June 13, 1944. G. H. RIDINGS 2,351,231

AUTOMATIC FACSIMILE TELEGRAPH SYSTEM

Filed July 3, 1942 2 Sheets-Sheet 1

FIG. 1

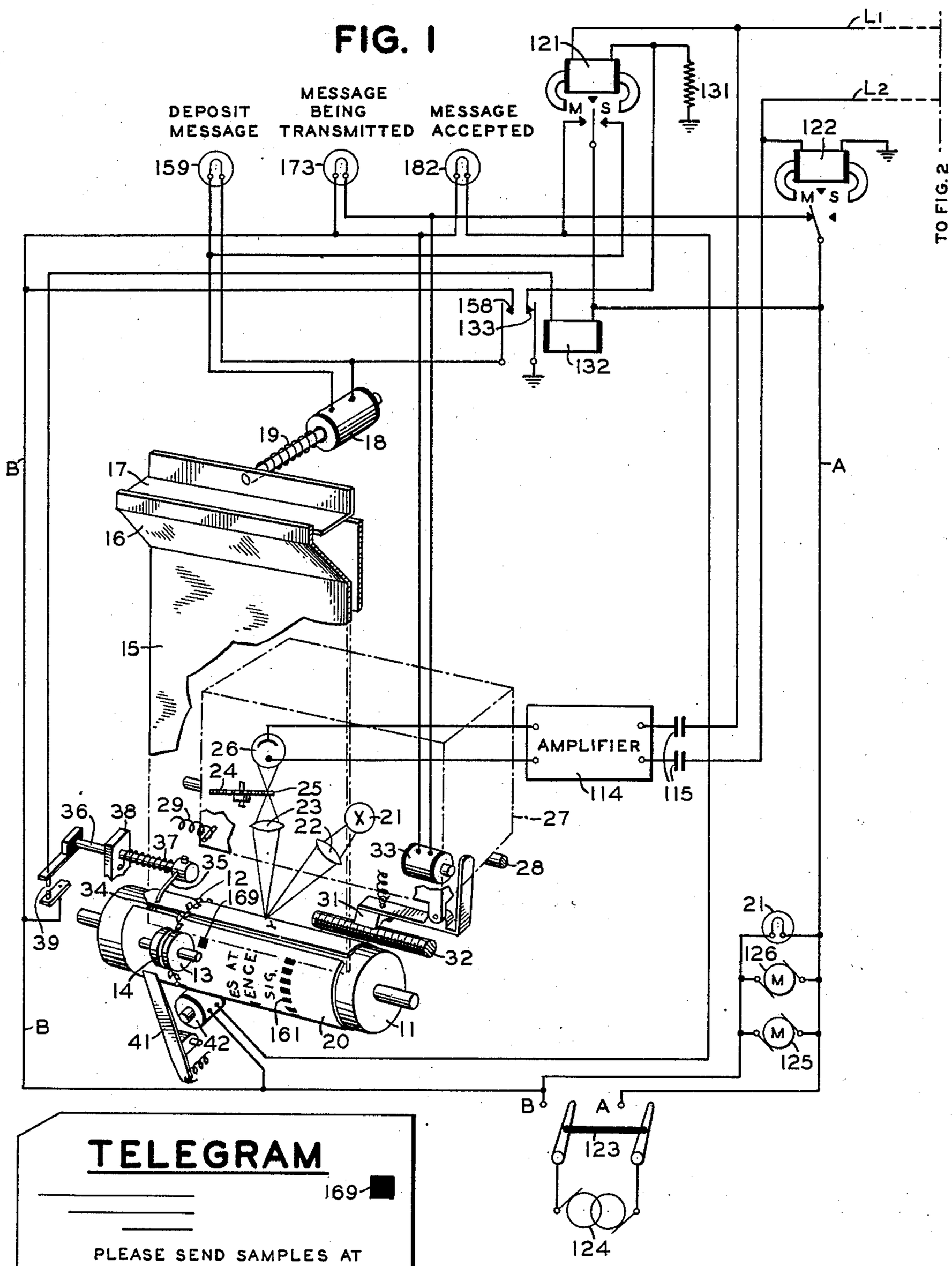

FIG. 3

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AUTOMATIC FACSIMILE TELEGRAPH SYSTEM

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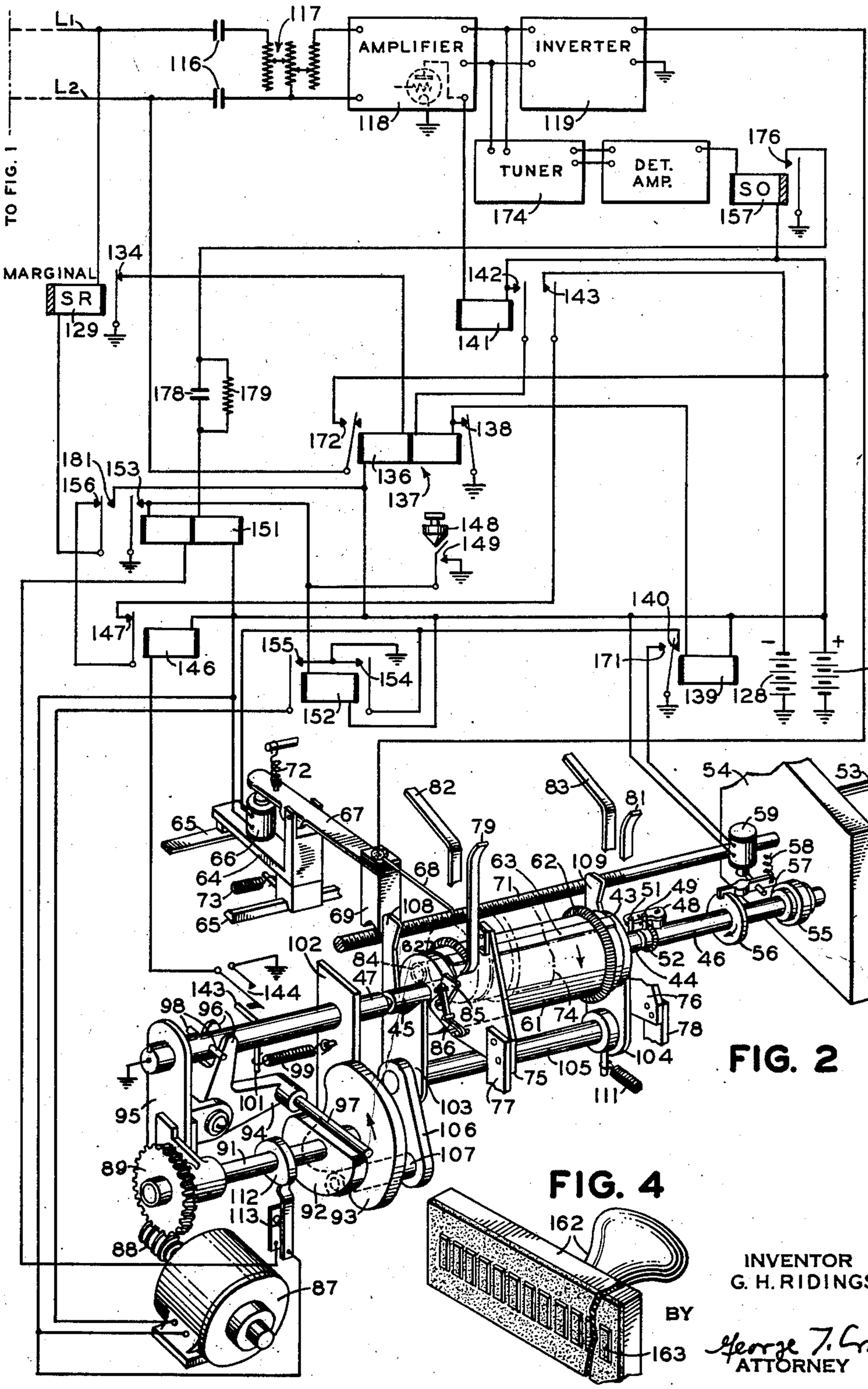

FIG. 2

FIG. 4

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AUTOMATIC FACSIMILE TELEGRAPH SYSTEM

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Application July 3, 1942, Serial No. 449,548

7 Claims. (Cl. 178—6.6)

The present invention relates to facsimile telegraph systems, and more particularly to a message sheet operated control system for terminal equipment.

In Patent No. 2,262,715, granted to R. J. Wise et al. on November 11, 1941, entitled "System and apparatus for automatic facsimile telegraphy," there is disclosed and claimed a facsimile machine suitable for use as a transmitter. A conveying chute is provided for guiding the message blank so that it may be positioned in the machine for scanning. The facsimile signals which are generated by the scanning operation are transmitted to a central station where they are employed to reproduce the subject matter on a recording machine. In this patent the various functions of the transmitter are remotely controlled by an attendant at the central station. This transmitting apparatus is provided with means for gripping and wrapping the message blank around a rotating cylinder. After the scanning operation, the attendant at the central station manipulates a control switch which actuates mechanism at the transmitter for removing the message blank from the rotating cylinder and depositing it in a storage bin.

In another patent to R. J. Wise et al., No. 2,255,868, granted September 16, 1941, and entitled "System and apparatus for facsimile telegraphy," there is disclosed a facsimile machine which is provided with facilities for automatic operation. The recording blanks are mounted upon cylindrical copyholders which are adapted to be inserted in the recording apparatus one at a time. A copyholder supporting and recording sheet is rotated and scanned in a direction parallel to the axis thereof by a stylus member which bears upon the recording sheet and has impressed thereon electrical potentials representative of the picture elements. The machine disclosed in this patent is provided with a mechanism for removing a copyholder from an operative position in the machine and for replacing it with another copyholder supporting a blank recording sheet. Means are also provided for storing a plurality of copyholders, supporting recording sheets, in a magazine from which they may be fed in succession to the facsimile machine. The apparatus disclosed in Patent No. 2,255,868 is suitable for use either as a transmitter or as a recorder, but for the purposes of the instant application, only the recording element will be considered.

The facsimile system which forms the novel subject matter of the present application is employed to interconnect a transmitter of the type disclosed in Patent No. 2,262,715 and a recorder of the type disclosed in Patent No. 2,255,868.

It is an object of the instant invention to provide novel interconnections between an automatic facsimile transmitter of the slot loading type and an automatic facsimile recorder of the drum changing type whereby certain of the functions of each facsimile machine may be automatically controlled by a special signal generated at the other machine.

Another object of the invention is to provide in a novel manner for conditioning an automatic facsimile transmitter to receive a sheet bearing subject matter to be transmitted only when the recording apparatus is in operative condition to receive and record facsimile signals.

A further object of the invention is to provide in a novel manner for operating the sheet removing mechanism at the transmitter under the control of the recording apparatus.

Still another object of the invention is to provide a novel arrangement for generating and utilizing an end-of-message signal whereby a more economical use of the line time may be made.

The means for attaining the aforementioned objects, together with more specific objects, will become apparent from the following description of an illustrative embodiment of the invention making reference to the accompanying drawings in which:

Fig. 1 is a schematic representation of an automatic facsimile transmitter of the slot loading type, together with the control apparatus and electrical circuits therefor;

Fig. 2 is a schematic representation of an automatic facsimile recorder of the drum changing type, together with the control apparatus and elecrical circuits therefor;

Fig. 3 is an illustration of a typical message blank to be used in conjunction with the end-of-message control apparatus shown in Figs. 1 and 2; and

Fig. 4 shows a conventional printing stamp having printing means for stamping an end-of-message marking.

The end-of-message feature of the present invention is illustrated and described in connection with a facsimile system designed to be installed between a central telegraph office and a remote branch office or agency which has sufficient business with the central station to warrant the installation of an exclusive circuit. A system of this type is disclosed and claimed in a copending application of G. H. Ridings et al., Serial No. 370,748, filed December 19, 1940.

The automatic transmitter located at the branch office is provided with a plurality of signs which may be selectively illuminated to give an indication of the performance of the machine. The machine is housed in a casing provided with a slot which is in communication with a chute leading to the scanning mechanism. The chute may be opened or closed at various times during the operation of the machine so as either to permit the insertion of a message blank or to prevent such an operation. At the branch office the desired message is written on a specially prepared blank which is inserted in the conveying chute at the proper time and is seized by the transmitting mechanism and placed in position for scanning, which operation follows immediately. The facsimile signals which are generated by the scanning operation are transmitted to the central station, at which place they are applied to a recorder which, preferably, is at all times prepared to operate. The operation of the recorder is also automatic and the attendant at that station has only to keep the machine supplied with copyholders bearing blank recording sheets and to remove the sheets upon which recordings have been made from the copyholders which are automatically discharged from the recorder.

Referring to the drawings, the transmitting apparatus illustrated in Fig. 1 comprises a cylindrical copyholder 11 which is mounted for rotation in suitable bearings. Adjacent one end of the cylinder 11 is a plurality of teeth 12 arranged circumferentially and extending outwardly from its surface. A pressure roller 13 is suitably journaled and bears against the surface of the cylinder 11. The roller 13 is provided with a groove 14 which is of suitable dimensions to accommodate the gripping teeth 12. A chute or guideway 15 is located so that its lower opening is adjacent to the surface of the cylinder 11 at the point where it is contacted by the roller 13. The upper end of the chute 15 is flared to form a lip 16 which facilitates the insertion of a flexible message sheet. An angular slide 17 is disposed at the mouth of the chute 15 in such a manner that it normally blocks the chute, thereby preventing the insertion of a message sheet. The position of the blocking slide 17 is controlled by an electromagnet or solenoid 18, the armature of which is connected to the slide. When the solenoid 18 is deenergized, a compression spring 19 mounted upon the armature forces the slide 17 into the closed position, but upon energization of the solenoid the armature is drawn against the action of the spring 19, thereby moving the slide 17 from its blocking position. A message sheet 20 may be inserted in the chute 15 by which it is conveyed by gravity to a point where it is gripped between the roller 13 and the cylinder 11 which is continuously rotated. The message sheet 20 is pierced by the teeth 12 and is drawn downward from the chute and wrapped around the cylinder 11 in a position to be scanned.

An optical scanning system is provided which includes an exciter lamp 21, the light from which is condensed by a lens 22 so that a small spot of light impinges on the message sheet 20 and is reflected from it in an amount dependent upon the tonal density of the elemental area scanned. The reflected light is again condensed by another lens 23 into a point which lies in the plane of a light chopper 24, which may be in the form of a perforated disc or, as illustrated, a disc having notches such as 25 formed in the periphery thereof. The disc is mounted upon a shaft which is rotated at the desired speed by means of a suitable electric motor (not shown) whereby the light reflected from the message sheet 20 is alternately transmitted and interrupted at a rate dependent upon the speed of rotation of the light chopper disc 24 and the number of openings provided therein. The light pulsations which are transmitted through the chopper disc 24 impinge upon a photocell 26 and thereby generate alternating current signals which are modulated in amplitude in accordance with the tone values of the elemental areas of the message sheet 20.

The entire optical scanning mechanism is mounted in a carriage 27 which is suitably arranged for sliding movement, in a direction parallel to the axis of rotation of the cylinder 11, upon a rail system such as 28, or in any other suitable manner. The carriage is normally urged toward the left hand end of the machine by means of a spring 29. When a scanning movement of the carriage 27 is desired, a half-nut 31 is moved into engagement with a continuously rotating feed screw 32 by means of an electromagnet 33. The feed screw 32 and the cylinder 11 may be rotated at their respective rates by means of a single driving motor (not shown) coupled thereto through appropriate reduction gearing.

The cylinder 11 is also provided with a groove 34 which extends circumferentially thereof and which, when there is no message sheet in position upon the copyholder, is adapted to receive the end of a small rod 35 which is secured to a rock shaft 36. A torsion spring 37 is connected to the rock shaft 36 and to any convenient supporting member such as a bearing bracket 38 and tends to rotate the shaft 36 in such a manner as to force the rod 35 into groove 34. The rock shaft 36 also carries the movable contact of a transmitting blank controlled switch 39. When there is no message sheet on the copyholder and the rod 35 is in the groove 34, the switch contacts 39 are closed. However, as soon as a message sheet 20 is secured on the copyholder 11, the rod 35 is raised from the groove 34, and the contacts 39 are opened for a purpose which will be described later.

The transmitting apparatus is provided with a mechanism for removing the message sheet 20 from the cylinder 11. The message sheet is shorter than the circumference of the cylinder 11 by an amount sufficient to leave a small gap between its edges when it is wrapped around the cylinder. A pivoted blank stripping member 41 is provided with a sharp end and is so located that, when it is pivoted under the influence of an electromagnet 42, the sharp end is placed in position to slip under the leading edge of the message sheet as it is rotated, thereby progressively pulling the sheet away from the cylinder and disengaging the perforated section from the teeth 12. The message sheet thus detached from the cylinder 11 is permitted to drop into a bin or other convenient compartment.

The recording apparatus installed at the central office is shown diagrammatically in Fig. 2 and in detail in the aforementioned Patent No. 2,255,868. The recording machine comprises a copyholding drum 43 which is cylindrical in form and is provided with two axially extending arbors 44 and 45. Centering spindles 46 and 47 are arranged to cooperate with the drum arbors to support the drum for rotation. An arm 48 is pivoted on the spindle 46 and extends in the direction of the drum to engage a pin

49 projecting radially from the spindle and also a pin 51 which extends radially from the arbor 44. This linkage serves to revolve the drum 43 when the spindle 46 is rotated. The rotation of the spindle 46 is effected by means of a driving motor 53 acting through suitable reduction gearing 54. Also included in the driving mechanism is a friction clutch 55 which permits the spindle 46 to stop while the motor is running. A disc 56 having a notch formed in the periphery thereof is secured to the spindle 46. A stop arm or latch 57 is arranged to engage the peripheral notch of the disc 56 when acted upon solely by a retractile spring 58. Upon energization of an electromagnet 59, which is referred to hereinafter as the framing magnet, the latch 57 is lifted and disengaged from the notch in the disc 56 to thereby permit rotation of the spindle 46.

A recording sheet 61 is wrapped around the drum 43 and is secured thereto by one or more circular elastic members such as 62. The sheet 61 is mounted on the drum so that the lap 63 formed therein invariably bears a definite relation to the notch formed in the disc 56. Such an arrangement is for the purpose of securing the proper phasing or framing between the recorder and the branch office transmitter and will be subsequently described in greater detail.

A carriage 64 is arranged to slide on a pair of rails 65 disposed parallel to the axis of rotation of the drum 43. An electromagnet 66 is mounted on the carriage and, when energized, serves to pivot a lever 67 into the retracted position shown in the drawings. A recording stylus 68 is attached to one extremity of the lever 67 and, as illustrated, is held out of engagement with the recording sheet 61 during idle periods. A half-nut 69 is also attached to the lever 67 and is adapted to engage a threaded feed screw 71 which is rotated at a suitable speed by the driving motor 53 acting through its associated reduction gearing 54. When the electromagnet 66 is deenergized, the lever 67 is moved by means of a spring 72 in such a manner that the half-nut 69 engages the feed screw 71 and the stylus 68 is brought into contact with the surface of the recording sheet 61. The engagement of the half-nut with the feed screw results in movement of the carriage 64 toward the right, as viewed in this figure, against the restraining action of a retractile spring 73. Obviously, at the end of a scanning operation, when the lever 67 is pivoted to disengage the half-nut from the feed screw, the carriage is returned by means of the retractile spring to the extreme left hand position shown.

The recording machine illustrated is provided with facilities for automatically discharging a drum after a recording operation and for feeding another drum into the machine. The machine is normally provided with a copious supply of drums, each bearing an unmarked recording sheet 61, one of which, 74, is shown fragmentarily in dot and dash outline. A rack or magazine is used to store the drums and comprises two rail members 75 and 76 mounted on a pair of supporting brackets 77 and 78, respectively, and spaced apart slightly more than the length of a drum 43. A pair of resilient upright members 79 and 81 are secured to the rail members 75 and 76, respectively, and cooperate with an auxiliary pair of spaced rails 82 and 83, respectively, to guide the stored drums toward the scanning device. The drum 74 awaiting positioning in the facsimile recorder is held in readiness by having its arbors, one of which, 84, is shown in Fig. 2, supported by the upper end of a pair of detents, one of which, 85, is shown. Each of the detents 85 is pivoted adjacent its lower end on the respective rail members and is normally held in this drum restraining position by means of a pair of resilient members such as the spring 86 attached thereto and also to the rail member 75.

Upon completion of a scanning operation, a drum changing motor 87 is started and drives a worm gear 88, which in turn drives a cooperating pinion gear 89. The pinion gear is keyed to a shaft 91 upon which is also secured a pair of cams 92 and 93. A bell crank 94 is pivoted on any convenient stationary member such as the bracket 95 and is provided with a forked portion 96 adjacent the extremity of one arm thereof and also with a rod or cam follower 97 adjacent the extremity of the other arm. Rotation of the shaft 91 brings the raised portion of the cam 92 into engagement with the rod 97, thereby pivoting the bell crank 94 and bringing the bifurcated portion 96 into engagement with a pair of pins 98 attached to the spindle 47. Further movement of the bell crank 94, caused by the continued rotation of the cam 92, moves the spindle 47 toward the left, as viewed in the drawings, against the action of a spring 99, one end of which is attached to a pin 101 extending from the spindle and the other end of which is secured to a stationary bracket 102.

The withdrawal of the centering spindle 47 as described permits the drum 43 to drop so that its arbors 44 and 45 rest in a cradle formed by notches in a pair of members 103 and 104. These members are secured adjacent their lower extremities to a rock shaft 105 which is suitably journaled in bearings mounted in any convenient fixed brackets. Also secured to the rock shaft 105 is an arm 106 carrying at its outer extremity a cam follower in the form of a roller 107. This roller is adapted to cooperate with the cam 93 so that, when the shaft 91 is rotated by means of the mechanism driven by the motor 87, the engagement of the roller 107 with the raised portion of the cam 93 results in a clockwise movement of the arm 106, as viewed from the left hand end of the facsimile machine, thereby imparting a rocking movement to the spaced members 103 and 104.

As the rock shaft 105 is rotated as described, the cradle members 103 and 104 are moved forward until a position is reached whereby the drum 43 is permitted to roll from the notches formed in these members into any suitable receptacle or conveyor. A continuation of the rocking movement brings the upwardly extending arms 108 and 109, respectively, of the cradle members 103 and 104 into engagement with the respective detents such as 85. These detents are thus moved out of the downward path of the arbors such as 84 of the drum 74, thereby permitting this drum to drop so that its arbors rest upon the upper ends of the arms 108 and 109. When, by continued rotation of the cam 93, the rock shaft 105 is permitted to return the cradle members 103 and 104 to their upright position under the influence of the spring 111 attached to one of the members and to any convenient stationary member, the upper ends of the arm 108 and 109 are withdrawn from under the arbors 44 and 45 of the drum 74, thereby allowing these arbors to roll into the notches formed in the cradle mem-

bers. The new drum 74 is thus carried into a position such that, when the cradle members have been fully restored to their upright positions, the indentations formed in the ends of the arbors may be engaged by the conical centering points formed on the spindles 46 and 47. Prior to this engagement, the axis of the drum which rests in the notches of the cradle members lies slightly below the center of rotation provided by the centering spindles 46 and 47. However, because of the conical configuration of the ends of these spindles, the subsequent movement of the shaft 47 toward the drum is instrumental in lifting the drum slightly so that it may rotate freely.

The initiation of the drum changing cycle just described is effected by applying power to the motor 87 subsequent to a scanning operation, or at any other desired time, by a means which will be described more fully in the following portion of the specification. A cam 112 is mounted on the cam shaft 91 for cooperation with the movable contact of a pair of contacts 113. The cam 112 is oriented with respect to the cams 92 and 93 so that at the completion of a drum changing cycle the contacts 113 are opened momentarily. It will be seen from the following portion of this specification that the momentary opening of these contacts causes power to be disconnected from the motor 87. However, the mechanism is so designed that before the motor can be brought to a stop by means of a braking system the cam 112 becomes disengaged from the contact members, thereby permitting the reclosure of the contacts 113.

The circuit interconnecting the transmitter of Fig. 1 and the recorder of Fig. 2 comprises a pair of conductors L1 and L2 which are used simultaneously for the transmission of the alternating current facsimile signals and the direct current control signals, by means of which the operation of the transmitting and recording apparatus is controlled. The facsimile signals originate at the photoelectric cell 26 which is connected to an amplifier 114, the output circuit of which is connected through a pair of blocking condensers 115 to the conductors L1 and L2. The purpose of the condensers 115 is to isolate the alternating current facsimile signals from the direct current control signals. At the recording station of Fig. 2 the line conductors L1 and L2 are connected through another pair of blocking condensers 116 and through an adjustable pad 117 to an amplifier 118. The output of this amplifier is connected to a signal inverter 119, the output circuit of which is arranged to be connected between ground and the recording stylus 68. The polarity of the direct current potentials which are applied to the conductor L1 is controlled by the apparatus at the recording station for the purpose of operating a polar relay 121 connected to this conductor at the transmitting station. Similarly, the polarity of the direct current potentials which are applied to the conductor L2 is controlled by the apparatus of the recording station for the purpose of operating a polar relay 122 connected to this conductor at the transmitting station. Both of these polar relays are of the three-position type whereby the armatures thereof are moved to one extreme contact in response to one polarity of potential, to the other extreme contact in response to the opposite polarity of potential, and to a mid-position disengaged from both of the extreme contacts in response to a no-current condition. These polar relays 121 and 122 are non-responsive to the alternating current signals generated in the photocell 26.

The operation of the foregoing facsimile apparatus will be described in conjunction with Figs. 1 and 2 taken together. Prior to the start of a series of operations, it is assumed that power is supplied to the transmitting apparatus by the movement of a switch 123 to its left hand contacts, thereby connecting a source of alternating current potential 124 to the bus bars A and B. The driving motor for the cylinder 11 and the feed screw 32, and the motor for the light chopper disc 24, indicated diagrammatically at 125 and 126, respectively, on Fig. 1, are thus energized to rotate the equipment coupled thereto. Also, the exciter lamp 21 is illuminated, thereby providing for the generation of alternating current in conjunction with the photocell 26 and the light chopper 24 by reflection from the surface of the cylinder 11. Similarly, power suitably rectified where necessary is applied to the amplifier 114 in any conventional manner (not shown).

At the recording station, power is supplied from a source of direct current potential 127, which in this case is of positive polarity. Negative direct current potential is also supplied from a source 128, as specified hereinafter. The driving motor 53 is supplied with alternating current energy which is synchronous with the transmitter alternating current power supply.

A relay 129, adjusted for marginal response to current values higher than the current values normally produced to effect operation of the polar relay 121, is included in circuit in the conductor L1 at the receiving station. The relay 129 is also of the type which is slow to release. A resistor 131 is also included in circuit with the polar relay 121 in the conductor L1 at the transmitting station to control the magnitude of the current of the marginal relay 129. A relay 132 at the transmitting station is energized from the bus bars A and B by way of the recording blank controlled switch contacts 39 when the cylinder 11 is not supporting a sheet 20. With a sheet 20 on the cylinder as shown in Fig. 1, and even with the switch 123 closed, the relay 132 is deenergized to short-circuit the resistor 131 upon closure of its make contact 133 and thereby raise the current flowing in the conductor L1 to the higher value. The marginal relay 129 responds by opening its break contact 134. Before the message sheet 20 is mounted on the cylinder 11, the contact 134 is closed, as shown, to apply ground to the left hand winding 136 of a phasing or framing relay 137. A tongue and make contact 138 of this relay applies ground to energize a relay 139 to connect ground through its make contact 141 to energize the electromagnet 66 to move the half-nut 69 and the stylus 68 into their disengaged positions. This is the idle condition of the receiving apparatus, which it will also assume when the switch 123 at the transmitter is opened.

At least a part of the plate current for the amplifier 118 is supplied from the source 127 through the winding of a relay 141. The signals which are generated at the transmitter by the photocell 26 under the described idle condition are of maximum amplitude whereby the amplifier 118 draws a current sufficient to energize the relay 141 to maintain its make contacts 142 and 143 in circuit closing position. The contact 142 energizes the right hand winding of the relay 137 in preparation for the phasing operation to be described.

It is assumed that the recording apparatus is not provided with a drum 43 in operative position for recording. The spindle 47 is thus permitted to move farther to the right than its normal position when it engages the arbor of a drum and in doing so effects the engagement of a pin 143 carried thereby with a set of overthrow contacts 144. The closure of the contacts 144 connects ground to the operating winding of a relay 146, thereby preventing the connection of the negative battery 128 to the line conductor L1 at its break contact 147. Consequently, at the transmitting station the polar relay 121 will be maintained in its neutral or mid-position.

In order initially to place the facsimile apparatus at the recording station in condition for operation, the attendant will place a number of drums 43 equipped with blank record sheets in the magazine of the recorder. The first of such a series of copyholders is inserted in the recorder by momentarily operating a push button 148, which closes a contact 149 to place a ground on one terminal of the left hand winding of a relay 151. The other terminal of this winding is connected through the closed recorder cam contacts 113 to the source of positive potential 127, thereby causing this relay to operate. Operation of the push button 148 also energizes a relay 152, which in normal automatic operation of the drum changing equipment is energized from a make contact 153 of the relay 151. The relay 151 is locked through its make contact 153 so that the push button 148 may be released. The operation of the relay 152 connects an additional ground to the stylus magnet 66 through its make contact 154, thereby insuring that the stylus will always be raised when the cycling mechanism for changing the drums 43 is in operation. The other make contact 155 of this relay completes a circuit to energize the drum changing motor 87. This motor drives the previously described drum changing mechanism through a cycle of operations resulting in the placing of a drum in operative recording position in the machine. At the completion of this cycle, the cam contact 113 is momentarily opened, thereby interrupting the locking circuit of the relay 151, permitting this relay to be released and thereby releasing the relay 152. Thus, power is disconnected from the copyholder changing motor 87 and one of the grounds removed from the winding of stylus magnet 66.

With a drum in position in the recorder, the spindle 47 is withdrawn sufficiently to permit opening of the overthrow contacts 144, thereby deenergizing the relay 146 and connecting the source of negative signaling potential 128 to the conductor L1 at its break contact 147. This circuit extends from the source 128 through the make contact 143 of the relay 141, through the break contact 147 of the relay 146, through a break contact 156 of the relay 151 and through the winding of the marginal relay 129. The relay 141 is energized at this stage of the operation, since the transmitter scanning apparatus is generating an alternating current, as stated above, and the relay 151 which serves as an end-of-message relay under control of a relay 157 in a manner to be described is deenergized.

The negative potential of conductor L1 operates the polar relay 121 at the transmitting station to effect the engagement of its armature with its spacing contact S. A connection is then established from the bus bar A through the spacing contact S of the relay 121, through the winding of the solenoid 18 and a make contact 158 of the relay 132 to the bus bar B. Connected in shunt with the solenoid 18 is a lamp 159 which is lighted to illuminate a sign reading "Deposit message." Simultaneously therewith the energization of the solenoid 18 withdraws the slide 17, thereby opening the chute 15.

Facilities are provided at the central office for controlling the transmitting and receiving apparatus in such a manner that the scanning operation is continued only as long as is necessary to completely scan the subject matter. The message to be transmitted is inscribed on a blank sheet 20 provided for the purpose and in accordance with the invention is to be marked by the attendant at the branch office so that the end-of-message feature will function at the proper time.

The sheet 20 of Figs. 1 and 3 is shown as having an end-of-message marking 161 in the form of a series of bars. The marking 161 may be conveniently applied with a rubber stamp 162 of the conventional type, shown in Fig. 4 of the drawings. The printing face of the stamp is provided with type markings 163 in relief which may be inked to produce the marking 161 on the message sheet 20. It will be understood that the marking 161 may be of any desired pattern or type, as will appear in the description hereinafter given of the end-of-message feature of the invention.

The sheet containing the message, after being marked as with the stamp 162, is then inserted in a chute 15 by means of which it is carried to the scanning apparatus where it is engaged and placed in position for scanning as previously described. The wrapping of the message bearing sheet 20 on the cylinder 11 disengages the arm 35 from the groove 34, thereby opening the contacts 39. This operation results in the release of the relay 132, which extinguishes the "Deposit message" lamp 159 and deenergizes the solenoid 18, thereby closing the chute 15. The release of the relay 132 closes its break contact 133, thereby to short-circuit the resistor 131 and cause an increase in the value of the signal current flowing in the line L1.

This current value increase causes the relay 129 at the recording station to break the circuit through the winding 136 of the relay 137 at its break contact 134. However, this relay is maintained operative by means of its right hand winding, which is energized at this time by way of the make contact 142 of the relay 141. When a black spot 169, which appears on the sheet 20, is scanned, a facsimile signal having the maximum amplitude is generated and transmitted to the recording station. This event usually occurs during the completion of the first revolution of the cylinder 11 following the placing thereon of the message sheet 20, since the carriage 27 in its left hand position permits light to be focused on the cylinder 11 at the point normally covered by the spot 169 when the blank is in position. The response by the amplifier 118 to such a signal reduces the plate current sufficiently to permit the release of the relay 141, thereby opening its make contact 142 and completely deenergizing the relay 137 and effecting its release. The opening of the contact 138 of this relay deenergizes the relay 139, which, through the opening of its make contact 140, deenergizes the electromagnet 66, thereby permitting the engagement of the half-nut 69 with the feed screw 71 and the engagement of the stylus 68 with the recording sheet 61. The closure of a break contact 171 of the relay 139 energizes the

framing magnet 59 to withdraw the latch 57 and permit rotation of the drum 43. The incoming facsimile signals properly amplified and inverted are applied by means of the stylus to the recording sheet 61. A break contact 172 of the relay 137 places a positive potential on the conductor L2 which causes the tongue of the polar relay 122 to move to its M contact, thereby energizing the half-nut magnet 33 at the transmitter. The "Message being transmitted" lamp 173 is illuminated to show that the recording process is being carried out.

When the entire subject matter inscribed on the sheet 20 has been transmitted, the light spot scans the series of marks 161 to thereby modulate the alternating current generated by the photocell 26 in conjunction with the light chopper 24, the frequency of the modulated current depending upon the width of the marks and their spacing and the peripheral speed of the cylinder 11. A modulated side band is selected at the receiving station by a tuner 174 which is detected and amplified to energize the relay 157, which is of the type which is slow to operate. The make contact 176 of this relay energizes the right hand winding of the relay 151 through a condenser 178 shunted by a high resistance 179. The slow to operate feature of the relay 157 prevents the relay 151 from responding to momentary modulation products produced when the subject matter on the sheet 20 is being scanned. The condenser-resistor circuit prevents any false operation of the drum changer in the manner set forth in Patent No. 2,255,868, above referred to. When the right hand winding of the relay 151 is energized, its left hand locking winding is energized by way of the make contact 153 and the cycling contacts 113. The relay 155 is also energized to start the drum changing motor 87. The stylus 68 and the half-nut 69 are positively raised at this time, since the make contact 154 of the relay applies ground to the electromagnet 66, as explained above. The drum 43 continues to run, since the relay 139 remains energized until the sheet 20 is removed from the cylinder 11 of the transmitter. Simultaneously with the drum changing operation, which is initiated by energization of the relay 151, positive potential is applied to the conductor L1 at a make contact 181 of the relay 151. The slow release relay 129 does not respond to the interruption of signaling current.

At the transmitting station the tongue of the polar relay 121 moves to its contact M, thereby energizing the operating solenoid 42 for the peeling member 41 which removes the sheet 20 from the cylinder 11. A lamp 182 illuminates the "Message accepted" sign at this time.

When the sheet 20 is removed, contacts 39 reclose to reenergize the relay 132 which reinserts the resistor 131 in the conductor L1 by reason of the opening of its break contact 133.

At the recorder, the relay 129 is released to close its break contact 134 and energize the left hand winding 136 of the relay 137. This energizes the relay 139 which stops the drum 43 and raises the stylus 68 and the half-nut 69. This also removes the positive signal potential from the conductor L2 applied at the break contact 172. At the transmitter, the tongue of the polar relay 122 is centered, which deenergizes the half-nut magnet and allows the carriage 27 to return to its starting position. At the end of drum changing cycle, initiated by the end-of-message signal, the negative signaling potential is restored to conductor L1, causing the tongue of the polar relay 121 to move to its contact S, thus energizing the solenoid 18 to open the chute 15 and light the "Deposit message" lamp 158. This indicates to the attendant at the transmitter station that the next message may be transmitted at once, if desired.

While the invention has been explained in connection with an illustrative embodiment thereof, it is to be understood that the invention may be embodied in other forms, and therefore the invention is not limited except as indicated by the terms and scope of the appended claims.

What is claimed is:

1. In a facsimile telegraph system, an automatic transmitter, an automatic recorder, means in said transmitter for receiving a message bearing sheet and automatically transmitting signals representative of the message on said sheet to said recorder, means responsive to the receipt of said sheet by said means for preparing said recorder for operation, said signal transmitting means being responsive to a marking on said message sheet for generating a control signal following the transmission of said message representative signals, and control means at said recorder responsive to said control signal for restoring said system to an idle condition in readiness for the delivery of a subsequent message bearing sheet to said sheet receiving means in said transmitter, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

2. In a facsimile telegraph system, a transmitting device having a scanner, means for automatically presenting a message bearing sheet to said scanner, a chute to convey said sheet to said sheet presenting means, a closure for said chute, a recorder, a signaling circuit interconnecting said transmitter and said recorder, a relay connected to said circuit responsive to a signal generated by an end-of-message marking on said record sheet, and means including said relay and circuits controlled thereby to withdraw said closure from said chute, thereby preparing said transmitter for immediate use for the transmission of a succeeding message, said relay being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

3. In a facsimile telegraph system, a transmitter having a scanner, conveying means operable to deliver a message bearing sheet to said scanner, means responsive to a marking on said message sheet for modulating alternating current signals generated at said transmitter by a predetermined frequency substantially at the time of completion of a scanning operation, a recorder having a cylindrical drum carrying a record sheet, control means at said receiver responsive to said predetermined modulated frequency for removing a drum carrying a recording from said recorder and placing another drum bearing a blank record sheet in said recorder, and means responsive to the completion of said drum changing operation at said recorder for operatively conditioning said conveying means for reception of a message bearing sheet, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration for-

tuitously occurring in message representative signals.

4. In a facsimile system, a transmitter, a recorder, means in said transmitter for receiving a message bearing sheet and automatically transmitting signals representative of the message on said sheet to said recorder, means in said transmitter for discharging said sheet from said transmitter, said signal transmitting means being responsive to a marking on said message sheet for generating a control signal following the transmission of said message representative signals, and control means at said recorder responsive to said control signal to control the operation of said sheet discharging means, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

5. In a facsimile telegraph system, a transmitter having a copyholder and a scanning device, means to produce relative movement between said copyholder and said scanning device, conveying means operable to deliver a message bearing sheet to said copyholder, a recorder having a copyholder adapted to carry a record sheet, means responsive to a marking on said message sheet for generating a control signal at the end of a scanning operation at said transmitter, control means responsive to said control signal for removing a copyholder from said recorder and placing another copyholder in said recorder, and means responsive to the completion of said copyholder changing operation at said recorder for controlling said means for producing relative movement between said copyholder and said scanning device, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

6. In a facsimile system, a transmitter, a recorder, said transmitter embodying means for receiving a message bearing sheet, means for automatically transmitting signals representative of the message on said sheet to said recorder, means for discharging said sheet from said transmitter, and said signal transmitting means being responsive to a marking on said message sheet for generating a control signal following the transmission of said message representative signals, control means at said recorder responsive to said control signal to control the operation of said sheet discharging means at the transmitter, and additional signaling means at said transmitter for generating a signal upon discharge of said message bearing sheet, and means at said recorder for restoring the latter to an idle condition in response to a signal from said signaling means, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

7. In a facsimile telegraph system, an automatic transmitter, an automatic recorder, said recorder being normally in an idle condition awaiting reception of a message, means in said transmitter for receiving a message bearing sheet and automatically transmitting signals representative of the message on said sheet to said recorder, means responsive to the receipt of said sheet by said means for preparing said recorder for operation, means at said recorder for starting said recorder in phase with said transmitter, means in said transmitter for discharging said sheet from said transmitter, said signal transmitting means being responsive to a marking on said message sheet for generating a control signal following transmission of said message representative signals, control means at said recorder responsive to said control signal to control the operation of said sheet discharging means at the transmitter, and means operable upon discharge of said message bearing sheet for restoring said recorder to its idle condition, said control means being responsive to continuous control signals of a predetermined duration and being non-responsive to similar signals of a shorter duration fortuitously occurring in message representative signals.

GARVICE H. RIDINGS.