

June 16, 1925.

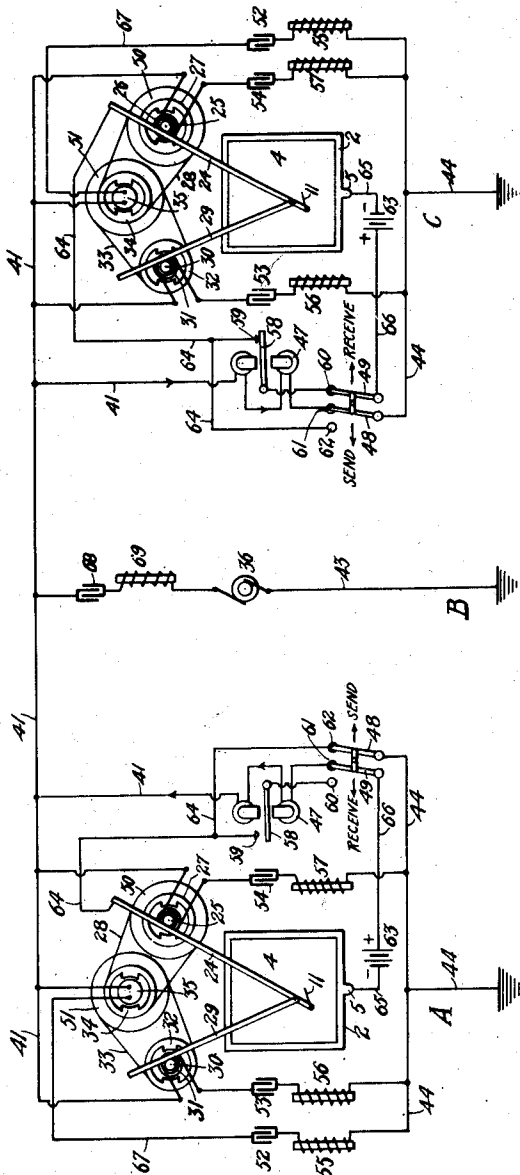
1,542,038

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TELAUTOGRAPH APPARATUS

Original Filed Aug. 26, 1908 3 Sheets-Sheet 1

Fig. 1.



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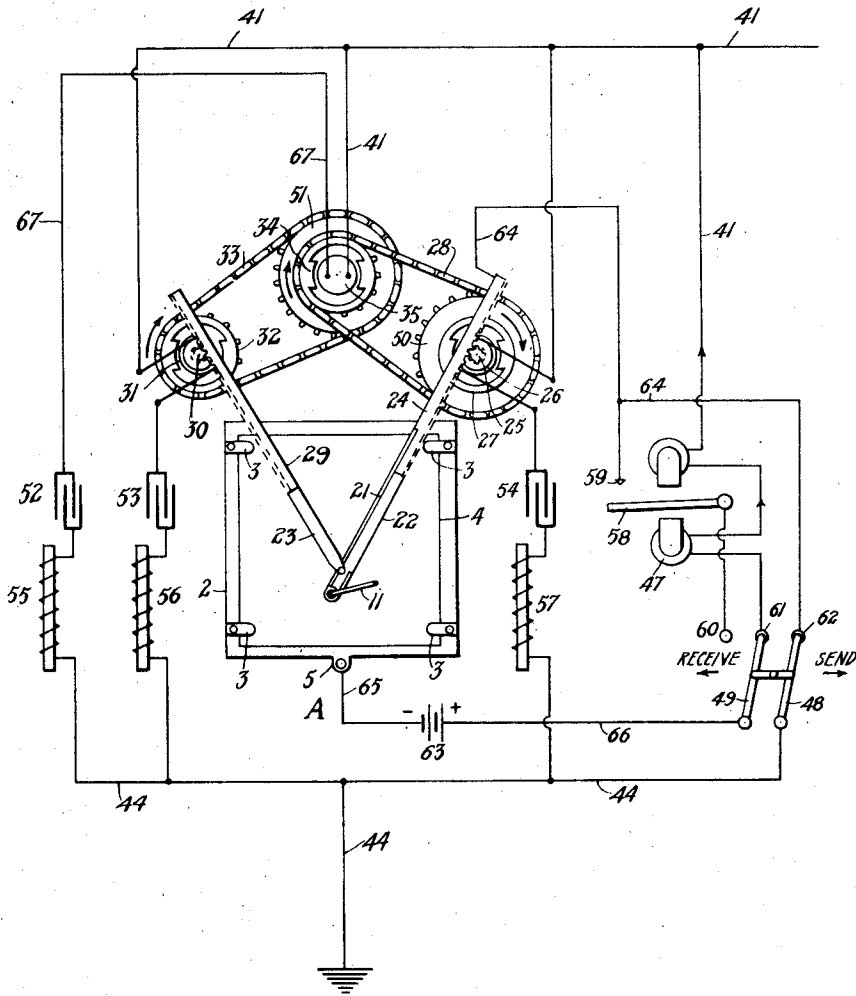
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Fig. 2.



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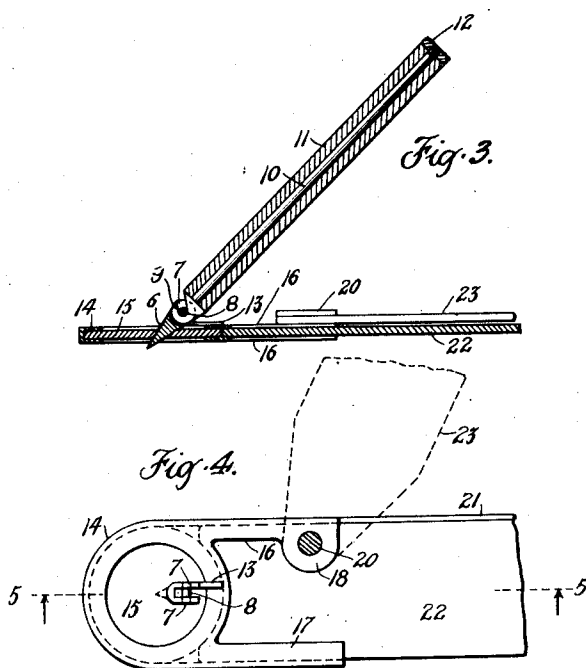
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Original Filed Aug. 26, 1908 3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

ALBERT V. T. DAY, OF PARIS, FRANCE.

TELAUTOGRAPH APPARATUS.

Continuation of application Serial No. 450,343, filed August 26, 1908. This application filed November 15, 1916. Serial No. 131,443. Renewed October 7, 1924.

To all whom it may concern:

Be it known that I, ALBERT V. T. DAY, a citizen of the United States, residing at Paris, France, have invented certain new and useful Improvements in Telaarograph Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings, forming part thereof.

My invention relates particularly to electric systems and apparatus for producing chirographic inscriptions at a point distant from the point where they originate, by causing the movement of the writer's pen, pencil or equivalent device to be reproduced in a corresponding pen or recording device at said distant point. This adaptation of my invention I term a kirograf. In its broader aspect however, my invention relates to electric systems and apparatus for transmitting and reproducing any movement for any purpose whatever, whether for making a written record or for effecting any other manipulation at a distance from the point of control.

The main object of my invention is to reliably reproduce chirographic or other movements, particularly at long distances from their points of origin.

The basic principles and features of my invention are so broad that they may be applied and embodied in many constructions and arrangements differing widely in specific form and details, and in the accompanying drawings I have illustrated only two of the many different forms in which my invention may be embodied; but in the broader of the claims that follow, I have pointed out my invention in terms which are intended to include all the different forms in which it may be embodied.

The accompanying drawings are largely diagrammatic, since, for sake of simplicity, I have omitted all details which are of such nature that they can readily be supplied by the skilled mechanic or electrician.

In these drawings:

Fig. 1 is a diagram of a kirograf system wherein two kirografs at stations A and

C communicate through a central station B, in the manner of a telephone exchange;

Fig. 2 is a partially diagrammatic plan of the form of kirograf employed at both stations A and C of Fig. 1, the connecting wires of Fig. 2 being represented as though the instrument were located at the station A of Fig. 1;

Fig. 3 is a longitudinal middle vertical section of the pencil 11 and part of the transparent section 22 of the right-hand co-ordinating arm of Fig. 2,

Fig. 4 is an enlarged plan view of the parts shown in Fig. 3, excepting the handle portion of the pencil, which is removed to expose the other portions to view. To this same end the portion 23 of the left-hand co-ordinating arm is indicated in Fig. 4 by a broken line.

The kirograf comprises a rectangular metal platen 2 upon which an electrolytically sensitized sheet of paper is secured by means of clips 3. This sheet will receive either the original or the reproduced chirographic record, or both, according as the instrument is being used to send or receive a message, or to alternately send and receive short messages on the same sheet of paper. The operator will face the front edge of the platen, which is the edge lowermost as the instruments are represented in the drawings. The marking point 6 of the pencil is carried at the front end of the right-hand co-ordinating arm 24, and the front end of the left-hand co-ordinating arm 29 is pivotally connected with the right co-ordinating arm near its front end. The outer edges of the right and left co-ordinating arms have rack teeth which respectively engage the pinions 25 and 30 of the right and left co-ordinators placed adjacent to the rear corners of the platen and having their axes disposed normal to the plane of the platen. Each co-ordinating arm swings angularly about the axis of its respective co-ordinator pinion, being held always in tangency therewith by means of a suitable pivoted guide which is omitted from the drawings for sake of clearness.

When the pencil is moved by the operator in the act of transmitting a message or other record, the movement of the pencil is resolved into components producing longitudinal movements of the two co-ordinating arms, which longitudinal movements in turn produce rotary movements of the co-ordinating pinions. These rotary movements of the right and left co-ordinator pinions of the sending kirograf are reproduced in the corresponding right and left co-ordinator pinions of the receiving or reproducing kirograf, which latter pinions thereby produce longitudinal movements of their respective right and left co-ordinating arms corresponding to the initial longitudinal movements of right and left co-ordinating arms of the sending instrument, and hence producing in the pencil of the receiving kirograf a resultant movement exactly corresponding to the initial movement of the sending pencil. Incidentally it will be noted that a simple angular movement of either co-ordinating arm about the axis of its co-operating pinion, must produce an equal angular movement of that pinion, which will be reproduced in the corresponding or homologous pinion of the receiving kirograf so as to permit a corresponding angular movement of its co-acting co-ordinating arm; but this action is not depended upon to transmit angular movements between corresponding arms, since the same is insured by transmission of the concurrent longitudinal movements between the other corresponding arms of the kirographs. Obviously, in the illustrated embodiment of my invention, the angular movements produced in the pinions by simple angular movements of their respective rack arms or co-ordinating arms, is very small in comparison with the movements produced in these pinions by the longitudinal movements of their rack arms.

The rear rack portions 24 and 29 of the co-ordinating arms are made of suitable metal, and the front portions 22 and 23 thereof are made of celluloid or other suitable transparent material through which the paper sheet and the writing thereon will be plainly visible. The right co-ordinating arm is employed as a conductor to convey current to the pencil, for which purpose a metal strip 21 extends from the metal rack portion 24 forward along the inner edge of the transparent portion 22 to the metal pencil frame with which the strip 21 is connected. This pencil frame comprises an annular eye 14 with inwardly projecting top and bottom flanges between which the flat circular disc or eye piece 15 of transparent material is mounted so as to turn freely. The peripheral or cylindrical portion of the eye 14 extends only through a semi-circumference at the front end of the arm, and is

tangentially united with rearward projections also having inwardly projecting top and bottom flanges 16 and 17 constituting extensions of the annular flanges of the eye. The front end of the transparent strip 22 is inserted between the rearward extensions of the eye 14 and between the top and bottom flanges of these extensions, and the front extremity of the strip enters between the annular flanges of the eye and is concaved to fit the circumference of the circular eye piece 15 and thus form a partial bearing for the eye piece. The upper flange 16 of the frame has an inwardly projecting lug 18 receiving a stud 20 which forms the pivotal connection between the two co-ordinating arms. The cone-shaped metal point 6 of the pencil is firmly fixed at an angle in the eye piece 15, so that the lower extremity or point proper projects slightly below the bottom plane of the eye 14 and terminates, and engages the paper, exactly in the axis of the eye piece, wherefore any angular motion of the pencil and eye piece about the axis of the eye piece is wholly ineffective to change the position of the point upon the paper. The metal point 6 is bifurcated at its upper end to form two lugs 7 between which is mounted a pin 8. The removable handle of the pencil comprises a stem 10 on the lower end of which is formed a hook 9 which enters the bifurcation between the lugs 7 on the pencil point and hooks over its pin 8. The barrel 11 of the pencil turns freely on the stem 10, but is held longitudinally between the head of the hook and a nut 12 on the upper end of the stem. A spring wiper 13 projects horizontally from one of the lugs 7 on the pencil point 6, and wipes over the upper flange of the eye 14, thus preserving conductive connection between the eye and the metal point of the pencil, no matter how much the pencil swings about the axis of the eye. Ample freedom of the pencil in the hand of the operator is afforded by its angular mobility about the vertical axis of the eye piece 15 and about the horizontal axis of the pin 8, and by the free axial turning of the barrel 11 on the stem 10. The co-ordinating arms will be sufficiently flexible to permit the point 6 to be raised from the paper and moved about without making contact therewith. Current is conveyed from the connecting wire 64 in Fig. 2, through the rack 24 and strip 21 to the pencil frame and thence from the upper flange of its eye 14 to the wiper 13 and thence to the point 6 and from the point through the sensitized paper to the metal plate and thence to the connecting wire 65 in Fig. 2.

The co-ordinators resemble alternating-current generators or motors, and in fact their action partakes of the functions of both generator and motor. The co-ordi-

nators have alternating-current armatures 26 and 31 which are normally stationary but are rotatably mounted on suitable bearings together with their respective pinions 25 and 30, the armatures and pinions being fastened together so that the pinions, when operated by their co-ordinating arms, may turn the armatures, or the armatures may turn their pinions and thus operate the co-ordinating arms. In the illustrated embodiment of my invention, these armatures are monophasic armatures provided with ordinary monophasic windings for a bipolar field.

The rotary bipolar field magnets 27 and 32 of the co-ordinators are rotatably mounted co-axially with their respective armatures 26 and 31. They will be either permanent magnets, or electro-magnets excited in any suitable manner. In the illustrated instances the co-ordinator field magnets are driven at a constant speed by a synchronizer consisting in an alternating-current motor having a stationary monophasic armature 35 and a rotary bipolar field magnet 34, either permanent, or suitably excited. This rotary field magnet of the synchronizer drives the field magnets of both co-ordinators through any positive transmission means which, in the present cases, is represented as a chain and sprocket drive. A large sprocket 51 is mounted on the synchronizer field magnet to drive the field magnet 32 of the left-hand co-ordinator, while the field magnet of the right-hand co-ordinator carries a large sprocket to receive the drive from the field magnet of the synchronizer. Thus the synchronizer armatures have one frequency, the left co-ordinator armatures have a higher frequency, and the right co-ordinator armatures have a lower frequency. This difference of frequencies in the three armatures could be obtained, however, by suitably changing their windings and providing their rotary field magnets with different numbers of poles, while rotating all field magnets with a common velocity.

The system of Figs. 1 and 2 employs a single line wire 41 to transmit all currents from station to station while the identity of the different currents mingling in this common line wire is preserved by employing currents of different character for the two co-ordinator circuits and the synchronizer and marking circuits. In this particular instance the currents for the synchronizer circuit and the co-ordinator circuits are alternating currents of three different frequencies while a unidirectional current is employed for the marking circuit.

At each of the kirograf stations A and C, the synchronizer and co-ordinator armatures are bridged across the line 41 and ground wire 44 in three parallel branches,

each branch including one of the said armatures in series with a condenser and inductance coil having their relative capacity and inductance adjusted for resonance at the particular frequency of the armature in series with them. Thus the synchronizer branch leads from the common wire 41 through the synchronizer armature 35, condenser 52, and inductance coil 55 to the ground wire 44. The branch of the right-hand co-ordinator leads from the common wire 41 through the right co-ordinator armature 26, condenser 54 and inductance coil 57 to the ground wire 44. The branch of the left-hand co-ordinator leads from the common wire 41 through the left co-ordinator armature 31, condenser 53, and inductance coil 56 to the ground wire 44.

The alternating-current synchronizing generator 36 at the central station B is connected between the ground and the common line 41 in a bridge including, in series, the ground wire 43, generator armature 36, inductance coil 69, and condenser 68. The inductance coil and condenser are relatively adjusted for resonance at the frequency of the generator armature, so that current from this armature freely passes to the line 41 where it divides into two parallel circuits leading in opposite directions through the line wire to the kirografs A and C where the current from the synchronizing generator flows through the armatures 35 of the synchronizers and through the capacity 52 and inductance 55 relatively readjusted in resonance with this current so as to oppose it only by the negligible ohmic resistance of the coil. Thus the synchronizers are driven, and in turn drive the co-ordinators. The armatures of the homologous co-ordinators at the two stations normally deliver to the common line 41 electro-motive-forces of the same frequency exactly opposed in phase, while the frequencies of the right-hand and left-hand co-ordinators are different from each other and different from the frequency of the synchronizers.

The generating portion of the synchronizer circuit bridged from ground to line, at the central station B, does not receive an appreciable amount of current from the co-ordinator armatures owing to the opposition of the condenser 68 or inductance 69 which are not adjusted in resonance with either co-ordinator frequency. For the same reason the condenser or inductance coil in the synchronizer circuit-branch bridged from line to ground at each kirograf offers relatively great opposition to the flow of co-ordinating current; but even if the co-ordinating currents were to flow in appreciable measure through the synchronizing armatures they would not affect the movement of these armatures because the latter

are entirely out of step with these currents. Likewise, the condenser or inductance coil in the circuit-branch of each co-ordinator bridged from line to ground, offers relatively great opposition, either to the synchronizing current or to the current from the non-homologous co-ordinators; although either co-ordinator armature would not be considerably affected by a very appreciable flow of current either from the non-homologous co-ordinators or from the synchronizing generator, since either current is entirely out of step with the armature in question. Hence it is obvious that the resonantly adjusted condensers and inductance coils may be omitted, in so far as their foregoing functions are concerned since these functions consist merely in economizing the currents by confining them principally to their proper circuit branches. Indeed in some cases, for instance where rapid writing is required and large currents may be used, it may be more advantageous to omit the resonantly adjusted condensers and inductance coils in the circuit branches of the co-ordinators, since their resonance will create some tendency to a persistence in phase of the co-ordinating currents, thus making slower the phase changes which are depended upon to shift the angular positions of the receiving co-ordinator armatures.

Furthermore, although in Fig. 1 the synchronizer and co-ordinators at either station are all in parallel with each other, it will be understood by electricians that the selective synchronous consonance of these elements with their respective current components would obtain if they were connected all in series.

From the foregoing it will be apparent, that in the system of Figs. 1 and 2, the synchronizers are controlled only by current from the synchronizing generator at the central station, and each co-ordinator armature is responsive only to phase changes in the electro-motive-force generated by its homologous armature at the other kirograf station. Obviously then, the angular movements of the co-ordinator armatures at the sending station will be repeated in the homologous armatures at the receiving station, and thereby the horizontal movements of the sending pencil will be reproduced in the receiving pencil.

The system of Figs. 1 and 2 employs a marking line-circuit extending from one kirograf to the other by way of the common line wire 41, and also a local marking-circuit at the receiving kirograf which is controlled by the polarized relay 47 actuated by the said marking line-circuit. The battery 63 at either kirograf station is alternately included in the local marking circuit of that station when that station is receiving a message, and is included in the mark-

ing line-circuit leading to the other station when the other station is the receiving station. The double-arm switches 48, 49 effect this change of connections. When either station is sending, its switch will be moved so that the arms 48 and 49 contact respectively with the buttons 62 and 61, and when the station is to receive, the switch will be moved so that the arm 48 will contact with the button 61, and the arm 49 will contact with the button 60. For instance when the station A is sending and the station C is receiving, as indicated in Fig. 1, the marking circuits will be as follows: The marking line-circuit will lead from one pole of the battery 63 at the sending station A which we may assume to be the positive pole as indicated, through the wire 66, switch arm 49, button 61, relay 47, line wire 41, relay 47 at the station C, button 61, switch arm 48, ground wire 44 to ground C, thence by earth to ground wire 44 at station A, and through the wire 44, switch arm 48, button 62, wire 64, right co-ordinating arm 24, point of pencil 11, paper sheet 4, platen 2, and wire 65 back to the negative pole of the battery 63. The foregoing circuit is closed while the pencil of the sending kirograf A rests on the paper, and it will be noted that, as indicated by arrow heads, the battery current in this circuit flows through the polarized relay 47 at the sending station A in the direction opposite to its flow through the polarized relay 47 at the receiving station C. Thereby, each time the circuit is closed by the sending pencil at A, the relay at C raises its armature 58 into contact with the stop 59, although the relay at A does not raise its armature. Each time the sending pencil at A is raised out of contact with its paper, the foregoing circuit is broken and the armature 58 of the relay at C falls out of contact with the stop 59. Hence this contact is made and broken as the foregoing line circuit is made and broken by the sending pencil at A; and thus is made and broken the local marking circuit at C, which includes this contact and leads from the positive pole of the battery 63 at C through the wire 66, switch arm 49, button 60, connecting wire, relay armature 58, contact stop 59, wire 64, right co-ordinating arm 24, point of pencil 11, paper sheet 4, platen 2, and wire 65 back to the negative pole of the battery 63.

It will be noted that the polarized relays 47 are included in circuit-branches bridged between the ground wire and line wire in parallel with the synchronizer and co-ordinator circuit-branches, but these relays will have such great impedence that they will receive only a negligible portion of the alternating currents which should be confined to the other said circuit-branches, and any amount of alternating current which flows through these polarized relays can only sub-

ject their armatures to a rapidly reversing effort to which the armature, because of its inertia, will not respond, and which will have no mean or constant resultant tending to move the armature in either direction. The other circuit-branches at the receiving station will not deprive the polarized relay of its unidirectional current, because the condensers in these other branches will not conduct unidirectional current; but even if these condensers were omitted so that these other branches would receive some unidirectional current, this would not affect the alternating current armatures of the synchronizer and co-ordinators, and the polarized relays could yet be made to operate on the share of unidirectional current which they would still receive.

It will be noted that the earth acts as one conductor from station to station, and that an extra wire conductor could be employed instead of an earth path. Therefore, the word "conductor" in the following claims is intended to include a path through the earth as well as a wire conductor.

Also, as to the broad scope of the claims, it must be understood that the idea of superposing two or more different waves, or electrical energy characteristics, upon a common transmitting medium, for the transmission of two or more components of a primary movement, is not limited to the employment of a conductive transmission circuit, since it is well known that electrical energy can be transmitted by electro-magnetic or electrostatic induction and by ethereal wave propagation.

For example, the composite kirograf current comprising the different-frequency alternating-current components for controlling the respective co-ordinators and the synchronizer, may be treated as an ordinary telephonic current to be translated by any usual or suitable means into the strength modulations of a high-frequency aerial current by which radio transmission is generally accomplished; and the rectified current derived from the receiving aerial and corresponding to the said original composite kirograf current, may be amplified by any suitable means to augment its power to a measure sufficient for controlling the receiving kirograf. The marking may be controlled by a fourth current component of a distinctive frequency different from the synchronizer and co-ordinator frequencies and superposed upon them and governed by the raising and lowering of the sending marker, and correspondingly effecting the marking action of the receiving marker.

The current components governed by the sending kirograf may be employed to produce corresponding sound waves in the air through the agency of one or more telephones preferably of high power, and these sound

waves may be received as a distant point by one or more microphones which will translate them into current components corresponding to the original kirograf current components so that when suitably amplified they may efficiently control a receiving kirograf.

Although in describing the illustrated embodiments I have for convenience, designated as "co-ordinators" those electro-magnetic devices which immediately co-act with the marker to receive or deliver its co-ordinate components of movement, it will be understood that, in the broad sense of the claims, the "co-ordinating means" includes all means of whatever character co-operating to combine and resolve the transmitted components of the primary movement.

Also it must be noted that the invention in its broad aspect is not limited to the transmission of two components, nor to the transmission of movements in a single plane; and the synchronizing circuits and motors of the illustrated embodiments are not essential to the broad invention, since any means may be employed to effect equal speeds of homologous parts which are required to move in consonance.

In the broad aspect of the invention the actual transmission of energy may be either from the sender to the receiver, or vice versa, for instance as when a sending co-ordinator of the illustrated type tends to speed ahead of, or lag behind, its homologous receiving co-ordinator. Also, broadly considered, the invention is not limited to the use of a common instrument for both sending and receiving, since in many cases it may be desirable to provide separate senders and receivers adapted especially to their respective functions; and I may employ any suitable means for producing and translating the different current components or characteristics. It will be understood that when a common transmitting conductor or medium is employed, a composite current or flow of energy results, for instance as when the alternating currents of different frequencies are superposed to produce a single composite current in which the separate waves appear as distinct periodic characteristics; and my invention broadly contemplates the employment of such a composite current or energy flow, however the same may be produced, whether by superposing separate components from separate sources or by producing distinct independent variations or characteristics in an existing current or flow of energy.

It will also be understood from a reading of the following claims that certain features of my invention do not essentially involve the continuous rotation of a magnetic field; and when a rotating field is to be employed it is not limited to the mechanically rotated field of the illustrated embodiment, since I

may employ any desired suitable method of producing a rotary field. For instance the synchronizer of the receiving kirograf may drive alternating-current generators to produce polyphase currents of the different frequencies corresponding to the respective co-ordinator frequencies, and these locally generated currents may energize stationary annulæ surrounding the respective co-ordinator armatures to induce rotary fields within them. Or the synchronizer may effect the rotation of brush yokes carrying brushes bearing on the rotating commutator of a direct-current generator so as to subject these brushes to polyphase potentials which may likewise be employed to induce rotary fields for the co-ordinator armatures.

Also, although I have illustrated and particularly described a monophase system, my invention is not limited to monophase fields and transmission, and those versed in the art will understand the adaptation of polyphase means. Obviously three transmission wires may be employed with triphase co-ordinator armatures, or monophase transmission may be employed with phase-splitting means to energize polyphase windings on the co-ordinator armatures.

Although in describing the illustrated embodiments of my invention I have mentioned, as an ideal the exact phase correspondence of the homologous co-ordinators, it will be understood by electricians that there must, in fact, be some relative phase displacement in the process of transmission sufficient to develop the slight torque necessary to actuate the receiver, and resulting in a slight lag of the reproduced movement behind the primary movement, although not materially affecting the accuracy of reproduction. Also, owing to unbalanced leakage of the transmission line or other dissymmetrical conditions, there may be a slight constant difference in phase of the homologous co-ordinators, though it cannot materially affect the reproduced movement or record. Indeed, it is one of the great advantages of my invention that the translating means or gearing between the co-ordinators and the marker or secondary device, by giving the co-ordinators a relatively great angular movement for a given movement of said marker or device, minimizes all phase errors or deformations in the reproduced movement or record. This translating means also permits an amplitude of movement or size of record sheet far greater than could be otherwise attained.

Although my invention contemplates any mode of response to phase variations in those embodiments which rely upon phase change for the transmission of motion components, it may be noted that, in the specific embodiment which is illustrated, the control is effected by the phase relation of

each co-ordinator current to the synchronizing current, independently of changes in the actual frequency and phase of the synchronizing current, so that the speed of the synchronizing generator might vary widely without affecting the accuracy of transmission.

A very great advantage of this invention is its capability of transmission over unlimited distances, in virtue of the circumstance that the controlling current may be transmitted through any number of successive repeaters or relays without impairment of its kirograf-controlling function which depends only on the phase changes in the initial current and is not affected by aberrations of wave form and intensity.

Not limiting myself to those particular embodiments of my broad invention which I have illustrated and specifically described, but intending to cover also all other embodiments containing the spirit and generic features of my invention, I claim:

1. An electric system for transmitting chirographic or other movements, comprising a common transmitting circuit, means for superposing thereon a number of component currents characterized by periodic variations of different frequencies, means for producing in each component current a phase variation corresponding to one respective component of the movement to be transmitted, and reproducing means controllable by the transmitting circuit and responsive to the phase variation in each component current to reproduce the component of movement corresponding thereto.

2. An electric system for transmitting chirographic or other movements, comprising sending and receiving apparatus and a medium for transmitting electrical energy between them, the sending apparatus including means for controlling such transmission of superposed separate components or characteristics of said electrical energy in accordance with respective separate components of the primary movement to be transmitted, and the receiving apparatus including rotatably mounted co-ordinating devices controllable respectively by said separate electrical components or characteristics in response to their accordance with the said respective separate components of primary movement, and the receiving apparatus also including a reproducing device adapted to move in correspondence with the primary movement and translating means arranged to translate one or more complete rotations of either co-ordinating device into a component movement of the reproducing device corresponding to the said respective separate component of primary movement which governs the co-ordinating device.

3. An electric system for transmitting

chirographic or other movements, comprising sending and receiving apparatus and a medium for transmitting between them electrical energy of periodic character, the sending apparatus including means for progressively varying the phase of superposed separate periodic components or characteristics of said energy to the extent of one or more complete cycles and in accordance with respective separate components of the primary movement to be transmitted, and the receiving apparatus including rotatably mounted co-ordinating devices controllable respectively by said separate periodic components or characteristics in response to their phase variations in accordance with the said respective separate components of primary movement, and the receiving apparatus also including a reproducing device adapted to move in correspondence with the primary movement and translating means arranged to translate one or more complete rotations of either co-ordinating device into a component movement of the reproducing device corresponding to the said respective separate component of primary movement which governs the co-ordinating device.

4. An electric system for transmitting graphic records comprising relatively movable co-acting record-receiving and record-marking means, electrically controllable means responsive to one characteristic of electrical energy to govern the relative movement of the record-receiving and record-marking means and responsive to another characteristic of electrical energy to govern the record-marking effected during such movement, means for producing electrical energy having said characteristics and for controlling the same at a point distant from the record-receiving and record-marking means, and a common medium adapted to transmit said energy between said distant point and the record-receiving and record-marking means.

5. An electric system for transmitting chirographic or other movements comprising a common transmitting circuit, means for producing therein electric current having two distinct periodic characteristics of different frequencies, means for producing in each periodic characteristic a phase variation corresponding to one respective component of the movement to be transmitted, and reproducing means controllable by the transmitting circuit and responsive to the phase variation in each characteristic to reproduce the component of movement corresponding thereto.

6. An electric system for transmitting chirographic or other movements comprising a common transmitting circuit, means for producing therein electric current having two distinct periodic characteristics of different frequencies, means for producing

in each periodic characteristic a phase variation corresponding to one respective component of the movement to be transmitted, and reproducing means controllable by the transmitting circuit and responsive to the variation in the phase of each characteristic to reproduce the component of movement corresponding thereto.

7. An electric system for transmitting chirographic or other movements comprising a common transmitting medium, means for producing therein two periodic series of electrical impulses characterized by different frequencies, means for producing in each periodic series a phase variation corresponding to one respective component of the primary movement to be transmitted, and reproducing means controllable by the transmitting medium and responsive to the phase variation in each periodic series to reproduce the component of movement corresponding thereto.

8. An electric system for transmitting chirographic or other movement comprising a common transmitting medium, means for producing therein two periodic series of electrical impulses characterized by different frequencies, means for producing in each periodic series a phase variation corresponding to one respective component of the primary movement to be transmitted, and reproducing means controllable by the transmitting medium and responsive to the variation in the phase of each periodic series to reproduce the component of movement corresponding thereto.

9. An electric system for controlling distant movements comprising a common transmitting medium, means for producing therein two periodic series of electrical impulses characterized by different frequencies, means for producing a change in the phase of one periodic series relative to the other, and apparatus controllable by the transmitting medium and including a movable device and responsive to said change in relative phase to effect a movement thereof.

10. An electric system for controlling distant movements comprising a common transmitting medium, means for producing therein a periodic series of electrical impulses of constant frequency or period and also a second periodic series having a mean period or frequency different from the constant period or frequency of the first said impulses, means for increasing or decreasing the period or frequency of the second said periodic series, and apparatus controllable by the transmitting medium and including a movable device and responsive to the change in periodic relation of said two periodic series of impulses to effect a movement of said movable device.

11. An electric system for transmitting

chirographic or other linear markings, comprising a common transmitting circuit, means for superposing thereon a unidirectional current component and a periodic
5 current component and for controlling one of said current components by the linear component of a transmitting marker and for controlling the other of said current components in conjunction with the begin-

ning and ending of a linear mark, and re- 10
cording means responsive to the current component controlled by the linear component to reproduce the linear mark and responsive to the other current component to begin and
15 end the mark.

In testimony whereof I have affixed my signature.

ALBERT V. T. DAY.