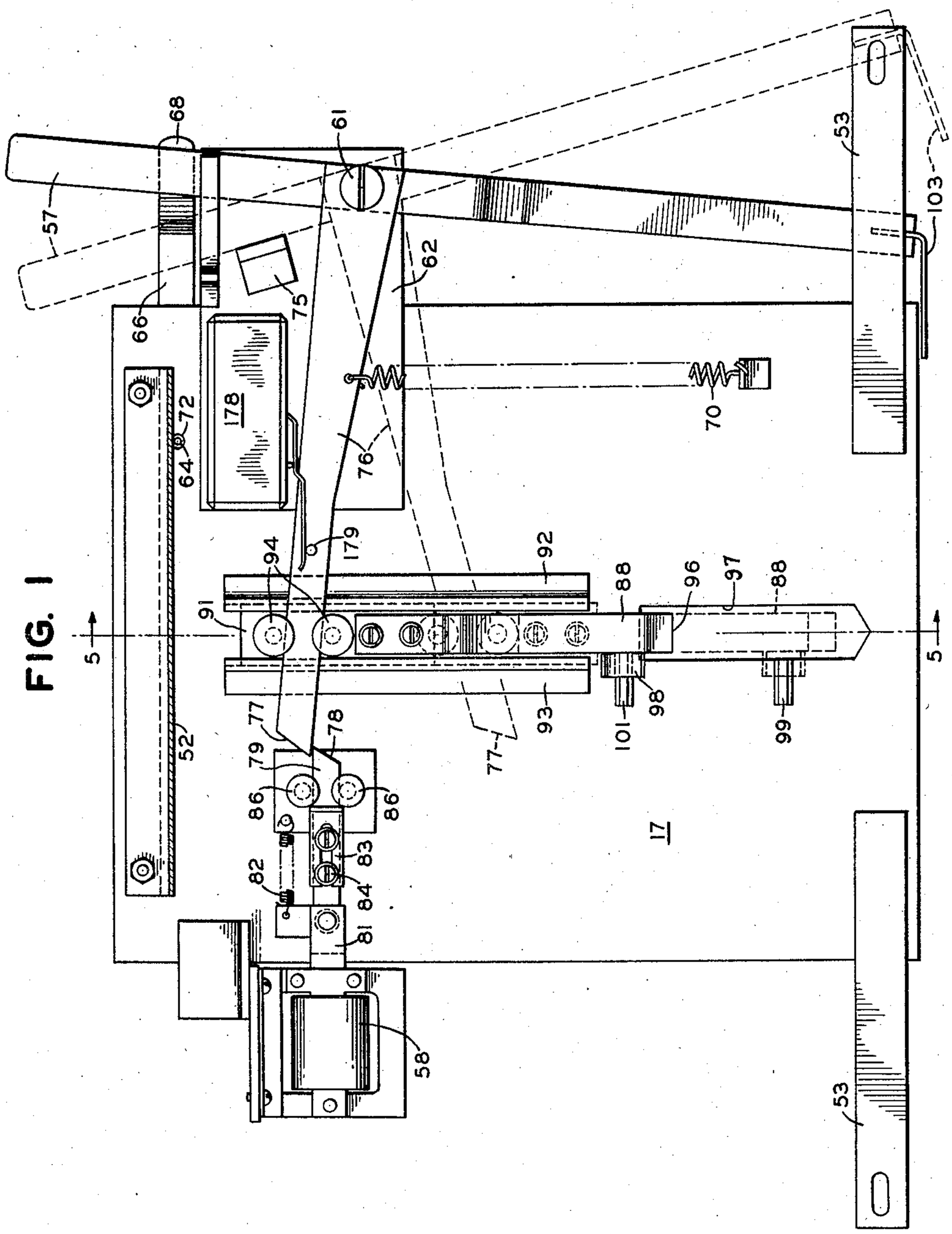
Jan. 8, 1946. R. J. WISE ET AL 2,392,442

FACSIMILE TELEGRAPH SYSTEM AND APPARATUS

Filed Oct. 3, 1942 4 Sheets-Sheet 1

FIG. 1



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FACSIMILE TELEGRAPH SYSTEM AND APPARATUS

Filed Oct. 3, 1942 4 Sheets-Sheet 2

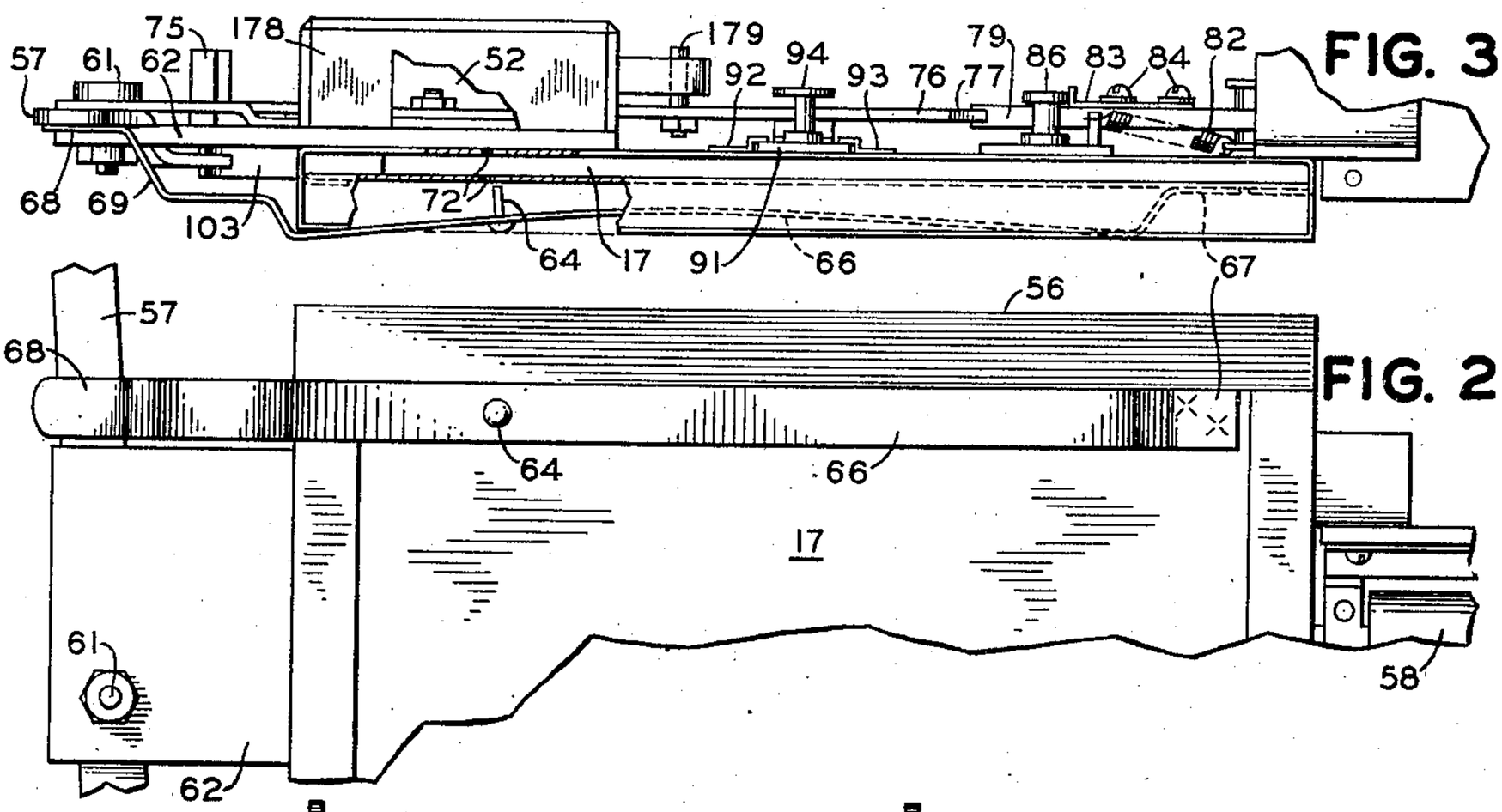

FIG. 3

FIG. 2

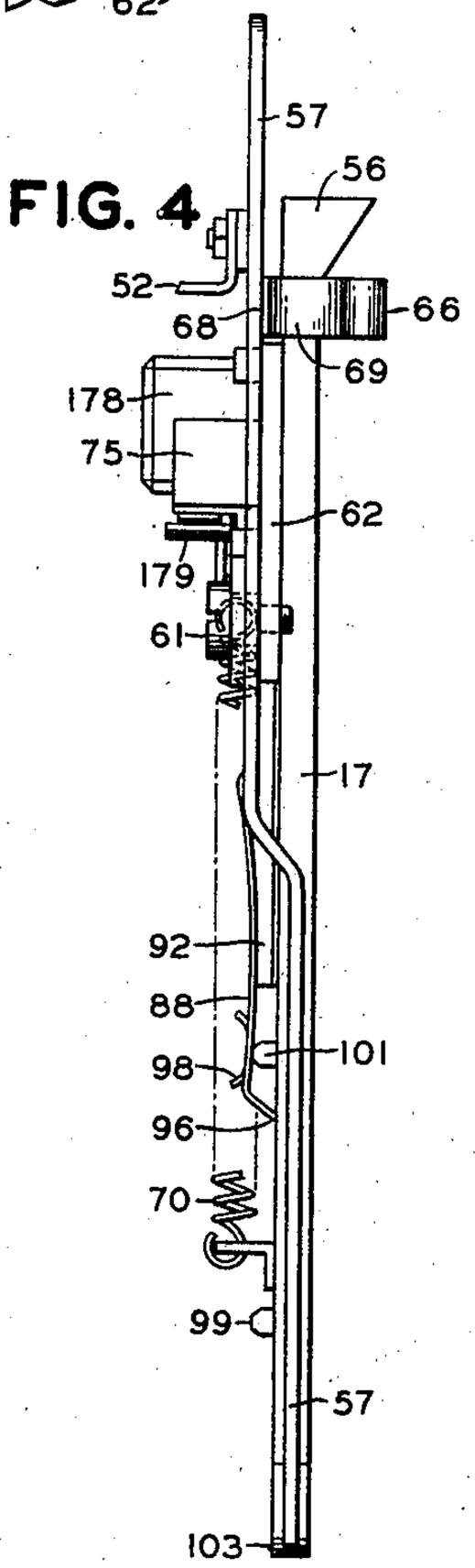

FIG. 4

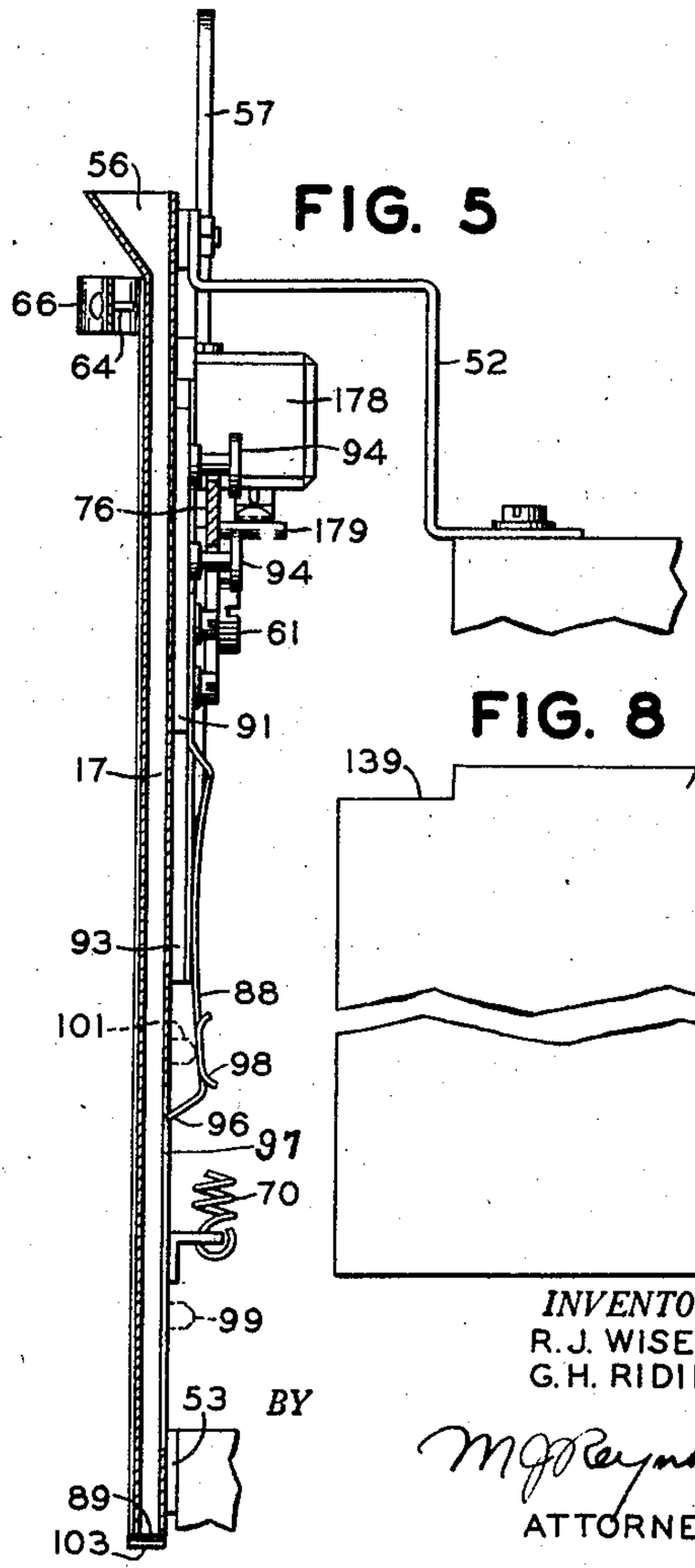

FIG. 5

FIG. 8

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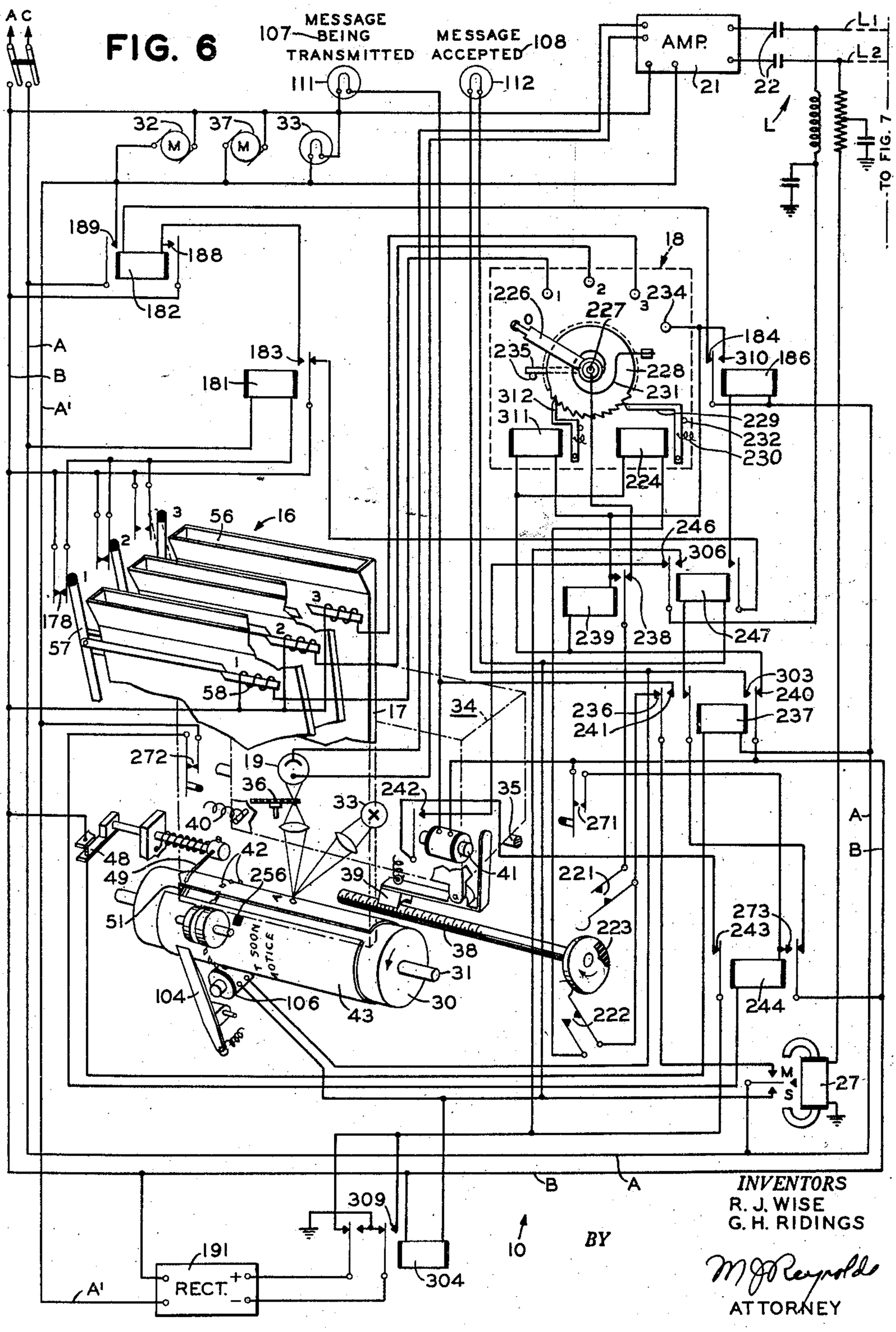
FACSIMILE TELEGRAPH SYSTEM AND APPARATUS

Filed Oct. 3, 1942 4 Sheets-Sheet 3

FIG. 6



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FACSIMILE TELEGRAPH SYSTEM AND APPARATUS

Filed Oct. 3, 1942 4 Sheets-Sheet 4

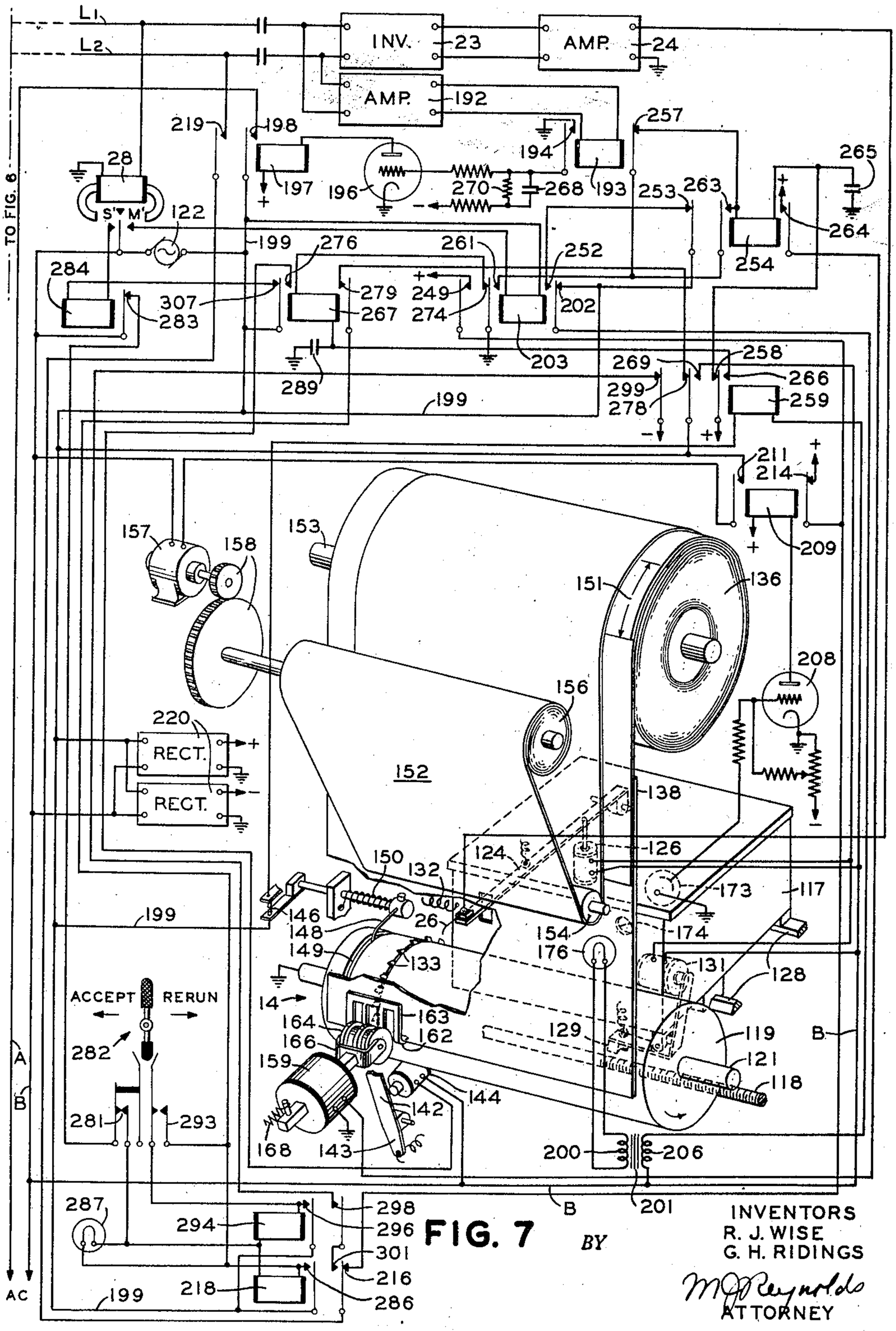

FIG. 7

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Patented Jan. 8, 1946 2,392,442

UNITED STATES PATENT OFFICE

2,392,442

FACSIMILE TELEGRAPH SYSTEM AND APPARATUS

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Application October 3, 1942, Serial No. 460,602

14 Claims. (Cl. 178—6.6)

The present invention relates to automatic telegraph systems and more particularly to a novel facsimile telegraph system for automatically transmitting and recording in facsimile one or any number of messages. The term "message" will be understood to embrace subject matter of any kind such as a telegram, picture or drawing, written or otherwise suitably impressed on a message sheet.

In accordance with this invention means are provided for the insertion at the transmitter of one or more message sheets in any desired order, following which the subject matter appearing on these sheets will be transmitted automatically to an attended or unattended recorder. A plurality of unattended automatic recorders may be connected to a communication circuit terminating in the automatic transmitter of this invention, facsimile communication with a desired recorder being obtained by a selective process by adapting to the system of this invention the arrangement disclosed and claimed in a copending application of G. H. Ridings et al., Serial No. 445,690, filed June 4, 1942. An automatic transmitter embodying the special features of this invention may be operated by an inexperienced person.

An object of the present invention is to provide for automatic transmission from an automatic facsimile transmitter of a plurality of messages each inscribed on a separate message sheet.

Another object of the present invention is to supply message sheets automatically to a transmitting or recording scanner of a facsimile machine without any necessity for joining the sheets to each other or mounting them on a copyholder or separate copyholders or other support.

Still another object of the invention is to provide for the automatic transmission of a plurality of messages from a facsimile transmitter by the act of placing the message sheet or sheets bearing the messages in one or more receptacles associated with the transmitter.

A further object of the present invention is to provide in a novel manner for controlling an interconnected facsimile transmitter and facsimile recorder whereby substantially automatic and, if desired, continuous operation is obtained.

These and other objects will be apparent to those skilled in the art and are accomplished by the present invention, one embodiment of which is illustrated in the accompanying drawings in which:

Fig. 1 is a view in rear elevation of a receptacle or chute for receiving a message sheet;

Fig. 2 is a fragmentary view in elevation of the chute of Fig. 1 as viewed from the front;

Fig. 3 is a top view partly shown in section;

Fig. 4 is a view in elevation of the chute of Fig. 1 as seen from the right hand side thereof;

Fig. 5 is a vertical section on line 5—5 of Fig. 1, looking in the direction of the arrows;

Fig. 6 is a wiring diagram showing one circuit arrangement for the transmitter embodying the features of this invention;

Fig. 7 is a wiring diagram showing one circuit arrangement for controlling and operating the recorder; and

Fig. 8 shows a recording blank for use in the recorder of Fig. 7.

The system of this invention comprises a transmitting station employing a transmitter 10 (Fig. 6), a communication circuit L composed of line conductors L1 and L2, and a receiving station employing a recorder 14, the essential mechanical parts and electrical wiring of which are shown by Fig. 7. The transmitter 10, in the illustrative embodiment of the system, is similar to the self-loading transmitter disclosed in Patent No. 2,262,715, granted to R. J. Wise et al., on November 11, 1941, and is provided with a special multiple chute arrangement 16 (Fig. 6) comprising a plurality of chutes 17, the details of which are shown in Figs. 1 to 5 of the drawings. A rotary stepping switch 18, shown diagrammatically in Fig. 6, is controlled jointly by the mechanism of the chute arrangement 16 and the recorder 14 for automatically transmitting messages deposited in any one or all of the chutes 17. The recorder 14 may be similar to the recorder disclosed in the copending application of R. J. Wise et al., Serial No. 389,164, filed April 18, 1941. The structural features and circuit details of the recorder not disclosed at the present time by an issued patent are illustrated in Fig. 7 of the drawings and will be described hereinafter for the sake of completeness of this disclosure.

The conductors L1 and L2 of the communication circuit L are used simultaneously for the transmission of alternating current facsimile signals or message impulses and, also, the direct current control signals which control operation of the transmitting and recording apparatus. The facsimile signals originate in the transmitter at the photoelectric cell 19 (Fig. 6) which is connected to an amplifier 21, the output circuit of which is connected through a pair of blocking condensers 22 to the conductors L1 and L2. The purpose of the blocking condensers is to isolate the alternating current facsimile signals from

the direct current control signals. At the receiving station the line conductors are connected to a signal inverter 23 and an amplifier 24. The output of the amplifier 24 is supplied, as shown, to the insulated recording stylus 26.

The polarity of the direct current potentials which are applied to the conductor L2 is controlled by apparatus at the receiving station for the purpose of operating a polar relay 27 connected to this conductor at the transmitting station. Similarly, the polarity of the direct current potentials, which are applied to the conductor L1, is controlled by the apparatus at the transmitting station for the purpose of operating a polar relay 28 forming a part of the control apparatus associated with the recorder. Each of these polar relays is of the three-position type whereby the tongue is 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 when direct current signaling potential is disconnected.

The transmitter 10 is located in a suitable box or housing, similar to that shown in the above-mentioned patent, adapted to be mounted on any suitable support such, for example, as a wall or pedestal. The several chutes 17 of the chute assembly 16 extend to a point adjacent a message scanning cylinder 30, the supporting shaft 31 of which is adapted to be driven by suitable gearing (not shown) by a synchronous or other speed-controlled motor 32. The scanning cylinder, the motor and the remaining parts of the transmitter mentioned hereinafter are diagrammatically shown in Fig. 6 of the drawings. The photocell 19, its exciter lamp 33 and the associated optical mechanism are mounted on a scanning carriage 34, which is movable longitudinally of the rotary cylinder 30 on a guide rail 35 to scan a message thereon. A light chopper 36 driven by a motor 37 forms a part of the scanning mechanism. The scanning carriage 34 is moved longitudinally of the cylinder 30, in the usual manner, by a rotary feed screw 38 driven by the motor 32 and adapted to be connected to the carriage by a half-nut 39 which is brought into engagement with the feed screw by the armature of the half-nut operating magnet 41. A carriage return spring 40 serves to return the carriage 34 to its original position at the left of Fig. 6 when the half-nut is disengaged from the feed screw.

The scanning cylinder 30 is provided with a circumferential series of sheet holding teeth 42 similar to the sheet holding teeth of the recorder shown in Fig. 7 of the drawings and in the issued patent referred to above. These teeth engage a message sheet 43 fed downwardly through any one of the chutes 17 of the chute assembly 16 and cause it to be wrapped in position around the cylinder 30. It will be understood, however, that any known means for securing the sheet on the cylinder 30 may be employed. Fig. 6 shows a sheet in position on the cylinder. As described in the above-mentioned patent, the sheet is preferably so formed, as by having a beveled corner, as to require being inserted in the chute in the way necessary to insure its being properly positioned on the cylinder for correct transmission of the message subject matter. When the sheet 43 is on the cylinder, it closes the contacts of a switch 48. When no message sheet is on the cylinder, the operating arm 49 for the switch 48 is accommodated by a groove 51 in the cylinder 30.

The previously mentioned chute assembly 16 comprises, in the specific example selected for the purpose of illustrating the invention, three similar chutes 17 which are secured together by any suitable means (not shown) and to the framework of the transmitter 10 by brackets 52 and 53 (Figs. 1, 4 and 5) so that, as stated above, the end of each chute will be in proximity to the scanning cylinder 30 whereby a message sheet discharged from any one of them will be seized by the teeth 42 and wrapped around the cylinder 30. It will be understood that any number of chutes 17 may be employed, and where it is deemed desirable the sheet receiving ends thereof, indicated by the reference character 56, may be located at points of different elevation above the scanning cylinder 30. This will permit increasing the number of chutes where gravity feed is relied upon to cause delivery of a message sheet to the scanning cylinder 30. Referring now to Figs. 1 to 5 of the drawings for a complete description of one of the chutes 17, a chute blocking and message sheet releasing and propelling mechanism operated jointly by an operating lever 57 and an electromagnet 58 is shown. The operating lever 57 is pivoted at 61 to a suitable bracket 62 secured to the body portion of the chute. The sheet receiving end 56 of the chute is arranged to be blocked to prevent insertion of a mesage sheet 43 by a pin member 64 carried by a flexible spring member 66 secured at 67 to the front wall 65 of the chute. The free end 68 of this spring member is bent, as indicated at 69, so that, when the lever 57 is in the solid line position of Fig. 1, the pin 64 is withdrawn from aligned apertures 72 in the front and rear walls 65 and 74, respectively, of the chute to permit insertion of a message sheet 43.

In the dotted line position of the lever 57 the end 68 of the spring 66 moves inwardly until the portion 69 thereof is free of the lever, thereby causing the pin 64 to be inserted in the aligned apertures 72. This is the normal position of the mechanism on each of the chutes 17 of the chute assembly 16 when the machine is idle, as will more fully appear from the following description. A stop 75 determines the dotted line position of the lever 57. When a message sheet 43 is to be inserted in one of the chutes 17, its lever 57 is moved from the dotted line position on Fig. 1 to its full line position, whereupon all of the parts associated with the lever and to be described assume their full line positions, as shown. An elongated member 76 is secured to the lever member 57 at or adjacent the pivot point 61 and is formed at its end 77 as shown so that it will be caught and retained in position by the end 78 of a reciprocable detent member 79 secured to the core 81 of the electromagnet 58. A spring 70 tends to maintain the arm 76 in its dotted line position. The spring 82 biases the detent member 79 to the right, as viewed in Fig. 1, so that the end 77 of the member 76 will be latched in the position shown. An adjustable stop 83 secured on the detent member 79 by screws or similar fastening means 84 abuts a pair of guide rollers 86 for the detent to limit movement of the member 79 under the influence of the spring 82.

A finger 88 designed to push a message sheet 43 outwardly through the bottom opening 89 of the chute is carried by a reciprocable member 91 which slides in a guideway provided by a pair of facing offset members 92 and 93 secured to the

rear wall 74 of the chute. The member 91 carries a pair of spaced rollers 96 which lie on each side of the swingable member 76 so that, as the lever 57 is rocked, for example, from the dotted line position of Fig. 1 to its solid line position, the member 91 together with the finger 88 is raised to the solid line position. The sheet engaging end 96 of the finger 88 is withdrawn from a slot 97 in the wall 74 by a lateral cam projection 98 which is positioned to cooperate with a projection 99 or a projection 101 raised from the wall 74.

The lower end of the lever 57 is provided with a chute closing projection 103 which projects over the open end 89 of the chute to retain a message sheet 43 in the chute until the detent member 79 is withdrawn from latching engagement with the end 77 of the member 76 upon energization of the electromagnet 58. While the novel feed chute 17 of this invention is disclosed as being employed in a transmitter along with several others to make up an automatically operated group 16, it will be understood that a single chute 17, or a group of these chutes, may be employed with any scanner, having a sheet mounting means, for transmitting or receiving. Details of the operation of the mechanism of the chute 17 will be described hereinafter in connection with the explanation of the operation of the entire system.

When a message sheet on the cylinder 30 is to be removed, it is stripped from the cylinder by a stripper blade 104 formed on or by the armature of a stripper magnet 106. The dimensions of the message sheet 43 are such that a gap is left between the edges of the sheet that is wrapped around the cylinder. The message sheet is stripped from the cylinder by energizing the magnet 106, which moves the stripper blade 104 into position against the cylinder so that the edge slips under the edge of the message sheet and peels it from the cylinder. When peeled from the cylinder, the sheet preferably falls into a bin or the like (not shown) where it remains until collected by an authorized person having access to the bin through a locked closure or the like.

A pair of openings or windows may be provided in the front of the transmitter enclosure having signs 107 and 108 for giving information concerning transmission of a message to the operator of the transmitter 10. The signs, indicated diagrammatically in Fig. 6, are illuminated at appropriate times by lamps 111 and 112, the illumination of which is controlled by electrical circuits to be described hereinafter.

The scanning carriage 117 of the recorder 14, the lead screw 118, the copy holding cylinder 119 and the parts associated therewith are or may be similar to corresponding parts of the transmitter of Fig. 6. If desired, these parts may follow the mechanical design of similar parts shown in the patent noted above. The supporting shaft 121 of the recording cylinder 119 is adapted to be driven through suitable gearing (not shown) by a motor 122 so that the transmitter and recorder cylinder surfaces travel at the same speed. The stylus 26, stylus insulating and mounting means 126 and the stylus operating magnet 126 are mounted on the scanning carriage which is movable on guide rails 128 longitudinally of the cylinder 119. The scanning carriage is moved longitudinally in the mechanical arrangement shown by the rotary feed screw 118 which is driven through suitable means (not shown) by the motor 122 and the half-nut 129 when a half-nut magnet 131 is energized. At the end of a scanning operation the half-nut is disengaged from the feed screw and the carriage returned to its original position at the left of Fig. 7 by a carriage return spring 132.

The scanning cylinder 119 is provided with sheet holding teeth 133 similar to the sheet holding teeth 42 of the transmitter of Fig. 6. The teeth 133 engage a recording blank 138 which is automatically fed into position from a supply roll 136 to cause it to be wrapped around the cylinder 119. The circumference of the recording cylinder 119 and the length of a recording blank 138 are preferably such with respect to each other that, when a blank is wrapped around a cylinder for scanning, its edges overlap slightly to afford a smoother path for the stylus and to keep it from contact with the cylinder. Each blank has a notched corner 139 (Fig. 8) formed in such a way that, when the blank is on the cylinder, the notch provides an open space between the edges of the blank at one end. This space permits the stripping finger 142 extending upwardly from the armature 143 of a magnet 144 to be inserted through the open space and under a blank for the purpose of stripping it from the cylinder. The blanks upon which a message has been recorded and which are removed by the stripper finger may be deposited in a chute or other receptacle or may be discharged upon a moving conveyor belt of any desired type. The chute or receptacle, if provided, may have a locked closure so that only an authorized person may have access to the recorded messages.

When a message blank 138 is in position on the cylinder 119, it closes the contacts of a switch 146. When no message blank is on the cylinder the operating arm 148 for the switch 146 is pressed into a groove 149 in the cylinder by a torsion spring 150. The switch 48 of the transmitter and the switch 146 of the recorder may be identical, as shown.

The blank supply roll 136 is formed of individual blanks 138 supported preferably in overlapping relationship, as shown at 151 in Fig. 7, on an elongated belt 152 of any suitable material, the end of the belt being secured to a mandrel 153. The ends of the mandrel 153 are rotatably supported in suitable bearings secured to any desired stationary portion of the machine. The belt 152 passes over an idler roller 154 to a belt take-up reel 156, which is driven by any suitable mechanism such, for example, as the motor 157, operatively connected to it through gearing 158. As indicated in Fig. 7, unwinding of the belt 152 and the blanks 138 releases the latter one at a time, permitting them to drop into position to be delivered to the recording cylinder 119 under control of a phasing or framing impulse or other signal supplied to a phasing magnet 159. The phasing or framing position is definitely determined by stops in the form of ledges 162 at the lower ends of stationary fingers 163. A blank 138, which is in the position shown in Fig. 7, with its lower edge resting on the ledges 162 of the stop fingers 163 is delivered to the rotating recording cylinder 119 at the desired moment by a pusher mechanism which is illustrated as being composed of a grooved roller 164 rotatably supported on one end of a frame 166 connected to the projecting end of the core of the phasing magnet 159. The grooved roller is biased by a tension spring 168 away from the recording cylinder 119. The grooves in the roller accommodate the fingers 163. It will be understood that the frame 166 may be elongated to carry several spaced grooved rollers where it is deemed desirable and that a corresponding number of fingers

may be placed opposite each roller along the lower edge of a blank in phasing position. Also, it will be understood that guiding means are preferably to be provided to assist in maintaining the blank in position on the fingers 163. This means may conveniently take the form of a pair of side channels. When the phasing magnet 159 is energized, in this instance through the medium of a phasing pulse received from the transmitter, the grooved roller or rollers 164 are projected against the adjacent edge of the blank 138, forcing it against the teeth 133 of the rotating cylinder, which pierces the blank and draws it onto the cylinder.

As soon as a blank 138 is removed from the ledges 162 of the stop fingers 163 and is delivered to the recording cylinder upon occurrence of a framing pulse, the take-up reel 156 is operated, drawing the belt 152 off the supply reel 136 until the next blank is deposited on the stop finger ledges. This serves to stop further operation of the take-up reel in a manner now to be described.

The mechanism for controlling the operation of the take-up reel 156 through its motor 157 is shown in Fig. 7 as comprising a photocell 173 positioned behind an aperture 174 formed in the housing for the parts of the scanning carriage 117. A lamp 176 for exciting the photocell is mounted opposite the photocell so that light directed from the lamp is cut off from the cell by the presence of a blank on the stop fingers 163. This serves to open the circuit of the take-up reel motor 157, as hereinafter described, and discontinues the feeding of another blank until the proper time.

The operation of the mechanical features of the recorder will now be described. Assuming a blank 138 to be in feeding position on the ledges 162 of the stop fingers 163, upon receipt of a framing impulse the magnet 159 is energized, causing the roller 164 to be projected toward the rotating cylinder 119, pressing the lower edge of the blank into engagement with the cylinder 119, the teeth 133 of which penetrate the blank and cause it to be wrapped around the cylinder with its edges overlapping except at the bevel 139. Removal of the blank from the stop fingers 162 permits the lamp 176 to excite the photocell 173 to close the circuit of the paper feed motor 157, causing the take-up reel 156 to draw the belt 152 off the supply roll 136 until the next blank has been released and drops onto the stop fingers 162, cutting off light to the cell and discontinuing further blank feeding.

During the scanning operation the carriage feed screw 118 is rotated from the motor 122 to produce the necessary scanning movement of the carriage and stylus longitudinally of the rotating cylinder. Incoming facsimile signals cause the stylus to record the incoming messages on the blank in position on the scanning cylinder. When the scanning operation is completed, the half-nut is disengaged from the carriage feed screw, permitting the carriage to be returned to its starting position by the spring 132. Also, the stripper magnet 144 is energized, causing the stripper finger 142 to strip the recorded blank from the cylinder.

In the description, immediately following, of the operation of the system it is assumed that the equipment shown by Figs. 6 and 7 of the drawings is idle and that the bus bars A and B at the transmitting and receiving apparatus are connected to a source of power. The equipment is shown as being wired for use of alternating current on these bus bars, but it will be understood that, where it is more convenient or economical or both, direct current may be used. Cathode heating current is preferably maintained in the filament circuits of the tubes in the amplifiers so that the equipment will be ready to function automatically at any time.

Someone at the transmitter, desiring to send one or more messages to the recorder 14, after having first inscribed each message to be sent upon a suitable blank for that purpose, will proceed in the following manner. Referring to Fig. 6 of the drawings, a condition is shown wherein two messages have been prepared and are to be sent. In this instance the levers 57, marked 1 and 2, of the chutes 17 of the chute assembly 16 are shown as having been moved to the left or, as viewed in Fig. 1, to the right so that the levers are latched in this position by means of the end 78 of the detent 79 engaging the member 76. Switches 178 associated with the levers 1 and 2 are closed by a switch operating pin 179 (Fig. 1) on each member 76. Lever 57, marked 3 in Fig. 6, is in its normal position, and its associated switch 178 is, therefore, open. When any one of the levers 57 is moved to close its corresponding switch 178, which in this case may be either the lever marked 1 or that one marked 2, the transmitter 10 is conditioned for operation by energizing a relay 181, which in turn energizes a power control relay 182 at the make contact 183 of the former and a break contact 184 of a relay 186 which is deenergized at this time. The relay 182 is locked by its make contact 188 and the break contact 184 of the relay 186.

The closure of a make contact 189 of the relay 182 connects the A bus bar of the alternating current source to a secondary bus bar which is labeled A'. Connected between the bus bar A' and the bus bar B are the exciter lamp 33, the motor 32 for driving the scanning cylinder 30 and the feed screw 38 for advancing the carriage, and also the motor 37 for driving the light chopper disc 36. A rectifier 191 for providing direct current signaling potentials also is connected to the alternating current source. The exciter lamp 33 being energized, an unmodulated carrier of maximum amplitude is generated by the reflection of the light from the cylinder 30 and is transmitted over the conductors of the communication circuit L to be employed at the receiving station.

At the recorder this carrier current, suitably amplified by an amplifier 192, causes operation of a relay 193, since the amplifier 192 by reason of its connection to the line conductors passes all of the facsimile signals to control the operation of the relay 193. The amplifier 192 is or may be of the type well-known in the art which rectifies the carrier current and filters or smooths the average rectified value. The input circuit of a vacuum tube 196 is energized through a make contact 194 of this relay to cause plate current to flow in the plate circuit thereof, thereby energizing a relay 197 connected in series with the output circuit of the tube. The closure of a make contact 198 of this relay connects the bus bar A to a conductor 199, which energizes the motor 122 for driving the recording cylinder 119 and the carriage feed screw 118.

One terminal of the primary winding 206 of a transformer 201 is connected to the conductor 199 by way of a break contact 202 of a relay 203, the other terminal being connected to the

bus bar B. The lamp 176 is connected to the secondary winding 200 of the transformer 201 and, therefore, is energized.

If it be assumed that the recorder is in a condition such that there is no recording blank in position to be placed upon the cylinder, then the light from the lamp 176 falls upon the photocell 173, thereby energizing the input circuit of a vacuum tube 208. Connected in the output circuit of this tube is a relay 209 which thus becomes energized to close its make contact 211, thereby connecting one terminal of the blank feed motor 157 to the conductor 199. The other terminal of this motor is connected to the bus bar B. Operation of the blank feed motor conveys one of the recording blanks 138 from the supply roll 136 into a poistion to be mounted upon the recording cylinder 119, in which position light from the lamp 176 falling upon the photocell 173 is interrupted. The vacuum tube 208 thereby releases the relay 209, stopping the motor 157. Upon release of the relay 209, positive direct current potential is connected through a break contact 214 of the relay 209, through a break contact 216 of a relay 218, and through a make contact 219 of the relay 197, to the line conductor L2. Normally, a blank 138 will be in position on the stop fingers 162, and therefore direct current potential will at once be connected to the conductor L2 inasmuch as the source of signaling potential 220, which may be a pair of rectifiers, as shown, is preferably energized from the conductor 199 and the bus bar B.

At the transmitting station the armature of the relay 27 connected to the conductor L2 in response to the positive signaling potential is moved to its contact M, thereby connecting the bus bar A to one of the contacts of a switch 221 and a switch 222. Both of these switches are periodically and alternately operated by a cam 223, shown as being mounted upon an extension of the lead screw shaft 38. It will be understood that any rotary part of the transmitter may be used to drive this cam, which is preferably driven at a relatively slow speed. Repeated closure of the switch 222 periodically energizes the stepping magnet 224 of the rotary switch 18.

The switch 18 is shown as being of a more or less conventional type, provided with a switch arm 226 secured upon a rotatable shaft 227 upon which is fastened a toothed ratchet wheel 228. A stepping pawl 229 steps the ratchet wheel through an angular distance equal to the spacing of the teeth for each revolution of the shaft 38 and each consequent energization of the stepping magnet 224. A spring 230 returns the pawl 229 to a position against a stop 232 in readiness to engage the next succeeding tooth. The switch arm 226 is arranged to sweep over a series of contact studs, three in number in the present example, marked 1, 2 and 3 to correspond with the release magnets 58 for the blank receiving chutes 17, also marked 1, 2 and 3. A fourth contact stud, designated by reference character 234, is a return or release stud, the function of which will be explained later. A stop and stop arm 235 check the return movement of the arm 226 under the tension of a spring 231 and define the off or "0" position of the switch 18.

The next succeeding closure of the switch 221 after the switch arm 226 makes contact with the stud marked 1 completes a circuit through the No. 1 release magnet 58 from the bus bar A, tongue and contact M of the relay 27, the break contact 236 of a relay 237, switch 221, the break contact 238 of a relay 239, switch arm 226, contact stud 1 and the magnet 58 to the B bus bar. The relay 237 is controlled directly by the message sheet operated switch 48, the contacts of which are open when the cylinder 30 does not contain a message sheet. Energization of the magnet 58 trips the lever 57, thereby projecting the message sheet contained in the chute toward the teeth 42 on the cylinder 30 or permitting it to fall by gravity into a position such that it is wrapped in position on the cylinder. When this occurs, the contacts of the switch 48 are closed to energize the relay 237 and thereby to interrupt the operating circuit of the stepping magnet 224 and the circuit of the unlocking magnet 58 at a break contact 240. Interruption of the stepping magnet operating circuit causes the arm 226 to remain on the No. 1 stud.

Energization of the relay 237 connects the bus bar A to one terminal of the half-nut magnet 41, through the contact M of the relay 27 and a make contact 241 of the relay 237. The other terminal of the half-nut magnet is connected to the bus bar B. The half-nut engages the feed screw, thereby imparting scanning motion to the carriage 34 containing the scanning apparatus. The lamp 111 is connected in parallel with the winding of the half-nut magnet, which becomes illuminated to illuminate the "Message being transmitted" sign 107. The closure of a make contact 242 controlled by the half-nut magnet 41 connects the positive terminal of the rectifier 191 to the line L1 through a break contact 243 of a relay 244, the make contact 242, break contact 246 of a relay 247, to the line conductor L1.

At the recorder the armature of the polar relay 28 engages its contact marked M'. The winding of the relay 203 is thereby connected between the bus bars A and B, and consequently is energized to operate its contacts. A make contact 249 of this relay is connected to shunt the break contact 214 of the relay 209 for a purpose to be more fully described hereinafter. Even though the break contact 202 of the relay 203 is opened, the transformer 201 is maintained energized through a circuit extending through the make contact 252 of this relay 203 and a break contact 253 of a relay 254.

On the next succeeding revolution of the transmitter cylinder 30, following energization of the half-nut magnet 41, a black spot 256 is scanned to generate a carrier current signal having a minimum amplitude.

The reception of this signal at the recorder momentarily deenergizes the relay 193, permitting the closure of a break contact 257. A circuit is thus completed for the operation of relay 254 and extends from the positive terminal of the source of direct current 220 through a break contact 258 of a relay 259, the winding of relay 254, break contact 257 of the relay 193, and the make contact 261 of the relay 203 to ground. The closure of a make contact 263 of the relay 254 locks it so that, upon the reoperation of relay 193 in response to carrier current signals having amplitudes greater than the minimum amplitude, the relay 254 is maintained energized independently of the relay 193.

The break contact 253 of relay 254 deenergizes the transformer 201 and extinguishes the light 176 temporarily. The closure of a make contact 264 of relay 254 completes a circuit from the direct current source 220 through the winding of the phasing magnet 159. This magnet actuates

the roller 164 which forces the blank 138 into a position where it is gripped by the teeth 133 of the recording cylinder 119 and is thus wrapped around the cylinder in position for recording.

The removal of the blank 138 from in front of the photoelectric cell 173 does not produce any result at this time because the light 176 is extinguished. As soon as the advancing edge of the recording blank reaches the arm 148, the switch 146 controlled thereby is closed. This operation connects the winding of relay 259 between the bus bars A and B, thereby operating the contacts of this relay. The opening of the break contact 258 deenergizes the relay 254, but connected in parallel with the winding of this relay is a condenser 265 having sufficient capacity to delay the release of the contacts of this relay until the recording blank is completely mounted upon the recording cylinder. The relay tongue associated with the break contact 258 of the relay 259 prepares a circuit via a make contact 266 which will, at a later step in the operation being described, cause operation of a relay 267 when the relay 203 is deenergized. After the blank mounting operation has been completed, the contacts of the relay 254 are released, thereby deenergizing the phasing magnet 159. The closure of the break contact 253 of the relay 254 again energizes the transformer 201 and operates the light 176 to excite the photoelectric cell 173 and thereby initiate the operation of the blank feeding motor 157 to convey another blank into position to be transferred to the recording cylinder when required. The opening of the break contact 214 of relay 209 in response to this operation opens one circuit from the source of positive potential. However, this potential is not disconnected from the line conductor L2 by reason of the shunt path provided through the make contact 249 of relay 203.

The operation of the relay 259 in response to the mounting of the recording blank upon the cylinder 119 completes a circuit from the conductor 199 through a make contact 269 of this relay, through the windings of the half-nut magnet 131 and the stylus magnet 126 to the bus bar B. The stylus 26 is thus moved into recording position in contact with the blank 138 on the cylinder, and the half-nut 129 is moved into engagement with the feed screw, thereby imparting a scanning movement to the carriage.

As the facsimile signals generated at the transmitter are received at the recorder, they are applied, after inversion and amplification, to the recording blank for the reproduction of the subject matter being scanned at the transmitter. These signals also are applied to the relay 193, which will vibrate as the amplitude of the signals varies between maximum and minimum values, but the closure of the break contact 257 of this relay is ineffective to operate the relay 254, since the operating circuit of this relay is open at the break contact 258 of relay 259. The opening and closing of the contact 194 of relay 193 alternately energizes and deenergizes the input circuit of the vacuum tube 196, but this circuit is provided with means for delaying the deenergization thereof during the interval of time that the contact 194 is open. This is accomplished by providing a condenser 268 connected between the grid of the tube and a source of negative biasing potential. When the contact 194 is closed, this condenser is charged to a potential whereby the input circuit of the tube is energized. As soon as the contact 194 is opened, the charge on the condenser begins to dissipate through a leak resistor 270 and, after the lapse of a predetermined time, the potential of the grid of the tube becomes sufficiently negative with respect to its cathode that the plate current is reduced to a value which is insufficient to maintain the relay 197 operated. However, the values of the condenser 268 and the leak resistor 270 are chosen so that the plate circuit of the tube 196 draws sufficient current during the normal operation of recording that the relay 197 remains operated.

At the transmitter, when the carriage 34 containing the scanning apparatus has advanced to the end of its movement, a normally open switch 271 operated by the carriage 34 is closed, thereby closing a circuit from the bus bar B through the winding of the relay 244, and a normally closed carriage operated switch 272 to the bus bar A'. The relay 244 is thus energized and locked at its make contact 273 and opens its break contact 243 to thereby disconnect positive potential from the line conductor L1.

At the recorder, disconnection of positive potential from conductor L1 disengages the armature of polar relay 28 from its right hand contact M' and thereby opens the operating circuit for relay 203. The release of this relay closes a circuit from positive potential, through the make contact 266 of relay 259, the winding of relay 267, and a break contact 274 of relay 203 to ground. The operation of the relay 267 closes a circuit through a make contact 276 to connect the winding of the blank stripping magnet 144 between the bus bars A and B. The sheet containing the recording is thus removed from the cylinder 119, permitting the switch 146 to be opened. The relay 259 is thereby released, and the closure of a break contact 278 of this relay completes a circuit from the bus bar A through a make contact 279 of relay 267, through the winding of relay 218, the normally closed contact 281 of a key switch 282, a break contact 283 of relay 284, to the bus bar B. Relay 218 is thus operated and locked through its make contact 286. Positive potential is removed from the conductor L2 at the break contact 216 of the relay 218. A light 287 is connected in parallel with this relay and is also energized to signal the attendant that a message has been received.

It will be noted that the operating circuit of the stripping magnet 144 includes the make contact 276 of the relay 267 which, at the time that the relay 259 is released by the opening of switch 146 controlled by the recording sheet, is deenergized by the opening of make contact 266 of relay 259. However, it is provided with a condenser 289 connected in parallel with its winding, which delays the release of its contacts until after the sheet has been completely removed from the cylinder. The relays 267 and 259 are now deenergized as pointed out above.

The removal of positive potential from the line conductor L2 produces a response at the transmitter by the polar relay 27 whereby the armature of this relay is disengaged from its contact M to deenergize the half-nut magnet 41, thereby opening the contact 242 to prevent reapplication of positive potential to the conductor L1 until the half-nut magnet is again energized and permitting the carriage 34 to return to its original position. The normally closed carriage operated switch 272 is opened upon return of the carriage 34 to its starting point, which causes the relay 244 to be unlocked.

Facilities are provided at the recorder for making another recording of the same subject matter, if a second copy is desired. To do this, the key switch 282 is momentarily operated to the right hand or "Rerun" position, thereby opening the contact 281 and unlocking the relay 218 and at the same time extinguishing the light 287. The release of relay 218 reconnects positive potential through its break contact 216 to the line conductor L2.

At the transmitter the polar relay 27 is again operated to its contact M, and the transmitting mechanism is started upon the same cycle of operation as previously described. Briefly, the relay 237 is still energized, since the sheet 43 is in position on the cylinder 30, and the half-nut magnet 41 is energized to re-scan the copy and to restore positive potential to the line L1 to set up phasing conditions as before.

When the attendant at the recorder has sufficient copies, the key switch 282 is operated to the left or "Accept" position to close a normally open switch 293. A circuit is thus completed from the bus bar A through the make contact 286 of the relay 218, the switch contact 293, the winding of a relay 294, the closed switch contact 281, the break contact 283 of relay 284, to the B bus bar. Relay 294 is operated and locked through its make contact 296. Closure of make contact 298 of this relay connects negative potential through the break contact 299 of relay 259, through the make contact 301 of relay 218 and make contact 219 of relay 197 to the line conductor L2.

The presence of an attendant has been mentioned, but it will be understood that the recorder may operate without the presence of an attendant if the key 282 is left in its "Accept" position. If the recorder is to be unattended at all times, the key operated switches 281 and 293 may be permanently shunted. If this is done, the wiring is similar to that shown in the application of G. H. Ridings et al., Serial No. 445,690, referred to above.

At the transmitting station the negative potential connected to the line conductor L2 effects the operation of the armature of the polar relay 27 to its contact S. This connects the peel magnet 106 from the bus bar A via the contact S of the relay 27 to the bus bar B via a make contact 303 of the relay 237. The "Message accepted" sign 108 is illuminated by the lamp 112, which is in parallel with the peel magnet 106. The stripper blade 104 removes the message sheet 43 from the cylinder 30, thereby opening the switch 48 and releasing the relay 237. A pole changing relay 304 is energized from the S contact of the polar relay 27. Negative potential is put to the line conductor L1 via make contact 306 of the relay 247, which is energized by the contact S of the polar relay 27 when the relay 237 is released following removal of the message sheet 43 by the stripper blade 104.

The negative potential on line L1 causes the tongue of the polar relay 28 at the recorder to make contact with the contact S' and thereby energize the relay 284 via a break contact 307 of the relay 267. The relays 218 and 294 are unlocked at the break contact 283 of the relay 284. The light 287 is extinguished, and a positive potential is again placed on the conductor L2 at the break contact 216 of relay 218.

The tongue of the polar relay 27 at the transmitter leaves the contact S so that the relays 247 and 304 are released to take the negative signaling potential off the conductor L1. The conductor L1 stays open until a later step in the operation being described is reached.

The tongue of the polar relay 28 at the receiver is centered, and the relay 203 is released, but positive signaling potential is maintained on the conductor L2, since the blank supply mechanism described above has had ample time to put a blank on the ledges 162 of the stationary fingers 163. The operating circuit of the relay 267 is again prepared, and the transformer 201 and the light 176 are maintained energized.

The tongue of the polar relay 27 at the transmitter connects the A bus bar at the contact M to the periodically operated switches 221 and 222. Upon closure of the switch 222, the stepping magnet 224 of the stepping switch is energized via the break contact 240 of the relay 237 to the B bus bar, thereby stepping the switch arm 226 to the stud No. 2, following which when the cam 223 closes the switch 221 the message sheet releasing magnet 58 marked No. 2 is energized. The second message sheet 43 is positioned on the cylinder by the teeth 42, and when this occurs the contacts of the switch 48 are closed to energize the relay 237. The operating circuit for the stepping magnet 224 is open, and the arm 226 remains on contact stud No. 2. The half-nut magnet 41 is energized, and positive signaling potential is applied to conductor L1, as before. The relay 181 is released, since all of the switches 178 are now open. The effect of this will be described later.

At the recorder the tongue of the polar relay 28 goes to the contact M', and the relay 203 is energized to prepare the phasing circuits, as before. The transmitter and recorders phase, and the recording process proceeds.

When the scanning carriage 34 at the transmitter has completed its scanning excursion, the end-of-message switch 271 is closed to energize the relay 244, which operates and is locked in the manner described above. This removes the signaling potential from line conductor L1.

At the recorder the tongue of the polar relay 28 centers, and the relay 203 is deenergized. The relay 267 is energized, which causes the stripping finger 142 to remove the recorded blank from the cylinder 119, whereupon the relay 259 is deenergized. The relays 267 and 259 are both energized before the recording blank 138 is removed from the cylinder so that the relay 218 is pulled up and locked to remove positive potential from the conductor L2. After the blank removal operation, the relays 267 and 259 are both deenergized.

At the transmitter the half-nut magnet 41 is deenergized, and when the carriage returns the normally closed switch 272 is opened to unlock the relay 244.

At the recorder the key 282 may be moved to the accept position to close the contacts of the switch 293, which will result in energization of the relay 294. When this occurs, the negative source of signaling potential will be connected to the line L2.

At the transmitter the peel magnet 106 and the pole changing relay 304 are energized. The message sheet 43 is removed from the cylinder 30, which results in deenergization of the relay 237, and the relay 247 is now energized, and negative potential is connected to conductor L1 from a make contact 309 of the relay 304 and the make contact 306 of the relay 247. Since the levers 57 of all the chutes in the chute assembly 16 are tripped, and the relay 181 is deenergized, when the relay 247 is energized, the relay 186 is ener-

gized, and its make contact 310 connects the bus bar A to a return magnet 311 of the stepping switch 18 by way of the break contatc 308 on the relay 237, which releases the ratchet holding pawl 312 and permits the arm 226 to snap back to the off stud marked 0. The operation of the relay 186 unlocks the relay 182, which disconnects the motors and scanning light of the transmitter from the energy supply source, thereby shutting down the transmitter.

At the recorder, since the carrier is no longer being received, the relay 193 and, therefore, the relay 197 are both deenergized. The entire system is now restored to its idle condition.

In the complete operation of the system described above it is assumed that only two message sheets have been prepared for transmission. However, as stated, the system is maintained in operation when additional message sheets are inserted in idle chutes 17 of the chute assembly 16. If, while the transmitter 10 is scanning a message sheet taken from one of the chutes, another sheet is put in any one of the empty chutes, the system is arranged so that this newly added message sheet will be projected onto the cylinder and scanned in its proper turn. The switch 178 on the reloaded chute, for example, No. 1, is closed and, following removal of the message sheet which was drawn from the chute No. 2, or any other loaded chute, the bus bar A is connected to the periodically operated switch 222 which operates the stepping magnet 224, thereby placing the arm 226 on the stud No. 3. The periodically operated switch 221 then energizes the release magnet 58 marked No. 3, and as no copy is in the third chute 17 the relay 237 is not energized through the message sheet operated switch 48. The cam operated switch 222 steps the switch arm 226 to the off stud No. 4. The cam operated switch 221 connects the return magnet 311 to the A bus bar at the contact M of the polar relay 27, and the arm snaps back to the off stud 0. The relay 239 is also connected in parallel with the return magnet 311 to prolong the pulse from the return stud No. 4, which is interrupted almost immediately upon energization of the return magnet 311. The cam operated switch 222 steps the switch arm 226 to the No. 1 stud, and the release magnet 58 marked No. 1 is operated, following which the transmitter 10 and the recorder 14 operate together and ultimately shut down in the manner explained above.

The nature of the invention may be ascertained from the foregoing complete description of an illustrative embodiment thereof. The scope of the invention is defined by the appended claims.

What is claimed is:

1. In a facsimile telegraph system, scanning mechanism including means for supporting a sheet in scanning relationship to said scanning mechanism, a plurality of sheet receiving means each adapted to support a sheet in non-scanning relationship to said scanning mechanism, means for automatically feeding sheets one at a time from each of said sheet receiving means to said first-mentioned means and mechanism including contact means individual to each of said sheet receiving means for controlling said feeding means.

2. In a facsimile telegraph system, scanning mechanism having a rotatable cylinder to receive a flexible sheet to be scanned, means arranged circumferentially on said cylinder adapted to engage and retain a sheet on said cylinder during rotation, means to receive a plurality of separated unsupported flexible sheets, and means automatically to supply sheets one at a time from said sheet receiving means to said cylinder whereby said circumferentially arranged means will engage said sheets.

3. In a facsimile telegraph system, scanning mechanism including sheet supporting means, a plurality of message receiving chutes arranged in feeding relationship to said sheet supporting means and means for automatically supplying a message sheet from each of said chutes in succession to said sheet supporting means.

4. A facsimile telegraph transmitting apparatus comprising a message sheet scanning mechanism including a message sheet support, means for receiving a plurality of separate message sheets, sequencing means operable automatically to supply sheets in succession from said receiving means to said support, means for scanning each sheet in succession, means for removing each sheet from said support following said scanning and means operable on removal of each sheet from said support for operating said sequencing means to supply the succeeding sheet to said support.

5. A facsimile telegraph transmitting apparatus comprising a message sheet scanning mechanism including a copyholder, a plurality of sheet receiving means each disposed in fixed predetermined relationship to said copyholder for supplying a message sheet thereto in operative relation to said scanning mechanism, means for feeding a message sheet from each of said first means in succession, means for scanning each sheet in succession, and means for removing each sheet from said copyholder following said scanning and preceding the supplying of the succeeding sheet thereto.

6. A facsimile telegraph machine comprising a scanning mechanism, a message sheet supporting means incorporated in said scanning mechanism, contact means to guide a message sheet to said support, and means associated with said last named means for rendering said scanning mechanism operative to scan a message sheet.

7. A facsimile telegraph machine comprising a scanning mechanism having a copyholder, means for receiving and storing a message sheet, means for feeding a message sheet from said first means to said copyholder, and presettable means associated with said receiving and storage means for controlling the feeding of said sheet to said copyholder and for causing movement of said copyholder to scan a message sheet thereon.

8. In a facsimile machine, a rotatable cylinder to receive a flexible sheet to be scanned, means arranged circumferentially on said cylinder adapted to engage and retain a sheet in fixed position on said cylinder during successive revolutions of said cylinder, a plurality of feed chutes each for receiving and retaining a flexible sheet, each of said chutes ending adjacent to said cylinder, and means for releasing said sheets one at a time from the ends of said chutes adjacent to said cylinder whereby said circumferentially arranged means will engage said sheets.

9. In a facsimile machine, a scanner having a movable member, said member receiving a flexible sheet to be scanned, means associated with said member adapted to engage and retain a sheet in fixed position on said member during movement thereof, a plurality of feed chutes each for receiving a flexible sheet, each of said chutes ending adjacent to said member, and means for releasing said sheets one at a time from the ends

of said chutes adjacent to said member whereby said sheet engaging means of said member will engage a sheet released from said chute.

10. In a facsimile machine, a movable copyholder to receive a flexible sheet in fixed position thereon to be scanned, a feed chute to supply a sheet to said copyholder, said chute comprising movable means to block said chute against the insertion of a sheet therein, and means, operable upon movement of said movable means to unblocking position for causing operative movement of said copyholder.

11. In a facsimile machine, a rotatable cylinder to receive a flexible sheet to be scanned, means arranged circumferentially on said cylinder adapted to engage and retain a sheet on said cylinder during rotation, a feed chute for the sheet to supply a sheet to said cylinder, said chute comprising movable means to block the chute against the insertion of a sheet therein, means operable upon movement of said movable means to unblocking position for causing operative movement of said cylinder, and means for releasing said sheet from said chute whereby said circumferentially arranged means will engage said sheet.

12. A facsimile transmitter comprising, a movable copyholder to receive a flexible sheet to be scanned, a feed chute to supply a sheet to said copyholder, said chute comprising movable means for blocking the chute against the insertion of a sheet therein, means for causing said movable copyholder to become operative upon movement of said sheet insertion preventing means to unblocking position, and means to retain a sheet in said chute, said last-named means being operable to release said sheet and being controlled by an operative function of said transmitter.

13. In a facsimile machine, a movable copyholder to receive a flexible sheet in fixed position thereon to be scanned, a plurality of chutes to supply sheets to said copyholder each adapted to receive a message sheet, means on each chute independent of said copyholder for releasing a sheet contained therein whereby to deliver the sheet to said movable copyholder, and means for operating said sheet releasing means in a predetermined order following a scanning operation by said copyholder.

14. In a facsimile machine, a movable copyholder to receive a flexible sheet to be scanned, means for engaging a sheet in position on said copyholder to remove the sheet therefrom after a scanning operation, a feed chute to supply a sheet to said copyholder, said chute comprising movable means for blocking said chute against the insertion of a message sheet therein, means for causing said movable copyholder to be operative upon movement of said sheet insertion preventing means to unblocking position, and means to retain a sheet in said chute, said last-named means being operable to release said sheet following operation of said sheet removing means.

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