

Dec. 9, 1941.

H. S. BACON

2,265,715

CIPHER APPARATUS

Filed May 29, 1940

2 Sheets-Sheet 1

Fig. 1.

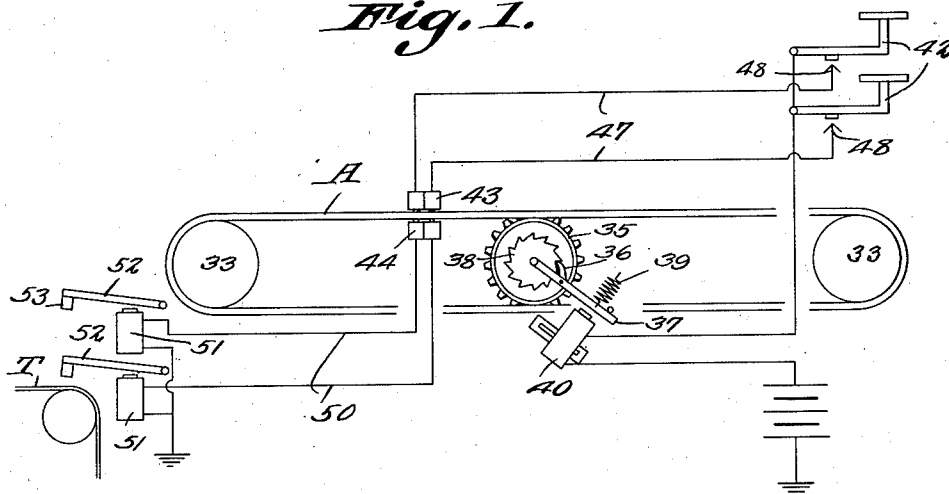
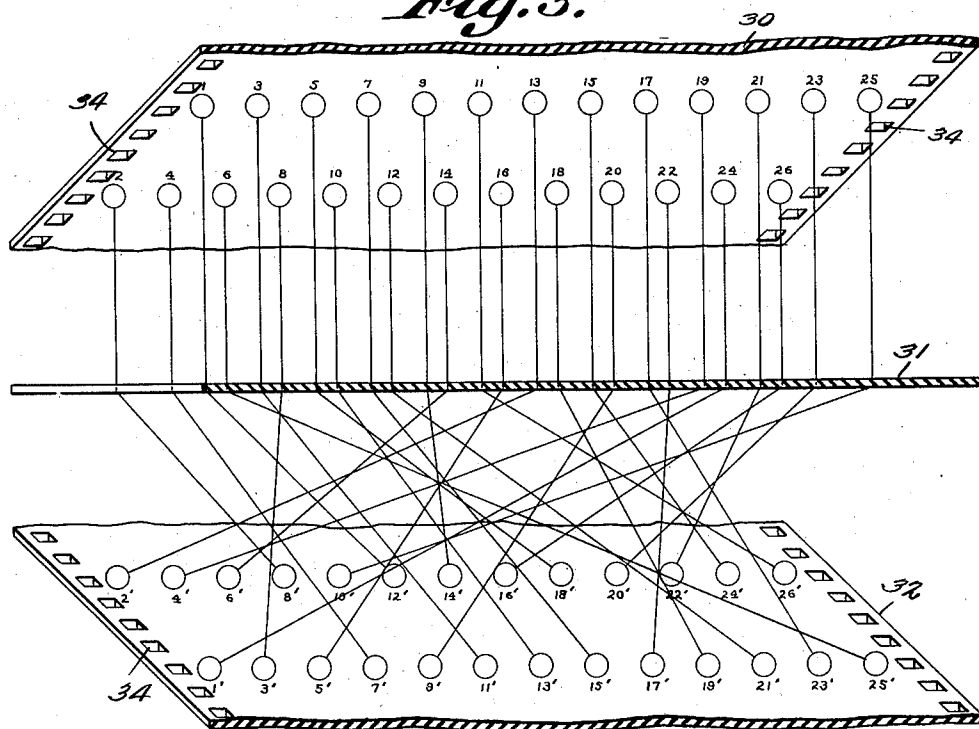


Fig. 5.



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Fig. 2.

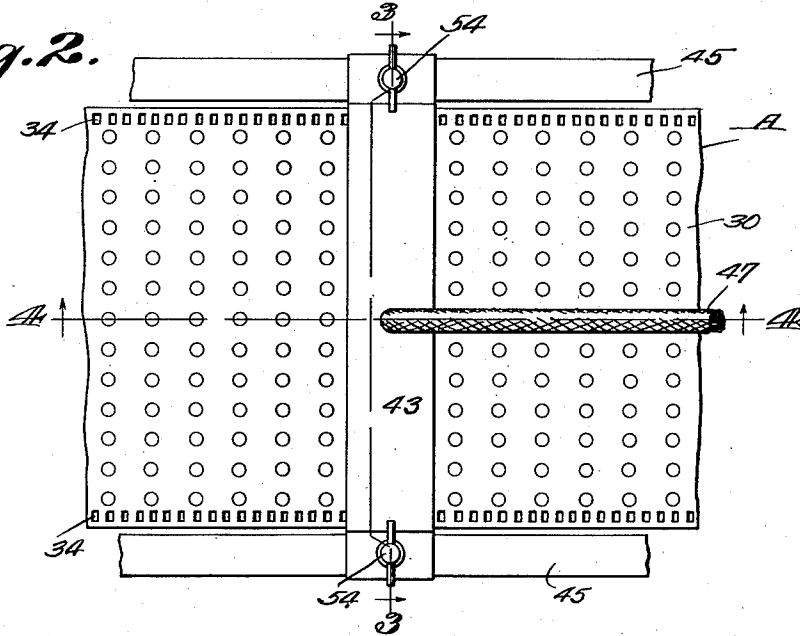


Fig. 3.

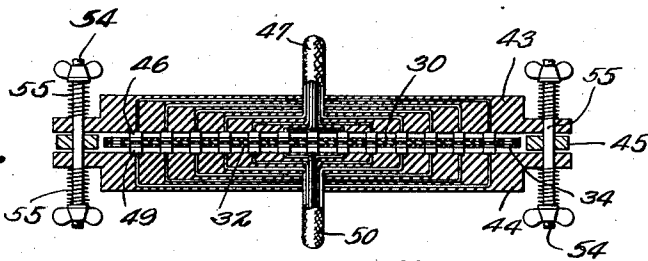
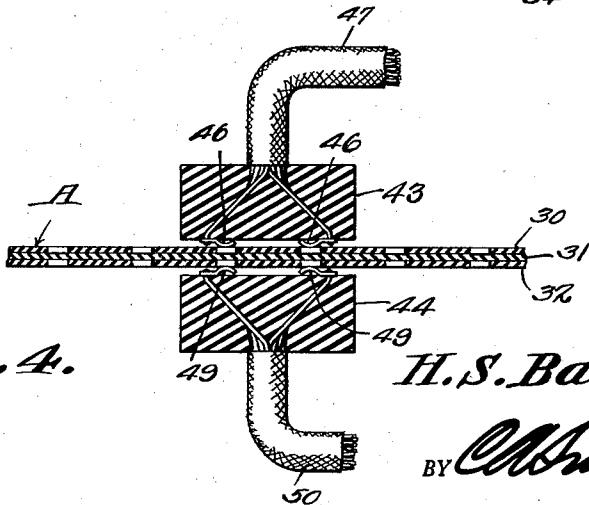


Fig. 4.



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UNITED STATES PATENT OFFICE

2,265,715

CIPHER APPARATUS

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Application May 29, 1940, Serial No. 337,944

4 Claims. (Cl. 35-4)

This invention relates to apparatus for systematically and automatically substituting one character for another in the conversion of messages into and out of cipher, the operation of the apparatus being such that repetitions are eliminated, thus assuring cryptographic security, the change from clear text to cipher being possible at different speeds and with repeated changes in the relationship between the transmitted characters and those contained in the message in cipher.

Another object is to provide a means converting clear text to cipher text and cipher text to clear text, said means being designed to serve as an accessory to machines that transmit, receive, print and/or record.

A further object is to provide a machine of this character utilizing a cipher tape which can be placed in or removed from the apparatus for the purpose either of translating a message from clear text into cipher or for transmitting a message without the cryptographic features.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings

Figure 1 is a view in diagram showing the apparatus constituting the present invention combined with a transmitter and a receiver.

Figure 2 is a plan view of a portion of the master tape used for garbling or mixing the transmitted message, the contact means being shown associated therewith.

Figure 3 is a section on line 3-3, Figure 2.

Figure 4 is a section on line 4-4, Figure 2.

Figure 5 is a view showing a portion of the master tape with the laminations thereof perforated and also illustrating the connections between the opposed sets of contacts carried by the tape.

Referring to the figures by characters of reference, A designates a master tape which, in the structure illustrated, is in the form of an endless belt made up of three plies of insulating material designated 30, 31 and 32 respectively. This tape can be mounted on rolls 33 and can be provided, along one or both edges, with series of

apertures 34. Each series is adapted to be engaged by the teeth of a wheel 35 which, in the structure illustrated, can be rotated intermittently by a pawl 36 carried by lever 37. This pawl engages one of the teeth of a ratchet wheel 38 rotatable with the wheel 35 and a spring 39 serves to hold the lever and pawl normally in one position. An electromagnet is disposed adjacent to the lever as indicated at 40 and each time this electromagnet is energized, it will attract the lever against the action of spring 39. When the magnet is deenergized the spring will actuate the lever to rotate the ratchet wheel 38 and the wheel 35 one point thereby correspondingly moving the tape A. This magnet is included in one side of a circuit leading to any desired number of switches 42 each of which can be in the form of a typewriter key. The magnet 40 can be adjusted toward or from the fulcrum of lever 37 so that the stroke of the lever will be varied when the magnet is energized thereby causing the tape to move a greater or a lesser distance, as desired. Obviously this adjustment of the movement of the tape can be effected in various other ways within the scope of the present invention.

In the structure illustrated, the tape is provided within the lamination 30 with parallel rows of contacts extending transversely of the tape. Thirteen of these contacts are in each row and two rows are provided for each group of contacts. The contacts on lamination 30 have been indicated by the numerals 1 to 26 inclusive and the corresponding contacts carried by the lamination 32 are designated by the numerals 1' to 26' inclusive. Each contact carried by one group of contacts on lamination 30 is connected electrically to one of the contacts of the corresponding group on lamination 32. The connections can be arranged in any manner desired. For example contact 1 can be electrically connected to contact 12' and contact 2 can be electrically connected to contact 8'. Thus whenever any one of the contacts on lamination 30 is charged with current, the current will be conducted therefrom to the contact on lamination 32 which is joined thereto electrically. If the contacts 1 to 26 inclusive are used for the twenty-six letters of the alphabet and circuits thereto are to be closed by means of key switches 42, twenty-six of these keys will be used.

For the purpose of directing current to and conducting it from the contacts of the master tape, upper and lower cross-bars 43 and 44 formed preferably of insulating material are ex-

tended transversely above and below the tape and are carried by the side members 45 of the frame of the machine. Each of these bars is preferably of insulating material and each contains, in the present structure, two parallel rows of contacts 46 all of which are electrically connected through a cable 47 to the contacts 48 of the respective switches 42. These contacts 46 are so positioned that all of them will simultaneously engage all of the contacts of one group on the lamination 30. In other words if twenty-six contacts are provided in each group on the lamination 30, these being positioned in two rows of thirteen each, twenty-six contacts 46 will also be provided in bar 43, these being similarly arranged.

Bar 44 is likewise provided with contacts 49 located beneath the respective contacts 46 and equal in number thereto. These contacts are all electrically connected through a cable 50 to electromagnets 51, one of these magnets being provided for each contact 49. Each magnet is adapted to actuate a lever 52 constituting the armature thereof and this lever can be provided with a type 53 for making an impression on a tape T or the like provided for receiving the transmitted message.

The bars can be joined at their ends by rods 54 on which springs 55 are mounted, these springs serving to thrust the bars toward each other so as to insure proper engagement of contacts 46 and 49 with the contacts 1 to 26 inclusive and 1' to 26' inclusive.

The apparatus herein described can be used in connection with an electric typewriter, a teletype machine, or any other apparatus employed for transmitting, recording or printing messages electrically. Where keys like those forming a part of a typewriter are employed, the depression of one of the keys will result in closing an electric circuit through cable 49 to the contact on lamination 30 connected thereto. From this contact current will be shunted to the contact in lamination 32 electrically connected thereto and from that contact the current will be directed through the cable 50 to the magnet 51 associated with the latter contact or, if desired, the current can be carried back to the originating machine for transmitting, recording or printing. Thus this magnet will be energized to actuate its lever 52 and print or transmit a character. At the same time that magnet 51 is energized, the magnet 40 is also energized and lever 37 actuated. When key 42 is released from circuit-closing position, spring 39 will actuate lever 37 to shift the tape A one point or notch, thus bringing a new row of contacts into position between the bars 43 and 44. The circuit to the energized magnet 51 is also broken.

The two opposed groups of contacts carried by the master tape can be joined in any suitable arrangement. For example if the key 42 belonging to the letter "a" is depressed, this being the circuit to the contact 1, a type controlled by the contact 12' will be actuated. This can be any letter which might be associated with said contact. Thus although the message as transmitted by the keys will follow the proper lettering of the words, the recorded or transmitted message will differ entirely therefrom. For the purpose of preventing repetition the master tape is shifted one or more notches following each actuation of a type thus presenting an alphabet with a differently arranged circuit so that there will be no repetition or, in other words, the actuation

of one key will very seldom result in the printing of the same character.

Obviously the tape can be caused to move one or more rows at a time through the actuation of the ratchet wheel and either to right or left.

In deciphering a message it is merely necessary to reverse the operation, always starting the tape at a predetermined point relative to the bars and reversing the transmission of the current through the tape, the keyboard of the transmitting instrument being positioned where the receiver is indicated in Figure 1 while the receiver is positioned where the transmitter is shown in said figure. Thus in deciphering it is essential only to know at which row the tape is started, and the length of each movement of the tape when actuated.

What is claimed is:

1. Coding and decoding apparatus including a transmitter, a receiver included in a normally open circuit with the transmitter, said transmitter having separately operated switches one of which is provided for each character to be transmitted, oppositely positioned groups of substantially stationary contacts included in the normally open circuit, one group being composed of parallel sets of contacts, the contacts of one of said sets being electrically connected to some of the switches and the contacts of the other set being electrically connected to the remaining switches, said receiver having separate elements responsive to the action of the respective switches when the circuit thereto is otherwise closed, the other group of contacts being composed of parallel sets of contacts, the contacts of one set being electrically connected to some of said elements of the receiver and the contacts of the other set being electrically connected to the remaining elements, and a tape movably mounted between the opposed groups of contacts, said tape being provided on each face with equally spaced rows of contacts, the contacts in each row being equal in number to the contacts of one of the sets and each contact on the tape being positioned for engagement with a predetermined contact of any one of the sets, said rows being arranged in groups each comprising two rows on each side of the tape and the said rows being so spaced that any two next adjoining rows on the two faces of the tape will simultaneously engage all of the stationary contacts respectively, and electrical connections carried by the tape for joining each contact on one face of the tape with a differently located contact in the same group on the other face of the tape, the relative location of the joined contacts of each group differing from the relative location of the joined contacts in other groups.

2. Coding and decoding apparatus including in an electric circuit a transmitter having separately operated switches, one for each character to be transmitted, a receiver having separate code receiving elements responsive to the respective switches when shifted to close an electric circuit, opposed groups of terminal contacts in two rows each, the contacts in the rows of one group being electrically connected to the respective switches and the contacts in the rows of the other groups being electrically connected to the respective receiving elements, an endless tape mounted for movement between said groups, and means for holding substantially straight that portion of the tape adjacent to and between said groups, said tape having opposed rows of contacts for engagement with the respective groups, and electrical connections joining opposed tape

contacts in pairs, the relative locations of the electrically connected contacts of each pair differing from the relative locations of the joined contacts of other pairs.

3. Coding and decoding apparatus including in an electric circuit a transmitter having separately operated switches, one for each character to be transmitted, a receiver having separate code receiving elements responsive to the respective switches when shifted to close an electric circuit, 5
opposed groups of terminal contacts in two rows each, the contacts in the rows of one group being electrically connected to the respective switches and the contacts in the rows of the other groups being electrically connected to the respective receiving elements, an endless tape mounted for movement between said groups, and means for holding substantially straight that portion of the tape adjacent to and between said groups, said 10
tape having opposed rows of contacts for engagement with the respective groups, and electrical connections joining opposed tape contacts in pairs, the relative locations of the electrically connected contacts of each pair differing from the relative locations of the joined contacts of 15
other pairs, the rows of contacts on the tape being 20
25

ing so positioned as to feed one row of contacts at a time to each group but maintain two rows in contact with each group, and means for intermittently moving the tape to feed said rows along a straight line to said groups.

4. In coding and decoding apparatus the combination with opposed groups of circuit terminals, each group comprising parallel rows of contacts, of an endless mixing tape mounted for intermittent movement between said groups and including spaced rows of contacts on each face, said rows on the tape being so located that two rows on each face will be in engagement with all of the contacts of the respective terminal groups during every pause in the intermittent movement of the tape, electrical connections joining the contacts on one face of the tape to contacts on the opposed face, said contacts being connected in pairs, the relative locations of the electrically connected contacts of each pair differing from the relative locations of the joined contacts of the other pairs, and means for intermittently operating the tape to feed the contacts on its two faces one row at a time between the opposed groups of two rows of terminal contacts.

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