be effected by means of a centrifugal governor or by other well-known methods.

The invention will be better understood from the following description when considered in connection with the accompanying diagrammatic drawings, Figs. 1-4.

Referring to the drawings, Fig. 1 illustrates a tape 1 on which the word "Berlin" is shown as recorded by a telegraph system to which the invention relates. For the recording of the separate letters a base or surface area having a height of 2 cm. in the width of the strip is utilized.

When a phase-displacement occurs between the transmitter and the receiver the picture lines of the letters recorded become displaced from the recording base or area, above or below according to whether the receiver leads or lags in its phase relationship with the transmitter, to an extent dependent on the distance to which the picture lines can reach above or below the base. The recording arrangement is shown in Fig. 2, in which a rotatable recording member 3 is provided mounted upon a spindle for recording the analyzed picture lines, and is so arranged that a line of the length of 4^a (Fig. 1) can be scanned across the strip 1 which is longer than the length of the line 2 corresponding to the width of the base for the transmitted letter signals. The recording edge 4 (Fig. 2) thus also scans the limiting surfaces 5 of the recording surface 6 forming the recording base for the letter signals. If by a phase displacement between the transmitter and the receiver the received signals are recorded as picture lines encroaching on either of the limiting surfaces 5, an adjustment of the phase relationship is effected in the direction of leading or lagging, in accordance with which of the limiting surfaces 5 is encroached upon by the letters.

As delineated above, a leading encroachment produces a decelerative correction and a lagging encroachment produces an accelerative correction. Were member 3 arranged always to lead, only means for decelerative correction would be required, or conversely only means for accelerative correction, thus simplifying the arrangement.

When, as shown in Fig. 2, the receiving magnet system 7 is energized, it moves its armature 8 in synchronism with the received signals and presses a knife edge on the armature against the recording strip 1 and applies the strip against the rotating member 3, thereby effecting by means of an ink-ribbon not shown, the recording of the received letter signals by the pressure exerted on the strip between the said knife edge and the particular point of the helix 4 on the member 3, which happens to be lowermost at the moment the magnet 7 is energized. The circuit 9 for adjusting the phase relationship of the receiver and transmitter is controlled by contacts 10 and 11 of which the contact 10 is arranged to be actuated by the armature 8 of the recording magnet system 7. The contact 11 is arranged to be closed by a cam 12 on the spindle of the recording member 3, at the moment when the helix 4 on the recording member 3 scans the limiting surface 5 of the recording surface 6. The circuit 9 is only closed when the contacts 10 and 11 are closed at the same time, that is the moment when the recording of the letter signals occurs on a limiting surface 5. In the circuit 9 an electro-magnet switch gear 13 is arranged, which effects the adjustment of the phase relationship by a differential gear 14, when the circuit 9 is closed.

Fig. 3 illustrates a modified arrangement in which the circuit 15 for adjustment of the phase is controlled by the two parallel connected switched contacts 16 and 17.

When the recording member 3 effects a record on the limiting surface 5 of the recording base 6 the armature 8 of the recording magnet system opens the contact 16, and the contact 17 is at the same time interrupted by the cam 12. Thus the short-circuit for the resistance 19 in the circuit of the driving motor 18 on the member 3

is also interrupted and an adjustment of the phase relationship between the transmitter and receiver is effected.

Fig. 4 illustrates a further arrangement in accordance with the invention, in which alternating current signals are received by an amplifier (not shown in the figure) and are transmitted over the wires *a*, *b* to the receiving magnet EM, which records by means of its armature bar S acting in conjunction with the rotating recording member A, the letter signals analyzed in picture lines, on the paper-tape P through a carbon-backed tape. The recording member A is so arranged as to scan a picture line longer than the height of one letter as in the preceding arrangement and thus also scans the limiting surfaces of the recording tape P. When a phase displacement between the transmitter and the receiver occurs to an extent which effects the recording of the received signals on the limiting surface of the tape P, an adjustment of the phase relationship is effected.

During the period of scanning the limiting surface a cam N on the spindle of the recording member A closes a contact T, and the received alternating current signals effect a displacement of the grid potential of an electric discharge tube V and energize in the anode circuit a relay R which is arranged to effect the necessary adjustment of the number of revolutions of the motor M. The discharge tube V is a "binode", which contains, in addition to the normal triple electrode-system, a further electrode E, which together with the normal indirectly heated cathode constitutes a two-electrode rectifier system (diode-system). This rectifier system is arranged to effect the necessary rectification for generating the required displacement potential.

A constant grid potential is tapped from a battery D₁ and supplied over a resistance R¹ to the grid-circuit. By suitable selection of the value of the resistance R¹ and of a condenser C bridging the resistance, the time constant for the adjustment can be determined so that it is equal to the period for recording one picture line, that is equal to the duration of one revolution of the recording member A.

The circuit of the two-electrode system for generating the displacement potential includes a constant biasing potential derived from a battery B₂ through a potentiometer resistance W, this biasing potential being opposed to the rectifying impulse-potential. By this means it is possible to change the operating potential of the discharge tube for effecting the adjustment. Alternating potential impulses, for instance disturbing potentials, the amplitude of which is smaller than the biasing potential have no influence on the adjustment.

In operation, with perfect synchronism there will be no current through the contact T and the relay R will be energized continuously to produce continuous full speed operation of the motor M. With an out-of-phase condition, contact T connects valve V in parallel with electromagnet EM during the transmission of that portion of the signal which is inscribed upon the limiting surface of the recording base and this picture signal current will flow from *a*, through C, E, and T, to *b*, charging the condenser C to a potential varying in magnitude from cycle to cycle according to the variation in number of picture points or length of picture line inscribed upon the limiting surface. This polarization of the dotted grid will interrupt current through

the relay R which will change the speed of the motor M. Upon opening of contacts T and cessation of current through electrode E, the condenser C will continue polarization of the dotted grid until the charge of the condenser C is exhausted, when current will begin again through relay R and restore the normal speed of motor M. It will be seen that a greater degree of recording on the limiting surface will produce a greater magnitude of charge on condenser C and a greater degree of control on relay R and motor M, thus producing a greater correction to adjust the phase condition.

The adjustment of the number of revolutions of the receiver station, which is controlled by the relay R in the anode circuit, can be effected in different manners. For example, the armature of the relay R can be utilized to change the contact clearances of a centrifugal governor of the driving motor, so that with the setting of the adjustment circuit the motor M is adjusted between two limits of the number of revolutions thereof. This arrangement is especially advantageous, as no adjustment of the anode current of the discharge tube is necessary.

What I claim is:

1. In a synchronizing system for telegraph apparatus, the receiver of which records letter signals analyzed in picture lines, the combination with an electrical responsive means, of a recording base having a normal recording zone and a margin, a recording element for scanning the recording zone and the margin of the recording base, means controlled by the recording element during the scanning period of the margin of the recording base, and means controlled by said last mentioned means and the received letter signals for causing a phase regulation independently of the recording of the letter signals.

2. In a synchronizing system for telegraph apparatus the receiver of which records letter signals analyzed in picture lines, the combination of an electrical responsive means, a recording member effective from said means for recording characters on a strip, means for causing a phase regulation between the signals received and said recording member, an element operated in timed relation with said recording member, and means controlled jointly by the received letter signals operative on said electrical responsive means and by said element for controlling the operation of said second mentioned means to cause a phase regulation independently of the recording of characters.

3. In a synchronizing system for telegraph apparatus, the receiver of which records letter signals analyzed in picture lines, the combination of a magnet system, a recording base provided with a normal recording zone and limiting surfaces, a rotatable recording member arranged to scan the normal recording zone and also the limiting surfaces of the recording base, contact means arranged to be actuated by the rotatable recording member during the scanning period of the limiting surfaces of the recording base, further contact means arranged to be actuated during receipt of a letter signal, means to vary the speed of said rotatable recording member, and a speed-control circuit including said two contact means and said speed-varying means, whereby the speed is varied in response to receipt of a letter signal during the scanning period of a limiting surface.

4. A system as claimed in claim 3 in which the recording member is arranged normally to rotate faster than the transmitter and wherein said

contact means applies lagging phase adjustment of said member.

5. In a synchronizing system for telegraph apparatus the receiver of which records received letter signals analyzed in picture lines, the combination of a transmission line, a magnet system connected to said transmission line, a normal recording base provided with a normal recording zone and at least one limiting surface, a rotatable recording member arranged to scan the normal recording zone and also at least one limiting surface of said recording base, an armature member cooperating with said rotatable member, a receiver driving motor, means for varying the speed of said motor, a contact controlled by said rotatable recording member, and a discharge tube connected to said transmission line and to said contact and to said means for varying the speed of the motor, to cause receipt of a signal from said line during closure of said contact to effect variation of speed of said motor.

6. A system according to claim 5, in which the discharge tube comprises two electrode systems having a cathode in common, one of said electrode systems including rectifier means connected with said contact, and the other of said electrode systems being connected with said means for varying the speed of the motor and including a grid connected with means for controlling the potential of said grid.

7. A system according to claim 5, in which the discharge tube comprises two electrode systems having a cathode in common, one of said electrode systems including rectifier means connected with said contact and with a source of regular biasing potential, and the other of said electrode systems being connected with said means for varying the speed of the motor and including a grid connected with means for controlling the potential of said grid.

8. A system according to claim 5, in which the discharge tube comprises two electrode systems having a cathode in common, one of said electrode systems including rectifier means connected with said contact, and the other of said electrode systems being connected with said means for varying the speed of the motor and including a grid in circuit with a condenser and a resistance of such values that the time constant of the grid circuit will be equal to the period for recording one picture line by said rotatable recording member.

9. A system according to claim 5, in which the discharge tube comprises two electrode systems having a cathode in common, one of said electrode systems including rectifier means connected with said contact, and the other of said electrode systems including an anode connected with a relay constituting the means for varying the speed of the motor, such second electrode system also including a grid connected with means for controlling the potential of said grid.

10. In a synchronizing system for telegraph apparatus the receiver of which records received letter signals analyzed in picture lines, the combination of a magnet system, a normal recording base provided with a normal recording zone and at least one limiting surface, a rotatable recording member arranged to scan the normal recording zone and also at least one limiting surface of said normal recording base, first means responsive to a received letter signal, second means operated while said rotatable member is scanning said limiting surface, and phase-adjusting means operatively connected with said rotatable re-

5 cording member and also connected with said first means and said second means and responsive during an encroachment of the recorded letters on the limiting surface and operable upon such response to effect an adjustment of the phase relationship between the transmitter and the receiver.

10 11. In a facsimile recorder for recording received character signals in successive lines upon a record surface, a rotary member having angles of rotation in which received character signals may be recorded in successive lines in a normal recording zone of a record surface alternating with intermediate angles of rotation in which received character signals may be recorded upon an edge zone of said record surface, phasing means for said rotary member, and means rendering said phasing means operative to effect phasing in response to character signals received during said intermediate angles of rotation.

20 12. In a facsimile recorder for recording received character signals in successive lines upon a record surface, a rotary recording member having predetermined angles of rotation for recording received character signals in successive lines in a normal recording zone of a record surface alternating with other angles of rotation for recording received character signals in an edge zone of said record surface, phasing means for said rotary recording member, and means associated with said phasing means and continuously in phase with said recording member and operating to render said phasing means responsive to character signals received during said other angles of rotation of said rotary recording member to effect phasing.

30 13. In a facsimile recorder for recording received character signals in successive lines upon a record surface, a rotary member having an angle of rotation in which received character signals may be recorded in a line upon a normal recording zone of a record surface and having a

further angle of rotation in which a received character signal may be recorded upon an edge zone of said record surface, phasing means for said rotary member, and means rendering said phasing means operative to effect phasing in response to a character signal received in said further angle of rotation.

5 14. In a facsimile recorder for recording received character signals in successive lines upon a record surface, a rotary recording member having a predetermined angle of rotation for recording received character signals in a line in a normal recording zone of a record surface and having another angle of rotation for recording a received character signal in an edge zone of said record surface, phasing means for said rotary recording member, and means associated with said phasing means and continuously in phase with said recording member and operating to render said phasing means responsive to a character signal received in said other angle of rotation of said rotary recording member to effect phasing.

10 15. In a synchronizing system for telegraph apparatus, the receiver of which records letter signals analyzed in picture lines upon a recording surface classified into a normal recording zone and an adjacent recording zone, a rotatable recording member arranged to scan said recording zone and also said adjacent recording zone, electrical means arranged to be controlled by said rotatable recording member during the scanning period of said adjacent recording zone, further electrical means arranged to be controlled during receipt of a letter signal, and speed control means for said rotatable member including said electrical means and said further electrical means and adapted to vary the speed in response to a letter signal received during the scanning period of said adjacent zone.

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