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R. J. WISE ET AL
FACSIMILE APPARATUS

2,646,335

Original Filed Aug. 14, 1942

2 Sheets-Sheet 1

FIG. 1

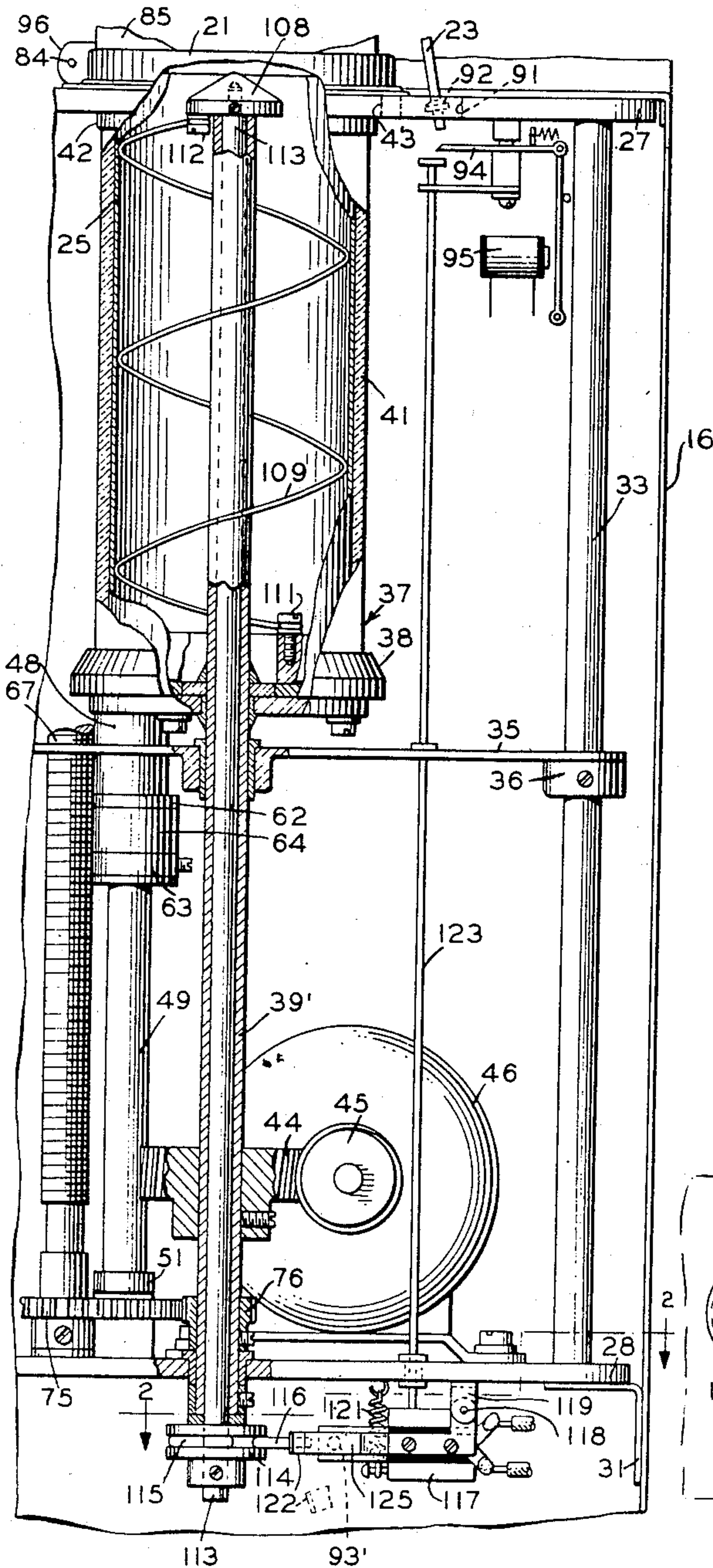


FIG. 3

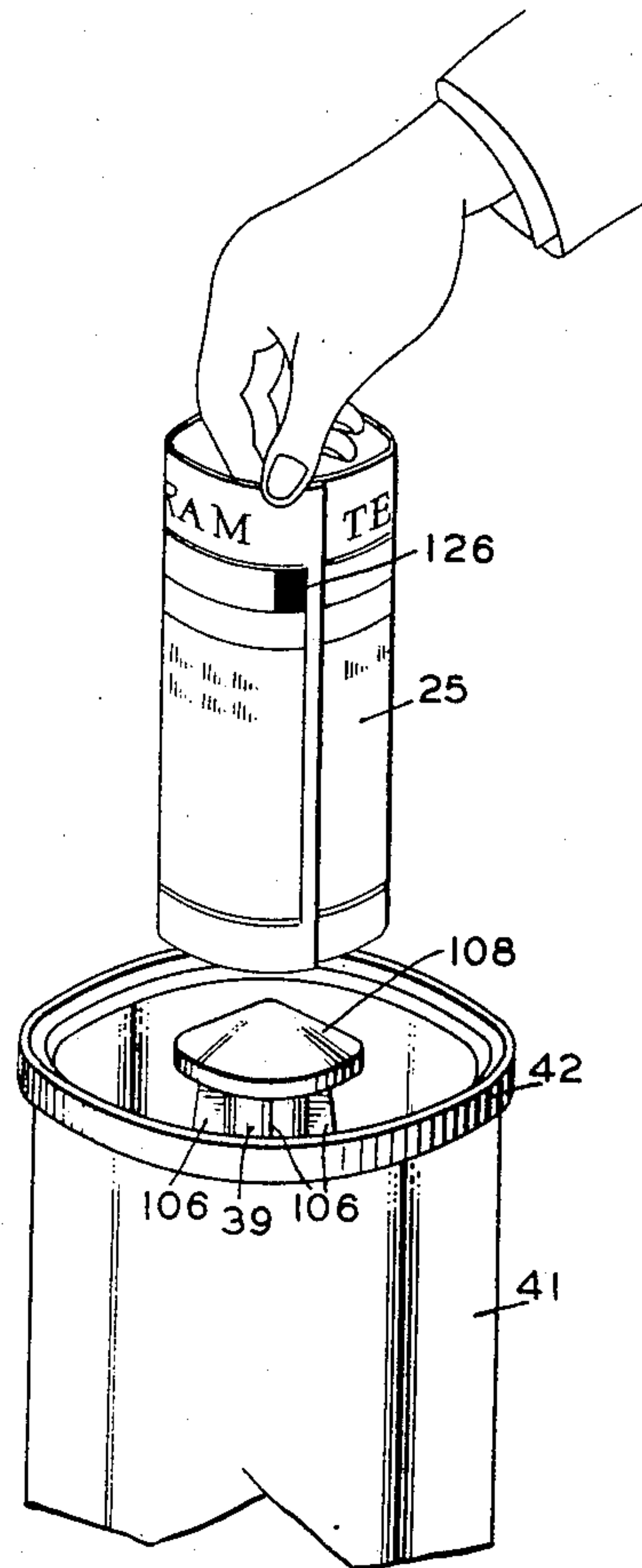
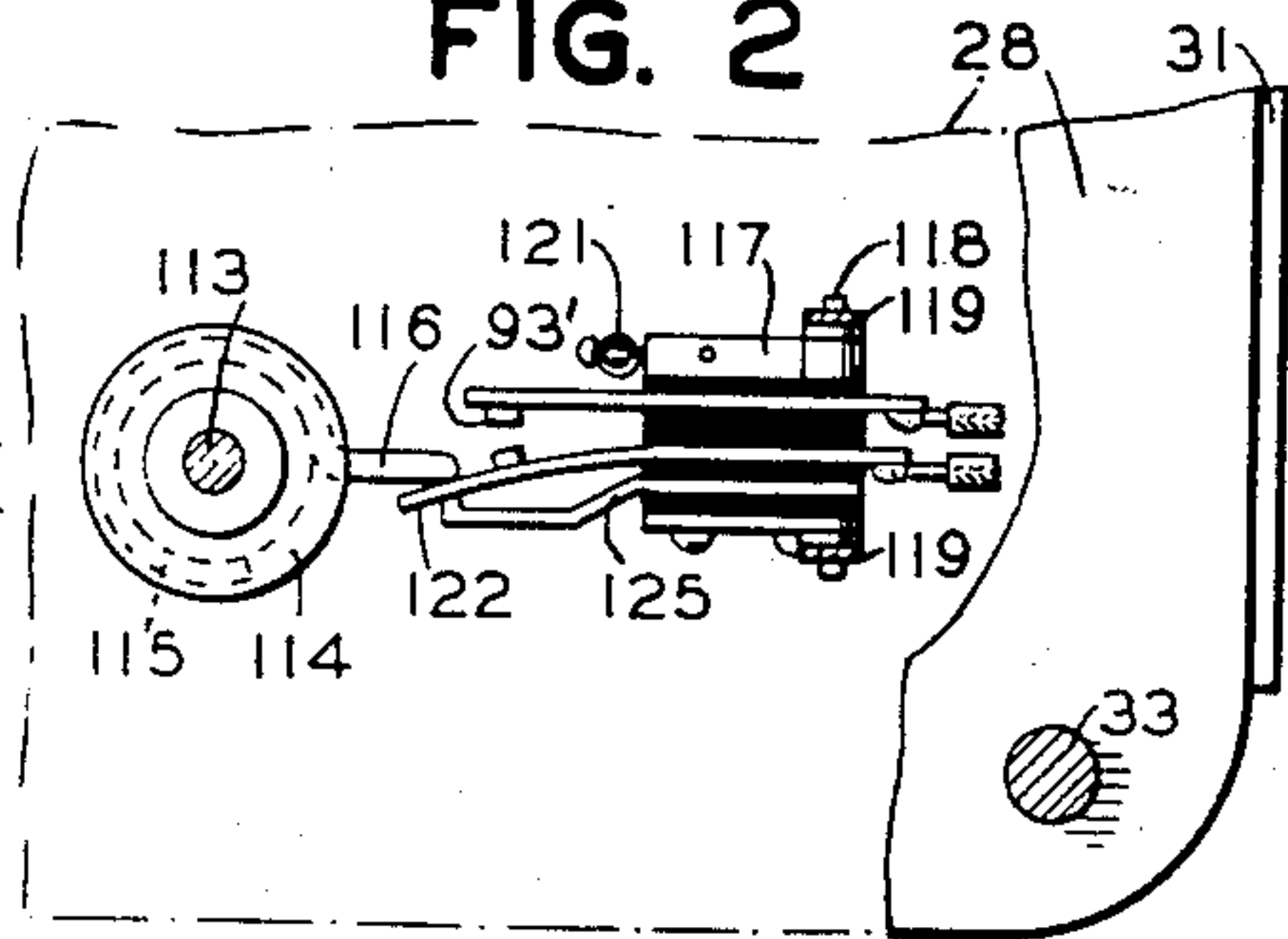


FIG. 2



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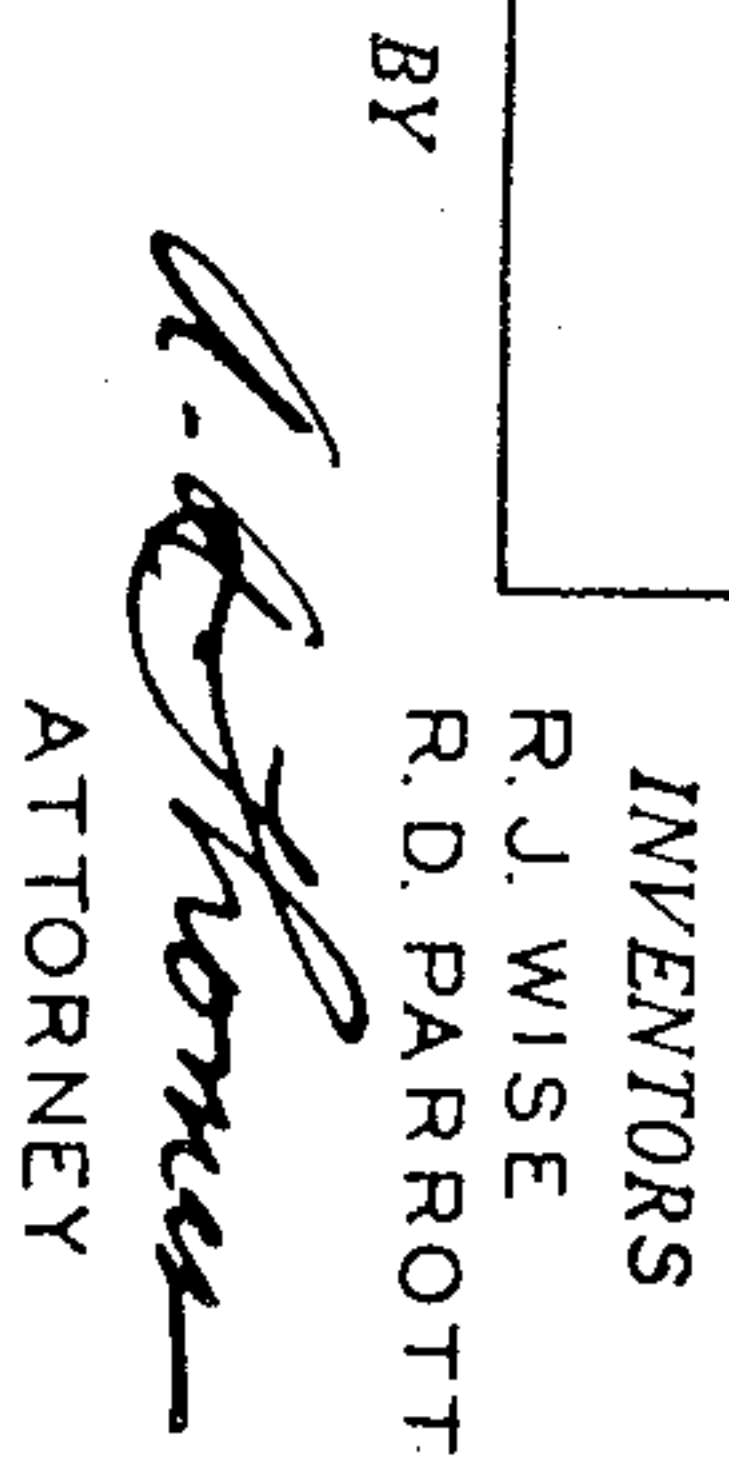
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2,646,335

FACSIMILE APPARATUS

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,646,335

FACSIMILE APPARATUS

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Original application August 14, 1942, Serial No. 454,768, now Patent No. 2,469,423, dated May 10, 1949. Divided and this application March 11, 1948, Serial No. 14,293

7 Claims. (Cl. 346—138)

1

This invention relates to facsimile systems, and has particular reference to apparatus employed for the mounting and supporting of a flexible sheet for scanning purposes.

This application is a division of application Serial No. 454,768, filed August 14, 1942, now Patent No. 2,469,423, issued May 10, 1949.

In order that the advantages of facsimile communication be made available as widely as possible, it is necessary to provide scanning apparatus which is relatively simple. In this manner such apparatus may be operated by persons who are not especially trained for the purpose. One drawback to the general use of prior art apparatus is that some degree of skill is usually required on the part of the operator. In apparatus where attempts have been made to minimize the degree of skill required by the operator relatively complex mechanisms have been devised. Obviously, it is desirable to limit, insofar as it is practicable to do so, the additional mechanical complications.

Accordingly, it is the principal object of the present invention to provide a relatively simple and novel facsimile scanner for operation by an unskilled person.

Another object of the invention is to provide novel means for securing a flexible sheet to a cylinder for scanning purposes.

Still another object of the invention is to provide expansible means for supporting a flexible sheet on the inside of a hollow cylinder or tubular member.

A further object of the invention is to provide for the securing of a flexible sheet to the inside of a hollow cylinder by means of an expansible helical member.

A still further object of the invention is to provide for the securing of a flexible sheet to the inside of a hollow cylinder by means of a plurality of centrifugally actuated members.

An additional object of the invention is to provide a facsimile machine with a novel cover for the scanner, the cover having means for being releasably locked in a closed position.

Another object of the invention is to provide, in a facsimile machine, novel means for actuating contacts by the movement thereof to intercept and stop a normally moving operating member.

These and other subsidiary objects of the invention are embodied in an illustrative embodiment thereof which will be described in connection with the accompanying drawings, of which:

Fig. 1 is a partial front elevation and sectional

2

view of the sheet mounting apparatus and the control mechanism therefor;

Fig. 2 is a fragmentary sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 illustrates the manner of forming the sheet for insertion in the supporting cylinder; and

Fig. 4 is a schematic circuit diagram showing one way of controlling the operation of the facsimile transmitter.

The invention is embodied in a machine which is designed so that it may be used in any business office or similar place. The sheet bearing the subject matter to be transmitted, after being roughly formed into a loose roll, is inserted through the top of the machine into a rotatable hollow transparent cylinder or tubular member. A cover is moved to close the opening, and a handle attached to the cover is actuated to start the machine whereby to transmit a signal to the recording station. The handle is then locked in this position for the duration of the scanning operation so that it is impossible to open the cover. As soon as the machine is put into operation, expansible means within the hollow cylinder operate to press the sheet firmly against the inside of the cylinder wall. A carriage, upon which is mounted optical scanning apparatus, is then moved longitudinally of the rotating cylinder whereby a helical scanning of the subject matter on the blank is effected. Following the scanning operation the cover handle is unlocked so that the cover may be moved to again provide access to the inside of the cylinder, which at this time is no longer rotating. The expansible means within the cylinder is also withdrawn from engagement with the sheet so that it may be removed and replaced by another, if desired, and the entire sequence repeated.

In the embodiment of the invention disclosed herein the expansible means comprises a helical spring-like member mounted within the hollow cylinder and connected to mechanism whereby, when the cylinder is at rest, the helical member is wound tightly about a spindle extending through the cylinder substantially coaxially therewith. This helical member is tensioned in such a manner that, when the cylinder is released for rotation, the helical member unwinds from the spindle until it presses the paper against the inside of the cylinder wall.

Fig. 1 shows details of the inner construction of the machine and Fig. 4 illustrates, at station A, the general exterior form thereof. The machine is supported by a base 15, Fig. 4, from

3

which there extends upwardly a cover or casing 16, Fig. 1. Toward the top of the machine is an opening leading into a transparent hollow cylinder or tubular member 41. The opening is normally closed by a cover 21 which is provided with a handle 22 pivoted thereon, as seen in Fig. 4 at station B, so that it may be depressed when the cover is in its closed position to move a handle rod or switch operating member 23, by means of which the machine is started. Formed in the front of the cover 16 is a window 24, seen at station A, through which may be viewed the transparent cylinder and a sheet 25, Figs. 1 and 3, mounted therein.

Having reference to Fig. 1, the sheet mounting and scanning apparatus will be described in greater detail. This apparatus is supported between an upper plate 27 and a lower plate 28 in the upper part of the machine housing. The lower part of the housing is used for the auxiliary apparatus, such as a power pack, amplifier, control relays, etc. The lower plate 28 is attached by means of angle irons, such as 31 to the casing 16. The upper plate 27 is supported by the lower plate and spaced therefrom by rods such as 33. An intermediate bearing plate 35 has formed adjacent the edges thereof a plurality of bosses such as 36, by means of which the bearing plate is attached to the rods such as 33.

The apparatus 37 in which the subject matter bearing sheet is supported for scanning comprises a base 38 secured to a shaft 39' and also a transparent hollow cylindrical or tubular section 41 extending upwardly from the base. The transparent cylinder wall may be made of glass or any equivalent material such as a transparent plastic. The top of the transparent cylinder 41 is capped by a ferrule 42 which is free to rotate in an opening 43 formed in the upper plate 27. There is no connection between the ferrule and the plate 27.

The shaft 39', upon which is supported the apparatus 37, is journaled in the bearing plate 35 and the lower plate 28. Secured to this shaft is a worm wheel 44 which meshes with a worm 45 mounted on the shaft of a driving motor 46. This linkage serves to rotate the sheet mounting apparatus 37 upon operation of the motor 46.

The optical scanning apparatus is mounted on a carriage 47, diagrammatically indicated in Fig. 4, which carriage is attached to an elongated sleeve member 48, Fig. 1, which is adapted for vertical sliding movement on a guide rod 49. This rod is supported at its upper end in the plate 27 and at its lower end in a bracket 51 which is mounted in spaced relation above the plate 28. A lamp 52, Fig. 4, is mounted in a bracket (not shown) which is attached to one side or flange of the carriage 47. Light from the lamp is directed by a condensing lens tube, also mounted on the flange, so that a small spot of light is focused upon a subject matter bearing sheet mounted within the transparent cylinder 41. Light which is reflected from the surface of the sheet is directed by a pickup lens tube, also mounted on the flange, onto the responsive element of a photoelectric tube 57 which is mounted on another flange of the carriage 47. Supported between the two flanges of the carriage is a small electric motor 59, upon the shaft 59 of which is carried a light chopper disc 61 which is provided adjacent its periphery with a series of notches. The disc is positioned with respect to the reflected pencil of light so that, upon rotation, the light which is directed toward the photoelectric tube

4

57 is periodically interrupted to produce in the output circuit of the photoelectric tube a series of unidirectional impulses, the amplitude of which represents the tonal value of the elemental areas of the subject matter being scanned.

The sleeve member 48, Fig. 1, is provided adjacent its lower extremity with two spaced collars 62 and 63, between which there is supported a ring-like member 64. The ring 64 is free to rotate about the axis of the member 48 and carries an arm on which is mounted a half-nut 66 that is adapted for engagement with a feed screw 67 under control of an electromagnet 73.

The feed screw is journaled for rotation in the plates 27 and 28 and has attached adjacent the lower end thereof a gear 75, Fig. 1, which is meshed with a gear 76 attached to the shaft 39'. Upon operation of the motor 46, the feed screw 67 is rotated at a predetermined speed so that, when it is engaged by the half-nut 66, the carriage 47 is moved downward for scanning purposes at a prearranged rate.

Upon completion of a scanning operation, the half-nut is disengaged from the feed screw, and the carriage is returned to its upper position by means of a spring (not shown) or other suitable retractive force. The spring is attached at one end to the carriage and at the other end to any other convenient stationary member, such as the upper plate 27. A rubber or other suitable shock absorbing stop (not shown) is attached to the upper plate 27 in a position to be struck by the carriage 47 when it is returned to its normal idle position.

The cover 21 which is hinged at 84 is adapted to close the opening 43 in the upper plate 27 when in the position illustrated in Figs. 1 and 4, and when raised upwardly, affords access to the interior of the transparent cylinder 41. A channel member 85 is attached to the top of the cover 21, and pivoted therein at 86 is the handle 22. The handle is normally held in the position shown by a spring (not shown). Adjacent the free end of the handle is the depending rod or switch operating member 23 which extends through an opening 91 formed in the upper plate 27. A collar 92 is formed adjacent the lower extremity of the rod 23 for a purpose to be described. When the cover 21 is in its closed position, a downward movement of the handle 22 brings the lower end of the rod 23 into position to actuate a rod 123 and close a pair of contacts 93 which are used for a control purpose to be described. With the handle in such an operated position, a forked member 94 may be moved to the left, as viewed in Figs. 1 and 4, by the energization of an electromagnet 95 and slipped over the top of the collar 92 so that the handle is retained in this position. If the electromagnet 95 is energized before the handle is depressed, the forked member 94 is in a position to intercept the collar 92 before the rod 23 can be moved sufficiently to close the contacts 93.

The cover 21 has formed therein adjacent the hinge 84 a cam surface 96. A cam follower 97 is for the purpose of operating a pair of contacts 99. The cam surface 96 is so shaped that, when the cover 21 is in its closed position as shown, the cam follower is in its lower position to close the contacts 99. When the cover 21 is moved to the position shown by the dotted lines, the cam follower 97 is permitted to move upwardly and to thereby open the contacts 99.

In Fig. 3 the manipulation necessary to insert a sheet in the cylinder is shown. The sheet 25 is roughly formed into a loose roll as shown and

placed within the cylinder until the lower edge of the sheet reaches the bottom of the cylinder. It is not even necessary to retain the illustrated grasp of the sheet until this operation is completed for the reason that, once the sheet is well within the cylinder, its roll form is retained by the cylinder itself. The insertion operation may then be completed simply by pressing with the palm of the hand upon the upper edge of the sheet until it is completely within the cylinder.

Referring to Fig. 1 it will be noted that the shaft 39' is hollow and is secured to the base 38 of the cylinder 41 so that, upon rotation of the shaft, the cylinder is also rotated. A retaining member 109 in the form of a wire having resilient properties is placed within the cylinder in the form of a helix. One end of the helical wire is attached by means of a screw 111 to the base of the cylinder, and the other end is attached by means of a screw 112 to the protecting cap 108. In this case the cap 108 is secured to a shaft 113 which is mounted inside the hollow shaft 39' and is free to rotate therein. The lower end of the shaft 113 extends beyond the end of the hollow shaft 39' and has secured thereto a peripherally grooved collar 114. Mounted within the groove of the collar is a circularly formed member 115, one end of which is bent outwardly to form stop arm 116. The circular member 115 is not rigidly secured to the collar 114, but it is arranged so that there is considerable friction between these members.

A contact structure 117 is pivoted at 118 on a bracket 119 which is mounted on the underside of the lower plate 28. The contact structure is normally urged by a spring 121 toward the position shown in Fig. 1. In this position one of the contact springs 122 is in position to intercept the stop arm 116 mounted on the shaft 113. The contact structure 117, however, is adapted to be pivoted counterclockwise as viewed in Fig. 1 so that the contact spring 122 takes the position shown in broken lines and allows the stop arm 116 to rotate unimpeded. A rod 123 extends from the contact structure 117 to a point adjacent the underside of the upper plate 27. When the handle attached to the cover is depressed to move the arm 23 downward, instead of this member closing a contact directly as in the other form of the invention, it actuates the rod 123 to pivot the contact structure 117 and thereby release the stop arm 116.

When the contact spring 122 is in the dotted position, it is no longer acted upon by the stop arm 116, and the contacts 93' (Fig. 2) are permitted to close. As described hereinafter, the closure of these contacts results in the operation of the motor 46 to rotate the cylinder 41 and to drive the scanning apparatus. As soon as the stop arm 116 is freed from the restraint of the contact spring 122, the resiliency of the wire 109 is such that the shaft 113 is rapidly rotated within the shaft 39' until the wire takes the form shown in the drawing, in which position the sheet is held in contact with the inside of the transparent cylinder 41. Upon completion of the scanning operation, the handle rod 23 is released, thereby allowing the contact structure 117 to be moved to the position shown. The stop arm 116 is then intercepted by the contact spring 122 and thereby stops the shaft 113; but since the shaft 33' is still rotating while the upper end of the wire 109 is held stationary, the lower end continues to revolve about the shaft 113. The wire 109, therefore, is wound upon the cylinder shaft and consequently is withdrawn from

its sheet holding position. The friction between the circular member 115 and the collar 114 is sufficient to permit this operation to be performed. Also, the spring 122 is of sufficient stiffness to maintain the contacts 93' closed. However, as soon as the wire 109 is tightly wound upon the cylinder shaft, there is in effect a non-yielding driving connection between the shaft 39' and the shaft 113, and the latter is rotated sufficiently to open the contacts 93'. Further movement of the stop arm 116 is prevented by the engagement of the contact spring 122 with a back stop 125. The opening of the contacts results in the disconnection of power from the motor 46, but since there is a slight overrun thereof, the shaft 113 does not stop immediately. However, because of the yielding frictional connection between the collar 114 and the circular member 115, the stop arm 116 is not moved any further.

Each subject matter bearing sheet 25 carries a mark such as 126 located definitely with respect to the frame of the subject matter carried by the sheet. In the form chosen for illustration this mark appears over the upper right hand corner of the subject matter frame. In accordance with principles which are well known in the art, the scanning at the transmitting station of the spot 126 generates a synchronizing signal which is utilized at the receiving station to initiate scanning by the recording apparatus. This insures that the recording of the subject matter will be within a predetermined frame.

Having reference now to Fig. 4, the operation of the apparatus will be described in connection with typical control circuits therefor. The apparatus may be connected to a circuit which is individual thereto or it may be connected to a circuit which is also utilized by other similar apparatus on a party line basis. Lines L1 and L2 are connected to the apparatus of transmitting stations A and B and also to a receiving station C. At the transmitting station B, the photoelectric tube 57 is connected through an amplifier 129 and direct current blocking condensers 131 to line conductors L1 and L2. The windings of two three-position polar relays 132 and 133 are connected respectively to line conductors L1 and L2. The windings of relays 132 and 133 are connected in shunt respectively with filter condensers 134 and 135, the purpose of which is to divert the alternating current facsimile signals from the relay windings which are responsive to direct current signaling potentials. Similar apparatus at station A is connected in a like manner to the line conductors.

At the receiving station C the line conductors L1 and L2 are connected permanently to the sleeve and tip respectively of a line jack 136. Also, the line conductor L1 is permanently connected through a direct current blocking condenser 137 to one input terminal of a line amplifier 138. Line conductor L2 is connected through a normal jack contact 139 and a direct current blocking condenser 141 to the other input terminal of the line amplifier. The output terminals of the line amplifier are connected to control a signaling relay 142. When a plug is inserted in the jack 136, the line conductor L2 is disconnected at the normal jack contact 139 from the line amplifier 138. At the same time line conductors L1 and L2 are connected by off-normal jack contacts 143 and 144, respectively, to the arms 145 and 146, respectively, of a manually operable rotary switch 147. The contacts associated with these switch arms are connected

in a predetermined manner to positive and negative grounded batteries 148 and 149, respectively. This portion of the receiving station apparatus is substantially similar to that disclosed in detail in Patent No. 2,262,715, granted to Raleigh J. Wise et al. on November 11, 1941, to which reference may be had for a complete disclosure of the apparatus illustrated diagrammatically herein.

A recorder 150, which may be of the type disclosed in Patent No. 2,255,868, granted to Raleigh J. Wise et al. on September 16, 1941, is connected to a plug 151, by means of which and the jack 136 the recorder may be connected to the line conductors L1 and L2.

In describing the operation of the apparatus, it is assumed that the circuit is idle, the transmitting apparatus of station B is not in operation, the jack 136 at the receiving station C is in its normal condition, and the rotary switch 147 is in the position illustrated. The operator at station B, desiring to transmit a message, moves the cover 21 to provide access to the interior of the hollow transparent cylinder 41 and inserts the subject matter bearing sheet 25 in the cylinder in the manner described. The cover is then moved to close the cylinder opening, and the handle 22 is depressed to cause the rods 23 and 123 effect the closure of the contacts indicated generally at 93 in Fig. 4 and specifically at 93' in Fig. 2. Relay 152 is thus operated by means of a circuit which may be traced from the A terminal of a source of alternating current potential 153 over conductor 154, the winding of the relay, contacts 93 and conductors 155 and 156 to the B terminal of the alternating current source. The closure of the inner right hand make contact of relay 152 completes a circuit from the A terminal of the alternating current source 153 over conductors 154, 157 and 158 to the light chopper motor 159, the scanning lamp 52 and the driving motor 46. The other terminals of these devices are connected by conductors 161, 162 and 156 to the B terminal of the alternating current source 153. Thus, the cylinder 41 is rotated, causing the arms 105 to press the sheet 25 against the inside of the cylinder wall, and the signal generating apparatus is put into operation, whereby an alternating current carrier signal is transmitted to the line conductors L1 and L2.

These alternating current signals are received at the receiving station C by the line amplifier 138 and effect the operation of relay 142. The closure of the inner make contact of this relay lights a lamp 163 by an obvious circuit from the positive battery 148. The closure of the outer make contact of this relay connects the positive battery 148 to the line conductor L1.

At station B the armature of relay 132, in response to the positive potential connected to line conductor L1, is moved to its marking contact M. A circuit is thus completed from the A terminal of the alternating current source 153 over conductors 164 and 165, the left hand make contact of relay 152, conductor 166, the winding of the electromagnet 95 and conductors 155 and 156 to the B terminal of the alternating current source. The energization of electromagnet 95 moves the forked member 94 into position over the collar 92 of the handle rod 23, thereby making it unnecessary to hold the handle down manually any longer. Also, the closure of the marking contact of the line relay 132 completes a circuit from the A terminal of the alternating current source over conductor 167, the winding of

relay 168, the inner break contact of relay 169 and conductors 171 and 156 to the B terminal of the alternating current source. When relay 168 operates, a locking circuit therefor is completed from the A terminal of the alternating current source over conductors 164 and 172, the make contact of relay 168, conductor 173, the left hand make contact of relay 152, conductor 167, the winding of relay 168, the inner break contact of relay 169, and conductors 171 and 156 to the B terminal of the alternating current source. The closure of the make contact of relay 158 also connects the A terminal of the alternating current source to one terminal of the electromagnet 95. It is seen that, by reason of this locking arrangement, relay 168 is maintained operated and electromagnet 95 is maintained energized independently of the contacts of the line relay 132. Also, as long as the electromagnet 95 is energized with the rod 23 in its depressed position, the contacts 93 are closed to maintain the operation of relay 152.

The lighting of the lamp 163 following the receipt of the alternating current signal indicates to an attendant at the receiving station C that one of the transmitting stations connected to line conductors L1 and L2 desires a connection to a recorder. The plug 151 is inserted in the jack 136 to connect the recorder 150 to the line conductors. At the same time the line conductor L2 is disconnected from the line amplifier to release relay 142 and thereby extinguish the lamp 163 and remove the connection of the positive battery 148 from line conductor L1 by way of the contacts of relay 142. With the rotary switch 147 in the position shown, however, the positive battery is connected by contact 174 and switch arm 145 to line conductor L1 by way of the off-normal jack contact 143.

The apparatus is now in condition to reproduce the message which station B desires to send. The operator at the receiving station C moves the rotary switch 147 so that the arms 145 and 146 are connected respectively to contacts 175 and 176. Positive potential is maintained connected to line conductor L1, and also a similar potential is applied to line conductor L2 by the engagement of which arm 146 with contact 176 by way of the off-normal jack contact 144.

In response to the positive potential on line conductor L2 the armature of line relay 133 is moved into engagement with its marking contact M'. A circuit is completed and may be traced from the A terminal of the alternating current source 153 over conductor 154, the inner make contact of relay 152, conductors 157 and 177, the marking contact of relay 133, conductor 178, the winding of the half-nut magnet 73 and conductors 161, 162 and 156 to the B terminal of the alternating current source. The half-nut 66 is thus moved into engagement with the feed screw 67 to initiate the downward vertical scanning movement of the carriage 47. The closure of the marking contact M' of line relay 133 also completes a circuit over conductor 179, the "message being transmitted" lamp 19, conductors 181, 182, 183, 162 and 156 to the B terminal of the alternating current source. The operator at the transmitting station B is thus given an indication that the message is being transmitted to the receiving station C.

The scanning by the transmitting apparatus of the mark 126 generates a synchronizing signal which, when received by the recording apparatus at station C, initiates scanning by the recorder in a well known manner. Every mark appearing

on the sheet 25 in register with the frame of the subject matter which is scanned subsequently is recorded at the receiving station.

At the completion of the transmission of the message, the operator at the receiving station C moves the rotary switch arms 145 and 146 into engagement with contacts 184 and 185, respectively. The positive potential of battery 148 is maintained connected to line conductor L1, and all direct current potentials are disconnected from the line conductor L2.

The disconnection of positive potential from line conductor L2 moves the armature of line relay 133 at the transmitting station B to its mid-position, thereby deenergizing the half-nut magnet 73 to permit the carriage 47 to be restored to its upper position and to extinguish the "message being transmitted" lamp 19.

The attendant at the receiving station C, after inspecting the received copy and finding it unsatisfactory, may make another recording with a different power adjustment by moving the switch arms 145 and 146 again into engagement with contacts 175 and 176, respectively. However, if the received copy is satisfactory, the switch arms 145 and 146 are moved into engagement with contacts 186 and 187, respectively. No potential is connected to line conductor L2, and the positive potential of the battery 148 is disconnected from line conductor L1 and the negative potential of battery 149 is connected thereto.

At the transmitting station B the armature of line relay 132 is moved into engagement with its spacing contact S in response to the negative potential connected to line conductor L1. A circuit is completed from the A terminal of the alternating current source 153 over conductor 164, the spacing contact of relay 132, the winding of relay 169, the outer right hand make contact of relay 152 and conductors 171 and 156 to the B terminal of the alternating current source. Relay 169 is operated and completes a circuit from the A terminal of the alternating current source over conductor 154, the inner right hand make contact of relay 152, the outer make contact of relay 169, the winding of relay 188 and conductors 183, 162 and 156 to the B terminal of the alternating current source. The operation of relay 169 also connects the A terminal of the alternating current source over conductor 189 to one terminal of the "message received" lamp 20, the other terminal of which is connected by conductors 182, 183, 162 and 156 to the B terminal of the alternating current source. As soon as relay 188 is operated, it is locked through its make contact, contacts 99 and conductors 172 and 164 to the A terminal of the alternating current source so that it is maintained operated independently of the contacts of relay 169. Also, the make contact of relay 188 closes a similar circuit to the lamp 20.

The operation of relay 169 also opens at its inner break contact the locking circuit for relay 168 which releases to open its make contact and to thereby deenergize the electromagnet 95. The latter apparatus is somewhat more sluggish in operating and releasing than any of the other relays and, consequently, introduces a time lag into the release of the transmitting station apparatus. As soon as the forked member 94 is permitted to release the handle rod 23, the contacts 93 are opened to release relay 152. The release of this relay opens, at its right hand make contact, the operating circuit for relay 169 and thereby effects the release of the latter relay. Also the release of relay 152 deenergizes the fac-

simile transmitting apparatus by the opening of its right hand make contact.

The apparatus at the transmitting Station B is restored to normal, with the exception of relay 188 and the "message received" lamp 20. Upon noting the illumination of the lamp 20, the operator at this station may open the cover 21 to withdraw the message bearing sheet 25 and, if desired, replace it with a similar sheet for subsequent transmission. Upon opening the cover 21, the contacts 99 controlled by the cam surface 96 are opened to release relay 188 and to extinguish the lamp 20. The apparatus is then completely restored to its normal idle condition.

When apparatus in accordance with the instant invention is connected to a circuit along with other similar apparatus for operation on a party line basis, facilities are provided for preventing all stations except the one in operation from conditioning their transmitting apparatus for operation and also for providing such stations with an indication that the circuit is being used by another station. A description of these facilities will be given on the assumption that the transmitting apparatus 191 at station A is using the line conductors L1 and L2 for communicating with the receiving station C. As soon as positive potential is applied to line conductor L1 by the operation of relay 142 at the receiving station C in response to the reception of a carrier current from the apparatus at station A, line relay 132 at station B and corresponding relays at all other transmitting stations which may be connected to the circuit are actuated to move their armatures to the marking contacts M. A circuit is thus established from the A terminal of the alternating current source 153 over conductor 164, the marking contact of relay 132, conductor 167, the winding of relay 168, the inner break contact of relay 169 and conductors 171 and 156 to the B terminal of the alternating current source. Relay 168 is operated to close its marking contact and connect the A terminal of the alternating current source over conductor 166 to energize the electromagnet 95. Forked member 94 is thus moved into a position to intercept the collar 92 of the handle rod 23 in case the handle 22 is depressed in an attempt to start the transmitting apparatus at this station. Contacts 93 are prevented from being closed so that, as long as this condition exists, it is not possible to operate relay 152, which operation is necessary to start the transmitting apparatus. Also, the closure of the make contact of relay 168 connects the A terminal of the alternating current source 153 over conductor 173 and the left hand break contact of relay 152 to one terminal of the "busy line" lamp 18. Since the other terminal of this lamp is connected by conductors 181, 182, 183, 162 and 156 to the B terminal of the alternating current source, the lamp is lighted to give the operator at station B an indication that the line circuit is in use at another point.

This lock-out condition exists for the duration of the operative engagement of the circuit by the transmitting apparatus 191 of station A by mean of the connection of the switch arm 145 at station C with its contacts 174, 175 and 184. Just prior to the release of the circuit, this switch arm is moved into engagement with its contact 186 to connect negative direct current potential to the line conductor L1, thereby opening the marking contact of relay 132 to deenergize relay 168 and the electromagnet 95. The apparatus at station B is thus no longer prevented from being oper-

ated, and the "busy line" lamp 18 is extinguished as an indication to the operator at that station that the circuit is now available for use by him, if desired.

As hereinbefore stated, the operation of the handle rod 23 effects the closure of contacts 93' to start the apparatus and the helical spring member 109 is actuated to its sheet securing position immediately upon the depression of the handle rod 23 before the motor 46 can come up to speed. Similarly, at the end of a scanning operation the sheet securing helical spring is withdrawn from its contact with the sheet before the driving motor for the cylinder is disconnected from its source of power.

The nature of the invention may be ascertained from the foregoing description of the illustrative embodiment thereof, it being understood that changes in the invention herein disclosed may be made within the scope of the appended claims without departing from the spirit of the invention.

We claim as our invention:

1. In facsimile apparatus, a rotatable hollow transparent cylinder to support interiorly thereof a sheet for scanning purposes, a helically formed spring disposed within said cylinder substantially coaxially therewith, said spring being biased to expand normal to the axis of said cylinder whereby to press a sheet against the inside of said cylinder wall, and means controlled by the rotation of said cylinder to contract said spring whereby to release said sheet.

2. In facsimile apparatus, a rotatable hollow transparent cylinder to support interiorly thereof a sheet for scanning purposes, a helically formed spring having a fixed length disposed within said cylinder substantially coaxially therewith, said spring being biased to unwind partially whereby to press a sheet against the inside of said cylinder wall, and means controlled by the rotation of said cylinder to wind up said spring whereby to release said sheet.

3. In facsimile apparatus, a rotatable hollow cylinder to support interiorly thereof a sheet for scanning purposes, a shaft disposed coaxially within said cylinder, said shaft and said cylinder being arranged for relative rotation, a resilient helical member having one end fixed relative to said cylinder and the other end fixed relative to said shaft, said helical member being biased to assume a partially unwound condition during equal rotation of said shaft and said cylinder whereby to press a sheet against the inside of said cylinder wall, and means for effecting a relative rotation between said shaft and said cylinder to wind up said helical member whereby to release said sheet.

4. In facsimile apparatus, a rotatable hollow

transparent cylinder to support interiorly thereof a sheet for scanning purposes, a hollow shaft disposed coaxially with said cylinder and connected to rotate the same, a second shaft disposed for relative rotation within said hollow shaft and extending substantially the length of said cylinder, a helically formed spring having one end fixed relative to said hollow shaft and the other end fixed relative to said second shaft, said spring being biased to unwind partially whereby to press a sheet against the inside of said cylinder wall, and means for stopping said second shaft during rotation of said hollow shaft to wind up said spring whereby to release said sheet.

5. The invention defined in claim 4, further characterized by means associated with said second shaft stopping means and responsive to the wound up condition of said spring to control the stopping of said hollow shaft.

6. The invention defined in claim 4, further characterized by means including a contact associated with said second shaft stopping means and responsive to the wound up condition of said spring to control the stopping of said hollow shaft, and means operable prior to a scanning operation to release said shaft stopping means whereby to allow said spring to unwind and whereby to actuate said contact to initiate rotation of said hollow shaft.

7. In a facsimile machine, a hollow cylinder having the curved portion thereof pervious to light, said cylinder serving to support interiorly thereof a sheet, expansible means mounted within said cylinder and normally disposed out of contact with the inner surface thereof when said cylinder is at rest to permit the insertion of a sheet in said cylinder, means for rotating said cylinder for scanning purposes, and a member engaging said expansible means and movable relative to said cylinder for effecting movement of said expansible means toward said cylinder to press said sheet against the inside of the curved portion of said cylinder.

RALEIGH J. WISE.

ROBERT D. PARROTT.

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