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C. R. WALKER

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TELETYPEWRITER TRANSMITTING SYSTEM

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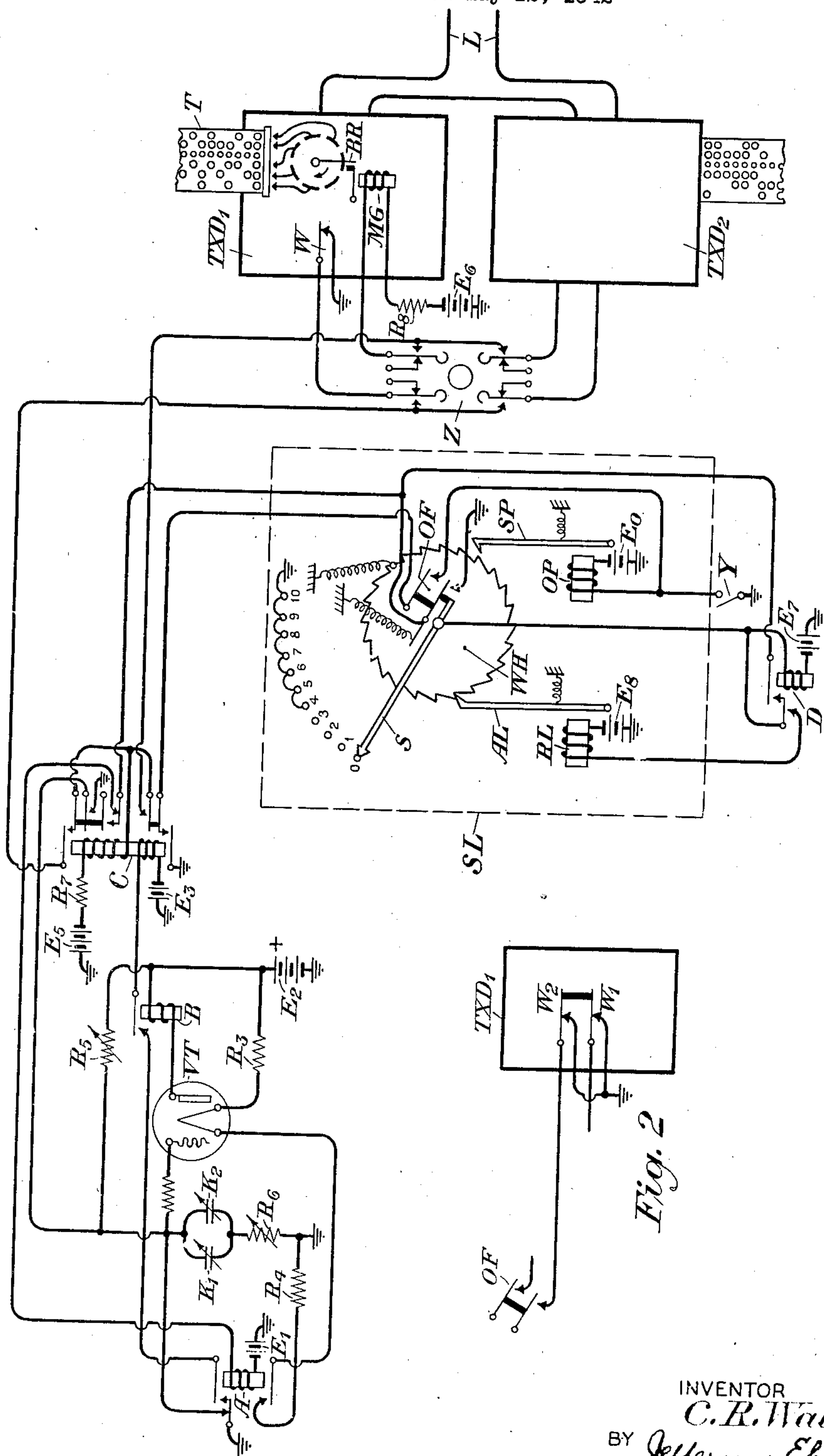


Fig. 1

Fig. 2

INVENTOR
C. R. Walker
BY *Jefferson Ehrlich*
ATTORNEY

UNITED STATES PATENT OFFICE

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TELETYPEWRITER TRANSMITTING
SYSTEM

Charles Robert Walker, Jersey City, N. J., assign-
or to American Telephone and Telegraph Com-
pany, a corporation of New York

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This invention relates to teletypewriter or other signaling systems, and more particularly to apparatus for transmitting teletypewriter or other characters or signals at predetermined intervals.

It is often necessary to transmit teletypewriter characters from one station to another station located at a remote point in order to check the operation of the teletypewriter apparatus located at the remote point. This generally requires the transmission by teletypewriter tape transmitters of a plurality of teletypewriter characters, and at the remote point receiving the characters and determining whether the apparatus at that point responds properly to reproduce the characters received at the remote point. In these operations it is important to fix the interval of time between the beginning of the first character transmitted and the beginning of the second and each subsequent character transmitted to the remote point. The transmitting apparatus may employ a suitably punched tape for this purpose, but the spacing between the characters on the tape may or may not correspond to the time spacing of the characters to be transmitted.

Accordingly it is an object of this invention to provide an arrangement for transmitting teletypewriter characters and timing the transmission of the characters so that a predetermined interval of time will elapse between the beginning of the first character and the beginning of the second character and between each two adjacent characters transmitted thereafter.

Another object of this invention is to transmit teletypewriter characters to a distant point and providing a predetermined interval of time between the characters transmitted, the interval being independent of the speed of transmission of the machine transmitting the characters. That is, an object of the invention is to transmit teletypewriter characters at predetermined intervals of time, the time intervals remaining the same even when the machine transmitting the signals is increased in speed or reduced in speed.

In accordance with this invention a tape is prepared at the transmitting point by punching certain selected characters therein and the tape so prepared is inserted into a tape transmitter. The tape transmitter is then connected to apparatus for controlling the interval between any two adjacent characters transmitted through the apparatus. The apparatus includes, among other things, condensive elements and resistive elements forming part of a timing arrangement which acts to control the transmission of the characters by the tape transmitter so that the

interval of time between the characters will be determined by the timing circuit independently of the spacing of the characters as punched in the tape or of the speed of the transmitter.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 shows one embodiment of the invention merely for the purpose of illustration and Fig. 2 shows a modification of the circuit of Fig. 1.

Referring to Fig. 1 of the drawing, the reference characters TXD_1 and TXD_2 designate two tape transmitters either of which may be used to transmit teletypewriter characters over a line L to a distant point. Both of these transmitters receive tape T of the usual type having teletypewriter characters punched therein, the transmitters being employed to convert the tape perforations into pulses of current corresponding to the tape perforations to transmit the characters over the line L . The apparatus connected to the two transmitters TXD_1 and TXD_2 will be employed to fix the interval of time between the beginnings of the transmissions of any two adjacent characters punched in the tape over the line L to the distant point, as will now be described. That is, there will be an interval of time, such as 0.7 of a second, for example, between the times when two adjacent characters are started in transmission over line L . The circuit arrangement of this invention includes a relay designated A which, in part, is used to control the charging circuit of one or more condensers, two being shown for illustrative purposes, these condensers being designated K_1 and K_2 . The condensers K_1 and K_2 are connected to the grid circuit of a vacuum tube VT which is, for example, of the 231-D type. The filament circuit of tube VT may also be controlled by relay A . The plate circuit of the tube VT includes the winding of a relay B which is controlled by the flow of current through the plate circuit of the vacuum tube VT . The relay B in turn controls the operation of a relay C which, together with other apparatus of the invention, will be employed to control the operation of a step-by-step selector SL .

The step-by-step selector SL may include, among other things, a selector arm S which is affixed to a ratchet wheel WH so that they may rotate together; an operating or stepping magnet OP for controlling the step-by-step action of the arm S ; a release magnet RL for controlling the return of the arm S to its original or starting position; and an off-normal switch OF which is

released, as shown on the drawing, when the arm S is at its starting position at contact #0, but becomes operated immediately after the operating or stepping magnet OP is energized and remains operated until the arm of the selector S returns to its original or starting position. The step-by-step selector SL may be, for example, of the 204-E type well known in the art.

The step-by-step selector SL may be started in operation by a non-locking key Y. A double pole key or switch Z of the locking type is employed to connect either of the two tape transmitters TXD₁ or TXD₂ to the timing circuit, to be more fully described hereinafter. It will be understood, of course, that a multi-pole key, such as Z, having additional blades may be employed to control the transmission from any number of tape transmitters. A relay D is also connected to the circuit to maintain the release magnet RL of the selector equipment energized after its energization is started in order to fully return the selector arm S to its original or starting position.

Assume that properly prepared tape T has been inserted into the transmitter-distributor TXD₁, and that this transmitter-distributor has been connected to the circuit arrangement of this invention by moving the lever of the key Z to the top position. The mechanism may then be started by operating the key Y, the key Y releasing shortly after it is operated. Upon the operation of key Y the stepping magnet OP of the selector will be energized by the flow of current through its winding over a circuit which includes battery E₀, the magnet OP, the key K and ground. The energization of the stepping magnet OP will attract the stepping pawl SP until it engages the teeth of the ratchet wheel WH and advances the stepping arm S one step to contact #1.

The movement of selector arm S from contact #0 to contact #1 releases switch OF' so that switch OF' may reach its operated position. Upon the operation of the switch OF' the relay A will become operated over a circuit which includes the battery E₁ which is connected to the lower terminal of the relay A, the winding of relay A, the make-before-break contact associated with the upper inner blade of relay C, the lower contact of switch OF' and ground. The operation of relay A will complete a circuit for the filament of the tube VT, the completed circuit including the battery E₂, resistor R₃, the filament of tube VT, the lower armature and make contact of relay A, the resistor R₄ and ground.

It will be observed that the condensers K₁ and K₂—which are in parallel relationship with each other—are grounded at their upper terminal when the relay A is released, the grounding circuit including the make-before-break contact associated with the upper armature of relay A. Upon the operation of relay A, however, the grounding circuit for condensers K₁ and K₂ is removed, and the condensers are then charged by current which flows to the condensers over a circuit which includes battery E₂, resistor R₅, condensers K₁ and K₂, resistor R₆ and ground. When the voltage at condensers K₁ and K₂ reaches a predetermined value, the current in the plate circuit of the tube VT will reach a magnitude which is sufficient to operate the relay B, the plate circuit of tube VT including battery E₂, the winding of relay B, the plate and filament electrodes of tube VT, the lower armature and make contact of relay A, resistor R₄ and ground. Upon the operation of relay B, relay C will become operated, the operating circuit for relay C including battery E₃, the lower or

operating winding of relay C, the armature and make contact of relay B, the upper armature and make contact of relay A and ground.

Upon the operation of relay C the upper terminals of condensers K₁ and K₂ will again be grounded, the grounding circuit including the second upper blade of relay C and its make contact. The condensers K₁ and K₂ will, therefore, discharge so as to prepare these condensers for a subsequent surge of current. As the voltage across condensers K₁ and K₂ drops below its former value, the potential on the grid of the tube VT will be such as to reduce the flow of current through the plate circuit of tube VT previously described, and, therefore relay B will become released. Although relay B controls the start of the operation of relay C, relay C, however, will remain operated after relay B releases due to the completion of a locking circuit for relay C, the locking circuit including battery E₅, resistor R₇, the upper or locking winding of relay C, the upper outer armature and make contact of relay C, the upper left swinger of key Z, the "bounce" contact W of the transmitter-distributor TXD₁ and ground. The bounce contact W is an element of the transmitter-distributor which, as is well known, is in its closed position when the commutator brush BR of the transmitter-distributor TXD₁ is on its so-called stop segment. Soon after the commutator brush BR starts rotating, however, this bounce contact is opened and remains open until the brush BR returns to its stop or rest position.

The operation of the relay C also causes the magnet MG of the transmitter-distributor to be energized, the energizing circuit for the magnet MG including the battery E₆, the resistor R₈, the magnet MG of the transmitter-distributor TXD₁, the upper right swinger of key Z, the lower inner blade and make contact of relay C, the upper armature and outermost make contact of relay C, the upper left swinger of key Z, the bounce contact W of the transmitter-distributor TXD₁ and ground. The energization of the magnet MG causes the commutator brush BR to be released by its armature, enabling it to rotate in the usual manner for the purpose of transmitting one of the teletypewriter characters punched in the tape over the line L to a distant point. The relay C is locked in its operated position through the bounce contact W of the transmitter-distributor TXD₁ so as to maintain relay C operated until the brush arm BR starts to rotate. This permits the magnet MG to become energized long enough to fully release its associated brush BR. This is an important feature of this circuit. Without this added feature it would be possible for the magnet MG to become released before the commutator brush BR was started in rotation in the usual way for transmitting a teletypewriter character. Thus it will be observed that the relay C operates and is maintained in an operated condition to energize the magnet MG for a sufficient length of time, thereby properly actuating the brush mechanism of the transmitter-distributor.

The operation of the relay C also causes the stepping magnet OP of the selector SL to be again energized for stepping the selector arm S from its contact #1 to its next contact #2. The circuit for energizing the stepping magnet OP includes battery E₀, the operating winding OP, the upper contacts of the off-normal switch OF', the lower armature of relay C and its make contact and ground. Thus it will be observed that relay C when operated causes the selector arm S

to step to its next contact in a clockwise direction and at the same time energize the starting magnet MG of the transmitter TXD₁ to transmit a group of pulses corresponding to a teletypewriter character.

The operation of relay C also opens the operating circuit for relay A at the make-before-break contact associated with the upper inner blade of relay C, thereby allowing relay A to become released. The operation of relay C will ground the upper terminal of condensers K₁ and K₂ through the second upper blade of relay C, thereby discharging these condensers. Upon the release of relay A the filament circuit of tube VT will be opened at the make contact of the lower armature of relay A. The release of relay A will apply an additional ground to the upper terminal of the condensers K₁ and K₂. Moreover the operation of relay C and the release of relay A will result in the connection of the grid of tube VT to ground, thereby reducing the plate current substantially to zero. The relay B will become released. Moreover, after the brush of the transmitter-distributor TXD₁ has started in rotation, its bounce contact W will be opened, thereby opening the locking circuit for relay C. Relay C will then also release.

After relay C has become released, the relay A will become reoperated, the operating circuit of relay A being the same as previously described. The lower make contact of relay A will, therefore, complete the filament circuit for tube VT. With relay A reoperated and relay C released, ground is again removed from the upper terminals of condensers K₁ and K₂, and these condensers are recharged as heretofore. After the voltage on the condensers K₁ and K₂ reaches the predetermined voltage previously noted, current in the plate circuit of tube VT will again flow in substantial magnitude, thereby reoperating relay B. Upon the reoperation of relay B, the relay C will become reoperated, as already explained. The reoperation of relay C will cause the stepping magnet OP of the selector SL to be reenergized, the reenergizing circuit being completed through the upper contact of the switch OF and the lower armature and make contact of relay C. When the stepping magnet OP becomes reenergized, it will cause the selector arm S to be moved to its next contact #3. The magnet MG of the transmitter-distributor TXD₁ will also be reenergized due to the operation of relay C, the circuit for the magnet MG being the same as already described hereinabove. The magnet MG will then again release the brush arm BR of the transmitter-distributor TXD₁, again allowing the brush mechanism to transmit a series of pulses over line L corresponding to the second character punched in the tape T.

It will be observed that the interval of time between the beginning of the first series of the pulses corresponding to the first character transmitted over line L pursuant to the closure of the contact #2 of the selector arm S and the beginning of the second series of pulses corresponding to the next character transmitted when the selector arm S closed its next contact #3 is determined by the timing circuit which includes, among other things, the condensers K₁ and K₂. The time interval between the beginnings of the two pulses is independent of the spacing between the two characters as punched in the tape T inserted in transmitter-distributor TXD₁. The time interval is also independent of the speed of machine TXD₁. Thus the interval of time be-

tween successive characters is fixed within limits by the local circuits and characters are regularly transmitted over line L with the desired spacing therebetween. It will be understood that by changing the constants of the condensers and resistors and other elements of the timing circuit, the time interval between signals or characters transmitted may be changed to any desired magnitude.

Upon the subsequent opening of the bounce contact W, the relay C will again be released to reoperate the relay A. The reoperation of the relay A will then allow the condensers K₁ and K₂ to become recharged, the relay B to become reoperated and the relay C thereafter reoperated so as to allow the stepping magnet OP of the selector SL to become reenergized, whereupon the arm of the selector mechanism S will be moved to its next contact #4. The magnet MG will also become reenergized to transmit a third character over the line L.

It will be observed, therefore, that one character is transmitted when the arm S of the selector mechanism SL reaches point #2, another character when it reaches point #3, and a third character when it reaches point #4. The selector mechanism may be wired so as to allow any number of characters to be transmitted in succession with a fixed and predetermined interval of time between the beginnings of these characters.

Upon the closure of contact #4 of the selector mechanism S, however, the relay D will become operated over a circuit which includes battery E₁, the winding of relay D, the arm S of the selector, its contact #4 and ground. The relay D will then become locked in its operated position, the locking circuit including the armature and first make contact of relay D, the lower contact of the switch OF and ground. The switch OF will remain operated until the arm S of the selector mechanism reaches contact #0. The operation of relay D causes the release magnet RL of the stepping selector SL to be energized and remain energized until relay D is released. The release magnet RL attracts the armature-lever AL having a detent which was used previously for holding the ratchet wheel WH. The attraction of lever AL allows the arm S to be returned in a counter-clockwise direction to its initial position at contact #0. The circuit for the release magnet RL includes battery E₂, the winding of the release magnet RL, the armature and two make contacts of relay D, the lower contacts of switch OF and ground. The addition of the relay D to the circuit is to insure the energization of the release magnet RL for a sufficient time to allow the selector arm S to return to its initial position at contact #0. Thus the release magnet RL is held operated until the arm S returns to its starting position. The release magnet may also include an upper or non-inductive winding (not shown) in shunt with winding OP for the purpose of reducing sparking following the energization of the winding OP.

It will be observed that the magnet MG of transmitter-distributor TXD₁ is operated once for each operation of relay C. The step-by-step selector SL registers the number of operations of magnet MG by relay C. The primary purpose of selector SL is to limit the operations of magnet MG to a predetermined number. With the circuit shown in the drawing the number of operations of magnet MG is limited to three, but

by removing the jumper between contacts #4 and #5 an additional operation of magnet MG is obtained. By removing additional jumpers, the number of operations of magnet MG may be further increased. Furthermore, if it is not desired to limit the number of operations of magnet MG, all of the jumpers may be omitted or the selector SL may be entirely removed.

It has been observed that by contacting the two swingers at the top of switch Z, the transmitter TXD₁ is employed for transmitting pulses of current corresponding to teletypewriter characters punched in tape T over the line L. If a different transmitter-distributor such as TXD₂—which may be of a different speed—is desired, the switch Z will be operated so as to contact the bottom swingers of the switch. Where the transmitter TXD₂ is of a different speed, the pulses of current transmitted over the line L will occur at a different rate determined by the speed of the transmitter TXD₂, but the spacing between the beginnings of each two successive series of pulses will be determined by the time constants of the circuit of this invention which includes the condensers K₁ and K₂. In other words, the arrangement of this invention may be employed to transmit pulses of current corresponding to different characters at any desired speed, yet the spacing between the start of the pulses of the various characters will remain the same, the spacing interval being determined by the timing circuit arrangement of this invention.

In the arrangement shown in Fig. 1 the timing circuit fixes the interval between the beginnings of transmission of successive signals or characters. If it is desired to fix the interval between the completion of the transmission of one signal or character and the beginning of transmission of the next succeeding signal or character, the modification shown in Fig. 2 would then be employed. In Fig. 2 the lower blade of the off-normal switch OF is connected to ground through a contact W₂ which is mechanically coupled to the contact W₁ so that both contacts W₁ and W₂ operate simultaneously.

Thus when the circuit arrangement of Fig. 1 is modified according to the scheme shown in Fig. 2, relay C will be released as soon as contact W₁ is opened as heretofore. But relay A will be re-operated only after contact W₂ is closed. Inasmuch as the operation of relay A determines the beginning of the timing interval, the timing interval will be started after each signal or character is transmitted.

While it has been shown that the teletypewriter transmitters TXD₁ and TXD₂ may be used with tape perforated according to a code corresponding to teletypewriter characters, it will be understood that the tape perforations may correspond to Morse or other codes. Furthermore, it is understood that the transmitter-distributors may be arranged for the transmission of signals embodied in or embossed on devices other than perforated tape. Thus the apparatus of this invention may be used with transmitters employing code wheels, magnetic tape, photoelectric scanning devices, etc.

While this invention has been shown and described in certain particular embodiments merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a teletypewriter tape transmitter, stepping mechanism controlling said transmitter so that said transmitter will successively transmit in regular order groups of pulses corresponding to groups of perforations in the tape of said transmitter, each group of perforations corresponding to a different character, and means comprising an electrical circuit for fixing the interval of time between successive groups of transmitted pulses, said means being independent of the spacing between said groups of perforations in said tape.
2. The combination of a tape having groups of perforations spaced from each other by fixed distances, each group of pulses corresponding to a signal, means including a transmitter and stepping mechanism controlling said transmitter for successively transmitting said groups of pulses in regular order, and means for fixing the interval of time between said groups of pulses, said means comprising an electrical timing circuit.
3. The combination of a teletypewriter tape transmitter, step-by-step apparatus connected to said transmitter to control the operation of said transmitter, means for transmitting groups of pulses of current corresponding to teletypewriter characters to be transmitted by said transmitter, said means including means whereby each group of pulses of current is transmitted in accordance with the progression of said step-by-step apparatus.
4. The combination of a teletypewriter tape transmitter, means for operating said transmitter step-by-step, said means comprising a step-by-step selector, and a timing circuit connected between said selector and said transmitter for controlling the interval of time between successive steps of said selector.
5. The combination of a teletypewriter tape transmitter having a perforated tape inserted therein, the perforations of said tape corresponding to teletypewriter signals or characters, stepping mechanism for controlling the operation of said transmitter and an electrical timing circuit for fixing the time interval between the transmissions of said signals or characters in regular order.
6. The combination of a teletypewriter transmitter having a starting magnet, step-by-step apparatus, means controlled by said step-by-step apparatus for regularly energizing said magnet, and a timing circuit for controlling the interval of time between successive steppings of said step-by-step apparatus.
7. The combination of a teletypewriter apparatus for transmitting groups of pulses of current controlled by perforations in a tape, means for fixing the interval of time between the beginnings of any two adjacent groups of pulses, said means comprising stepping apparatus and a timing circuit connected between said stepping apparatus and said teletypewriter apparatus for controlling the time interval between adjacent steps of said stepping apparatus.
8. The combination of means for transmitting signals, an electrical circuit for timing the interval between any two adjacent signals transmitted, and means for limiting the signals transmitted to a predetermined number.
9. In a signaling system, the combination of means for transmitting signals, an electrical circuit for fixing the time interval between adjacent signals transmitted, means for counting the num-

ber of signals transmitted and limiting the signals transmitted to a predetermined number.

10. The combination of means for transmitting signals successively, means for limiting the number of successive signals transmitted, means for fixing the interval of time between the transmission of successive signals, and means for changing said time interval to any desired value.

11. In a signaling system, the combination of a complete telegraph transmitter for transmitting

5 telegraph signals at predetermined intervals, an electrical timing circuit connected to said transmitter, means including said timing circuit controlling the operation of said transmitter for the transmission of signals at different predetermined intervals, and step-by-step means for operating said timing circuit at said latter predetermined intervals.

10 CHARLES ROBERT WALKER.