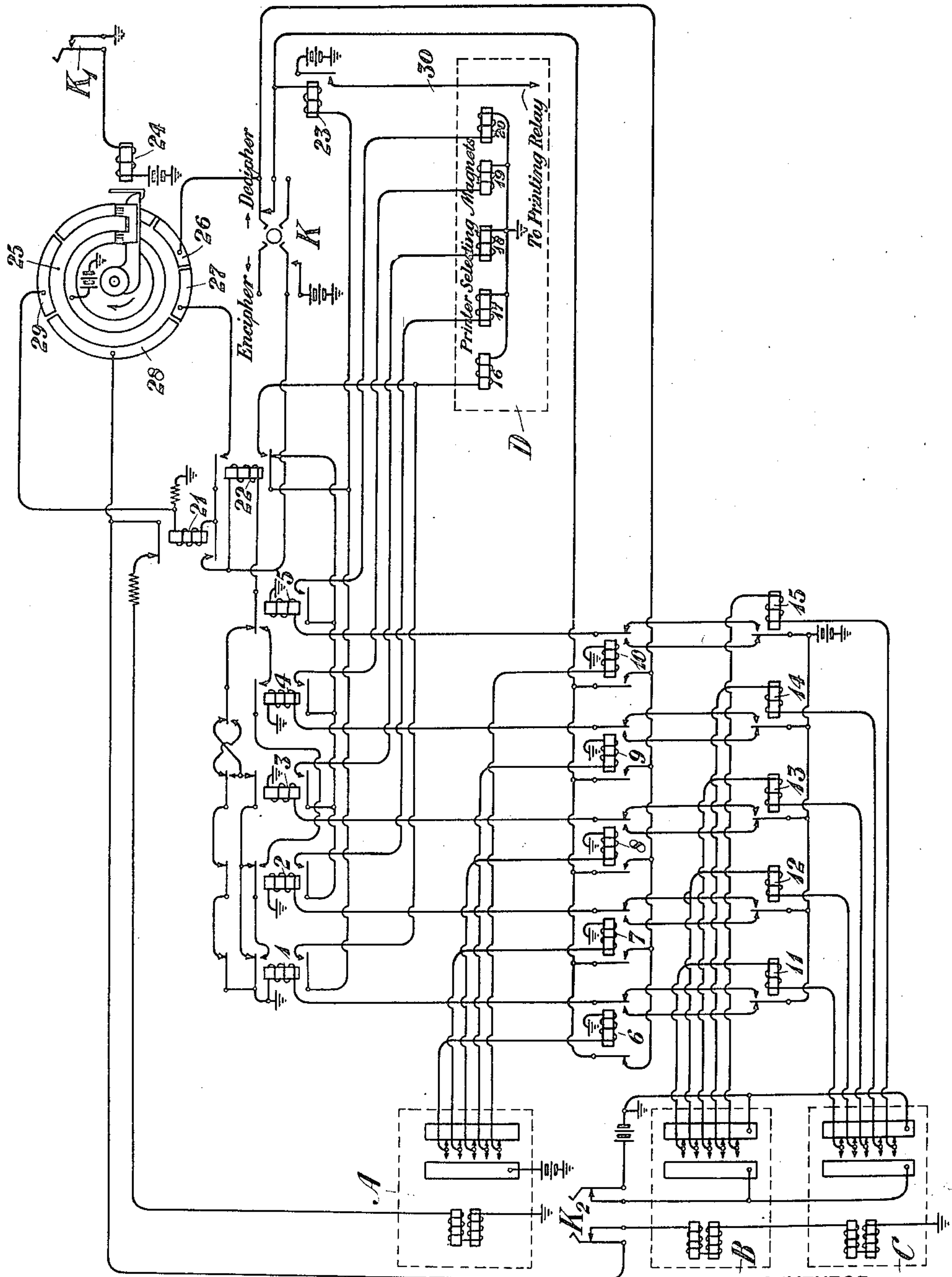


R. E. PIERCE.
CIPHERING DEVICE.
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1,426,669.

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CIPHERING DEVICE.

1,426,669.

Specification of Letters Patent. Patented Aug. 22, 1922.

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To all whom it may concern:

Be it known that I, RALPH E. PIERCE, residing at Larchmont, in the county of Westchester and State of New York, have invented certain Improvements in Ciphering Devices, of which the following is a specification.

This invention relates to a device for enciphering and deciphering messages and more particularly to a device of this character which is adapted for use with messages prepared by printing telegraph mechanism.

Arrangements have been developed for enciphering and deciphering messages by the use of printing telegraph equipment in which arrangement the characters of a message, which are in code formation, are combined in effect with the code combinations of one or more perforated key tapes, and the resulting code combinations make up the characters of the enciphered message. To decipher such a message the code combinations representing characters of the enciphered message are combined at the receiving station with the code combinations of two cipher tapes identical to those used at the sending station, and the resulting code combinations will represent the characters of the original message. Such an arrangement is illustrated in detail in the U. S. Patent No. 1,320,908, issued November 4, 1919, to R. D. Parker. In this device the code combinations of the enciphered or deciphered message may be recorded on a perforated tape, or the corresponding characters may be printed, if desired, and the message may then be transmitted in any desired manner to its destination.

One of the well known codes utilized with messages prepared by printing telegraph equipment is the Baudot code, in which each character is represented by a combination of five "markings" or "spacing" impulses. In a five unit code of this sort there are 32 different code combinations, of which 26 are used to designate letters of the alphabet, and the remaining 6 combinations are used as "stunt signals" to control operations of the printing mechanism, such as "line feed," "carriage return," etc. In the

above mentioned method of enciphering messages, these six "stunt signals" will ordinarily appear at irregular intervals in the cipher message, and therefore they must be recorded in some way in the written or printed form of the message. The presence of these "stunt signals" cannot be avoided by omitting them from the original message and key tapes, because of the fact that they are produced by various combinations of letters in the message with letters in the key tapes. If an ordinary printer is used to record the cipher messages prepared in this manner, the result would be a badly confused message due to the fact that the "stunt signals" occur at other than the proper times. Furthermore, if numerals or punctuation marks were utilized to represent the "stunt signals" in the printed form of the message, the message in this form would be undesirable for transmission over commercial telegraph or cable lines due to the fact that mixed groups containing both letters and numerals or punctuation marks are not accepted for transmission by cable, and when transmitted over land lines each such group is counted as five words. If numerals or punctuation marks were used for designating "stunt signals" in the printed form of the cipher message, these numerals or punctuation marks might appear frequently in the enciphered message and the charge for transmitting such a message over a commercial line would be exceedingly high. Accordingly, it is the general purpose of this invention to provide arrangements for preparing the cipher messages in a desirable form for transmission over commercial lines, and this is accomplished substantially by providing means for eliminating the "stunt signals" from the printed form of the message. Other objects and features of the invention will appear more fully in the detailed description thereof hereinafter given.

The method of enciphering the original message is accomplished by the arrangements of the invention in the following manner:

When the characters of the key tapes and the message tape combine so as to produce a

stunt signal combination, arrangements are provided so that the message tape will be stopped while the key tapes are advanced one or more steps until they combine with the same character of the message tape to produce a code combination which is not a stunt signal. This combination will then be printed and all of the tapes will be stepped ahead in the normal manner. In order to be able to decipher the message, it is necessary to designate the points where the message tape has been stopped. For this purpose, one letter may be chosen as a "designating letter" and the apparatus is arranged so that each time the key tapes are stepped ahead while the message tape is stopped, this "designating letter" will be printed in the enciphered message. In the arrangements of this invention the "designating letter" has been chosen as the letter "E," although it is understood that the invention might be so arranged that any other letter might be utilized for this purpose. When the cipher tapes and the message tape combine to produce the signal combination which normally represents the "designating letter," this combination should be treated as a stunt signal; in other words, the message tape should stop and the key tapes should be stepped ahead.

The method of deciphering the message is accomplished by the arrangements of this invention in the following manner:

The deciphering operator should perforate a tape the characters of the received cipher message, including the "designating letter" whenever it occurs. The deciphering apparatus is arranged so that it will combine this message tape with two cipher tapes and print the deciphered message. It

is also arranged so that all characters produced by combining the "designating letter" with the cipher message tape with the key tapes will be discarded; in other words, the printer will fail to operate when the "designating letter" in the cipher message tape passes through the message transmitter. By including the designating letter in the enciphered message tape, compensation is made for the relative shifting of the key tapes with respect to the original message tape in enciphering and accordingly, when the enciphered message tape is recombined with the key tapes at the deciphering station the appearance of the designating letter therein at every point where the original relationship between key tape and message tape was changed will serve to restore the relationship.

The invention may be more fully understood from the following description, together with the accompanying drawing, in which is illustrated a preferred arrangement of the invention. In the drawing there is shown a transmitter A for the mes-

sage tape and two transmitters B and C for the cipher tapes. The cipher transmitters control the cipher relays 11, 12, 13, 14 and 15. The message transmitter A controls the transmitter relays 6, 7, 8, 9 and 10. The transmitter relays and the cipher relays in turn control the selecting relays 1, 2, 3, 4 and 5, upon which will be set up the code combinations resulting from a combination of the message tape with the cipher tapes. As this method of operation is fully described in the aforementioned patent to R. D. Parker, no further description thereof will be given. The selecting relays 1, 2, 3, 4 and 5 in turn control the selecting magnets 16, 17, 18, 19 and 20 of a printer D, which may be of any desirable type well known in the art. A control key K and a starting key K₁ are also provided. Associated with the arrangement are the release control relay 23, the "E" relay 22, and the control relay 21, the function of which relays will be pointed out later. In order to control the sequence of operation of the apparatus, there is provided a distributor 25.

With the control key K not operated, the printer D will record all the combinations set up on the selecting relays. The operation of the arrangements under these conditions is as follows:

When the start key K₁ is operated, a circuit will be closed for operating the distributor start magnet 24. This will release the brush arm of the distributor 25, which will rotate continuously over the segments of the distributor. When the brush crosses segment 26, a circuit will be closed from battery, through the brush, segment 26, right hand contact of control key K, winding of release control relay 23, to the lower armature of selecting relay 1 and also through the lower back contact of "E" relay 22 to the armatures of selecting relays 2, 3, 4 and 5. If any of the selecting relays are operated at this time, the circuit will be extended through their contacts and through the windings of the corresponding printer selecting magnets 16, 17, 18, 19, and 20 to ground. The closing of this circuit will operate one or more of the selecting magnets, and also the release control relay 23. The release control relay 23 will close a circuit over conductor 30 for starting the operation of the printer. The printer will operate in the normal manner and record the character corresponding to the combination set up on the selecting relays. The "E" relay 22 cannot operate as its circuit is open at the lefthand contacts of the control key K. The control relay 21 cannot operate unless the "E" relay 22 operates. When the brush crosses segment 28, the stepping magnets of all three tape transmitters, A, B and C, will be operated thus stepping the tapes

ahead, and when the brush passes off of segment 28 the transmitter magnets will be released and new signal combinations will be set up on the cipher relays, transmitter relays and selecting relays. The combination thus set up on the selecting relays will be printed on the next revolution of the brush arm. These operations will be repeated as long as the brush arm is allowed to revolve.

To eliminate the stunt signals in enciphering a message, the control key should be thrown so as to operate its lefthand contacts. This will connect battery to the "E" relay 22 and through the winding of the "E" relay 22 to the upper contacts of the selecting relays. These contacts are so wired that they will operate "E" relay 22 only when a combination representing a stunt signal or the letter "E" (the "designating letter") is set up on the selecting relays. The circuits for operating the "E" relay 22 may be traced through the contacts of the selecting relays as follows:

1. Letter shift signal (++++), and figure shift signal (++--).

From "E" relay 22 through the front contacts of selecting relays 5, 4, 2 and 1 to ground.

2. Blank tape signal (----), and line feed signal (-+--).

From "E" relay 22 through the upper back contacts of relays 5 and 4 and middle back contacts of relays 3 and 1 to ground.

3. Letter "E" (+----).

From "E" relay 22 through upper back contacts of relays 5 and 4, and middle back contacts of relays 3 and 2, and middle front contact of relay 1 to ground.

4. Space signal (-++--).

From "E" relay 22 through upper back contact of relays 5 and 4, upper front contact of relay 3, and upper back contacts of relays 2 and 1 to ground.

5. Carriage return signal (---+-).

From "E" relay 22 through upper back contact of relay 5, upper front contact of relay 4, and upper back contacts of relays 3, 2 and 1 to ground.

6. A study of the circuit will show that for all other combinations the circuit of "E" relay 22 will be open.

As long as no stunt signal or letter "E" combinations are set up on the selecting relays, the apparatus will operate as previously described. If, however, a combination representing the letter "E" or a stunt signal is set up on the selecting relays, the "E" relay 22 will operate. Under these conditions the circuit arrangements will operate in the following manner:

When the brush crosses segment 26, battery will be connected through the right hand contacts of the control key K, winding of release control relay 23, lower arma-

ture and front contact of "E" relay 22 and winding of selecting magnet 16 to ground. This will operate selecting magnet 16 and the release control relay 23 with the result that the printer will print the letter "E", the "designating letter".

The "E" relay 22 also prepares a circuit for operating the control relay 21, and when the brush crosses segment 27 the latter relay will operate and lock itself. The control relay 21 also opens the circuit of the stepping magnet of the message transmitter A. Accordingly when the brush crosses segment 28, the key tapes will be stepped ahead, but the message tape will remain stationary. When the brush crosses segment 29, the control relay 21 will be short circuited and released.

When the key tapes step ahead, a new combination will be formed with the same letter in the message tape. This new combination will ordinarily be different from the previous combination and usually it will not be a stunt signal. Cases will arise, however, where a stunt signal combination is again produced. In the former case, "E" relay 22 will be released and the apparatus will operate in a normal manner (as described previously), but in the latter case "E" relay 22 will be operated when the brush revolves again and the printer will print the letter "E" again and the key tapes will step forward to form a new combination with the same letter, these operations being repeated until a combination which is not a stunt signal is produced.

The apparatus of the invention may also be used for deciphering and printing the messages coming in in enciphered form. As previously pointed out, the received cipher message should first be converted into perforated tape form by means of a keyboard perforator. This tape should be run through the message transmitter A with the control key thrown so as to operate its right hand contacts. This will cut the battery off the "E" relay 22, and therefore the "E" relay 22 and the control relay 23 will not operate. It will also connect the lefthand contacts of the transmitter relays 6, 7, 8, 9 and 10 in series with the conductor from segment 26 to the release control relay 23. The left hand contacts of these transmitter relays are so wired that they open the circuit of the release control relay 23 whenever the combination representing the letter "E" (+----) is set up on them. Accordingly whenever the letter "E" in the cipher message tape passes through the transmitter, the printer will fail to operate, and therefore the printer will discard all characters formed by combining the letter "E" (the "designating letter") with the characters in the key tapes. In order to more clearly point out how

compensation is made in deciphering for the relative shifting of the key tapes and message tape which takes place in enciphering, let it be assumed that in the original message tape there were four characters or code combinations. Let it be assumed that in combining with the key tapes the first two characters combine normally to produce enciphered characters; then in the original message tape, the cipher tapes, and the enciphered message, there would be two characters apiece. Suppose now that the third character in the original message tape in combining with the key tapes should produce a "stunt" combination. There would then be produced in the enciphered message the designating letter and the key tapes would be stepped ahead. The third character would then combine with the fourth character of the key tapes to produce an enciphered character. There would then be three characters in the original message and four characters in the cipher tapes and the enciphered message. Let the fourth character of the original message tape now combine with the fifth character of the key tapes to produce an enciphered combination. The result would be that from four characters of the original message there would be an enciphered message with five characters, one of which was the designating letter, and five of the characters of the key tapes would have been utilized. To decipher, the enciphered tape of five characters would be combined with key tapes similar to those utilized before. The first two characters of the enciphered message would be recombined with the first two characters of the key tapes in the normal manner to produce the first two characters of the original message. The third character of the enciphered message would be the designating letter and nothing would happen except that both the enciphered tape and the key tapes would be stepped ahead. The fourth character of the enciphered tape would now combine with the fourth character of the key tape and would give the third character of the original message. The fifth characters of enciphered tape and key tapes would then give the fourth character of the original message. Under these conditions the apparatus will automatically decipher the message and the printer will record a correct copy of the original message.

While the invention has been disclosed in certain specific arrangements which have been deemed desirable, it is understood that it is capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A transmitter including a message tape,

a transmitter including a cipher tape, a plurality of selecting relays, means for combining the code combinations of said message tape with the code combinations of said cipher tape and setting up the resulting code combinations on said selecting relays, said resulting code combinations representing characters and "stunt" signals, a printer normally controlled by said selecting relays, and means operating whenever said resulting code combination represents a "stunt" signal, said means when operated causing said printer to print an arbitrarily chosen character and causing said cipher tape to be stepped ahead. 65 70 75

2. A transmitter including a message tape, a transmitter including a cipher tape, a plurality of selecting relays, means for combining the code combinations of said message tape with the code combinations of said cipher tape and setting up the resulting code combinations on said selecting relays, said resulting code combinations representing characters and "stunt" signals, a printer including a plurality of selecting magnets normally controlled by said selecting relays, a relay associated with said magnets and said selecting relays and operating whenever the resulting code combination set up on said selecting relays represents a "stunt" signal, said relay when operated causing said printer magnets to operate in an arbitrarily chosen manner, operating circuits for advancing the tapes of said transmitters, and means controlled by said relay when operated for holding open the operating circuit of said message transmitter tape. 80 85 90 95 100

3. A transmitter including a message tape, a plurality of transmitter relays upon which the code combinations of said message tape may be set up, a transmitter including a cipher tape, a plurality of cipher relays upon which the code combinations of said cipher tape may be set up, a plurality of selecting relays, the operating circuits of which are controlled over the contacts of said transmitter relays and said cipher relays, a printer controlled by said selecting relays, and a controlling relay for starting said printer in operation, the operating circuit of said controlling relay being so associated with the contacts of said transmitter relays that whenever a certain arbitrarily chosen code combination is set up on said transmitter relays said operating circuit will be held open and said printer will fail to operate. 105 110 115 120

4. In a ciphering device in which the code combinations of a message tape are combined in effect with the code combinations of a key tape and the resulting code combinations forming the ciphered message are utilized to control a printer, the method of eliminating certain signals from the printed 125

form of the ciphered message which consists in automatically stopping the normal operation of said printer whenever the resulting code combination represents one of said signals, automatically changing the relationship between said message tape and said key tape to produce a different resulting code combination, and automatically recording said change in relationship in the printed form of said message.

In testimony whereof, I have signed my name to this specification this 9th day of July, 1920.

RALPH E. PIERCE.