

April 10, 1934.

R. F. DIRKES ET AL

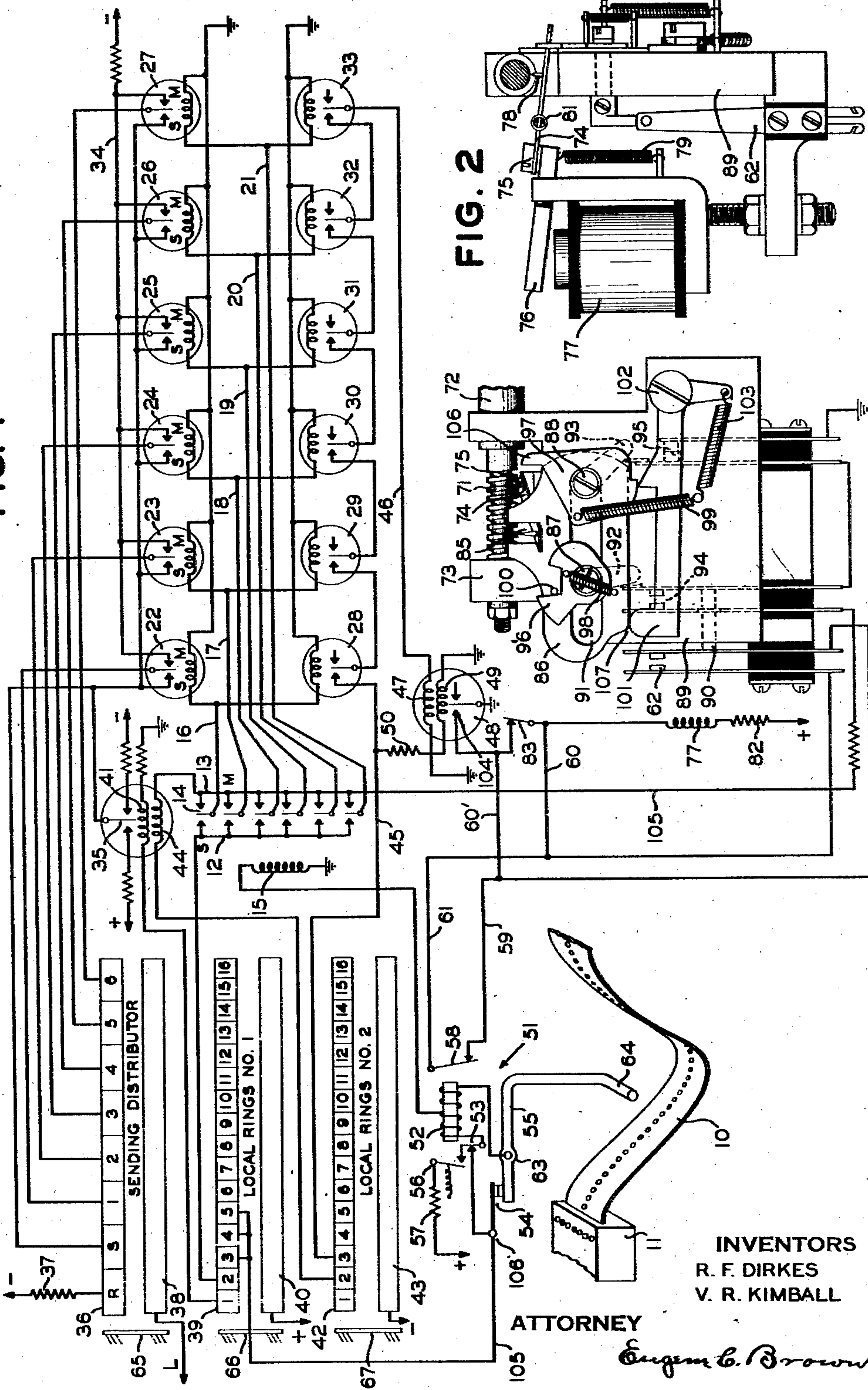
1,954,621

TELEGRAPH TRANSMITTING SYSTEM

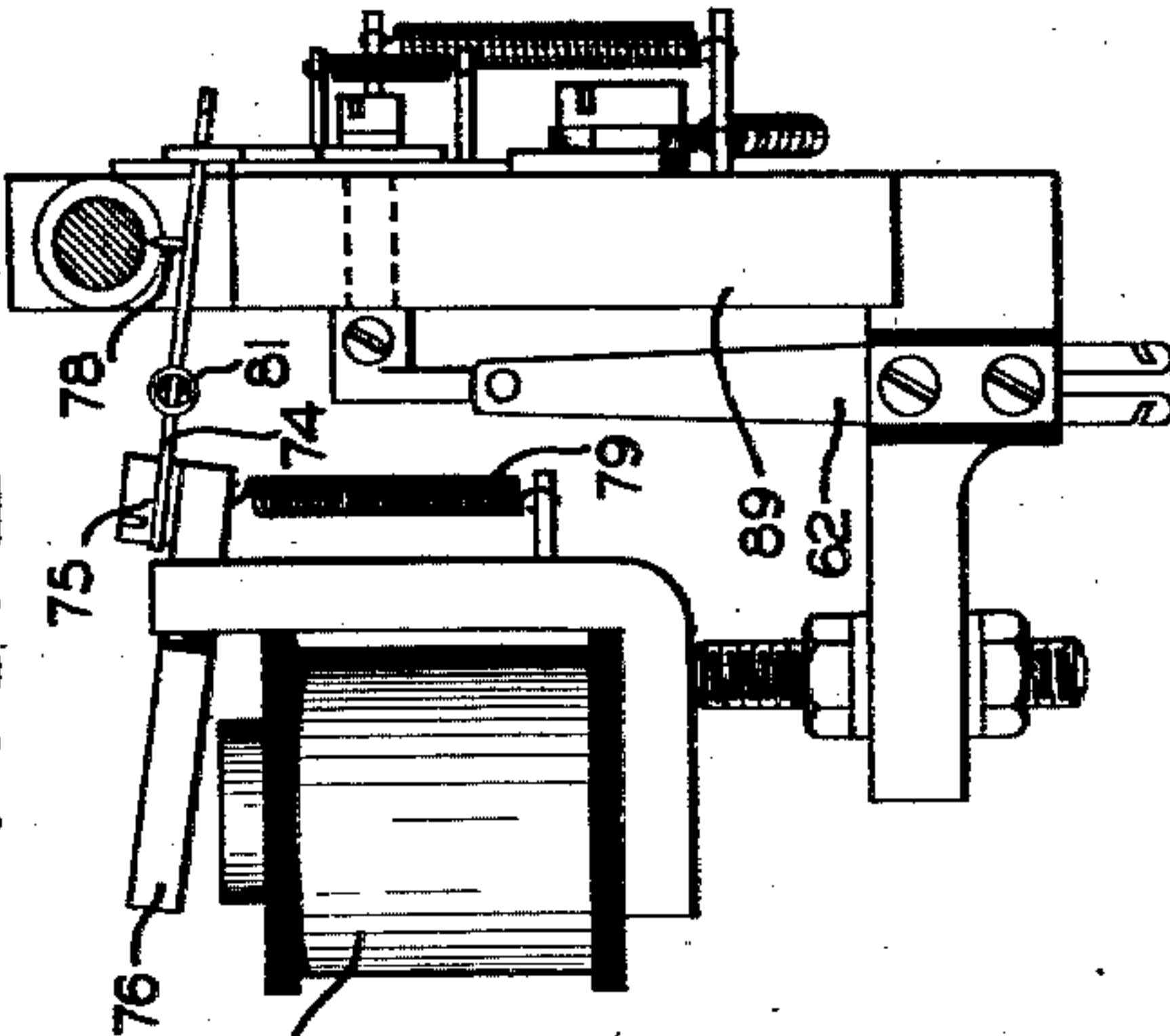
Filed July 7, 1931

2 Sheets-Sheet 1

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NO



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April 10, 1934.

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1,954,621

TELEGRAPH TRANSMITTING SYSTEM

Filed July 7, 1931

2 Sheets-Sheet 2

FIG. 3

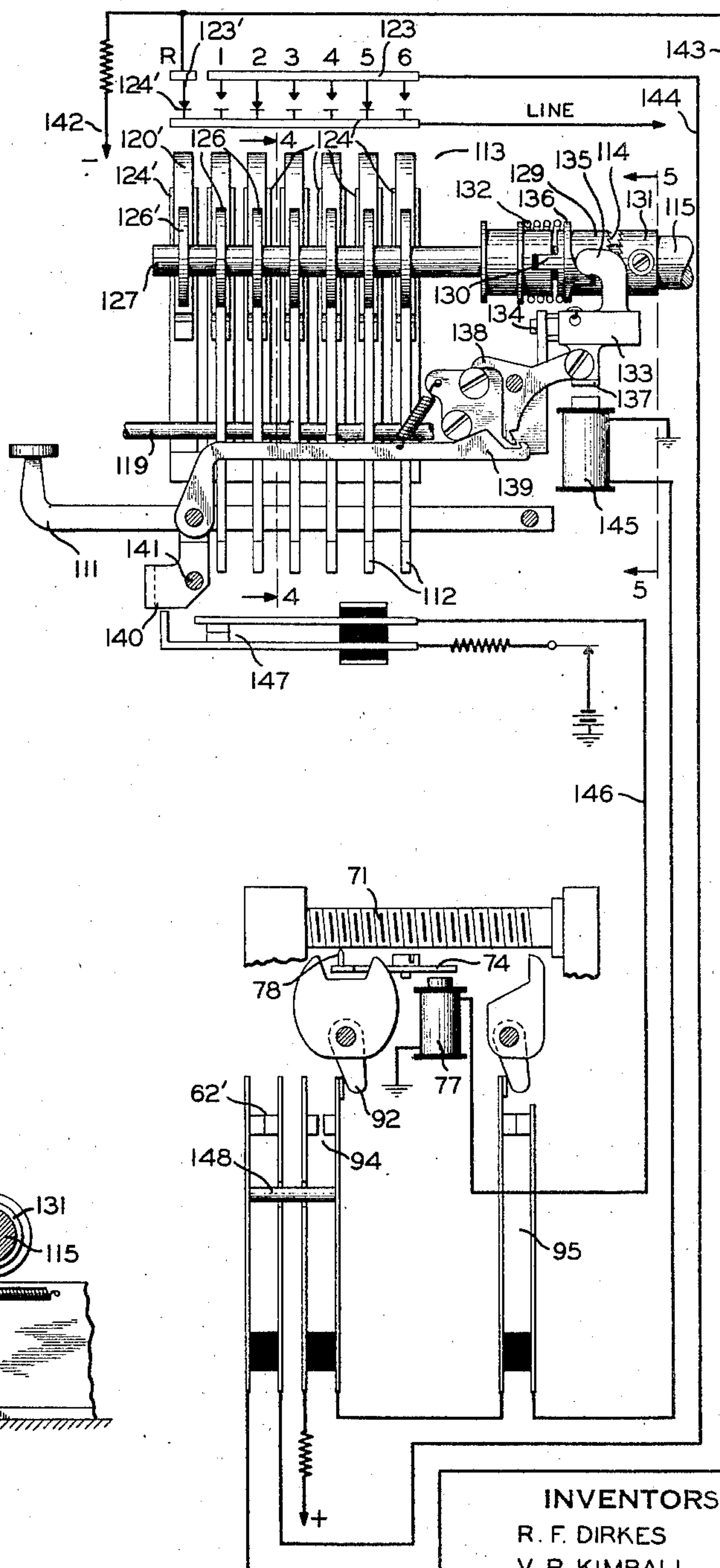


FIG. 4

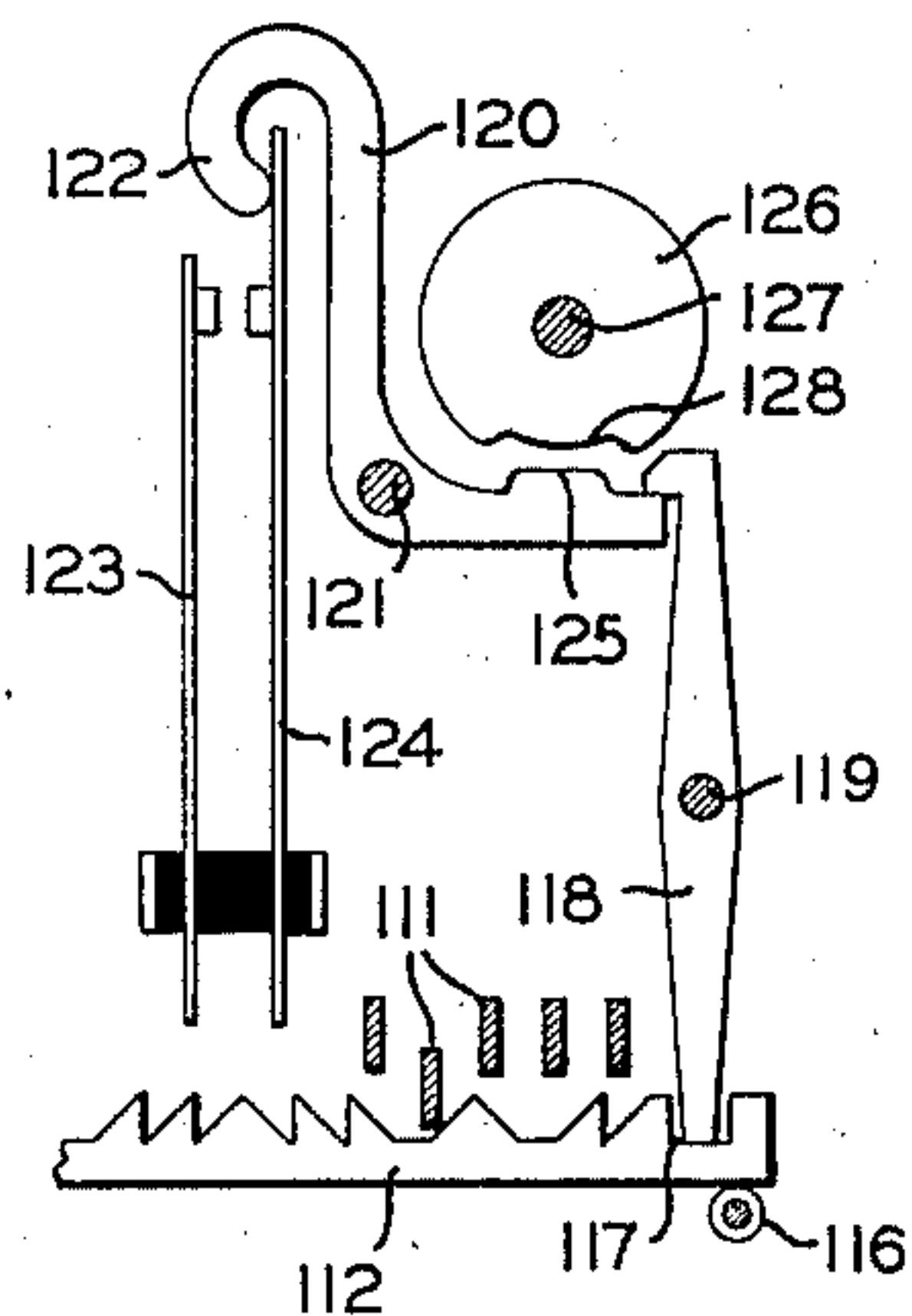
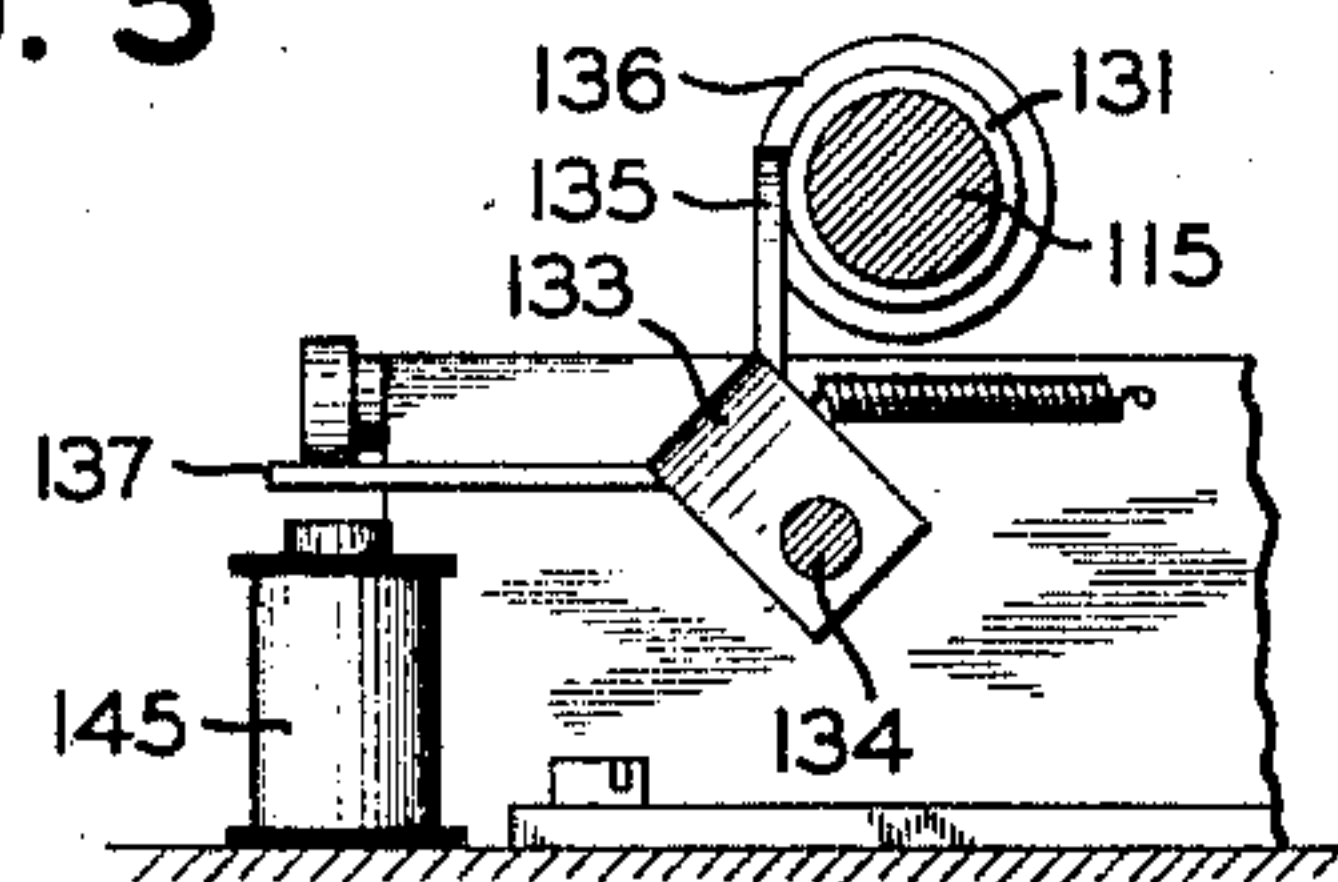


FIG. 5



UNITED STATES PATENT OFFICE

1,954,621

TELEGRAPH TRANSMITTING SYSTEM

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Application July 7, 1931, Serial No. 549,294

20 Claims. (Cl. 178—3)

This invention relates to a telegraph transmitter and more particularly to a transmitter for a telegraph system employing a receiving tape perforator or other type of storage transmitter at the distant end of the line.

At the home station either a tape or metallic storage transmitter or a keyboard transmitter may be used. As is well known, when employing tape or metal storage transmitters, the signals are set up in the storage element, either as perforations in the tape or by positioning groups of pins or equivalent elements in a metallic storage transmitter, by means of a manual keyboard. The storage device allows for variations in the relative rate at which the keyboard is operated and the signals transmitted and as a consequence there is always an appreciable number of signals stored between the tape perforator and transmitter or between the setting up and transmitting positions of the storage transmitter. Mechanism, usually termed an auto-control, serves to stop the transmitting mechanism when the number of stored signals decreases to a pre-determined minimum.

At the distant station, the transmitted signals may be received directly on a telegraph printer or they may be used to perforate a second tape or actuate a storage transmitter by which they are re-transmitted over one or more additional lines. A single perforated tape or a key board transmitter at the home station may be used for producing a number of tapes each of which is employed for re-transmitting the signals over one or more lines in the same or different types of telegraph systems. For instance, a single operator may produce a tape from which signals are transmitted to a number of receiving perforators located in the same or distant offices and the record produced by one of said tapes re-transmitted over a start-stop system, by automatically filling in the start and rest impulses, another tape operating one channel of a multiplex system and the third tape possibly operating a translating device for sending equivalent character signals over a ticker or step-by-step system. In each of these systems, however, there is always a minimum length of tape between the receiving perforator and the re-transmitter containing a considerable number of signal perforations and if for any reason the home station discontinues transmission for a short period, which occurs at frequent intervals, a portion of the message previously transmitted will be held up in the tape between the idle receiving perforator and its transmitter. Consequently, there is a total

lag in the re-transmission equal to the number of characters between the keyboard perforator and its transmitter and between the receiving perforator and its transmitter.

Normally, if the operator discontinues the production of perforator tape, the transmission of the signals held up in tape between the keyboard perforator and its transmitter and between the receiving perforator and its transmitter, will be delayed until the operation of the keyboard perforator is again resumed. A portion of this lag may be eliminated when manual transmission is employed or where a tape transmitter is used at the home station, if the operator, upon ceasing to perforate intelligence signals in the tape, steps out sufficient blank tape to bring the last group of intelligence perforations into the tape transmitter. Even in this case there will still be a number of intelligence signals tied up between the receiving perforator and its transmitter.

It is, therefore, one of the objects of the present invention to overcome this difficulty by causing the continued operation of the receiving perforator after the last intelligence signal has been transmitted to it, so that all of the intelligence perforations produced by the receiving perforator will be advanced automatically into transmitting position.

A further object is to control this continued operation of the receiving perforator from the distant transmitter.

More specifically, an object of the invention is to provide a transmitting system which, upon the interruption of the transmission of intelligence signals will automatically transmit a pre-determined number of tape stepping or feeding signals to the receiving perforator.

Short interruptions in the signals corresponding only to a few characters often occur which do not seriously delay the re-transmission and during such periods there is no necessity for automatically advancing the tape. Such idle periods are some times an advantage since they enable the transmitter to use up any slack tape which may have accumulated between the transmitter and the receiving perforator.

Therefore it is another object of the invention to provide a system in which the transmission of the tape stepping signals will not occur upon short interruptions in the transmission of intelligence signals.

In certain telegraph systems employing step-by-step tickers, the transmission of a large number of tape stepping or feeding signals may cause the receiving apparatus to get out of step with

the transmitter and in such cases it is desirable or even necessary to follow the feed signals with a unison signal for restoring the apparatus into unison. Where the receiving perforator operates into such a system, it is undesirable to have the automatic transmission of feed signals each time the home transmitter is stopped by its auto control, which as stated before, occurs at frequent intervals due to the operation of the keyboard perforator at a slower rate than the normal rate of transmission. It is still desirable, however, in such ticker systems to step the tape through the perforator upon an appreciable interruption in the transmission and therefore it is a further object of the invention to enable the transmission of feed signals to be controlled at the will of the transmitting operator, since in such instances the operator may transmit the unison signal preceding the resumption of the signal transmission.

Other objects and advantages of the invention will hereinafter appear.

In accordance with one preferred embodiment of our invention, we employ a keyboard perforator feeding into a tape transmitter which serves to operate a bank of transmitting relays for setting up the signals on the segments of a continuously rotating distributor. The distributor fills in the rest and start signals and transmits the intelligence signals over the line to a start-stop receiving perforator.

In the ordinary operation of start-stop receiving perforators, upon the receipt of the start or spacing signal, the operating shaft of the machine is released for a single revolution during which the punch pins are selected in accordance with the received impulses and near the end of the revolution the punch hammer is brought into engagement with the punch pins to perforate the tape and feed it forward one step through the punch block. In this manner, as each succeeding group of code impulses is received, the tape is perforated and advanced through the machine towards the tape transmitter, ordinarily located as near as possible to the perforator. As stated, however, there is always a minimum length of tape both between the receiving perforator and its transmitter.

An auto-control mechanism is provided for the tape between the keyboard perforator and tape transmitter which serves when the tape becomes fault, as by operating the keyboard perforator at a slower rate than the tape transmitter or by interrupting its operation, to stop the tape transmitter and to lock up the tongues thereof on their spacing contacts. However, with the tongues so positioned, marking battery is applied by the transmitting relays to all of the segments of the rotary transmitter and as a consequence the start mechanism of the receiving perforator does not operate and the last few characters perforated are locked up between the re-perforator and its tape transmitter.

A second group of relays, also actuated by the tape transmitter, serve at this time, that is, when all of the tongues of the transmitter are on their spacing contacts, to start a control timing mechanism into operation which serves, after a predetermined short interval, to place spacing battery on the start segment and the intelligence segments of the rotary distributor so that as its brushes continue to revolve, a start or spacing signal is transmitted once per revolution. This signal releases the start mechanism of the receiving re-perforator and allows it to complete

one cycle of operation. Since the intelligence signals are also all of spacing character, none of the punch pins will be selected and only feed holes will be perforated. The tape feeding mechanism of the re-perforator operates during each of these cycles to advance the tape towards the transmitter. The operation continues until sufficient tape has been advanced to bring the last intelligence signal into the transmitter. Thereafter the timing control mechanism at the home station completes its operation and restores marking battery to all of the segments of the rotary distributor thereby causing the operation of the receiving perforator to cease.

As soon as additional tape is supplied by the keyboard perforator, the auto-control releases the tape transmitter and the transmission of intelligence signals is resumed.

In order that the invention may be more fully understood reference will be had to the accompanying drawings in which:

Figure 1 is a circuit diagram of the apparatus employed in a preferred embodiment of the invention, including a front elevation of a switch timing mechanism utilized in carrying out the invention;

Figure 2 is a side elevation of the switch timing mechanism.

Figure 3 is a schematic showing of the invention applied to a keyboard transmitter;

Figure 4 is a detail of one of the transmitting contacts of the keyboard transmitter; and

Figure 5 is a section on the line 5-5 of Figure 3.

Referring first to Figure 1, the transmitting mechanism is shown controlled by a perforated tape 10 which passes from the punch block 11 of a keyboard perforator (not shown) to a tape transmitter diagrammatically indicated by a spacing bus bar 12, a marking bus bar 13, and co-operating contact tongues 14. The tongues of the transmitter are operable into engagement with the bus bars 12 and 13 in various combinations in accordance with the perforations of the tape in a manner well known to those versed in the art. A stepping magnet 15 is provided for advancing the tape following the transmission of each code combination of signal impulses. The tape transmitter may be of the type shown in patent to Benjamin, No. 1,298,440.

The tongues 14 of the transmitter are connected over individual conductors 16 to 21, inclusive, to the windings of a set of polarized transmitting relays 22 to 27, inclusive, and in parallel to the windings of a group of polarized control relays 28 to 33, inclusive. The opposite terminal of the windings of each of the relays is grounded. The marking contacts of each of the transmitting relays 22 to 27 is connected to negative battery by a conductor 34 and the spacing contacts are connected through the tongue of a polarized relay 35 selectively to either positive or negative battery, applied to the contacts of this latter relay. The tongues of the relays 22 to 27 are respectively connected to the segments 1 to 6 of the segmented ring 36 of the sending distributor. The start segment S of ring 36 is also joined to the tongue of relay 35 and the rest segment R is connected to negative battery through a resistance 37. The solid ring 38 of the sending distributor is joined directly to the line L.

The sending distributor is provided with two additional rings designated local rings No. 1 and local rings No. 2. Local rings No. 1 comprise a segmented ring 39 having segments numbered

1 to 16 and a solid ring 40 connected to positive battery. Segment 1 of ring 39 is connected to one terminal of a winding 41 of the cut-off relay 35, the opposite terminal of which is grounded, and segment 2 is connected to the spacing bus bar 12 of the tape transmitter.

Local rings No. 2 comprise a segmented ring 42 having segments numbered 1 to 16 and a solid ring 43 connected to negative battery. Segment 2 of the ring 42 is connected to one terminal of a winding 44 of the cut-off relay, the opposite terminal of which is connected to the marking bus bar 13. Segment 3 of ring 42 is connected by conductor 45 to the spacing or left hand contact of control relay 28, and the tongue of each of the relays 28 to 32 is connected to the spacing contact of the succeeding relay. The tongue of the relay 33 is connected by a conductor 46 through the winding 47 of a polarized relay 48, to ground. The relay 48 is provided with a second winding 49, one terminal of which is connected to the conductor 45 through a resistance 50, the opposite terminal being grounded.

The tape stepping magnet 15 is energized from segments 3, 4 and 5 of ring 39 through an autostop mechanism indicated generally at 51 and comprising a differential relay 52 having its center tap joined to one terminal of the stepping magnet, the opposite terminal of which is grounded. The segments 3, 4 and 5 are normally connected through a flexible contact 53 to one end of the differential relay and through the autostop contacts 54 and pivoted stop arm 55 to the opposite terminal of the differential relay. The armature 56, of relay 53, is connected through a resistance 57 to a source of positive potential. The opposite armature 58 and its back contact are connected by conductors 61 and 59 respectively, to a pair of contacts 62, the purpose of which will appear hereinafter. The autostop arm 55 is pivoted at 63 and has an intumed end 64 which lies within a loop formed in the tape 10 and is adapted when the tape becomes taut to interrupt the tape transmitter, as will more fully appear hereinafter.

The sending distributor and local rings are traversed by brushes 65, 66 and 67 operating in unison.

In order to step the tape ahead in the receiving perforator located at the opposite end of the line L after the tape transmitter has been brought to rest, we provide a switch timing mechanism which serves to cause a predetermined number of tape feed signals to be transmitted over the line, sufficient to advance the last intelligence perforation, produced by the receiving perforator, into the tape transmitter at the distant station.

This switch timing mechanism comprises a worm 71 formed on a shaft 72 mounted in bearings 73 and operated by a continuously rotating motor (not shown). An arm 74 is disposed beneath the worm and is pivoted at one end 75 to the free end of the armature 76 of a magnet 77. A pin 78 in the end of the arm 74 is arranged to engage the convolutions of the worm so as to swing the lever through an arc as the worm revolves. When the magnet is deenergized, the pin is held out of engagement with the worm by a spring 79 and at such times the lever 74 is rocked to its initial or lefthand position by means of a spring 81. The magnet 77 has one terminal connected to positive battery through a resistance 82, the opposite terminal being connected through switch 83 to the lefthand contact of relay 48. It is adapted to be energized only when all spacing

signals are transmitted over the line and to be deenergized during normal operation when at least one of the signal impulses is marking. When the relay 48 is operated to energize the magnet 77, the arm 74 is moved along the worm towards the right.

The lever 74 extends through a slot 85 in a slide 86. The slide is mounted upon a pair of pins 87 and 88 extending through a plate 89 and journaled therein. The slide has an elongated slot 91 whereby it may be moved backward and forward with the lever 74.

On the opposite side of the plate 89 from the slide 86 the pins 87 and 88 are provided with downwardly extending lugs 92 and 93 respectively adapted to engage the contacts 94 and 95 respectively. The contacts 62 and 94 are operated together by the insulated pin 90. On the outside of the pins 87 and 88 beyond the slide 86, irregular shaped plates 96 and 97 are secured. The plate 96 is normally held in the position shown, by a toggle spring 98 in which position the contacts 62 and 94 are open. The plate 97 is also normally held in the position shown by a spring 99 in which position the contacts 95 are closed. A pin 100 projecting outwardly from the slide 86 normally extends through a notch in the upper side of the plate 96 and a latch bar 101 pivoted at 102 is urged upwardly against the slide by a spring 103.

The operation of the mechanism described is as follows. Assuming the tape to be perforated with intelligence signals and the same to be passing through the tape transmitter in the normal manner the contacts 14 of the tape transmitter will be shifted against the bus bars 12 and 13 in different combinations corresponding to the code signals. The brushes of the rotary distributor operate continuously and as the brush 65 passes on to the start segment S a spacing impulse is transmitted over the line L which starts the receiving perforator at the distant station into operation in substantial synchronism with the distributor brushes 65 to 67. When the brush 66 engages segment 1 on the ring 39, a positive impulse is supplied to the winding 41 of the cut-off relay 35, this circuit extending from positive battery over the solid ring 40, brush 66, segment 1 of ring 39, and winding 41 to ground. This impulse throws the tongue of the relay against its righthand or negative contact. As the brush 66 passes on to segment 2, positive battery is applied to the bus bar 12 and this battery will be extended over any of the conductors 16 to 21, the contacts 14 of which are resting on their spacing contact, thus energizing certain of the polarized relays of the group 22 to 27 and of the group 28 to 33. At the same time brush 67 engages segment 2 of ring 42 thereby applying negative battery through the winding 44 of the cut-off relay 35 to the marking bus bar 13. The tongue of relay 35 is thereupon returned to its spacing or lefthand contact and the negative battery applied to the marking bus bar 13 is extended, through the contacts of the tape transmitter which rest on the marking side, over the conductor 16 to 21 to the predetermined relays of groups 22 to 27 and 28 to 33. The tongues of the relays 22 to 33 are thus set up in accordance with the signal combination.

It will be noted at this time that the righthand or marking contacts of the relays 22 to 27 are connected to negative battery over conductors 34 and the lefthand or spacing contacts are connected to positive battery through the tongue of the relay 35. Consequently, positive battery is

applied to the start segment S and the signal code combination is set up on the segments 1 to 6 of ring 36 through tongues of the relays 22 to 27. Therefore, as the brush 65 sweeps over the sending distributor the start impulse and six code impulses are transmitted over the line.

If the code combination includes any marking impulses, at least one of the relays 28 to 33 will rest on its marking or righthand side and the circuit between conductors 45 and 46 will not be completed.

While the brush 65 is sweeping over the start and first segment of ring 36 the brush 66 engages segments 3, 4 and 5 of ring 39, establishing a circuit from positive battery over the solid ring 40, brush 66, and conductor 105, the current dividing at the point 106 and part flowing through the spring contact 53 and one-half of the differential winding 52 and part through the autostop contact 54 and the opposite half of the differential winding, and thence through the tape stepping magnet 15 to ground. The stepping magnet 15 is energized and removes the pins of the tape transmitter (not shown) from the perforations in the tape and prepares to step the tape ahead in a manner well known. When the brush 66 passes on to segment 6 the magnet 15 is deenergized and the tape is stepped to the next position, thus setting up a new code combination on the contacts of the tape transmitter. This has no effect, however, on the relays 22 to 33 due to the fact that the spacing and marking bus bars 12 and 13 are not connected to battery at this time.

As the brush 67 engaged segment 3 of ring 42, negative battery was applied to the conductor 45, but since in normal operation each code combination contains at least one marking impulse, this circuit was not completed through the contacts of the relays 28 to 33.

During normal transmission of intelligence signals if for any reason the signals are transmitted at a faster rate than that at which the tape perforator is operated, the loop of tape 10 becomes taut raising the lever 55 and opening the switch contact 54. This causes the circuit to the right half of the differential winding 52 to be interrupted, thus disturbing the balance of the relay and causing it to close its contact 56, at the same time opening the spring contact 53. Battery is then applied directly through the contact 56 and winding 52 to the tape stepping magnet 15, the relay 52 being locked up through its lefthand winding. With the stepping magnet 15 continuously energized, the transmitting pins of the tape transmitter will be held withdrawn and the contacts of the transmitter will rest continuously on the spacing or lefthand side against the bus bar 12. Consequently, the circuit for the winding 44 of relay 35 will be incomplete and the relay will be retained on its marking side so as to apply negative battery to the tongue of the relay by means of the circuit completed through winding 41. It will be noted, therefore, that negative battery is applied to both contacts of the relays 22 to 27 and therefore to all of the segments of the sending distributor. Consequently, as the distributor brush rotates marking battery is continuously applied to the line.

Since the contacts of the tape transmitter are held against the spacing bus bar 12 the relays 28 to 33 will be positioned on their left hand or spacing contacts and each time the brush 67 rotates across segment 3 of ring 42 a circuit will be completed from negative battery through the solid ring 43, brush 67, segment 3, conductor

45, spacing contacts and tongues of the relays 28 to 33 in series, and winding 47 of the relay 48, thus applying ground to the contact 104 of this latter relay and completing a circuit through the switch 83 to the winding of magnet 77 of the switch timing device.

Upon operation of the magnet 77 the arm 74 is raised to bring the pin 78 into engagement with the convolutions of the worm, thereby causing the arm to move along the worm. The arm 74 as it moves to the right carries the slide 86 with it. During the first part of this movement while the pin 100 is passing from the rear to the front wall of the slot in the plate 96, nothing occurs, this period being equivalent to the time of transmission of several characters and constituting the period during which the tape transmitter may remain idle without the transmission of tape stepping signals. As soon as the pin 100 engages the right wall of the slot the plate 96 is rocked closing the contact 94. A circuit is then completed for the winding 44 of relay 35 through the conductor 105, closed contacts 94 and normally closed contacts 95 to ground. Consequently the relay 35 is moved to its spacing contact each time the brush 67 passes over segment 2 of ring 42 so that it applies positive or spacing battery to the spacing contacts of the relays 22 to 27. Since these relays are on their spacing contacts at this time this spacing battery is continued to the segments of the ring 36 and during each revolution of the brush 65 a single marking impulse, followed by seven spacing impulses is transmitted. The spacing impulses release the receiving perforator to complete one cycle of operation to perforate the feed hole only and to advance the tape towards the transmitter. This operation continues until sufficient blank tape has been advanced by the receiving perforator to bring the last intelligence signal into transmitting position after which the arm 74 of the switch timing mechanism reaches its extreme right hand side, whereupon it engages the upward projection 106 of the plate 97, rocking the plate clockwise so as to open contacts 95. This interrupts the circuit through the winding 44 of relay 35 and the tongue of the relay is held on its marking side continuously. Marking battery is therefore again applied to all segments of the sending distributor whereby the operation of the receiving perforator ceases.

The plate 97 on rocking to open the contact 95 is engaged by the latch 101 and locked in its rocked position. When the perforator is again operated to supply additional tape to the loop 10 the auto-control arm 55 drops closing the contact 54, thus completing a circuit from segments 3, 4 and 5 of ring 39 to the right hand path of the differential winding 52, again balancing the relay and permitting the armature 56 to open. The stepping magnet 15 of the tape transmitter is then released to permit the tape to be advanced to bring the next portion of the tape into transmitting position. If this portion contains intelligence perforations at least one of the transmitting contacts will move to its marking side, thus operating one of the relays 28 to 33. This in turn operates the relay 48 and thereby interrupts the circuit of the magnet 77 of the switch timing device, causing the pin 78 to be pulled away from the worm so that it is returned to its left hand position by the spring 81, carrying the slide 86 therewith. The contacts 95 are held open during this movement, however, by the latch 101 until the pin 100 rocks the plate 96

to open contacts 94 after which the beveled end 107 of the slide engages the up-turned end of the latch bar 101 and trips the same, releasing the plate 97 and permitting the contacts 95 to close. The maintaining of the contacts 95 open until after the contacts 94 have opened is important from the standpoint of preventing movement of the tongue of the relay 35 to its marking side at the improper time.

As previously mentioned, if the keyboard operator is to discontinue the perforating of intelligence signals in the tape for any appreciable period, she may step out a sufficient length of blank tape to bring the last intelligence signals into the tape perforator. After the last intelligence signal has been transmitted and a blank portion of the tape stepped into the transmitter the contacts thereof will all be held on their spacing side by the blank tape thereby again causing the operation of relay 47 and the resulting cycle of operation of the switch timing device, whereby the tape stepping signals are transmitted over the line. In this manner every intelligence signal appearing either between the keyboard perforator and its transmitter and between the receiving perforator and its transmitter, will be retransmitted over the line.

In certain instances it is undesirable to transmit tape stepping signals unless followed by a unison signal. In such cases the tape stepping signals may be transmitted only at the will of the keyboard operator rather than through the control of the auto-stop mechanism. For this purpose, switch 83, contacts 62 and contacts 58 are provided. With the switch 83 open the switch timing mechanism is rendered operative only when blank tape is in position in the tape transmitter, which occurs only when the transmitting operator spaces out a definite length of blank tape succeeding the last intelligence signal. Assuming the tape transmitter to be stopped during normal transmission of intelligence signals by the operation of the auto control so as to operate the relays 48 and 52, it will be noted that the circuit for the magnet 77 of the switch timing mechanism, although closed at the contacts of relay 48, is at the same time open at the contacts 58. Consequently at this time the switch timing mechanism does not come into operation. However, if upon discontinuing the perforation of intelligence signals the operator steps blank tape ahead followed by a unison signal, as soon as the blank tape passes into the tape transmitter to move the contacts to their spacing side, the circuit for the magnet 77 is completed. This circuit extends from battery through the magnet 77, conductors 60 and 61, contacts 58 and conductors 59 and 60' to ground at the lefthand contact of relay 48. Consequently the switch timing mechanism starts into operation and after a short interval closes the contact 62, thereby completing the circuit for the magnet 77 independently of contacts 58, through the contacts 62. The switch timing mechanism therefore completes its cycle of operation even though the tape may again become taut so as to cause the operation of relay 52 and opening of the contacts 58. Since the blank tape is followed by perforation corresponding to a unison signal, the receiving printers at the ends of the lines will be restored to unison before another group of intelligence signals are transmitted.

It will be noted, therefore, that we have provided a transmitting system in which, upon the interruption of intelligence signals for a definite period, a group of tape stepping signals will be

automatically transmitted. These signals may occur after every interruption of the intelligence signals if switch 83 is closed or, only when the intelligence signals are followed by portions of blank tape, if switch 83 is open.

In Figures 3 and 4 we have shown the present invention applied to a keyboard transmitter of the general type shown in patent to Krum 1,595,472, granted August 10, 1926, only such features of the machine being illustrated as are essential for a proper understanding of the invention.

Briefly the keyboard transmitter includes a bank of key levers 111, a number of notched selector bars 112 adapted to be engaged by the key levers when depressed, a contact mechanism indicated generally at 113 for setting up the selected signal combination and a clutch 114 by which the contact mechanism is operated from a constantly rotating shaft 115 driven from a suitable motor, not shown.

The selector bars 112, six in number in the present case, extend across the width of the keyboard beneath the key levers and are provided with triangular notches according to the requirement of the signal code so that they will be moved sideways over rollers 116, either to the right or to the left, when the key lever strikes the slanting sides of the notches. At the righthand end of each selector bar is a slot 117 in which one end of a vertical locking latch 118 is set. The latch is pivoted at 119 so that when the corresponding selector bar is moved to the right, the upper end of the latch engages the horizontal arm of a contact lever 120, one of which is provided for each selector bar. The lever 120 is pivoted at 121 and the vertical arm thereof has a hooked end 122 engaging one of a pair of contacts 123 and 124. The contact levers, in combination with the locking latches control the transmitting contacts 123 and 124, which are normally held open by the contact lever against the tension of the spring contact 124.

The horizontal arm of each contact lever 120 has a hump 125 thereon, engaging the periphery of a cam 126 mounted upon a shaft 127. The cam has a depression 128, which, when opposite the hump 125, permits the lever to rock under the pressure of the spring contact 124 to close the contacts 123 and 124, provided they are not held open by the locking latch 118. There is an individual cam 126 for each contact lever, arranged so that the depressions 128 come opposite the humps 125 successively. By permitting certain of the contacts to close and others to remain open as the cams revolve, the desired intelligence signal is formed. In addition to the contacts and contact levers corresponding to the selector bars 112, there is an additional contact lever 120' and operating cam 126' for controlling the transmission of the start-stop impulses preceding and following the signal combination. This latter element is disposed at the left end of the group of contacts shown in Figure 3.

The cam shaft 127 is normally at rest and is permitted to make one complete revolution by means of the ratchet clutch 114, for each signal combination set up. The driven ratchet 129 of the clutch is keyed to the cam shaft by the key and slot 130, so as to be movable longitudinally into engagement with the driving ratchet 131 by a spring 132. The clutch faces are normally held out of engagement by a clutch stop arm 133 pivoted below the shaft at 134 and having a curved

end 135 extending into the path of a collar 136 of the driven ratchet 129. Stop arm 133 has a horizontal extension 137 which is engaged by a pivoted pawl 138 operated by a trip pawl 139 to which is connected a universal bar 140 extending beneath the key levers, so as to be engaged by each key lever as it is depressed. The universal bar 140 is pivoted at 141 and upon downward movement thereof it rocks the pawl 138 through the link 139 and thereby moves the stop arm 133 out of engagement with the driven ratchet of the clutch, permitting the clutch faces to engage and causing the cam shaft to make one complete revolution. At the end of the revolution the clutch stop arm forces the driven ratchet out of engagement with the driving ratchet, so that the cam shaft comes to rest. All of the foregoing mechanism is well known in the art.

With the mechanism so far described, if it is desired to send out a group of tape feed signals to the receiving perforator, it is necessary to depress the "blank" key lever each time the tape feed signal is to be transmitted.

In accordance with our invention, however, we provide automatic repeating mechanism for transmitting a predetermined number of blank or tape feed signals whenever the keyboard operator ceases to transmit the regular intelligence signals. For this purpose we employ the switch timing mechanism described in connection with Figures 1 and 2. The battery connection for the code contacts 123 are completed from the source of potential 142 through the conductor 143 and normally closed switch 62' of the switch timing mechanism and thence by conductor 144 to the contacts 123. The contacts 124 are connected to the outgoing line L in the usual manner. The rest contact 123' operated by cam 126' is connected directly to the source of potential 142.

A magnet 145 is disposed below the horizontal extension 137 of the stop arm 133 and is included in circuit with the contacts 94 and 95 of the switch timing mechanism. The control magnet 77 of the switch timing mechanism is normally energized by a circuit completed through conductor 146, normally closed contacts 147 to source of potential. The contacts 147 are disposed immediately beneath the universal bar 140, so that upon depression thereof the contacts are opened to de-energize the magnet 77. It will be recalled that each time the magnet 77 is energized it serves to move the pin 78 into engagement with the worm 71, so as to cause the pivot arm 74 to travel along the worm. During normal transmission of intelligence signals, however, the circuit for the magnet 77 is interrupted for each signal transmitted, thereby releasing the pin 78 and permitting the arm 74 to return to its initial or lefthand side of the worm. If for any reason the operator ceases to transmit intelligence signals, the contacts 147 remain closed and the arm 74 travels along the worm 71. After a predetermined interval the lug 92 engages the contacts 94 to close the same, thereby completing a circuit through the normally closed contacts 95 to the magnet 145. The magnet 145 draws the stop arm 133 from engagement with the ratchet clutch, causing the clutch to engage and continuously rotate the cam shaft 127. At the same time the switch 62' is opened by means of the insulating pin 148, thereby interrupting the line battery to the contacts 123. Consequently upon each revolution of the cam shaft, the contacts 123' and 124' are closed and opened in the usual manner to transmit a rest signal to the line followed by an

open line or spacing condition, corresponding to the time of operation of the start signal and each of the code contacts 123 and 124.

The cam shaft continues to rotate in this manner to transmit blank or tape feed signals, that is, signals consisting of a rest or single marking impulse only, each revolution until the arm 74 of the switch timing mechanism reaches its right-hand extremity to open the switch contacts 95, in which position it is locked by the latch 101 (Figure 1), interrupting the circuit to magnet 145 and permitting the stop arm to again move into engagement with the clutch to disengage the same and thereby interrupt the transmission. With the cam shaft at rest the contacts 123' and 124' are closed, thereby applying steady marking battery to the line. As soon as the keyboard operation again transmits intelligence signals the magnet 77 is deenergized, permitting the switch timing mechanism to return to its initial position in readiness for the next interruption in the transmission.

The tape feed signals automatically transmitted upon interruption of the intelligence signals actuates the receiving perforator at the distant station to advance sufficient blank tape to bring the last intelligence perforations into the tape transmitter.

It is obvious, of course, that the invention may be embodied in other forms and that many changes and modifications may be made therein without departing from the invention. Therefore, we do not desire to be limited to the exact details shown and described, except in conformity with the appended claims.

What we claim is:

1. A telegraph transmitting system comprising a line, means for transmitting intelligence signals over said line and means acting automatically a predetermined substantial period after interruption of said intelligence signals for automatically transmitting a predetermined number of groups of function signals over said line.
2. In a start-stop telegraph transmitting system, a line, a perforated tape transmitter associated therewith, means for stopping said transmitter when the tape supply is reduced to a predetermined minimum and means independent of said tape transmitter acting upon stopping thereof for periodically transmitting start signals over said line.
3. In a start-stop telegraph transmitting system, a line, a perforated tape transmitter associated therewith, means for stopping said transmitter when the tape supply is reduced to a predetermined minimum and means acting after a predetermined substantial period has elapsed following the stopping of said tape transmitter for periodically transmitting start signals over said line.
4. In a start-stop telegraph transmitting system, a line, a perforated tape transmitter associated therewith, means for stopping said transmitter when the tape supply is reduced to a predetermined minimum and means independent of said tape transmitter acting upon stopping thereof for transmitting a definite number of start signals over said line.
5. A telegraph transmitting system comprising a line, means for transmitting groups of intelligence signal impulses of mixed marking and spacing character and means acting upon the interruption of said intelligence signals for transmitting signals of spacing character, said means serving after the transmission of a predetermined

number of said groups of spacing signals for applying potential of marking character only to the line.

5 6. A telegraph transmitting system comprising a line, a tape transmitter having a plurality of contacts associated with said line, an auto-control mechanism for stopping said transmitter with each of its contacts in spacing position when the tape supply is reduced to a predetermined minimum, means for normally applying potential of marking character to said line when all of said contacts are in spacing position and means acting for a definite period after the stopping of said tape transmitter for causing groups of spacing impulses to be transmitted to the line.

10 7. A telegraph transmitting system comprising a line, a tape transmitter having a plurality of transmitting contacts associated with said line for transmitting groups of signal impulses thereto, means acting when all of said contacts of the tape transmitter are in spacing position for normally transmitting groups of marking impulses through the line and means acting for a definite period after all of the contacts of the tape transmitter assume their spacing position for causing a predetermined number of groups of spacing impulses to be transmitted to said line.

20 8. A telegraph transmitting system comprising a line, a tape transmitter having a plurality of transmitting contacts associated with said line for transmitting groups of signal impulses thereto, an operating magnet for said transmitter, a normally balanced differential relay in circuit with said magnet, an auto-control mechanism operable when said tape supply is reduced to a predetermined minimum to unbalance said relay, thereby to energize said magnet so as to hold each of the transmitting contacts in spacing position, means for transmitting a plurality of groups of spacing signals over the line while the contacts are so positioned and means acting after a definite number of such groups of spacing signals have been transmitted for sending groups of marking impulses over the line.

30 9. A telegraph transmitting system comprising a line, a tape transmitter having a plurality of transmitting contacts associated with said line for transmitting groups of signal impulses thereto, an operating magnet for said transmitter, a normally balanced differential relay in circuit with said magnet, an auto-control mechanism operable when said tape supply is reduced to a predetermined minimum to unbalance said relay, thereby to energize said magnet so as to hold each of the transmitting contacts in spacing position, and means for transmitting a predetermined number of groups of spacing signals to the line while the transmitting contacts are so positioned.

40 10. A start-stop telegraph transmitting system comprising a line, a continuously rotating distributor, a tape transmitter having a plurality of transmitting contacts associated with the distributor for transmitting groups of signal impulses to the line, an operating magnet for said transmitter, a normally balanced differential relay, an auto-control mechanism operable when said tape supply is reduced to a predetermined minimum to unbalance said relay, thereby to energize said magnet so as to hold each of the transmitting contacts in spacing position and means for transmitting a predetermined number of start and rest signals to the line while the contacts are so positioned.

75 11. A telegraph transmitting system comprising a line, a tape transmitter associated with said

line for transmitting groups of signal impulses thereto and means acting upon the advancement of a section of blank tape into the tape transmitter for causing a predetermined number of groups of spacing signals to be transmitted to the line. 80

12. A start-stop telegraph system comprising a line, a rotary distributor having rest, start and code contacts, a tape transmitter associated with said distributor for transmitting groups of code signal impulses to the line and means acting upon the advancement of a section of blank tape into the tape transmitter for causing a predetermined number of groups of rest, start and spacing code signals to be transmitted by the distributor to the line. 85 90

13. A telegraph transmitting system comprising a line, a rotary distributor, a storage transmitter having a plurality of transmitting contacts, a group of transmitting relays arranged to be operated by said transmitter to set up code combinations of impulses on the contacts of said distributor, means, including said relays, normally acting when all of the contacts of the transmitter are in spacing position for applying marking signals to each of the contacts of the distributor and a second group of relays also acting when all of the contacts of the storage transmitter are in spacing position to cause spacing signals to be applied for a definite period to at least a part of the contacts of said distributor. 95 100 105

14. A telegraph transmitting system comprising a line, a rotary distributor, a storage transmitter having a plurality of transmitting contacts for setting up code combinations of impulses on the contacts of the distributor, means normally acting when all of the contacts of the transmitter are in spacing position for applying the marking signals to each of the contacts of the distributor, a time control switch mechanism and a group of relays actuated when all of the contacts of the transmitter are in spacing position to cause operation of said time control switch mechanism thereby to cause spacing signals to be applied to at least a part of the contacts of the distributor for a definite period. 110 115 120

15. In a start-stop telegraph transmitting system, a line, a transmitter associated therewith, said transmitter acting a predetermined substantial period after the stopping of the transmission of intelligence signals for automatically transmitting a definite number of groups of non-intelligence start and stop signals over said line. 125

16. A telegraph transmitting system comprising a line, a transmitter having a plurality of contacts associated with said line, means for normally applying potential of marking character to said line when said transmitter is not transmitting intelligence signals, and means acting for a definite limited period after the cessation of the transmission of intelligence signals for causing groups of spacing signals to be transmitted to said line. 130 135

17. In a telegraph transmitting system, a line, a keyboard transmitter having key levers and transmitting mechanism operative upon actuation of a key lever for sending groups of code impulses to the line, and means operative automatically upon continued inaction of said key levers for a predetermined substantial period for causing said transmitting means to send to the line a succession of groups of code impulses of predetermined character. 140 145

18. In a telegraph transmitting system, a line, a keyboard transmitter having key levers and trans- 150

mitting means operative upon actuation of a key lever for sending groups of impulses to the line, each group comprising a rest signal of marking character, a start signal of spacing character, and
5 code signals of mixed marking and spacing character, and means operative upon continued inaction of said key levers for causing said transmitter to send to line a succession of groups of such impulses having the code signals all of a
10 spacing character.

19. In a telegraph transmitting system, a line, means for setting-up code combinations, each comprising a rest signal of marking character, a start signal of spacing character, and code sig-
15 nals of mixed marking and spacing character, a transmitter controlled by said means for sending said code combination to line, and control mechanism inoperative during continued operation of

said setting-up means but operative upon cessation of the operation of said setting-up means for causing said transmitter to send a succession of such signal combinations having the code signals all of spacing character.

20. In a telegraph transmitting system, a line, a keyboard transmitter having character key levers, transmitting means operative upon actuation of a key lever for applying a group of character code combinations to the line, a switch mechanism normally inoperative on inaction of said key levers for short periods but operative automatically upon continued inaction of said character key levers to render said transmitting means operative to apply a predetermined number of
90 groups of definite code conditions to said line.

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