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PAGE AND LINE SYNCHRONIZING APPARATUS

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2 Sheets-Sheet 1

*Fig. 2*

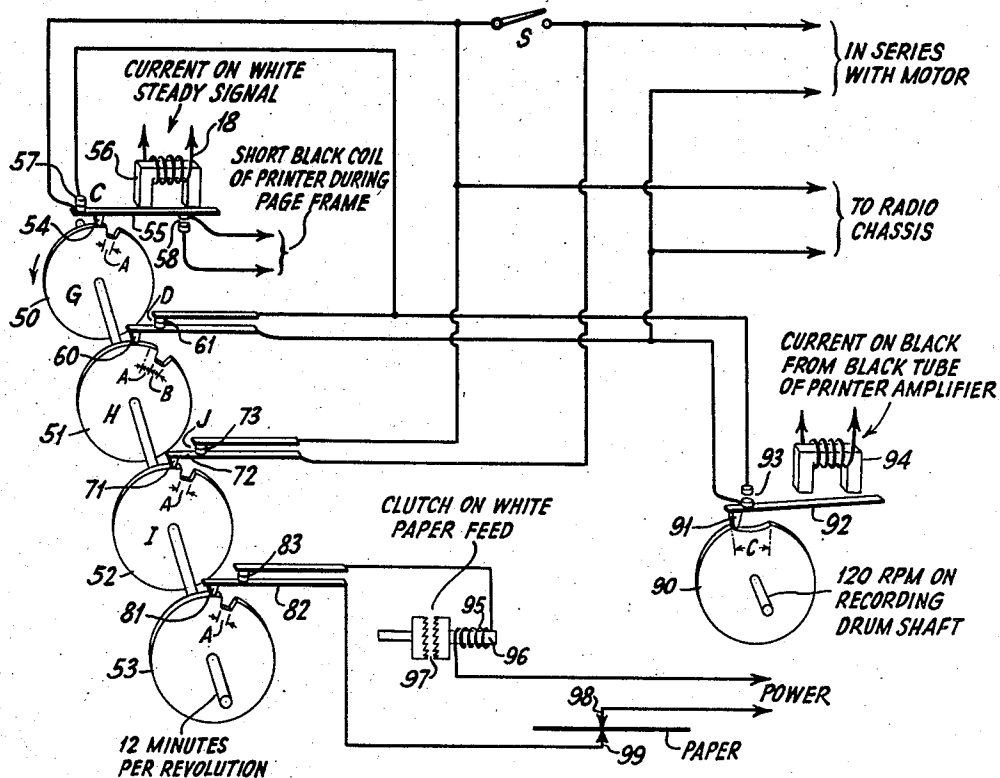
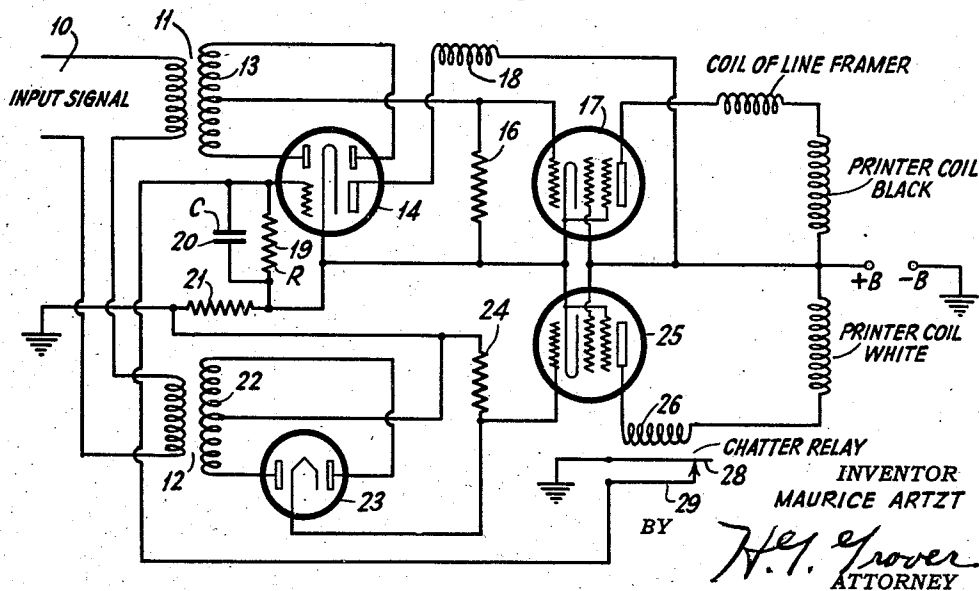


*Fig. 1*





## UNITED STATES PATENT OFFICE

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PAGE AND LINE SYNCHRONIZING  
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9 Claims. (Cl. 178—69.5)

My invention relates broadly to synchronizing apparatus, and more particularly to line and page framing apparatus adapted for use with facsimile or photoradio machines.

In the so-called facsimile or photoradio transmission of intelligence, a picture of the intelligence to be transmitted is scanned line by line by scanning apparatus which interprets the variations in optical density along the lines sequentially, and these representative variations are transmitted to receiving apparatus. Accordingly, it is necessary that the material on which the received intelligence is to be recorded be maintained at all times in synchronism with the transmission apparatus or else a distorted or unintelligible representation is obtained. The material which is transmitted is usually a single picture whereas at the receiving apparatus the received intelligence is recorded on a reproducing material which is usually quite lengthy and is rolled up on the machine in the form of a long roll. This being the case, it is necessary to identify both the position of the page at the transmitter, that is to say, the start of the picture which is transmitted, and it is also necessary to identify properly the position on the particular line which is transmitted. Hence, it is an object of this invention to provide page and line framing apparatus which will maintain the receiver in a synchronized relationship with the transmitter from which it is receiving intelligence.

It has been found from practical experience that the roll of material on which the intelligence is reproduced, which is usually paper, is subject to variations in length with temperature, weather conditions, etc. It is also customary to provide advertising material on the back of the sheet upon which the intelligence is recorded and as a result when a single complete picture or representation is removed, unless some means is provided for exactly identifying the beginning of the position at which the representation is to be recorded, the result will be that the advertising material on the back will be entirely out of line with the recorded material on the front of the paper. Therefore, it is an object of my invention to provide a framing apparatus in which sheet-spacing on one side of the recording material may be maintained in accurate and definite relationship with the material recorded on the recording surface on the front of the sheet.

Since the recording material is fed through the machine by friction feed, there is also the possibility that the paper may slip, that is to say,

the feed may not be absolutely constant and as a result this would also tend to disalign the printed material on the back of the sheet and the recorded material on the front and, accordingly, it is another object of my invention to provide apparatus by which this is rendered impossible.

Again, the user may find it necessary at times to switch off at a time when only a portion of the picture has been recorded. If this is done, under ordinary circumstances, the machine would immediately stop and disalignment of the printed material on the back of the recording sheet in so far as the received material was concerned would result since it is contemplated that this material would be stricken from the machine in complete unit sheets. Therefore, it is another object of this invention to provide a device whereby the machine will automatically assume the correct framing position upon the breaking of the power circuit and will then stop.

It is also not only possible but probable that the person using the machine may switch on or start to operate the machine at a time which is not coincident with the beginning of a picture from the transmitter. If the machine immediately began to operate under these circumstances, then again disalignment of the printed material and the recording material in so far as a sheet arrangement is concerned would result. It is therefore another object of my invention to provide an apparatus whereby the machine even though switched on will begin to operate only at the correct page framing position.

In addition to correct page framing, it is of course necessary that the correct line relationship be maintained also since a highly distorted representation, if not an unintelligible representation, would result if the two machines, that is to say, the transmitter and receiver were out of line synchronizing position. Accordingly, it is another object of my invention to provide a synchronizing apparatus by means of which the receiver may be drawn into correct line relationship with the transmitter in response to line synchronizing signals from said transmitter.

In general, the operation of the device is as follows: Immediately prior to the beginning of the transmission of a picture at the transmitter, a steady impulse is transmitted for a short time period, which in practice has been found usually to be of the order of thirty seconds. This steady signal comprises the page framing impulse and is transmitted insofar as the picture is concerned in a direction usually opposite to the line synchronizing signal and, here again, it has been

found satisfactory from an operation viewpoint to transmit this signal in the so-called "white" direction. Means are provided which are responsive to the signal to complete initially the energizing circuit of the driving motor of the machine. A signal of less than the predetermined time duration, suggested herein as thirty seconds, will not result in response by the machine. At the end of the page frame signal above described, there is a line frame signal transmitted for a shorter time period, say fifteen seconds, and this line signal comprises a number of signal energy pulses of definite frequency, the total length of time amounting, as has been stated, to the order of fifteen seconds. Each line pulse signal is sent out from the transmitter when the transmitter scanning drum is at a definite position with respect to the scanning pickup apparatus. Therefore, the transmitted line control impulses bear a definite relationship to the angular position of both the transmitter and the receiver drum since the receiver is to be maintained in synchronous relationship and in co-phasal condition with respect to the transmitter. Assuming that the machine is responding to the page framing signal, herein assumed thirty seconds duration, then means are provided whereby the machine is conditioned to be responsive to the line synchronizing signals, and unless the complete page frame signal is transmitted, no receiver actuation will result. At the end of the line synchronizing signals the machine is automatically rendered non-responsive to any other synchronizing signals which might be transmitted either from the desired transmitter or from any other transmitter.

My invention will best be understood by reference to the accompanying drawings, in which—

Fig. 1 is the receiver circuit used in conjunction with the apparatus of Fig. 2.

Fig. 2 shows the synchronizing control apparatus schematically, and

Fig. 3 shows a mechanical delay arrangement.

Referring to Fig. 1, there is shown the diagram with a circuit which is responsive only to the assumed thirty-second page framing signal. As has been stated, this signal is sent in a white or positive direction so that applied to the control grid of a vacuum tube in its normal direction, it will increase the grid potential and hence the output plate current of the tube. An input circuit 10 is joined to the primaries of two transformers 11 and 12. The secondary circuit 13 of the transformer 11 is joined to the plates of the diode section of a duplex-diode-triode tube 14. The output of the triode section of this tube joins the starting relay coil 18 on the page framing cam hereinafter explained in connection with Fig. 2. The center tap of the secondary winding 13 then is connected to a resistor 16 across which is developed potentials adapted to control the potential of a control grid of a pentode tube 17. The plate circuit of the pentode 17 is joined to the coil 18 of the relay in the line framing device which will be referred to hereinafter in connection with Fig. 2. Also joined in the plate circuit of the tube 17 is the black printer coil 19. In the control grid circuit of the duplex-diode-triode tube 14 is a resistance 19 and a condenser 20, the latter being joined in parallel with the resistance 19. One side of the resistance 19 is joined to the cathode of the tube 14, and thence to ground through a resistor 21.

A portion of the input signal is fed to the transformer 12 and by means of the secondary 22

thereof thence to the full wave rectifier 23. This rectified signal is fed across a resistor 24 which is in the control grid circuit of the pentode 25. The output of the pentode 25 is fed to the magnetic winding 26 of a chatter relay and one of the contacts of the chatter relay is grounded, the other of said contacts being joined to the point of connection of resistance 19 and condenser 20. The time constants of this latter condenser-resistance combination is comparatively high.

The action of the circuit is as follows: Let us assume that the thirty second synchronizing signal is not being received but that an ordinary picture or some other comparatively rapidly varying signal is impressed on the input circuit 10 of this circuit. A portion of this signal will be rectified by the full wave rectifier 23, the control grid of tube 25 will be rendered more positive, and the chatter relay will be alternately closed and opened. When the chatter relay is open or, in other words, when the contacts 28 and 29 are closed, the resistance 19 will be effectively in parallel with the resistance 21 and, accordingly, condenser 20 will also be in parallel with resistance 21 and will be charged by the plate current potential drop across this resistance. As this takes place comparatively rapidly, that is to say, the chatter relay will open and close fairly rapidly, the charge on condenser 20 will not have time to leak off across resistance 19, and the duplex-diode-triode 14 will be biased to a cut-off value. Hence, there will be no current through the starting relay coil or, as it will be referred to hereinafter as the page framing coil.

However, with a steady signal, the rectifier 23 will furnish a steady current which will bias the control grid of tube 25 to a definite value and will open the contacts 28, 29 of the chatter relay for a time as long as the duration of the signal. During this length of time, the charge on condenser 20 will after a time be dissipated across resistance 19, and accordingly the potential of the control grid of the tube 14 will rise past a cut-off value and the tube 14 will draw plate current and, accordingly, after an interval depending upon the time constants of the relay, this relay will be actuated due to the current through the coil 18. This has been of the order of fifteen seconds.

Referring to Fig. 2, there is shown a schematic arrangement of the actual synchronizing mechanism. Four cams 50, 51, 52, and 53 are adapted to be driven by the driving motor of the device so that each cam makes a complete revolution in a time interval equal to the time which is necessary to print one page of the intelligence which is transmitted. In this particular instance, the time has been of the order of twelve minutes. Cut on the face of each one of these cams is a cam slot, and the relative spacing of the position of these slots is shown by the letters A and B. Adjacent the cam 50 is a cam rider 54 which is joined to the armature 55 of a relay 56, the actuating coil of which is the coil 18 shown in Fig. 1. It will be seen that there are two distinct sets of contacts adapted to be closed by this armature, one set is referred to as 57, and the other as 58. At the beginning of a page, that is to say, in the page frame position, the cam rider C fits into the slot A of cam 50 and opens the contacts 57 and at the same time closes the contacts 58, these latter contacts shorting out the black coil of the printer which will be referred to hereinafter.

The cam 51 which is mounted on the same shaft as cam 50 and accordingly will rotate with equal angular velocity therewith, contains in the

face therein a slot B which is spaced behind the position of the slot A of cam 50 by an amount equal to the width of slot A, that is to say, the angular width with respect to the circumference thereof. This cam has riding thereon a rider 60 which is adapted to open and close contacts 61, the contacts being open when the rider is in the cam slot, and being closed when the rider is forced against the periphery of the cam.

The cam 52 is placed in the same relative position on the same shaft as cam 50 and contains in the face thereof a cam slot A of the same width and the same location relative to cam 50, that is to say, the cam rider 71 will fit into the slot A in cam 52 at the same time that the rider 54 will fit into the slot A of the cam 50. The two slots are of the same angular width with respect to the circumference of the cam. The rider 71 is joined to an arm 72 which is adapted to open and close contacts 73 depending upon whether the rider is riding on the face of the cam or is fitting into the cam slot thereof. When riding upon the face, the contacts 73 are closed; and when fitting into the slot, the contacts 73 are open. The cam 53 is in the same relative position with respect to cam 50 as was cam 52, and operating in conjunction therewith is a rider 81, an arm 82, and contacts 83, the latter being open when the rider is in the cam slot A and being closed when the rider is engaged with the face of the closed cam 53.

The operation of the device is as follows: It will be noted that the armature of relay 56 is adapted to close the contacts 57, thus completing the driving motor circuit through the contacts 61 which are mounted on the rider 60 which is used in conjunction with cam 51. Normally, as has been stated when the machine is in a page frame position, the rider 54 fits into the slot A of cam 50, the contacts 57 are open and the motor does not start even though the starting switch has been connected unless the armature 57 is lifted out of the cam slot A of cam 50 and joins the contacts together. This latter will be done only when there is current through the coil 18 of relay 56 and, as has been explained hereinbefore with reference to Fig. 1, this can take place only when a portion of the thirty second page framing signal has been received. This normally closes at the end of about fifteen seconds of that signal and is held upwardly out of engagement with the slot and closing the contacts until the cam slot A passes through from under the rider 54 which normally takes about fifteen seconds. Hence, it will be seen that if the page framing synchronizing signal is received the motor circuit is automatically closed and the motor will start, it having taken about fifteen seconds to actuate the armature of the relay 56, and the remaining fifteen seconds being used in the interval necessary to take the slot A from under the rider 54, this rider will then hold the motor circuit closed normally for a length of time equal to one complete rotation of the cam which is normally twelve minutes from the average sheet.

At the end of that second fifteen second interval, the cam 51 has then passed to the position where slot B of this cam will be immediately under the rider 60. Now, when this latter happens, the motor circuit would normally be broken. However, it will be noted from the figure that a fifth cam 90 having a slot C cut in the face therein is adapted to co-operate with a rider 91 joined to the armature 92 of a relay 93 whose magnetic coil is adapted to be actuated by current from the black tube of Fig. 1. Joined to the armature 92

is a pair of contacts 93 which are closed when the rider is engaged with the upper face of the cam and which are open when the rider is in the cam slot C.

Now, at the end of the page framing synchronizing signal, a series of line synchronizing pulses are sent in the black direction, and each one of these pulses is indicative of the position of the scanning drum at the transmitter. Since the cam 90 is mounted directly on the shaft of the recording drum, the position of the slot C will be indicative of the position of the recording drum. Now, if the recording drum is in correct line framing position a synchronizing pulse will be received when the rider 91 is directly opposite the cam slot C and the relay will hold the armature, and hence the rider out of contact with the slot and will close contacts 93. Since contacts 93 short-circuit contacts 61, the motor circuit will remain closed and the motor will continue to rotate. However, if the machine is not correctly synchronized with respect to the line synchronizing position, the line synchronizing pulse will be received at a time when the rider 91 is riding on the face of cam 90, and these pulses being of short duration, when the rider goes around to the position opposite the cam slot C it will fall into the cam slot, thus breaking the motor energizing circuit for a short period of time or, in other words, jogging the motor. This will take place for a few times until the position of the helix drum of the facsimile machine on which this device is used is in correct line framing position and the motor circuit remains unbroken due to the armature 92 being held at the proper time out of engagement with the cam slot C. These synchronizing pulses are sent for an interval of about fifteen seconds.

The action of the cam 52 is as follows: It will be noted that the contacts 73 are arranged in such a position that when they are closed they short-circuit a switch S in one of the motor energizing leads. This cam assures that the machine will always stop in the proper position to start a new page of recording material with respect to the printed material which is printed on the back of the recording roll and which is definitely spaced. A time of twelve minutes approximately has been required in actual practice to transmit one sheet of this material and this corresponds to the time of one complete rotation of each of the cams 50 through 53 respectively. Now the rider 71 will be engaged in the cam slot A of cam 52 at the same time that the rider 54 is engaged with cam slot A of cam 50, and hence will not be taken out of the slot until after the machine has started in response to a page synchronizing signal. After the machine has started, this rider will short-circuit the switch S until the cam 52 makes one complete rotation and comes back again to the proper page position with respect to the printed material. Hence, if a user should decide to turn off the machine in the middle of a received page of recording material, the machine will automatically run until it has been properly spaced and will then close due to the opening of contacts 73 when the rider 71 falls into the slot A of 52.

It has been noted in practice that the paper which is used ordinarily as a recording surface has a tendency to increase or decrease its length in accordance with the humidity of the weather, the temperature, and other factors, so that material printed on the back of this roll will expand or contract without regard to an actual linear measurement. As a result, if the full sheet of material were transmitted and another sheet im-

mediately begun, it would be quite possible that the transmitted intelligence would not match up correctly with printed material such as advertisements on the back of the material and the effect of material printed on both sides evenly would very shortly be spoiled. As a result, it has been customary to punch the paper with an indicative hole definitely spaced from the printed material, and it is the function of the cam 53 to control passage of the material in properly spaced arrangement through the machine. At the time when the machine is started due to the lifting of the armature 54 from the slot A of cam 50, due to their relative positions, the rider 81 will be lifted from the slot A of cam 53 at an interval some fifteen seconds later than the activation of armature 54 due to the rotation of the driving motor and the consequent change in position of slot A. Now, when this rider 81 is forced up outwardly from the slot A, it closes contacts 83 on the arm 82 which are also joined to the power circuit of the driving motor. Connected in series with these contacts is a magnetic coil 95 which is adapted to control the movement of a solenoid arm 96 which is joined to a clutch 97, and when current passes through the coil 95 the solenoid retracts one portion of the clutch out of engagement with the other, stopping the paper feed. Also in series with contacts 83 are two wiping contacts 98 and 99 between which the recording material, which in this case is paper, passes. Now, as the paper is properly punched to give correct spatial arrangement with respect to the printed material on the back of the sheet, the clutch will remain in engagement and hence feed the paper until the contacts 98 and 99 come to an opening in the paper, and when they do, the solenoid arm 96 will retract a portion of the clutch 97 from the paper feed and even though the machine keeps running, the paper will not be fed through. As borders are necessary to the recorded material, the only result will be a small shortening or lengthening of the border dependent on the relative spacing of the holes in the paper and the actual transmitted intelligence is unaffected.

Now, of course, it may be desired to keep the machine running steadily from one page of transmitted material to the next and, accordingly, it may be arranged that the page synchronizing signal may send, say, fifteen seconds ahead of the time when cam slot A of cam 50 comes opposite the rider 54. This will assure that the armature 55 will be retracted by the relay 56 at exactly the time when the cam slot A passes to the rider 54 and, hence, the rider will be held out of engagement and there will be no interruption of service.

Referring to Fig. 3, there is shown a mechanical arrangement for effecting the fifteen second time delay in the starting of the motor of the device in response to the thirty second page framing signal and, therefore, is analogous to the electrical circuit illustrated in Fig. 1. In this case, the recording drum has attached thereto a cam A which performs the same function as the cam 90 of Fig. 2. Also attached to the shaft is a cylindrical member G having a detent pin therein which is adapted to strike a pivoted lever arm L, and thus effecting a movement of the pawl D. In intimate relationship with the pawl D is a toothed ratchet wheel E to which is fastened one of a set of contacts F. It will be noted that a spring member normally retains the ratchet wheel in a definite position so as to normally space the contacts F apart by a predetermined amount.

Immediately adjacent the pawl D is a locked pawl D'. The contacts F are adapted to short-circuit the contacts on the relay armature B. Immediately adjacent both the pawls D and D' is a magnetic core which is adapted to be energized by the page framing signal.

The action of the device is as follows: Since the winding of the electromagnetic device C is joined to the "black" tube, no current will pass therethrough with steady signals in a "white" direction. As a result, when the page framing signal is received, and which is a steady signal in the "white" direction, no current will flow in the plate circuit of the "black" tube. The scanner drum shaft is rotating at approximately 120 R. P. M. and, as a result, the detent pin will strike the lever arm L twice per second. This will draw the pawl D' across the teeth of the wheel E and if, for instance, a fifteen second time delay is desired, then the wheel E will have thirty teeth since the pawl will be actuated twice per second. When the pawl reaches the top tooth despite any continued action by the detent pin, there will be no further turning of the ratchet E, and in this position the contacts F are closed. Hence, the paper feed clutch is actuated and the paper begins to feed through in correct page framing position. Now, if there should be an interruption of the page framing signal prior to the fifteen second interval, due to the pulls in the "black" direction, the "black" tube output current will flow through the winding of the electromagnetic device C, and both the locking pawl D' and the actuating pawl D will be attracted to the core of the device, thus releasing the wheel which will be returned to its normal or starting position due to the action of the spring, and then take a complete steady signal of at least fifteen seconds to start the actuating feed clutch.

What I claim is:

1. A page and line framing system for facsimile apparatus wherein page and line framing signals of predetermined duration are received at selected time periods comprising a driving motor, means operable upon the receipt of a predetermined portion of said page framing signal to initially complete the driving motor energizing circuit, line framing means, means operable only after the receipt of the complete page framing signals to render operable said line framing means for a definite period, said line framing means controlling means to interrupt the driving motor circuit for a predetermined interval of time upon non-receipt of a line framing signal at the interrupting interval.

2. A page and line framing system for facsimile apparatus wherein page and line framing signals of predetermined duration are received at selected time periods comprising a driving motor, means operable upon the receipt of a predetermined portion of said page framing signal to initially complete the driving motor energizing circuit, said means comprising a cam mounted in driven relationship to the driving motor, a cam slot, a cam follower, a relay armature connected to said follower, said relay armature being adapted to open and close the driving motor circuit, means associated with said relay to operate said relay upon receipt of a predetermined portion of the page framing signal, and means operable only after the receipt of the complete page framing signal to render operable said line framing means for a definite period, said line framing means controlling means to interrupt the driving motor circuit for a predetermined interval of time upon

non-receipt of a line framing signal at the interrupting interval.

3. In a page and line frame system adapted to respond to page and line synchronizing signals of definite duration transmitted from transmission apparatus, motor means, means operable upon the receipt of a predetermined portion of said page framing signal to initially complete the driving motor energizing circuit, means operable only after the completion of the aforesaid motor circuit to render operable line framing means for a predetermined time period, said latter means comprising a cam containing a slot extending for a definite portion of its peripheral length and a cam follower, the cam follower being adapted to make and break an electric switch means in the driving motor circuit initially closed by the page framing signal responsive means.

4. In a page and line frame system adapted to respond to page and line synchronizing signals of definite duration transmitted from transmission apparatus, motor means, means operable upon the receipt of a predetermined portion of said page framing signal to initially complete the driving motor energizing circuit, means operable only after the completion of the aforesaid motor circuit to render operable line framing means for a predetermined time period, said latter means comprising a cam containing a slot extending for a definite portion of its peripheral length and a cam follower, the cam follower being adapted to make and break an electric switch means in the driving motor circuit initially closed by the page framing signal responsive means, said electric switch being connected in parallel with another switch circuit, the latter switch being operable to close the motor circuit by line framing means at definite intervals.

5. A page and line frame apparatus wherein signals of definite duration indicative of page and line correct positions are transmitted comprising, motor means, means operable upon the receipt of a portion of said page frame signal for initially completing the energizing circuit of said motor means, a recording material, means associated with said material for indicating correct spacing of said pages, means associated with the material feeding apparatus for de-energizing said material feed at intervals determined by the spacing indication associated with said material, and

means for resuming feed of the material in response to the page signals.

6. A page and line synchronizing apparatus comprising motor means, a plurality of cams of line configuration, a portion at least of which are driven at equal angular speeds by said driving motor, a portion of said cams being mounted in like angular relationship to said motor means, switching means controlled by each of said cams, and means for locking the switching of a plurality of said cams in accordance with the switching of one of said cams.

7. A page framing system for facsimile apparatus wherein page frame signals of definite duration are transmitted at predetermined intervals comprising, a driving motor, means operable upon the receipt of a predetermined portion less than the complete signal of each of said page framing signals to initially complete the driving motor energizing circuit, and means for interrupting said driving motor energizing circuit at predetermined intervals in the absence of one of said page framing signals.

8. A page framing system for facsimile apparatus wherein page frame signals of definite duration are transmitted at predetermined intervals comprising, a driving motor, means operable upon the receipt of a predetermined portion of each of said page framing signals to initially complete the driving motor energizing circuit, said means being adapted to reset itself upon receipt of a portion of said page framing signal of less duration than said predetermined portion, and means for interrupting said driving motor energizing circuit at predetermined intervals in the absence of one of said page framing signals.

9. A page frame apparatus for facsimile wherein signals of definite duration indicative of correct page frame position are transmitted comprising, motor means, means operable upon the receipt of predetermined portion of said page framing signals to initially complete the energizing circuit of said motor means, a recording material comprising a plurality of distinct pages and feed means for said recording material, said feed means being adapted to initially feed a single page in synchronous relationship with said page framing signals.

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