

March 1, 1949.

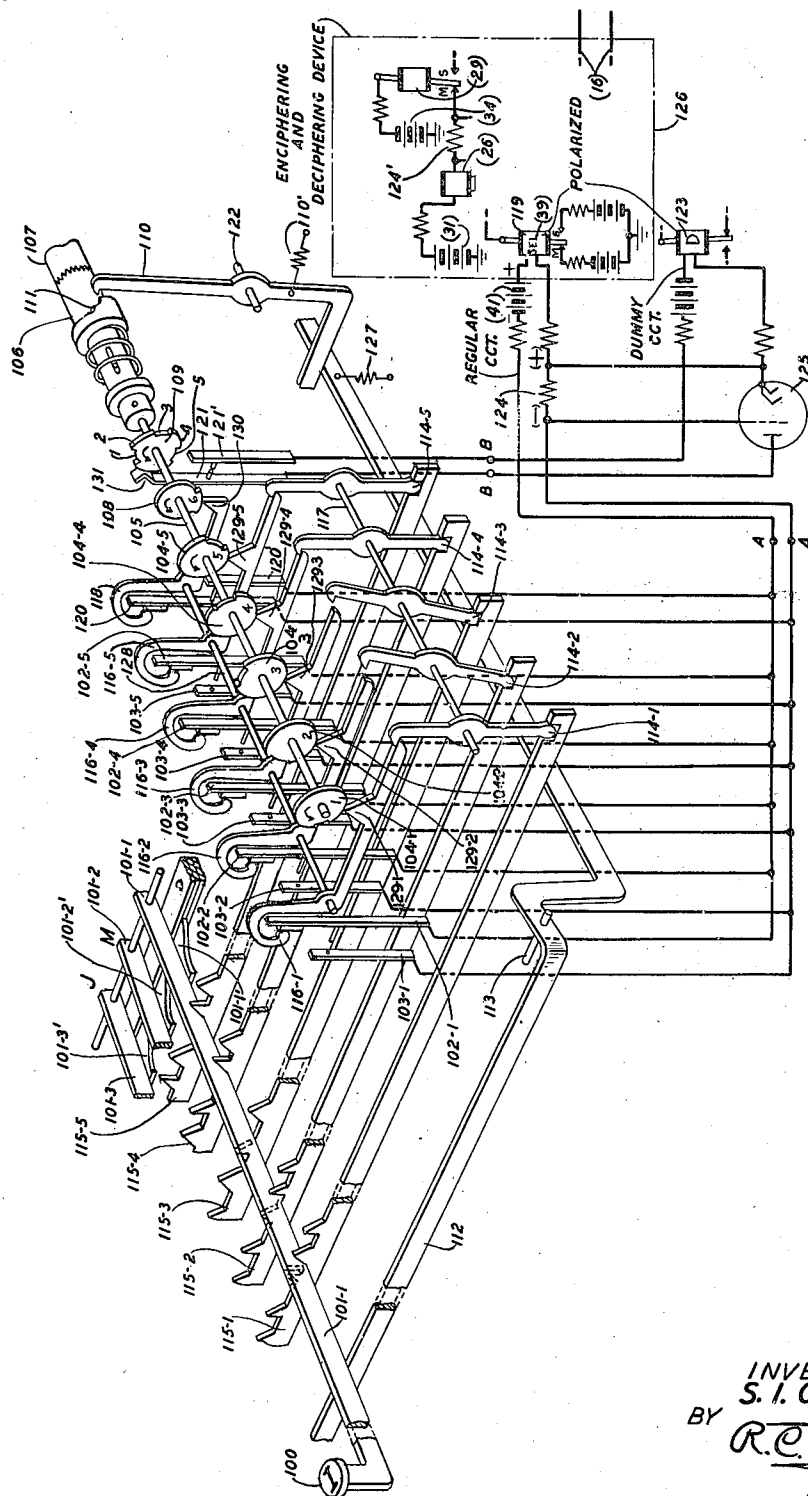
S. I. CORY

2,463,248

SECRET TELEGRAPH SYSTEM

Filed March 8, 1946

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

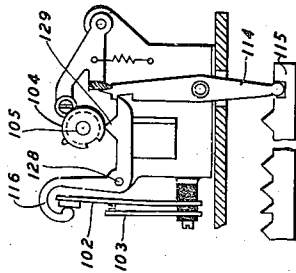


FIG. 1B

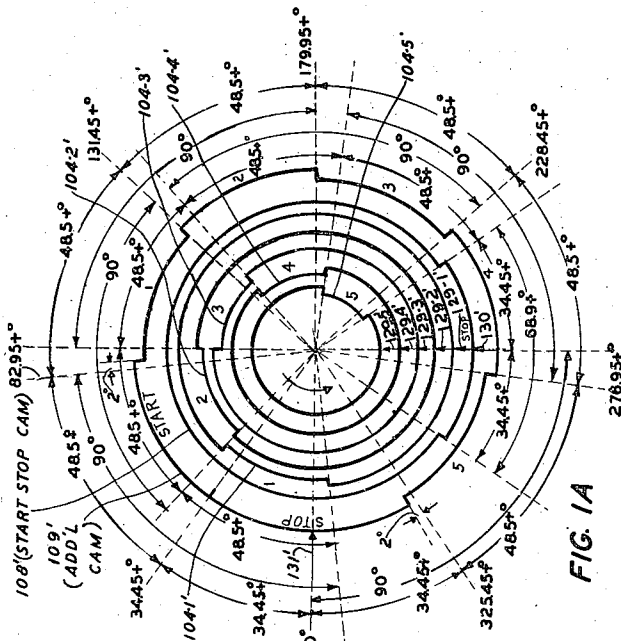


FIG. 1A

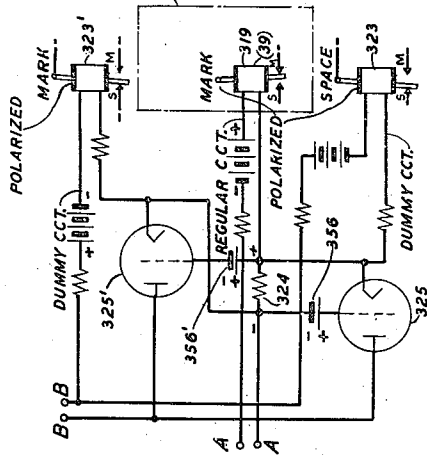


FIG. 3

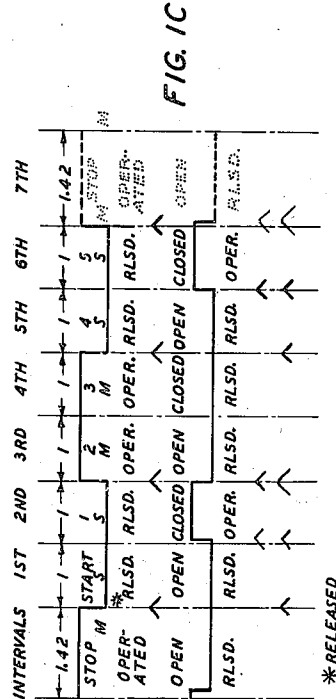


FIG. 1C

- (a) RELATIVE DURATION OF PULSES OF START-STOP FIVE UNIT PERMUTATION CODE SIGNALS
(b) PLAIN TEXT SIGNAL CHARACTER (LETTER I)
(c) SELECTOR MAGNET 119
(d) PLAIN TEXT PICK-UP
(e) CONTACTS AT ADDED MASKER CAM 109
(f) PLATE CURRENT IN AMPLIFIER VACUUM TUBE
(g) DUMMY MAGNET 123
(h) MASKER PICK-UP
(i) COMBINATION PICK-UP (d and h)

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3 Sheets-Sheet 3

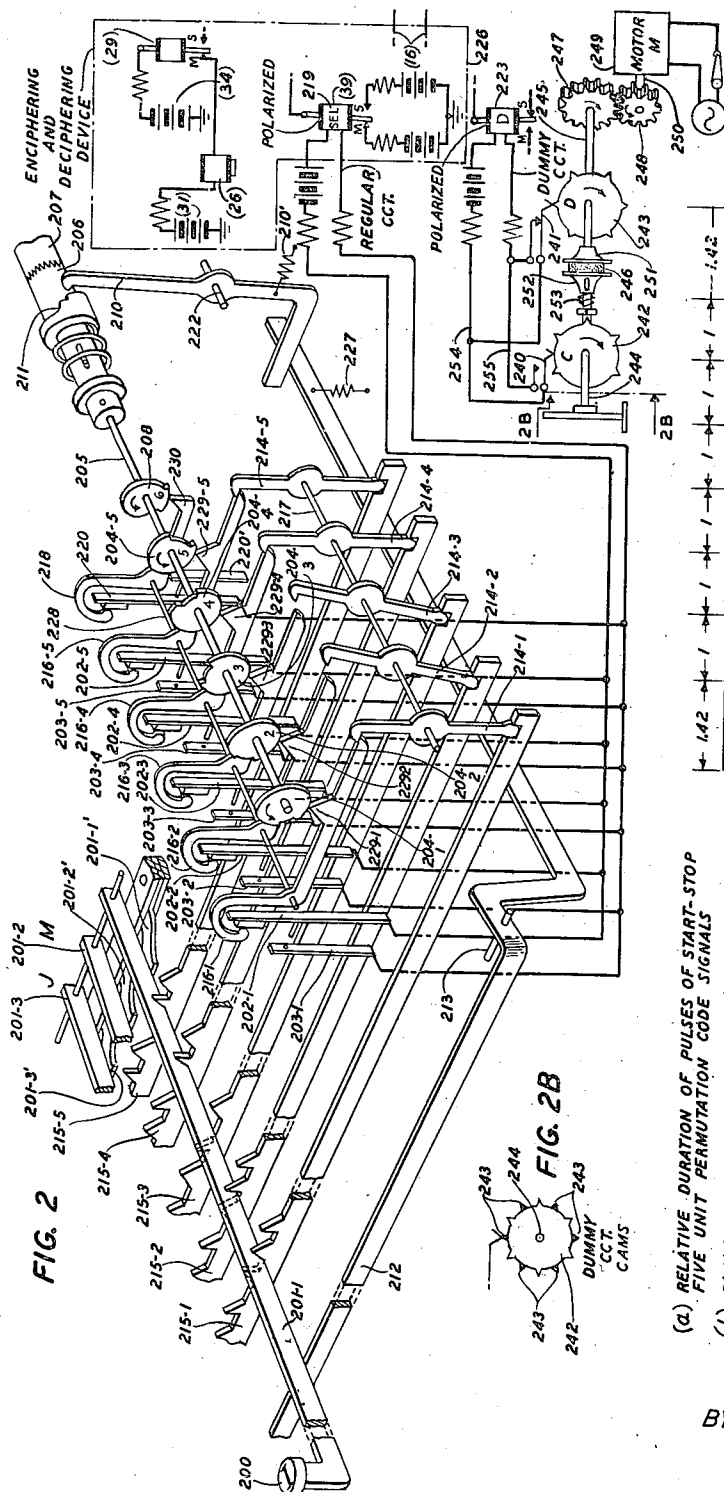


FIG. 2B

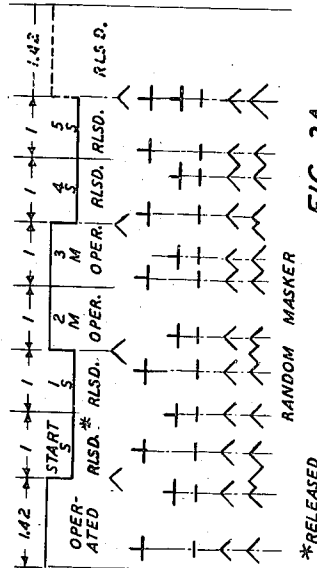


FIG. 2A

- (g) RELATIVE DURATION OF PULSES OF START-STOP FIVE UNIT PERMUTATION CODE SIGNALS
- (h) PLAIN TEXT SIGNAL CHARACTER (LETTER I)
- (i) SELECTOR MAGNET 218
- (j) PLAIN TEXT PICK-UP
- (k) SPACING BETWEEN CLOSURES OF MASKER CONTACTS 240
- (l) SPACING BETWEEN CLOSURES OF MASKER CONTACTS 241
- (m) DUMMY MAGNET 223 OPERATION (MOMENTARY)
- (n) MASKER PICK-UP
- (o) COMBINATION PICK-UP d AND h

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2,463,248

SECRET TELEGRAPH SYSTEM

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11 Claims. (Cl. 178—22)

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This invention relates to telegraph systems and more particularly to secret telegraph systems.

In telegraph systems, messages are transmitted and received in any well-known code and when intercepted in this condition, during the course of transmission, are intelligible to anyone skilled in the art. However, in secret telegraph systems the message signals are altered for transmission over the line and when intercepted in their altered form are unintelligible.

At the transmitting end of a secret system, these intelligible messages prepared at the transmitter, are, before being impressed on the line, enciphered by means of other signals of what is generally known as a key code and the enciphered messages with their altered signals are transmitted over a line so that any interception on the line will cause to be received by the one intercepting, unintelligible messages. At the final receiving end these unintelligible messages are deciphered by means of other signals identical with those of the key code at the transmitting end and the deciphered messages are recorded to produce the messages as originally prepared.

Heretofore in secret telegraph systems difficulties were experienced in developing a completely shielded device for transmitting messages to the enciphering set or for receiving messages from the deciphering set for recordation. At the sending end where the transmitting device may be a keyboard or an automatic tape transmitter or a transmitting relay of a sending teletypewriter, or at the receiving end where the receiving device may be a line relay or a repeating relay or the selector magnet of a receiving teletypewriter, it has been found that each device upon the "make" or "break" of its operating contacts, radiates a short, sharp voltage pulse. These pulses, when radiated in a location which is comparatively free from other electrical disturbances and in which a ciphering or deciphering set is operated, may be surreptitiously or otherwise received or "picked-up," by a radio receiving device located in an adjacent room or within some other short distance, or at a much greater distance along a power or signal wire which is connected to or passed close by the set, and recorded as pulses by an oscillograph. From these pulses appearing on an oscillogram can be constructed the signals of the complete message as originally prepared.

An object of the present invention is to protect a secret message from detection at any point between the point of transmission and its associated

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enciphering set and at any point between a deciphering set and its associated receiving teletypewriter.

According to the present invention, an arrangement is provided in connection with a transmitting or a receiving teletypewriter, for masking the short, sharp voltage pulses which are radiated from the operating circuit of the message signal repeating, or relaying, element, by adding other short, sharp voltage pulses radiated from a similar element in a dummy circuit having the same electrical characteristics as the circuit of the message signal repeating element.

A feature of the invention is the provision of an additional cam arrangement for alternately opening and closing the dummy circuit which has electrical characteristics identical with the operating circuit of the message signal repeating element, the dummy circuit including an element which operates and releases to radiate short, sharp voltage pulses simultaneously with and intermediate those radiated by the energization and deenergization of the message signal repeating element in response to plain text signals.

Another feature is the provision of a pair of cams frictionally interconnected, arranged to close and open the dummy circuit fortuitously and driven at different speeds, both of which are different from that of the transmitting cam shaft to furnish short, sharp voltage pulses independently of, or at random with, the pulses radiated by the operation and release of the message signal repeating element.

Another feature is the provision of an amplifier vacuum tube arranged to be made electrically active and inactive during each plain text signal at times predetermined in accordance with the transitions in the plain text signals.

Another feature is the provision of an electromagnetic circuit having electrical characteristics identical to those of the circuit of the message signal repeating element and having means arranged to be alternately closed and opened for predetermining the active and inactive periods, respectively, of the above-mentioned vacuum tube.

Another feature is the provision of two dummy circuits, each having electrical characteristics identical with those of the plain text signal circuit for operating the message signal repeating element, and each having a vacuum tube. The vacuum tubes are arranged to become active in response to the marking and spacing pulses, respectively, of each of the signal combinations received by the message signal repeating element.

The invention will be better understood by reference to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 represents one embodiment of the invention shown in connection with the transmitting end of a teletypewriter system wherein the teletypewriter is provided with an additional cam on the regular transmitting cam shaft for conditioning the dummy circuit for operation at predetermined times during the transmission of each of the plain text signals of a transmitted message. The teletypewriter is represented as a part of a schematic circuit instead of as a part of the actual apparatus;

Fig. 1A represents a superimposed arrangement of the cams on the transmitting cam shaft shown in Fig. 1, the arrangement including the five selecting cams and the start-stop cam for controlling the plain text signal circuit, and the additional cam for conditioning the dummy circuit for operation;

Fig. 1B shows an end elevation view of a regular transmitting cam shaft arrangement as it actually appears on a transmitting teletypewriter. The transmitting cams are mounted on a rotatable shaft and arranged in conjunction with pivoted selectors to control goose-neck shaped switch-shifters for opening and closing the transmitting signal pulse contacts;

Fig. 1C is a diagrammatic showing of a plain text signal wave for the letter I in start-stop, five-unit permutation code in both the plain text signal circuit and the dummy circuit of the sending arrangement illustrated in Fig. 1;

Fig. 2 represents another embodiment of the invention shown in connection with the transmitting end of a teletypewriter system wherein a pair of cams mounted and operated independently of the transmitting cam shaft are arranged to condition the dummy circuit for operation at random with respect to the transitions of each plain text signal. In this figure also, the teletypewriter is represented as part of a circuit schematic; reference being had to Fig. 1B for the relative arrangement of the cam shaft parts as they actually appear on the teletypewriter;

Fig. 2A is a diagrammatic showing of a plain text signal wave for the letter I in start-stop, five-unit permutation code in the plain text signal circuit of the sending arrangement illustrated in Fig. 2, and the effects of the alternate opening and closing of the associated dummy circuit whereby short, sharp voltage pulses are radiated independently of, or at random with, the short, sharp voltage pulses radiated by each message signal transmitted through the plain text signal circuit;

Fig. 2B is a view taken along arrow 2B shown in Fig. 2. It resembles a superimposition of the pair of cams required for determining the radiation, at random, of voltage pulses for use in the arrangement shown in Fig. 2. The distances between camming points are shown as being equal, but during operation these distances are continuously changing due to the slippage occurring in the friction clutch which serves to interconnect the pair of cams or discs; and

Fig. 3 is a modification of the circuit schematic of Fig. 1, wherein two dummy circuits, each having electrical characteristics identical with those of the circuit of the plain text signal repeating element, are provided for producing, in response to plain text signals, a masked signal wave approaching a uniform pattern for all signal com-

binations, one of the dummy circuits being capable of responding to the spacing pulses only, of the signal combinations as in Fig. 1, and the other being capable of responding to certain of the marking pulses only, simultaneously with certain operations of the circuit of the plain text signal repeating element.

The present invention will be described with reference to the drawings showing three different types of transmitting ends of a secret teletypewriter system, it being understood that the invention, adapted for operation at the receiving end, will be obvious from the description herein given.

The signaling code used herein for transmission is the start-stop, five-unit permutation code which comprises five selecting pulses used in various combinations of "current" and "no current" intervals, namely, "mark" and "space," depending upon the signal transmitted. Each group of five selecting pulses is preceded by a start, or space, pulse, and followed by a stop, or mark, pulse, the latter being used to maintain synchronism between all stations on the circuit. The mark pulses operate the printer selector magnet of the teletypewriter and are known as "marking," and the space, or non-operative, pulses which cause it to release, are known as "spacing." The operating circuit for the printer selector magnet may be referred to as the regular circuit to differentiate from the dummy circuit.

The use of reference characters has been kept to a definite plan. All reference characters are numbers, the first digit of which corresponds to the number of the figure wherein the element designated is located. Thus, those elements of Fig. 1 are designated with numerals in the 100 series and those of Fig. 2 are designated with numerals of the 200 series and those of Fig. 3 with numerals in the 300 series, the hundreds digit designating the figures in which the particular element is found. In Figs. 1, 2 and 3 the corresponding elements have similar reference characters except for the hundreds digit.

Figure 1—General description

Referring to Fig. 1 the teletypewriter keyboard transmitter comprises a set of keys represented by key 100, key levers represented by levers 101-1, 101-2, 101-3, etc. which are maintained in a normal position by springs 101-1', 101-2', 101-3', etc., respectively, a bank of sending contact springs 102-1, 102-2, 102-3, 102-4 and 102-5 in engageable relation with fixed terminals 103-1, 103-2, 103-3, 103-4 and 103-5, respectively. Selecting cams 104-1, 104-2, 104-3, 104-4 and 104-5 fixedly mounted on rotatable shaft 105, driven clutch member 106 and driving clutch member 107 are connected through a set of gears (not shown) to the main shaft of the printer unit which, in turn, is driven by a motor (also not shown). The teletypewriter employed herein may be of the type disclosed in United States Patent Re. 20,330 granted to S. Morton on April 13, 1937. The sending cams on shaft 105 include in addition to the selecting cams, start-stop cam 108 and additional cam 109. Cam 109 is added as part of the present invention and will be hereinafter described. The sending cams are normally held stationary because clutch members 106 and 107 are held apart by latch member 110 which is normally in engagement with throw-out cam 111.

When a key, such as key 100, is momentarily depressed, universal bar 112 which is pivotally

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supported at each end by a pin, such as pin 113, and extends beneath all the key levers, is momentarily operated in a counter-clockwise direction around pin 113, to move the free end of latch member 110 in a clockwise direction against the tension of coil spring 113'. Latch member 110 is pivotally supported at pin 122 and, upon being rotated around pin 122, disengages at its free end from throw-out cam 111, thereby permitting the driven clutch member 106 to mesh with the driving clutch member 107 and cause sending cam shaft 105 to rotate about its axis. At the end of one revolution of shaft 105, driven clutch member 106 is disengaged from the driving clutch member 107 by the throw-out cam 111 again engaging latch member 110, and the cams on shaft 105 are brought to a stop and remain stationary until a key of the keyboard is again operated. Beneath the key levers 101-1', 101-2, 101-3, etc., are five selector, or code, bars 115-1, 115-2, 115-3, 115-4 and 115-5. The selector, or code, bars are provided with saw-tooth shaped notches arranged according to the requirements of the signaling code. These bars rest on rollers (not shown) and are guided at each end so that they may be easily moved lengthwise. When a key is depressed, the key lever strikes the slanting sides of certain of these notches moving one or more of these bars either to the left or to the right depending upon whether the corresponding pulses of the signal combination are to be marking or spacing pulses, as described in the S. Morton reissue Patent Re. 20,330, supra.

Each of the selector, or code, bars when moved toward the right, causes the corresponding pivoted selector latch member of those designated 114-1, 114-2, 114-3, 114-4 and 114-5, respectively, to be rotated in a counter-clockwise direction on a common supporting pivot rod 117 and when moved toward the left causes its corresponding latch member to be rotated in a clockwise direction. Each of these latch members controls through a goose-neck shaped switch-shifter 116 supported on pivot rod 128, the motion of a sending contact spring 102 by either allowing the contact spring to engage its fixed terminal 103 to send a mark pulse when its selecting cam 104 revolves with transmitting cam shaft 105, or restricting the motion of the sending contact spring so that no engagement with its terminal is established when its selecting cam revolves with the transmitting cam shaft, to send a space pulse. Normally, each of the spring contacts 102 is open due to cam shaft 105 being normally locked by latch member 110.

The selecting cams 104 have peripheral indents of the same angular distance, the indents on cams 104-1 to 104-5 being spirally arranged with respect to each other so as to follow successively, during each revolution of cam shaft 105, in passing the point whereat the cam indentations may be engaged by the peak portions 129 of the switch shifters 116. In the present invention, peak portions 129 are in continuous engagement with their respective cams of cams 104 whenever their respective switch-shifters 116 are not locked by the pivoted selector latch members 114. As cam shaft 105 rotates, the selecting pulses, either marking or spacing, may be transmitted in succession to the printer selector magnet or a repeating, or relaying, element shown in the drawing as a biased relay of the polarized type and referred to as plain text signal or main, repeating relay 119. In practice, polarized repeating relay 119 would have two windings, one biased to nor-

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mally hold the relay in its spacing position and the other, the line winding, when energized, to operate the relay to its marking position. The current in the line winding would predominate over the current in the biasing winding.

Start-stop cam 108 controls the contact between spring member 120 and fixed terminal 120', the spring member 120 being in engageable relation with fixed terminal 120'. Normally, spring member 120 and fixed terminal 120' are in inter-engagement, and the contact therebetween is closed to maintain the main repeating relay 119 normally operated. However, the normally closed contact between spring member 120 and terminal 120' is opened at the beginning of each revolution of cam shaft 105 to transmit a start, or space, pulse to relay 119. After the fifth selecting pulse is transmitted to relay 119, the closure of the contact between spring member 120 and terminal 120' is again established by start-stop cam 108 to send a stop, or mark, pulse to relay 119 which again operates. This closure of the contact between spring member 120 and terminal 120' will remain until the keyboard is again operated, at which time the clutch-driven member 106 will again be permitted to mesh with clutch-driving member 107 to start another revolution of shaft 105. It will be noted that relay 119 is designated in Fig. 1 with a second reference character such as (39). The reference character (39) shown in parentheses in Fig. 1 of the present application represents a corresponding element shown in Fig. 2 of the K. E. Fitch et al. U. S. Patent 2,405,571, dated August 13, 1946, which discloses an enciphering and deciphering device of the type employed in the present invention and designated 126 herein. Also, other reference characters in parentheses shown in the drawings of the present application represent corresponding elements in the K. E. Fitch et al., U. S. Patent 2,405,571, supra. The deciphering set of device 123 utilizes repeating relay (25) and printer selector magnet (26) for receiving deciphered signals incoming over line (16). Magnet (26), upon operating, is effective to control in a receiving printer a cam shaft of the type shown in S. Morton et al., U. S. Patent 1,904,164, issued April 18, 1933. Should the masking arrangement shown in Fig. 1 of the applicant's arrangement be employed at the receiving end, then the receiving cam shaft of S. Morton et al., U. S. Patent 1,904,164 would require an additional cam, such as cam 109 of Fig. 1 to alternately close and open a dummy circuit during the time when magnet (26) is responding to the selecting pulses of a deciphered incoming signal combination. In order to provide means for operating the dummy magnet during those intervals when certain space selecting pulses are being received by magnet (26), resistor 124' is inserted in the operating circuit for magnet (26) and thus resistor 124' serves the same purpose as resistor 124 in the operating circuit for repeating relay 119. U. S. Patent 1,904,164 is referred to in the K. E. Fitch et al., U. S. Patent 2,405,571, supra.

The additional cam 109 fixedly mounted on shaft 105 controls contact spring member 121 and normally holds it out of engagement with its associated fixed terminal 121'. Cam 109 is divided into seven sectors, arranged at its periphery in three indented and three unindented segments including that of the combined start and stop sectors, and these seven sectors correspond to the seven pulses employed in the start-stop five-unit permutation code. They lag by 90 de-

grees their corresponding sectors of the transmitting cams 104—1 to 104—5 and 108, because the point of peak portion 131 of spring member 121 in engagement with cam 109 is 90 degrees out of phase with the alignment of the points of contacts of peak portions 129—1 to 129—5 and 130 in engagement with their respective cams 104—1 to 104—5 and 108. Of the sectors of cam 109, only those sectors corresponding to selecting pulses Nos. 1, 3 and 5 are indented at the periphery. The indentation of sector 3 has the same angular width as that of each of cams 104, but the indentation of the sector corresponding to selecting pulse No. 1 is shorter by 2 degrees at the end adjacent to the sector corresponding to the start pulse and that of the sector corresponding to selecting pulse No. 5 is longer by 2 degrees at the end adjacent to the sector corresponding to the stop pulse. In Fig. 1A the lag of 90 degrees is represented by the angle between the row of arrowheads designated 129—1' to 129—5' and 130' and arrowhead 131'. These arrowheads respectively correspond to peak portions 129—1 to 129—5, 130 and 131 shown in Fig. 1.

Ordinarily, in the start-stop, five-unit permutation code, the pulses of each signal are generally arranged so that the start pulse and each of the selecting pulses Nos. 1 to 5, are of equal duration, that is, unity, and the stop pulse is 1.42 times longer. This means that each of the sectors encircling a teletypewriter transmitting cam shaft respectively corresponding to the start pulse and the five selecting pulses, would have an angular width of 48.5+ degrees and the sector corresponding to the stop pulse would have an angular width of 68.9+ degrees. However, by increasing the unindented periphery of the start sector of cam 109 a small angular amount, such as 2 degrees, at the end adjacent the sector No. 1, the angular width of the unindented periphery of the sector corresponding to the start pulse is increased to 50.5+ degrees, whereas the angular distance of the sector corresponding to selecting pulse No. 1 is decreased 2 degrees, as hereinbefore stated, to 46.5+ degrees. Likewise, by increasing the indented periphery of the sector corresponding to selecting pulse No. 5 at the end adjacent to the sector corresponding to the stop pulse, the angular width of the indented periphery of the sector corresponding to the stop pulse is increased to 50.5+ degrees, whereas the angular distance of the sector corresponding to the stop pulse is decreased 2 degrees, such as represented in Fig. 1A by (32.45+)+(34.45+) or 66.9+ as the actual angular width of the stop sector on cam 109. The reason for increasing on cam 109 the angular width of the start sector and that of the sector corresponding to selecting pulse No. 5 is to confuse the identity of the starting and the ending of each group of selecting pulses of the plain text signal combinations as each group of radiated voltage pulses appear on an oscillogram.

The contact spring members 120 and 102—1 to 102—5 transmit the plain text signals into the operating circuit for main repeating relay 119 which, as hereinbefore stated, may be replaced with the regular printer magnet of a teletypewriter, but which herein is shown as a sending or a repeating relay for transmitting the plain text signals to code ciphering device 126 wherein the signals of a key code are superimposed on the plain text signals for transmitting unintelligible signals over the line.

The contact at spring member 121 in engageable relation with cam 109 alternately closes and

opens the operating, or dummy, circuit for dummy magnet 123 during each revolution of the cam. The dummy circuit, during the closed intervals, is conditioned for operation but due to current normally flowing in the plain text signal circuit, the grid of vacuum tube 125 is normally biased negatively by the voltage produced across resistor 124, and no current can flow in the dummy circuit. However, when the voltage across resistor 124 decreases to about zero value due to an open condition in the plain text signal circuit caused by the transmission of a space pulse to main repeating relay 119, the operating circuit for dummy relay 123, during a closed interval of the contact on spring member 121, becomes energized to operate dummy relay 123. Therefore, main repeating relay 119 is arranged to operate in response to marking pulses and release in response to spacing pulses, and dummy relay 123 is arranged to release in response to the marking pulses and to operate in response to those spacing pulses that are transmitted at a time when the dummy magnet circuit is closed at the contacts controlled by cam 109. An effective rise in current value in the operating circuit for dummy relay 123 will cause a voltage pulse to be radiated. Likewise, an effective decrease in current value, whereby dummy relay 123 releases, will cause another voltage pulse to be radiated.

Inasmuch as the operating circuit for the dummy relay 123 has electrical characteristics identical with those of the operating circuit for main repeating relay 119, the dummy relay is therefore biased and of the polarized type, like that of main repeating relay 119. Should relay 119 be replaced with a printer selector magnet, then relay 123 should be replaced with magnet of identical electrical characteristics.

In Fig. 1A additional cam 109', stop cam 108' and selectors cams 104—1' to 104—5' are shown, for the purpose of illustration, with successively reduced diameters and so super-imposed, one on the other, as to clearly define the relative arrangement of the indents provided along the peripheries of the respective cams. Arrow 131' in Fig. 1A represents portion 131 of spring member 121, shown in Fig. 1, as being in engagement with cam 109. Peak portions 129—1 to 129—5 and 130 are formed as integral parts of switch-shifters 116—1 to 116—5 and 118, respectively, and are shown in Fig. 1 as being positioned in engageable relation with their respectively associated cams 104—1 to 104—5 and 108. These peak portions are respectively indicated in Fig. 1A by arrows 129—1', 129—2', 129—3', 129—4', 129—5' and 130' in proximity to their respective cams 104—1', 104—2', 104—3', 104—4', 104—5' and 108'.

The method of operation of Fig. 1

The method of operation of the arrangement shown in Fig. 1, will now be described with particular reference to Fig. 1C wherein a start-stop, five-unit permutation code signal representing the letter I is shown in diagrammatic form in line b, and the relative duration of the pulses of each of the signal combinations is indicated in line a, the start pulse and the five selecting pulses being represented by unity and the stop pulse being represented as 1.42 times longer.

When key 100 representing the letter I on the keyboard of the sending teletypewriter is operated, key lever 101—1 is momentarily depressed against the tension of spring member 101—1', to move selector, or code, bars 115—2 and 115—3 to-

ward the left, and selector bars 115-1, 115-4 and 115-5 toward the right unless these bars are already in their respective desired positions. The selector bars moved toward the right cause their respectively associated pivoted selector members 114-1, 114-4 and 114-5 to rotate on shaft 117 in a counter-clockwise direction thereby locking switch-shifters 116-1, 116-4 and 116-5 in such positions as to hold contact springs 102-1, 102-4 and 102-5 out of engagement with their respectively associated terminals 103-1, 103-4 and 103-5 during the revolution of cam shaft 105. Code bars 115-2 and 115-3, upon being moved toward the left unless already in these positions, cause the respectively associated pivoted selector members 114-2 and 114-3 to rotate on shaft 117 in a clockwise direction thereby releasing switch-shifters 116-2 and 116-3 to allow peak portions 129-2 and 129-3 to enter the indents in cams 104-2 and 104-3, respectively when the indents are presented to the peak portions. The depression of key lever 101-1, or any other key lever of the keyboard, causes universal bar 112 to rotate in a counter-clockwise direction around pin 113, and the free end of the universal bar moves upwardly against the tension of coil spring 127 to cause latch member 110 to disengage throw-out cam 111. When latch member 110 moves out of engagement with throw-out cam 111, driven clutch member 106 is permitted to mesh with driving clutch member 107 and cam shaft 105 is started on a revolution through a single cycle. Should there be no further operation of the keyboard following the operation of a key, such as key 100, latch member 110 having immediately returned to normal, would engage throw-out cam 111 at the end of the cycle of cam shaft 105, and the cam shaft would again be locked in its normal position.

In transmitting the start-stop, five-unit permutation code signal corresponding to the letter I the space and mark pulses constituting the signal are established during a revolution of shaft 105 in the following manner:

(1) the contact at terminal 120' is opened at the beginning of the start pulse, or first interval, and remains open for the duration of the five selecting pulses of the signal combination and a space pulse is sent to the main repeating relay 119 operating circuit, but relay 119 does not operate in response to a space pulse;

(2) the contact at terminal 103-1 remains open during the second interval to transmit the first selecting pulse, because switch-shifter 116-1 is restrained at this time from riding freely on cam 104-1 and a second space pulse is thereby sent to the main repeating relay 119 operating circuit as selecting pulse No. 1 which, like the start pulse, does not operate relay 119;

(3) the contact at terminal 103-2 is permitted to close during the third interval wherein peak portion 129-2 of switch-shifter 116-2 is in engagement with the indent of cam 104-2 and the second selecting pulse which is a marking pulse operates main repeating relay 119 for the duration of the closure of the contact;

(4) during the fourth interval the contact at terminal 103-3 is also permitted to close during the time that peak portion 129-3 of switch-shifter 116-3 is in engagement with the indent on cam 104-3 and the third selecting pulse is a marking pulse which continues the operation of relay 119 for the duration of the closure of the contact;

(5) during the fifth interval the contact at

terminal 103-4 remains open because peak portion 129-4 of switch-shifter 116-4 is restrained at this time from riding freely on cam 104-4 and, therefore, the fourth selecting pulse is a space to prevent main repeating relay 119 from being energized during this interval and the relay releases;

(6) during the sixth interval the contact at terminal 103-5 remains open because peak portion 129-5 of switch-shifter 116-5 is restrained from riding freely on cam 104-5 and the fifth selecting pulse is a space, so that main repeating relay 119 does not operate;

(7) during the seventh interval the contact at terminal 120' closes immediately after the fifth selecting pulse is transmitted, to send a stop, or marking, pulse for restoring main repeating relay 119 to its normally operated position, inasmuch as cam 103 has now returned to normal, and relay 119 is maintained operated until the next signal is transmitted.

These seven pulses for the start-stop signal for letter I are shown as stated above on line b of Fig. 1C.

In line c is shown the condition of main repeating relay 119 in response to each of the pulses of the letter I, received from the transmitting contacts over terminals 120', 103-1, 103-2, 103-3, 103-4, 103-5 and 121' respectively, the magnet becoming operated in response to each marking pulse and released in response to each spacing pulse.

In line d is shown the letter I signal "pick-up" which would appear on an oscillogram, in the form of short, sharp voltage pulses which are radiated by the operating circuit for main repeating relay 119, received by a nearby radio receiving set and recorded by an oscillograph (not shown). During the transmission of a signal combination, the contact at terminal 121' which is normally opened, is, beginning with selecting pulse No. 1, alternately closed and opened during the transmission of the five selecting pulses of each signal combination during a revolution of cam shaft 105. An alternation, with two exceptions, occurs coincidentally with each of the possible transitions in the wave of the five selecting pulses. The two exceptions are those respectively effected at the beginning of selecting pulse No. 1 and at the end of selecting pulse No. 5.

These exceptions are provided in order to eliminate the possibility of producing by means of the dummy circuit, short, sharp voltage pulses coincidentally with the end of the start pulse and the beginning of the stop pulse, respectively, of a signal combination. In this way the chance of recognizing the beginning of a signal combination is minimized.

In line e is shown the condition of the contacts controlled by cam 109, for each pulse of each signal combination during each revolution of cam shaft 105.

In line f is shown a wave representing the plate current in amplifier vacuum tube 125, which is effective to operate the dummy relay 123 during the transmission of the signal combination for letter I. The respective intervals of selecting pulses Nos. 1 and 5 are the only intervals of the transmitted letter I wherein the contacts at terminal 121' are closed at a time when the operating circuit for main repeating relay 119 is open to permit plate current to flow in the operating circuit for dummy relay 123.

Line g shows the condition of dummy relay 123

during the transmission of the letter I. The relay is indicated as being operated during the respective intervals of selecting pulses Nos. 1 and 5 in accordance with line *f*.

In line *h* is shown a series of short, sharp voltage pulses radiated by the operation and release of dummy relay 123 during the transmission of the signal combination corresponding to letter I.

In line *i* is shown the combined pick-up represented by a series of short, sharp voltage pulses radiated each time main repeating relay 119 operates and releases and each time that the dummy relay 123 operates and releases. Whenever the two relays operate or release simultaneously and each relay radiates a pulse, a combination pulse, additive in its result, is received by a radio receiving circuit in close proximity or in a room adjacent to the signal transmitter.

With reference to Fig. 1B the transmitting cam shaft 105 and its appurtenances are shown in a cross-sectional side view elevation (in front of selecting cam No. 1) as they actually appear in the teletypewriter, shown in Fig. 3 of U. S. Patent Re. 20,330, *supra*. Like reference characters in Figs. 1 and 1B designate like parts. In Fig. 1 the parts are shown widely separated and not as they are actually positioned in the teletypewriter, in order to give a clear illustration of the circuit arrangement.

Figure 2—General description

Fig. 2 is a modified form of Fig. 1 wherein the additional cam 109 is omitted and in its stead is provided a pair of cams mounted and operated independently of the transmitting cam shaft. This pair of cams is arranged to prepare the dummy circuit for operating at random with respect to the transitions in each of the plain text signal combinations. The teletypewriter like that in Fig. 1 is shown in schematic form in order to show the circuit arrangement. The transmitting cam shaft 205 is identical to that shown in Fig. 1B wherein the elements corresponding to those shown in Fig. 2 are designated with like reference characters, except for the hundreds digits which in Fig. 2 are of the 200 series.

The plain text signal circuit shown in Fig. 2 comprises main repeating relay 219, and operates in the same manner as the plain text signal circuit shown in Fig. 1. Also in Fig. 2, it will be noted that the main repeating relay, such as relay 219, is also designated with a second reference character, indicated in parentheses, such as (39). This and other reference characters shown in parentheses in Fig. 2 of the present application, represent corresponding elements in Fig. 2 of the K. E. Fitch et al., U. S. Patent 2,405,571 *supra*, which discloses an enciphering and deciphering device designated 226 herein. The operating circuit for dummy relay 223 is different from that for dummy relay 123 shown in Fig. 1 in that it is controlled by contact spring members 240 and 241. Contact spring members 240 and 241 are respectively arranged to be closed at random by cams 242 and 243 fixedly mounted on separate shafts 244 and 245 interconnected by a friction clutch 246. Cam 243 is driven by gear 247 which is in mesh with driving pinion 248 which, in turn, is driven from motor 249 by means of shaft 250. Driving clutch member 251 which is also driven by gear 247, is in frictional relation with driven clutch member 252, and the latter member is driven under the influence of the tension of coil spring 253. Friction clutch

246 during the rotation of shafts 244 and 245 effects a slippage in the rotation of cams 242 and 243 and thereby cause contacts 240 to close and open fortuitously with respect to the opening and closing of contacts 241. Each of cams 242 and 243 is provided with contact closing points at its periphery. The points on each of the cams may be arranged at equal or unequal distances apart, as described. In the arrangement shown in Fig. 2, the points on each of cams 242 and 243 are shown spaced 60 degrees apart. The angular distances between points on the two cams 242 and 243 may vary, during operation, from zero to 60 degrees. However, these points on the two cams taken together are shown herein as being 30 degrees apart as indicated in the view taken along dash line 2B which view is represented in Fig. 2B. Because of the friction clutch interconnecting shafts 244 and 245, the time interval between the closing of spring contacts 240 and the closing of spring contacts 241 will be always varying during operation and therefore the interval for operating dummy relay 223 will likewise vary at random.

In Fig. 2B wherein the points provided on cams 242 and 243, taken together, are shown spaced 30 degrees apart, with respect to their effect on the operating circuit for dummy magnet 223, the shaded points represent those provided on cam 243 and the unshaded, or open, points are those provided on cam 242.

Method of operation of Fig. 2

The method of operation of the arrangement shown in Fig. 2 will now be described with particular reference to Fig. 2A wherein a start-stop, five-unit permutation code signal representing the letter I is shown in diagrammatic form in line *b*, the relative duration of the pulses of each of the signal combinations being shown in line *a*. Lines *a*, *b*, *c* and *d* are the same as those shown in Fig. 1C.

Line *e* for the purpose of illustration shows the spacing between points on cam 242 to be of unequal distances, at which points contacts 240 momentarily close.

Line *f* shows the spacing between points on cam 243 as being of equal distances, at which points contacts 241 momentarily close. In the course of rotation of the two cams 242 and 243, the time intervals between the closures of contacts 240 and 241 are, due to slippage in clutch 246, continuously varying and, therefore, the timing of the closures of contacts 240 with respect to the closures of contacts 241 have an angular equivalent varying between zero and 60 degrees.

Line *g* shows the intervals wherein dummy relay 223 is operated in accordance with the timing of the closures of contacts 240 and 241 by means of the points on their respectively associated cams 242 and 243.

Line *h* shows the series of short, sharp voltage pulses that are "picked up" by the radio receiving set, a pulse being radiated each time the dummy magnet 223 momentarily operates.

Line *i* shows a combination of the short, sharp voltage pulses produced by the operation and release of main repeating relay 219 and the momentary operation of dummy magnet 223, the pulses radiated by both magnets being sufficient to disguise any "pick-up" from the transmitted plain text signals. The combination pick-up as shown in line *i* varies for each of the signals in the transmitted message.

Should the masking arrangement shown in Fig.

2 of the applicant's drawings be employed at the receiving end, the cam shaft of the receiving printer of the type shown in S. Morton et al., U. S. Patent 1,906,164, supra, would be employed without any additional cam and would be actuated by selector magnet (26). The dummy circuit including a magnet having the electrical characteristics identical to those of magnet (26) and corresponding to dummy repeating relay 223, together with a set of motor driven cams identical with the set comprising cams 242 and 243 would be employed to produce the masking pulses.

Figure 3—General description

Fig. 3 shows a modification of the circuit arrangement shown in Fig. 1 whereby two dummy circuits are employed to operate in conjunction with the plain text signal circuit. As hereinbefore stated, the dummy relay operating circuit shown in Fig. 1 operates at the time the spacing pulses only of the plain text signals are transmitted and then only at such times as when the contact between spring member 121 and terminal 121' is closed. In the modified circuit arrangement shown in Fig. 3, the operating circuit for main repeating relay 319, which responds to the plain text signals, is arranged to be connected at connecting terminals A—A to the teletypewriter in Fig. 1, and the two dummy circuit paths, the lower path comprising amplifier vacuum tube 325 and relay 323 and the upper path comprising amplifier vacuum tube 325' and relay 323' are arranged to be connected at connecting terminals B—B to spring member 121 and terminal 121' in Fig. 1. The lower dummy circuit path, including relay 323, corresponds to the dummy path shown in Fig. 1 and, like that of Fig. 1, responds whenever the contact between spring member 121 and terminal 121' is closed, to the spacing pulses only of the transmitted plain text signal. The upper dummy circuit path including relay 323' differs from the lower path of relay 323 in that the grid of vacuum tube 325' is connected to resistor 324 at the side opposite to that to which the grid of vacuum tube 325 is connected. Unlike the dummy circuit shown in Fig. 1, the dummy circuit paths shown in Fig. 3 have grid biasing batteries 356 and 356'. Normally the grid of vacuum tube 325 is positively biased and that of vacuum tube 325' is negatively biased. The purpose of the biasing battery in the grid circuit of tube 325' is to prevent the operation of relay 323' in the upper dummy circuit path whenever a spacing pulse is received in the plain text signal circuit during a time when spring member 121 is in engagement with terminal 121'. The purpose of the biasing battery in the grid circuit of tube 325 is to maintain normal conditions in both dummy circuits substantially equal. In a circuit arrangement such as shown in Fig. 3, a short, sharp voltage pulse is radiated from a relay in one or the other of the dummy circuits at every possible transition in the transmitted plain text signal wave, thus improving the masking effect.

Also in Fig. 3 it will be noted that the main repeating relay, such as relay 319, is designated with a second reference character (39). This reference character, in parentheses, represents a corresponding element shown in Fig. 2 of K. E. Fitch et al. U. S. Patent 2,405,571 supra, which discloses an enciphering and deciphering device designated 326 in the present application. Device 326 is the same as those respectively designated 126 in Fig. 1 and 226 in Fig. 2, each of which represents, in diagrammatic form, the device

shown and described in the Fitch et al. U. S. Patent 2,405,571, supra.

The deciphering set of device 326 also utilizes relay (29) and selector magnet (26) shown in Fig. 1 but not shown in Fig. 3, and operates on the same general principle outlined above in the description of the arrangement shown in Fig. 1. The circuit for receiving the deciphered signals will be hereinafter described.

Method of operation of Fig. 3

The method of operation of the arrangement shown in Fig. 3 will now be described with reference to Fig. 1C wherein the start-stop, five-unit permutation code signal, represented by the letter I, is shown in diagrammatic form. The operating circuit for main repeating relay 319 responds to the pulses of the signal in the same manner as main repeating relay 119 in Fig. 1, hereinbefore described. The lower dummy circuit path, including dummy relay 323, responds to the spacing pulses of the signal in the same manner as the dummy circuit shown in Fig. 1, also hereinbefore described. The upper dummy circuit path, including dummy relay 323', responds to the marking pulses of the signals but only at such times as when the contact between spring member 121 and terminal 121' is closed. Normally, dummy relay 323' is in its spacing position because of its normal, biased condition, and the grid of vacuum tube 325' is negatively biased by battery 356'. However, as soon as a signal for letter I is transmitted, the upper dummy circuit path functions as follows:

(1) The contact at terminal 120' is opened at the beginning of the start pulse, or first interval, and remains open for the duration of the five selecting pulses of the signal combination. A space pulse is thus sent to the plain text signal circuit, and normally operated main repeating relay 319, included therein, releases. The open condition of the contact between spring member 120 and terminal 120' causes the voltage across resistor 324 to decrease to zero value. Neither of the dummy relays 323 nor 323' operates because contact between spring member 121 and terminal 121' is open at the beginning of the first interval and, therefore, the dummy circuit paths are still in their normal condition, that is, open. The decrease in current in the operating circuit for relay 319 causes a voltage pulse to be radiated but no pulse is radiated by either of the dummy circuit paths.

(2) The contact at terminal 103—1 remains open during the second interval to transmit the first selecting pulse, because switch-shifter 116—1 is restrained at this time from riding freely on cam 104—1 and a second space pulse is thereby sent to the plain text signal circuit as selecting pulse No. 1 which, like the start pulse, does not operate relay 319. During the second interval the contact between spring member 121 and terminal 121' closes and the absence of voltage across resistor 324 permits vacuum tube 325 in the lower dummy circuit path to become active and dummy relay 323 operates. The zero voltage drop across resistor 324, however, does not affect vacuum tube 325' in the upper dummy circuit path because of the negative bias normally applied to the grid of vacuum tube 325' by battery 356'. The rise in value of the energizing current for relay 323 at the beginning of the second interval radiates a voltage pulse. No voltage pulses are radiated by the operating circuits for relays 319 and 323'.

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(3) The contact at terminal 103—2 is permitted to close at the beginning of the third interval when peak portion 129—2 of switch-shifter 116—2 moves into engagement with the indent of cam 104—2 and the second selecting pulse, which is a marking pulse, operates main selecting relay 319 for the duration of the closure of the contact. At the beginning of the closure, dummy relay 323 which became operated at the beginning of the second interval, now releases because when the contact at terminal 103—2 closed the voltage drop occurring across resistor 324 impresses a negative bias on the grid of vacuum tube 325 and the contact between spring member 121 and terminal 121' opens. The opening of the contact between spring member 121 and terminal 121' also prevents any operation of dummy relay 323' even though the bias on the grid of vacuum tube 325' is at this time positive. At the beginning of the third interval the rise in value of the energizing current for relay 319 and the decrease of energizing current for relay 323 cause voltage pulses to be radiated with additive effect. No voltage pulse is radiated at this time by relay 323' at the beginning of the third interval.

(4) At the beginning of the fourth interval, the contact at terminal 103—3 also is permitted to close when peak portion 129—3 of switch-shifter 116—3 moves into engagement with the indent on cam 104—3 and the third selecting pulse, which is a marking pulse, continues the operation of main repeating relay 319 for the duration of the interval. The voltage across resistor 324 is, during the third interval, continued for the fourth interval and, although the contact between spring member 121 and terminal 121' now becomes closed, the negative bias applied to the grid of vacuum tube 325 prevents dummy relay 323 from operating. However, the voltage across resistor 324 impresses a positive bias on the grid of vacuum tube 325', overcoming the negative charge normally applied to the latter grid, to cause dummy relay 323' to operate. No voltage pulses are radiated by the operating circuit of either relay 319 or 323, but one is radiated by the rise in the energizing current in dummy relay 323'.

(5) During the fifth interval, the contact at terminal 103—4 remains open because peak portion 129—4 of switch-shifter 116—4 is restrained at this time from riding freely on cam 104—4 and, therefore, the fourth selecting pulse is a space to prevent main repeating relay 319 from being energized during this interval and the relay releases. The absence of voltage across resistor 324 at this time has no effect on vacuum tube 325 inasmuch as the contact between spring member 121 and terminal 121' is open during the fifth interval. The open condition between spring member 121 and terminal 121' causes dummy relay 323' to release. At the beginning of the fifth interval the decrease in the current in each of relays 319 and 323' radiates a voltage pulse and these pulses are additive in their effect. No voltage pulse is radiated by the operating circuit for dummy relay 323.

(6) During the sixth interval, the contact at terminal 103—5 remains open because peak portion 129—5 of switch-shifter 116—5 is restrained from riding freely on cam 104—5 and the fifth selecting pulse is a space, so that main repeating relay 319 does not operate. The absence of voltage across resistor 324 causes vacuum tube 325 to be active and therefore dummy relay 323 operates, inasmuch as the contact between spring member 121 and terminal 121' is closed during the sixth

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interval. The normal negative bias on the grid of vacuum tube 325' prevents dummy relay 323' from operating at this time. No voltage pulse is radiated by the operating circuit of either of relays 319 and 323' at the beginning of the sixth interval, but one is radiated by the rise in the energizing current in the operating circuit for dummy relay 323.

(7) During the seventh interval, the contact at terminal 120' closes immediately after the fifth selecting pulse is transmitted to send a stop, or marking, pulse for restoring main repeating relay 319 to its normally operated position, inasmuch as cam 108 has now returned to normal, and relay 319 is maintained operated until the next signal is transmitted. The contact between spring member 121' and terminal 121' becomes open at the beginning of the seventh interval and dummy relay 323 which was operated for the duration of the sixth interval, now releases. The open condition of the contact between spring member 121 and terminal 121' prevents dummy relay 323' from operating at this time. A voltage pulse is radiated by the rise in current in the operating circuit for relay 319 and another by the decrease in current in the operating circuit for dummy relay 323 and these pulses are additive in effect. No voltage is radiated by dummy relay 323' at this time.

It will, therefore, be noted that for the signal corresponding to letter I a voltage pulse is radiated at every possible transition in the transmitted signal wave and that those voltage pulses radiated at the beginning of the third, fifth and seventh intervals are respectively additive in their effect. It will also be noted that except for the additive effect of certain pulses, depending upon the character transmitted, the radiated pulses form a pattern that is uniform for all signal combinations.

Should the masking arrangement shown in Fig. 3 of the applicant's arrangement be employed at the receiving end, then the cam shaft of the receiving printer of the type shown in S. Morton et al. U. S. Patent 1,904,164, supra, would require an additional cam such as cam 109 for controlling the two dummy circuits which would be similar to those shown in Fig. 3, except that each would include a magnet instead of a repeating relay, the magnets having electrical characteristics identical with those of magnet (26).

What is claimed is:

1. A method of protecting the secrecy of a telegraph message which comprises transmitting messages over a message signaling circuit having the inherent attribute of radiating nocuous voltage impulses, intermittently closing a path at regularly recurring intervals for conditioning a dummy circuit adapted to radiate like voltage impulses, and applying to said dummy circuit, when conditioned, a change of voltage occurring across a portion of said message signaling circuit to radiate electrical energy components at least in part at times different from the occurrence of those radiated by said message signaling circuit in addition to the electrical energy components radiated from said message signaling circuit by said message signals, the energy components radiated from said dummy circuit, when intercepted along with the energy components radiated by said message signaling circuit, serving to confuse an intelligible interpretation of said message.

2. In a telegraph system, means for generating

telegraph signals, a work circuit responsive to said signals and including signal responsive means having the inherent attribute of radiating nocuous electrical impulses, a dummy circuit having electrical characteristics identical with said work circuit and including similar means for radiating electrical impulses identical in character to those radiated by said work circuit and at least in part at times different from the occurrence of those radiated by said work circuit, and means for pulsing said dummy circuit whereby the electrical energy components radiated by said two circuits are identical in character rendering impossible the detection of the components radiated by said work circuit.

3. In a telegraph system, means for generating telegraph signals, a work circuit responsive to said signals and including signal responsive means having the inherent attribute of radiating nocuous electrical impulses, a dummy circuit having electrical characteristics identical with said work circuit and including similar means for radiating electrical impulses identical in character to those radiated by said work circuit, and means for pulsing said dummy circuit at random with respect to the signal transitions whereby the electrical energy components radiated by said two circuits are identical in character rendering impossible the detection of the components radiated by said work circuit.

4. In a telegraph system, means for generating telegraph signals, a work circuit responsive to said signals and including signal responsive means having the inherent attribute of radiating nocuous electrical impulses, a dummy circuit having electrical characteristics identical with said work circuit and including similar means for radiating electrical impulses identical in character to those radiated by said work circuit, and means for pulsing said dummy circuit at instants of certain transitions and possible transitions of said telegraph signals whereby the electrical energy components radiated by said two circuits are identical in character rendering impossible the detection of the components radiated by said work circuit.

5. In an impulse transmission system, a source of signaling current impulses, a channel of signal transmission including means responsive to impulses from said source and having the inherent attribute of radiating nocuous electrical impulses, a circuit including other impulse responsive means and adapted to radiate like electrical impulses, contact means for conditioning said circuit, and control means in said channel of signal transmission responsive to changes in potential of the signals from said source for energizing said other impulse responsive means when conditioned by said contact means to cause said other impulse responsive means to radiate a series of electrical energy components at least in part at times different from the occurrence of said nocuous electrical impulses and effective to prevent detection of the signaling current impulses from the electrical energy components radiated by the impulse responsive means in said transmission channel.

6. In a telegraph system, telegraph signal generating contacts, a signal responsive device having an operating circuit controlled by said contacts, non-message signal generating contacts, a circuit including an operable device and controlled by said non-message signal generating contacts, the second-mentioned circuit having electrical characteristics identical with those of

the first-mentioned circuit, means for alternately opening and closing said non-message signal generating contacts at times coincident with every possible transition of the signals transmitted from said telegraph signal generating contacts, means included in the first-mentioned circuit and controlled by said telegraph signal generating contacts for conditioning the second-mentioned circuit for operating said operable device, and other means jointly controlled by said conditioning means and said non-message signal generating contacts for operating said operable device at times different from said signal responsive device to radiate components like those from said signal responsive device.

7. In a telegraph system, means for generating telegraph signals, a work circuit responsive to said signals and having the inherent attribute of radiating nocuous electrical impulses, a dummy circuit having electrical characteristics identical with those of said work circuit and adapted to radiate like electrical impulses, and means comprising an element in said work circuit and interrupting contacts in said dummy circuit for pulsing said dummy circuit to radiate electric energy components at least in part at times different from the occurrence of those radiated by said work circuit during the transmission of telegraph signals whereby the electric energy radiated by said circuit includes components rendering the components attributable to said work circuit indistinguishable from those attributable to said dummy circuit.

8. In a telegraph system, telegraph message signal generating contacts, a message signal responsive device having an operating circuit therefor controlled by said contacts, non-message signal generating contacts, a circuit including an operable device and controlled by said non-message generating contacts, the second-mentioned circuit having electrical characteristics identical with those of the first-mentioned circuit, means for alternately opening and closing said non-message signal generating contacts in timed relation with every possible transition of the signals transmitted from said message signal generating contacts, means included in the first-mentioned circuit and controlled by said message signal generating contacts for conditioning the second-mentioned circuit for operating said operable device, other means in the second-mentioned circuit jointly controlled by said conditioning means and said non-message signal generating contacts for operating said operable device at times different from said signal responsive device, and energy producing means in each of said circuits effective at the energization and the deenergization of each of said circuits whereby the energy produced by one circuit combines with the energy produced by the other to mask the message before such message is transmitted to a receiving point.

9. In a telegraph system, telegraph message signal generating contacts, a message signal responsive device having operating means therefor controlled by said contacts, non-message signaling generating contacts, parallel operating means controlled by said non-message signal generating contacts, each having electrical characteristics like those of the operating means for said message signal responsive means, an operable device included in each of said parallel means, means for opening and closing said non-message signal generating contacts in timed relation with the opening and closing of the first-mentioned con-

tacts, a resistance element in the first-mentioned operating means arranged to operate in conjunction with said non-message signal generating contacts for controlling the operation of one of said parallel operating means in response to certain of the impulses of each of the message signals generated by the first-mentioned contacts and for controlling the operation of another of said parallel means in response to the other of said impulses, and means for radiating energy components by the operation of the responsive device and each of said operable devices that are alike in character and therefore indistinguishable whereby to prevent intelligible detection of the message signals.

10. In a telegraph system, telegraph message signal generating contacts for transmitting mark and space impulses, message signal responsive means having operating means therefor controlled by said contacts, non-message signal generating contacts, a plurality of dummy operating means controlled in part by said non-message signal generating contacts and each having electrical characteristics like those of the first-mentioned operating means, means for opening and closing said non-message signal generating contacts in timed relation with the opening and closing of the first-mentioned contacts, impedance means included in said first-mentioned operating means for operating under the control of both sets of said contacts one or another of said dummy operating means in accordance with the mark or space nature of the impulses transmitted from said first-mentioned contacts, and means for radiating electrical energy every time each of said operating means operates to produce an energy component for every possible transi-

tion of the signal transmitted, said components being alike and therefore indistinguishable whereby to prevent intelligible detection of the message signals.

11. In a telegraph station, telegraph signal generating contacts, a signal responsive device having an operating circuit controlled by said contacts, non-signal generating contacts, a circuit associated with said non-signal generating contacts having electrical characteristics like those of the operating circuit for said signal responsive device, means for alternatively opening and closing said non-signal generating contacts at successive times of possible signal transitional operation of said signal generating contacts, and means also associated with said second-mentioned circuit and controlled by said signal generating contacts for controlling the conductivity of said second-mentioned circuit jointly with said non-signal generating contacts whereby the pattern of energy radiated by said station includes components like and coinciding with certain of the possible signal transitional components in addition to actual signal transitional components.

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