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FACSIMILE APPARATUS

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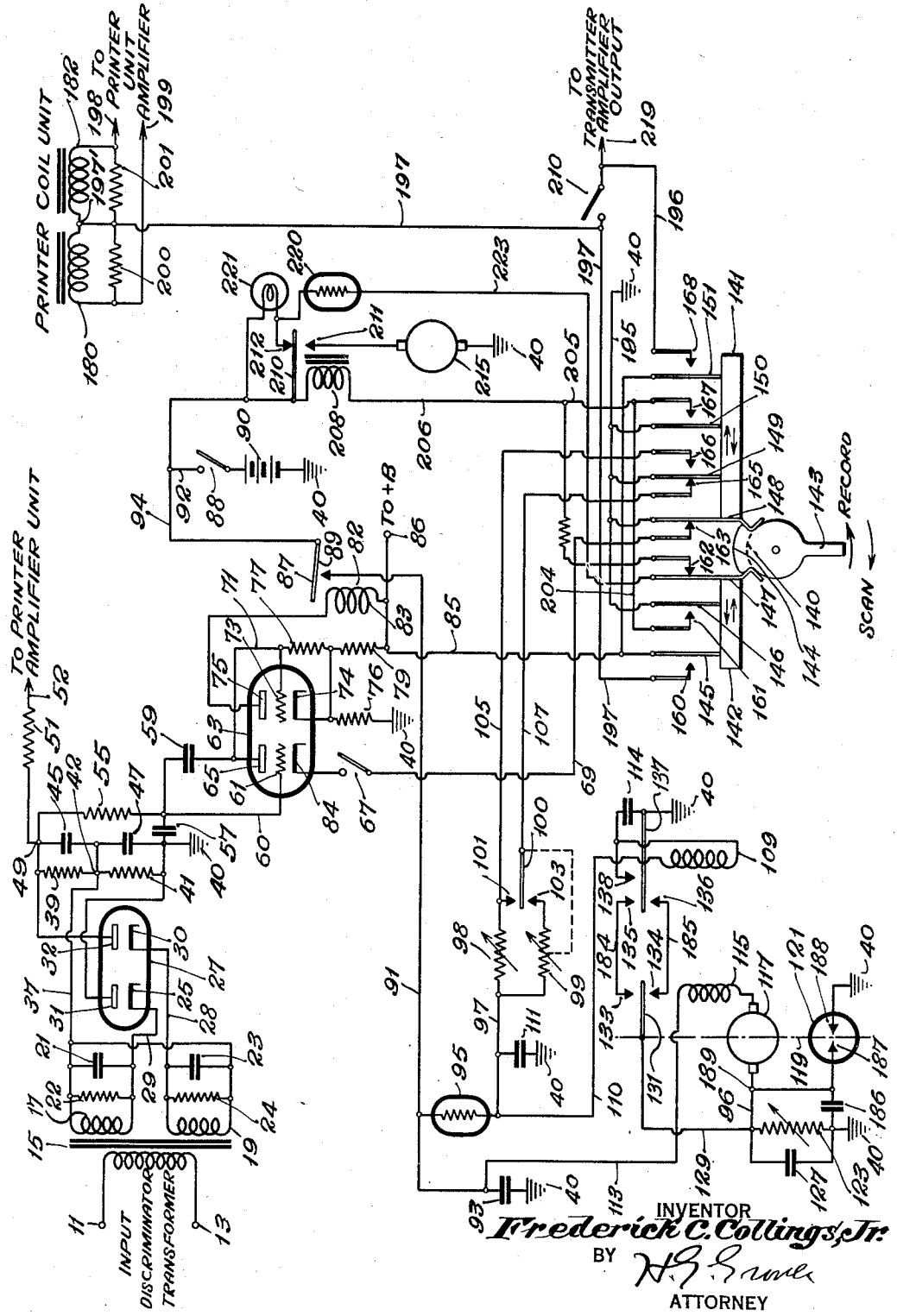

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FACSIMILE APPARATUS

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9 Claims. (Cl. 178—69.5)

This invention is directed to facsimile apparatus, and is particularly concerned with the control arrangements for operating monitor or receiving equipment and the like.

Essentially, the system is applicable primarily to the so-called "tape" facsimile type where a continuous record is made from a transmitted signal, but primarily the system is one which is particularly adapted for use with the so-called "black and white" forms of transmission and reception to the exclusion of the so-called "halftone" or "modulation" type system.

In the form in which the invention has been disclosed, it is apparent that by the use of the so-called black and white forms of recording, the signal energy which is to produce the recording effect changes from one value to another, that is, there may be a change in either amplitude frequency or phase, which, when translated into recordings, will produce the desired form of record.

In a companion case, Ser. No. 467,423, filed concurrently herewith, entitled "Facsimile apparatus," there have been disclosed the related portions of the apparatus wherein the particular forms of transmitting and receiving equipment for producing the signal energy and for receiving the signal energy are set forth. In such forms of apparatus, it is known that the light values on a record are converted into variations in intensity of current output from a light translating element, such as a photo-electric tube or the like.

In the particular arrangement disclosed by the companion case above referred to, provision has been made for translating a record subject into a series of signalling impulses where the frequency of the produced impulses varies between two limiting values, so that by the use of appropriate forms of receiving instrumentalities the various produced signals may be caused to actuate a recorder which will either mark or space, depending upon the frequency of the energy received.

The present invention is more particularly concerned with the control of the complete instrumentality and the provision of a suitable means to control scanning and recording and, at the same time, provide for operating and controlling the equipment so as to maintain proper speed and the like.

Furthermore, the present invention is particularly concerned with certain auxiliary apparatus for use with facsimile devices, and with suitable control provisions for actuating and starting the driving motor, depending upon the receipt of signals in the receiver discriminator.

Among the objects and advantages of the invention are those of providing a system particularly adapted for facsimile uses and for the recording of signal energy as a permanent record of either the so-called tape or continuous or even interrupted type.

Other objects and advantages of the invention are those of providing facsimile apparatus of a particular simplified and efficiently operating form.

Still other objects and advantages are those of providing apparatus of a relatively simple and compact nature which overcomes the defects of the prior art through the omission of complex circuit arrangements and at the same time which provides a small and compact, and yet efficiently operating unit particularly designed for the purposes herein set forth.

Another object of this invention is to provide for a high degree of regulation of the driving means used for driving the recording drum, and at the same time to increase substantially the range over which the control is made effective.

Other objects and advantages will become apparent from considering the following specification in conjunction with the accompanying drawing, wherein a portion of a complete facsimile recorder scanner unit has been shown.

In considering the drawing, the portions of the scanner and transmitter amplifier and the recorder amplifier, which are not particularly applicable to the present invention, have not been shown in detail. However, reference is made to the companion application hereinabove named for illustration of one of several forms which such apparatus may assume.

Generally speaking, the scanner amplifier unit comprises a photo-electric tube which has been subjected to the light of an image to produce output currents varying in accordance with the intensity of light and shadow on the subject. The phototube then produces signal output energy which is duly amplified and caused to control, in a manner such as that explained in the companion application, the modulating frequencies for a transmitter unit.

The form of record scanned and the means by which scanning is accomplished may, for example, be such as that conventionally represented in a publication by Shore and Whitaker, entitled "Tape facsimile synchronizing systems" published in a book entitled "Radio Facsimile" in October, 1938, by RCA Institute, Technical Press, New

York, and particularly to the form of scanning system illustrated on page 271 of the said publication, wherein it can be seen that the tape message is scanned preferably by means of a light source directed by way of a rotary prism to scan the message and by virtue of the reflected light to control the output from a photo-electric tube.

Preferably, the transmitter unit comprises a fixed oscillator whose frequency is beaten against that of a variable oscillator adapted to generate two pre-selected frequencies, depending upon the signal to be transmitted, that is, depending upon whether the representation is to be that of black or that of white.

In the reference herein made, it is to be understood that for purposes of illustration only, the so-called black and white system is to be used to the exclusion of other systems, although it is to be understood that where half-tone values are desired, provision may be made for varying the frequency of one of the oscillators at a preselected rate between the two limiting frequencies. After the oscillator frequency has been controlled, the outputs of the two oscillators are then fed through a detector and caused to control either a transmitter or to provide control signals for directly influencing a recorder amplifier.

The recorder amplifier preferably comprises the usual type of input transformer with suitable limiting devices, such as those disposed in the companion application, after which the output energy is applied through a discriminator network into a final driver and power amplifier combination to actuate a recording instrumentality.

Under such circumstances, the signal energy fed to the recorder amplifier through the threshold limiter may be either the output from the scanner amplifier, where monitoring of the transmitted signals is desired, or the energy may be that received from remote sources for the purpose of directly controlling the recorder in accordance with remotely received signals.

In the recording, the tape record strip upon which the recordings are to be reproduced is preferably passed over a roller of appropriate form, and by virtue of the helical ridge on the roller being caused to bear against a suitable presser bar under signal marking conditions, the message is reproduced. In many instances the message becomes a double record where the spiral extends for a plurality of turns on the rotary element, such as has been illustrated, for instance, by the British Patent 427,257, which shows one convenient form of recording member for use in the system herein disclosed.

Examples of the form of tape record resulting under such circumstances may be found in the publication "Radio Facsimile" hereinabove identified, and particularly in the article therein entitled "Practical application of tape facsimile system" written by J. N. Whitaker and this applicant, which commenced on page 284 of the text.

Referring now to the drawing, and with the foregoing brief description of the general nature of the recorder amplifier having been set forth, it is apparent that the received signals may be applied to an input discriminator transformer 15 by way of the input terminals 11 and 13, so that the output energy from the discriminator transformer 15 may be fed to each of a pair of transformer secondaries 17 and 19 which are suitably tuned by the parallel capacity elements 21 and 23 respectively, and which may, where desired, be shunted by suitable damping resistor elements 22 and 24.

It may be assumed, for instance, that the acceptor circuit comprising the parallel combination of the secondary winding 17, the capacitor 21 and the resistor 22, all connected in parallel, is tuned to one frequency, say of the order of 1800 cycles, to represent one extreme frequency value, such for instance as white in the picture, and the other acceptor combination, comprising the inductance, in the form of the transformer secondary 19, the capacitor 23 and the resistor 24, all tuned in parallel, is tuned to another extreme frequency value, say of the order of 1000 cycles, to represent black. The tuned circuit combination comprising the inductance 17 and the capacitor 21 then has its energy supplied to the cathode 25 of a discriminator tube 27, while the energy output from the circuit comprising the transformer secondary 19, the capacitor 23 and the resistor 24 is fed by way of the conductor 26 to the second cathode 30 of the tube 27.

The tube 27 is preferably one of the double diode type consisting of two independent cathodes and anodes contained within a single envelope and, accordingly, may be a tube of the type known as the 12H6, for instance, although various other types of tubes may be substituted where desired, and the two sections even may be in separate envelopes.

The opposite ends of the tuned receiving circuits are then connected by way of a conductor 35 which is joined into a second conductor 37 which preferably connects at a junction point 42 to the midpoint of two relay resistor elements 39 and 41, of which the resistor element 39 is connected to the plate or anode element 32 of the second half of the discriminator tube, and the combination forms a load circuit for the tube. The other anode or plate element 31 of the tube 27 preferably connects to ground 40 by way of the conductor 43 and across the series resistor combination 39 and 41 there is also connected a pair of series connected capacity elements 45 and 47 which also connect to ground as indicated.

At a point intermediate the connection of the two series connected capacity elements 45 and 47 a connection is made to the junction point 42 for the resistors 39 and 41. The outer terminal of the capacity element 45 is connected at its upper end to both the resistor 39 and the anode 32, so that at the junction point 49 a connection may be made through a resistor element 51 and conductor 52 to the printer amplifier unit (not shown), but shown in the companion application hereinabove referred to.

From the same junction point 49 a connection is made by way of the conductor 53, the resistor 55 and the condenser 57 to ground at 40, and at a point intermediate the connection of the series combination of the resistor 55 and the capacitor 57 a connection is made by way of a capacitor 59 to the anode 65 of what will be termed an automatic start-stop tube 63, and also the grid 73 of the second section of this tube. The anode element 65 of the first half of the tube is connected by way of a conductor 71 to provide a direct current connection to the control electrode 73 of the second half of tube 63. The anode 65 derives its voltage through resistors 79 and 77 from the source 86 connected to conductor 85.

Also at a point intermediate the resistor 55 and the capacitor 57, corresponding to the junction of the condenser 59 to these elements, there is connected a second conductor 60 providing a direct connection to the control electrode 61 of

the first half of the automatic start-stop tube 63.

It will be assumed that for a white portion of the picture record to be reproduced by the printer amplifier unit, there is voltage appearing at the point 49 which is negative in sign, so that the control electrode 61 is carried negative for a white portion of the picture, whereas for a black portion of the picture, the polarity at the point 49 will be positive relative to ground 40, so that the control electrode 61 likewise tends to be carried positive but this potential is not sufficiently positive for the tube section including control element 61 to draw current. The first half of the tube 63 is, however, caused to draw current if the black signal is of a duration long enough to charge condenser 57 positive with regard to the control electrode or grid element 61.

Under normal conditions, the black signal is of relatively short duration, for it is the marking signal, and usually the messages transmitted are letters, so that except for peculiar types of letters the marking is not of lengthy duration. This type of signal then is such that the control electrode 61 of the first half of the tube 63 is not permitted to go sufficiently positive during the black signal to cause the first half of the tube to draw current, as above mentioned. The result is that the second half of the tube 63 will draw current for the white signal because control electrode 73 is connected with the anode or plate 65 of the first half of the tube, and when no current is drawn by that section, the anode 65 (and consequently control electrode 73) is at its maximum positive potential since no anode current is flowing through resistors 77 and 79 to produce a voltage drop therein. The result is that the relay 82 will operate by reason of the current flowing in the second half of the tube 63.

The current flow through the second half of the tube 63 is controlled by the control electrode 73 which, in the absence of current flowing through the first half of the tube, will tend to assume its maximum positive potential, as above noted, so as to cause current to flow.

The combination of the resistor 55, the capacitor 59 and the capacitor 57 has a relatively long time constant in order to hold the effects of the white signal in a negative sense for an appreciable time on the first half of the tube 63 so as to permit the second half of the tube 63 to remain in a conducting state in the manner last herein explained.

It can be seen that the second half of the tube 63 has its cathode 74 biased by means of the bleeder resistor combination 76 and 79. The anode 75 connects by way of the conductor 81 to one terminal of the winding 83 of the relay 82, and thence, by way of the conductor 85 to the source of positive potential or anode voltage connected to the terminal 86. The result of the combination of the long time constant circuit, consisting of the resistor 55 and the condensers or capacitors 57 and 59 is that the whole arrangement has substantially the effect of a continuous white signal, generally speaking for most types of message transmission, as far as the operation of the second half of the tube 63 is concerned, so that the relay 82 is maintained in an energized state due to the current flowing through the second half of the tube 63 which will, in turn, maintain contact between the armature 87 and the contactor 89.

The cathode circuits of the tube 63, like those of the tube 27, have not been completed, so far as the heater circuits are concerned, merely for the sake of simplicity. However, the cathode 64 of the first half of the tube 63 connects by way of the switching element 67 through the conductor 69 to one terminal point or contact element 136 of the switch unit 141, as will later be explained.

The tube 63 serving, as will hereinafter be appreciated, as an automatic start-stop tube, is preferably one of the type known as the 12SN7GT, and is essentially a double triode. However, various other forms of tubes may be substituted, and it is contemplated within the scope of this invention to use also tubes contained in completely separate tube envelopes.

Under the circumstances hereinabove explained, it is apparent that if a signal potential is developed at the junction point 49 from the discriminator tube 27 which is of negative voltage (herein assumed to be white in the picture), the current flow will be interrupted through the first half of tube 63, but will flow through the second half of the tube and the coil 83 to energize the relay 82. Energization of the relay 82 will then close the armature 87 against the contact 89 and supply energy to a driving motor 117 and to the vibrator coil 109, in a manner later herein to be explained.

To provide for this operation, a power switch 88 connects through a voltage source 90 (such as that to drive the dynamotor 215 and motor 117 later to be explained) to ground 40. When closed, this switch 88 is adapted to close a circuit, so that energy from the source 90 flows through the conductors 92 and 94 through the relay armature 87 and the contact 89 (it being assumed that the second half of tube 63 draws current to close the relay 82) to the conductor 91, and thence through the conductor 113 into the motor coil 115 and to the motor 117, and thence to ground 40 by way of the conductor 96 and one of the paths embodying resistor 123, the governor 121, or one of the conductors 184 or 185. At the same time that energy is supplied from this source 90 to the contactor 89, a parallel current path to ground 40 is provided through a current regulator tube 95 and the conductor 110 to the vibrator coil 109, and thence through the contactor 138 and the vibrating tongue 137, with the capacitor 114 connected between one end terminal of the vibrator coil 109 and ground 40.

In order to provide the correct voltage for the vibrator coil 109, as will herein later be more particularly explained, suitable variable resistor elements 98 and 99 respectively are connected by way of the conductor 97 to one terminal of the current regulator tube 95 and to the conductor 110 which feeds energy from the source 90 to the coil 109. Depending upon the position of the switch element 100 relative to the contactors 101 and 103 respectively, will determine which of the resistor elements 98 and 99 is effective to provide the voltage correction, and, after the correction is made, it is apparent that the resistor elements 98 and 99 may be varied to provide the desired voltage.

The motor 117, which is driven, as above explained, from the energy source conventionally represented by the energy source 90 through the power switch 88 being closed, and by virtue of the closure on the contactor 89 of the armature 87 by operation of the relay 82, is adapted to drive the recording drum and helix combination

(not shown), but which is preferably of the general type disclosed for instance by Reissue Patent No. 20,152, dated October 27, 1936, granted to Charles J. Young, and also Patent No. 2,215,806 granted September 24, 1940, to Charles J. Young, or, for instance, by British Patent No. 427,257.

It will be understood that where the system herein disclosed is particularly adapted for use in so-called tape facsimile type of arrangement where a tape of a width just slightly in excess of one letter height or two letter heights is being recorded, then the length of the drum and the contacting drum helix, which is made to contact a suitable presser bar such as disclosed in the aforesaid patents, will be materially shorter than intimated for the page width recording, but, in principle, will operate in a similar manner.

Also, it is to be understood that the present invention, while disclosing, like the companion case Serial No. 467,423, filed concurrently herewith hereinabove referred to, the use of printer coils such as the coils 180 and 182 later to be referred to, to drive the presser bar, may be replaced by the contact bar itself where electrolytic recording is relied upon, as disclosed, for instance, in the mentioned Young Patent No. 2,215,806.

Referring now more particularly to the motor 117 which is to drive the said recording drum or the scanning prism (or its equivalent), depending upon whether the system is being used for the purpose of reception or monitoring, or for the purpose of transmission, the motor is essentially intended to be rotated at a predetermined optimum speed to maintain it substantially in synchronism with a suitable control frequency, say of the order of 60 cycles. To this end, a governor 121 is driven from the motor shaft 119 and, at the same time, a movable armature member 131 is likewise moved between the contact points 133 and 134 by reason of a cam contact (not shown) carried on the end of the motor shaft which permits contact momentarily to be established between the armature 131 and either the contact 133 or 134 during each rotation of the motor shaft. Suitable gear reduction is provided from the motor to the cam contactor so that the contact between the armature 131 and the points 133 or 134 will be broken at the frequency of the vibrator 137 when the motor 117 is operating at its desired and rated speed. In such operation the "break" period is but a minor fraction of the total time of each motor shaft rotation, so that the effective control period is relatively long.

The governor 121, it will be seen from the conventional showing, consists of a rotating element having two contact points 187 and 188 which, when rotating, and at times when the motor is not rotating as fast as the desired speed, are in contact with each other so that the motor connection or terminal remote from the coil 115 is maintained at ground potential, which tends to speed up the motor to a speed which, for instance, might even be too fast for that desired. However, when the motor is up to the desired speed by reason of rotation of the governor 121 due to its connection to the motor shaft 119, the contacts 187 and 188 separate so that there is no longer a direct connection of the motor terminal 189 to ground 40 through the governor, but rather any connection of the motor terminal 189 to ground must now be through the resistor element 123, or by way of the vibrating contactor 131 hereinabove explained to be driven and moved between the contact points 133 and 134 due to the rotation of the motor shaft 119.

It was above explained that when the relay 82 became closed, so that the armature 87 moves to the contact 89, current would also flow through the current regulator tube 95 and thence through the conductor 110 to the coil 109, which was to drive the vibrator so that when the coil 109 is energized it will draw the vibrating armature 137 away from the contact point 138 and thus instantaneously open contact also between the vibrating armature 137 and the contactor 135, which latter contactor connects to the contact point 133 by way of the conductor 184.

The operational frequency of the vibrating armature 137 is so regulated that it may herein be assumed to vibrate at substantially 60 cycles, which frequency is determined by the voltage applied to the vibrator coil which can, in turn, be regulated by the adjustment of the variable resistors 98 and 99 which are connected to the terminal of the current regulator corresponding to that at which the conductor 110 connects.

It can be seen, generally speaking, that the vibrator frequency will tend to increase with any increases in voltage without the use of the current stabilizer. The current regulator tube 95 overcomes this effect and the vibrator tends to stabilize regardless of voltage changes in conductor 91. Generally speaking, the current regulator 95 is such that the current can increase at an established rate with increases in voltage in conductor 91. This variation in current is chosen to cause the vibrator 137 to remain at substantially constant frequency. Due to the heating of the vibrator itself, the increase in temperature tends to make the vibrator frequency become slower, but if the voltage across the coil 109 increases, the vibrator will tend to return to the desired frequency. The resistance value of the variable resistors 98 and 99 will tend to increase with temperature and, accordingly, the voltage across the coil will tend to increase, and this will tend to return the vibrator to the desired frequency.

The vibrating armature 137 alternately contacts the contactors 135 and 136 in its movement due to current in coil 109. Similarly, due to the vibration of the contactor 131, it contacts the contactors 133 and 134. The connecting conductor 184 between the contactors 133 and 135 and the connecting conductor 185 between the contactors 134 and 136 provide such connections that it can be seen, if the position of the armatures 131 and 137 is such that there is a closed path to ground 40 through either conductor 184 or 185 at any instant, from the conductor 96 which connects to the motor terminal 189, the motor will tend to speed up because the same effect has been obtained as if the motor had not already been brought up to speed and the contact points 187 and 188 of the governor 121 were making contact. However, if there is lack of coincidence in phase relationship in the vibration of the vibrating armatures 131 and 137, it is apparent that the motor terminal 189 can connect to ground only through the resistance 123, which is shunted by the capacity 127, so that the tendency is for the motor to slow down. Obviously, the resistor 123 also has the function of preventing excessive current flowing through the contactors hereinabove referred to at any instant, in addition to that of providing for maintaining the motor speed constant.

Accordingly, it can be seen that due to the lack

of possibility of any substantial difference in phase relationship of the armatures 131 and 137 extending over any considerable period of time, the motor speed may be held quite constant and the motor may thus be driven at a speed commensurate with that desired to maintain proper synchronism between the record drum (not shown) at the point where recording is to take place, and the record drum or scanning prism or other suitable device at a remote point when once the desired phasal position has been established.

In order that the apparatus herein described may be controlled, a switch unit, generally designated, 140, has been provided. This switching unit consists essentially of two separate switch sections 141 and 142, of which the former will be assumed to be operated for the purpose of "scanning," while the latter will be assumed to be operated for purposes of "recording." To this end, a switch element 143, in the nature of a toggle, has been provided, so that by means of the cam surface 144 on the switch, a clockwise motion of the toggle 143 will cause the complete switch unit 141 to move to the right from the position shown, to close a series of contacts later herein to be explained, and likewise, a counterclockwise motion of the toggle arm 143 will cause the switch section 142 to move to the left from the position shown, to establish certain new connections and to break certain other connections. Each switch section moves independently of the other.

As herein illustrated in a schematic form, the switch comprises a series of armatures 145 through 151 inclusive, and a series of contacts 160 through 168 inclusive.

In the position shown, the switch is represented in what may be termed a "standby" operational state, so that contact is established between the armature 147 and the contactor 162, and also between the armature 148 and the contactor 163, as well as between the armature 149 and the contactor 165. Therefore, by reason of the connection established through the contact 163 and the armature 148, a connection to ground 40 is made by way of the conductor 195 for the conductor 69 connecting to the switch element 67 in the cathode circuit of the first half of the tube 63.

All of the armatures 146, 148, 149 and 150 are preferably connected to ground 40 through the common conductor 195.

The switch unit 140 will, for the first part of its operation, be assumed to be moved counterclockwise, so that the switch section 142 is moved to the left from the position shown, (that is to the assumed "record" position) so that the contact between the armature 147 and the contactor 162 is broken, and contacts are now established between the armature 145 and the contactor 160, and between the armature 146 and the contactor 161.

It is accordingly seen that a connection is at once established from the point 86, which was the terminal connection for the positive anode voltage to be applied to the tube 63, to the midpoint 197' of the printer coils 180 and 182. This connection is established by way of the conductor 85 and the armature 145, and the contactor 160 through the conductor 197, so that suitable voltage is now applied to the printer amplifier unit connected to the terminals 198 and 199 at the outer ends of the printer coils 180 and 182. Suitable damping resistor elements 200 and 201 have been provided across the printer coil units 180 and 182.

At the same time that the energy is supplied to the printer coils, a connection to ground 40 is also established through the conductor 196, the armature 146, the contactor 161, conductor 204 and conductors 205 and 206, through the relay winding 208 to the power switch 88 and the energy source 90, and thence to ground again at 40. Current flow through the circuit last described causes the relay armature 210 to move down against its lower contact 211 and away from the upper contact 212, and provides a connection to a dynamotor, conventionally represented at 215, to be connected between ground 40 through the conductor 216, the contactor 211, armature 210 and conductor 92 through the closed power switch 88 to the source 90 and thence to ground, which path is open-circuited in the absence of the operation of the record switch section 142. This, it will be seen, starts the generator for the high voltage for various tubes, which generator forms a part of the dynamotor combination 215.

When the switch 140 is in the "record" position, so that the switch section 142 has been moved to the left from the position shown, and if a "white" signal has operated the relay 82 through the energization of the coil 83 causing the armature 87 to make contact with the contactor 89, it is apparent that a closed circuit between ground 40 and the voltage source 90 exists. This circuit may be traced from ground 40 through the energy source 90, the closed power switch 88, the conductors 92 and 94, the armature 87 and contactor 89, and thence through the current regulator tube 95 and the conductor 97 through either of the variable resistors 98 or 99, depending upon the position of the switch arm 100, and thence through conductor 107 to the contactor 165 and the armature 149, back to ground 40 through the conductor 196.

Next, if it is assumed that the device is to be placed in a scanning position, the switch is rotated clockwise so as to move the switch section 141 to the right, which will have the effect of breaking the contact previously established between the contactor 163 and the armature 148, as well as between the contactor 165 and the armature 149, and new contacts will be established between the armature 149 and the contactor 166, the armature 150 and the contactor 167, and the armature 151 and the contactor 168.

Under the conditions when the switch has been moved so that the right hand section 141 is placed in the "scan" position, as last described, the monitor switch 210 is closed if it is desired to monitor an outgoing transmission. It will be seen that a connection is established to the printer amplifier unit through the conductor 85, the armature 151, the contactor 168 and conductor 211 through switch 210 to the midpoint 197' of the coils 180 and 182. Likewise, with the armature 150 having been moved to the contactor 167, it is evident that the connection of the relay coil 208 to ground is maintained by virtue of the connection through the conductors 205 and 195, through the contactor 167 and the armature 150. Likewise, due to the fact that the armature 149 has moved over against the contactor 166, it is apparent that a ground connection to resistor 98 is established by way of the conductor 105 through the said armature 149 to the conductor 195, so that there shall be a ground connection from the current regulator tube 95 through the variable resistor 98.

Under these conditions, current can flow through the current regulating device 220 and the exciter lamp 221 from the ground connection 40 through the source 90, the switch 88 and the conductor 92. The relay winding 208 thus forms a part of a closed circuit which is energized from the source 90 for either a "scan" or a "record" position of the switch 140, as hereinabove explained. Since the relay is to provide for open circuiting, the exciter lamp 221, when the armature 210 moves away from contactor 212 and over to contact 211 to energize the dynamotor 215, the relay preferably should be of the relatively slow operating type in order that the exciter lamp 221 in the current path last above explained shall be short circuited initially by way of the connection established through the armature 210 and the contactor 212, but upon energization of the relay 208, the exciter lamp will form a part of the circuit last described.

Connection to the transmitter amplifier output is established by way of the conductor 219 and is indicated only in schematic form.

From the above description, it becomes apparent that the general instrumentality hereinabove explained provides for maintaining the desired motor speed for scanning or recording and holding the said speed substantially constant within moderate limits of hunting, which are not detrimental to the recording action.

Furthermore, it is apparent that the connections herein shown provide for the standby position for transmitting the signals, and at the same time provide for energizing the printer unit coils so as to scan or to record.

Various other modifications and changes may be made without departing from the spirit or scope of what is herein shown and set forth.

Having described my invention, what I claim as new and desire to have protected by Letters Patent is:

1. A control circuit comprising an electric motor whose speed is to be controlled, a voltage source for energizing said motor, a first switching device driven by said motor and operated at a rate proportional to the motor speed, a second switching device, an electro-mechanical vibrator to drive the said second switching device at a predetermined and substantially constant rate, and a resistance element controlled as to its period of operation by the phasal identity and difference of the said switching devices for varying the voltage applied to the motor between two predetermined limiting values.

2. A control circuit comprising an electric motor whose speed is to be controlled, a voltage source for energizing said motor, a first switching device driven by said motor and operated at a rate proportional to the motor speed, a second switching device, means to drive the said second switching device at a predetermined and substantially constant rate, and means controlled as to its period of operation by the phasal identity and difference of the said switching devices for varying the voltage applied to the motor between two predetermined limiting values.

3. A signalling system comprising signal amplifying means for amplifying signalling energy occurring at different polarities to represent periods of marking and spacing, signal reproducing apparatus, a motor drive for the signal reproducing apparatus, a source of energy, thermionic means responsive to one polarity of signalling impulses for applying energy from the source to the motor to drive the said motor, resistance and capacity means having a relatively long time constant for applying the signalling energy to the thermionic means and for holding over the effects of one polarity of signal for a relatively long period of time during the period of receipt of the other polarity of signal so as to maintain energization of the motor from the source.

4. A signalling system comprising signal amplifying means for amplifying signalling energy occurring at different polarities to represent two extreme signalling conditions, a motor for driving signal reproducing apparatus, a source of energy, thermionic means responsive to one polarity of signalling impulses for applying energy from the source to the motor to drive the said motor, resistance and capacity means having a relatively long time constant for applying the signalling energy to the thermionic means and for holding over the effects of one polarity of signal for a relatively long period of time during the period of receipt of the other polarity of signal so as to maintain energization of the motor from the source, and vibratory means for maintaining the motor speed at a predetermined substantially constant rate.

5. A control circuit comprising an electric motor whose speed is to be controlled, a voltage source for energizing said motor, thermionic means in a combination with a resistance and capacity means having a relatively long time constant for applying the signalling energy for controlling the periods of application of the voltage from the source to the motor under the control of received signalling energy, a first switching device driven by said motor and operated at a rate proportional to the motor speed, a second switching device, a vibrator means to drive the said second switching device at a predetermined and substantially constant rate, means controlled as to its period of operation by the phasal identity and difference of the said switching devices for varying the voltage applied to the motor between two predetermined limiting values, and constant current means for controlling the said vibrator means for driving the second switching device whereby compensation for temperature and voltage changes is provided.

6. A signal recording device comprising a signal recording unit, a driving motor, a source of energy for driving said motor, a signal amplifying means for amplifying signalling energy to energize said recording means, said signalling energy being of opposite polarity for indicating marking and spacing conditions, thermionic means responsive to the signalling energy to be recorded for controlling the periods of energization of said motor, a switching device, means for shifting the said switching device alternately to supply the recording unit with energy from the amplifying unit in accordance with remote and locally developed signals, means responsive to each position of the switching device for applying energizing voltages to the thermionic amplifier units, and means for driving the motor at substantially constant speed.

7. A signal recording device comprising a signal recording unit, means for deriving signalling energy representative of a message to be communicated, a driving motor for driving at least a portion of the recording unit, a source of energy for driving said motor, a signal amplifying means for amplifying the signalling energy to energize said recording means, said signalling energy being of opposite polarity for indicating marking and spacing conditions, a motor control relay

element, thermionic means responsive to the signalling energy to be recorded for controlling the periods of energization of said motor control relay element, a switching device, means for shifting the said switching device alternately to supply the recording unit with energy from the amplifying unit in accordance with remote and locally developed signals, means responsive to each position of the switching device for applying energizing voltages to the thermionic amplifier unit, and a vibratory means for driving the motor at substantially constant speed.

8. A speed control device comprising a motor element, a source of energy, means for applying energy from said source to said motor, a vibratory element driven from said motor at a rate proportional to the motor rotational speed, a pair of contact points positioned relative to the vibrating element alternately to be contacted by said element as it vibrates, a second pair of contact points connected individually to the first pair of contact points, a vibrating device having an armature positioned to vibrate between the second pair of contact points and alternately contact said points, means for energizing said vibrating element from said source of energy, means for maintaining the vibration frequency of the said vibrating element substantially constant at a predetermined frequency, and means for changing the effective voltage applied from the energy source to drive the motor in accordance with phasal variances of the two vibrating elements.

9. A speed control device comprising a motor element, a source of energy, means for applying energy from said source to said motor, a vibratory element driven from said motor at a rate proportional to the motor rotational speed, a pair of contact points positioned relative to the vibrating element alternately to be contacted by said element as it vibrates, a second pair of contact points connected individually to the first pair of contact points, a vibrating device having an armature positioned to vibrate between the second pair of contact points and alternately contact said points, means for energizing said vibrating element from said source of energy, means for maintaining the vibration frequency of the said vibrating element substantially constant at a predetermined frequency, means for changing the effective voltage applied from the source of energy to drive the motor in accordance with phasal variances of the two vibrating elements, and means including a plurality of resistance elements for compensating for temperature and voltage changes tending to vary the vibration frequency of the said vibrating element.

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