Sept. 29, 1936. A. L. PATTON 2,055,702

ELECTRICAL CIPHERING AND DECIPHERING DEVICE

Filed Dec. 15, 1934 2 Sheets-Sheet 1

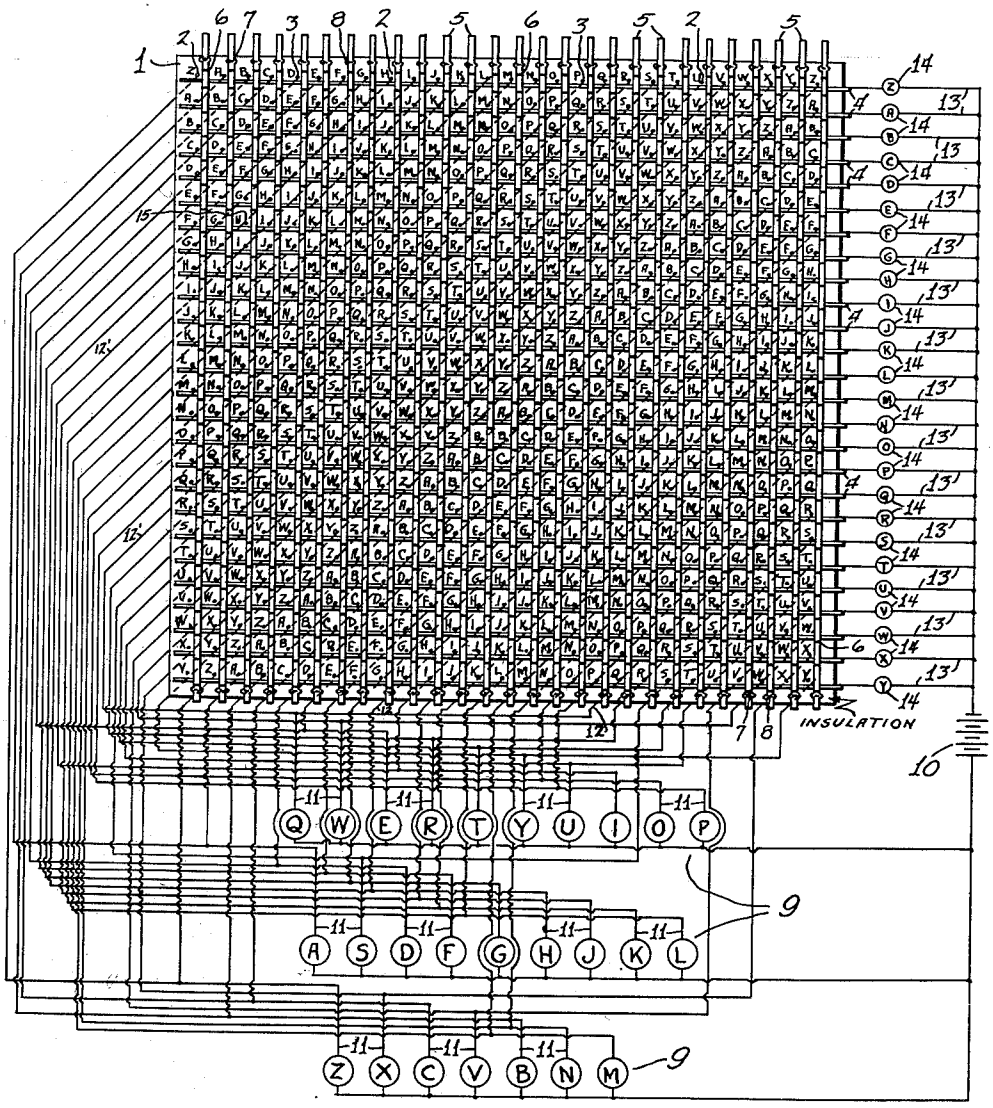


Fig. 1.

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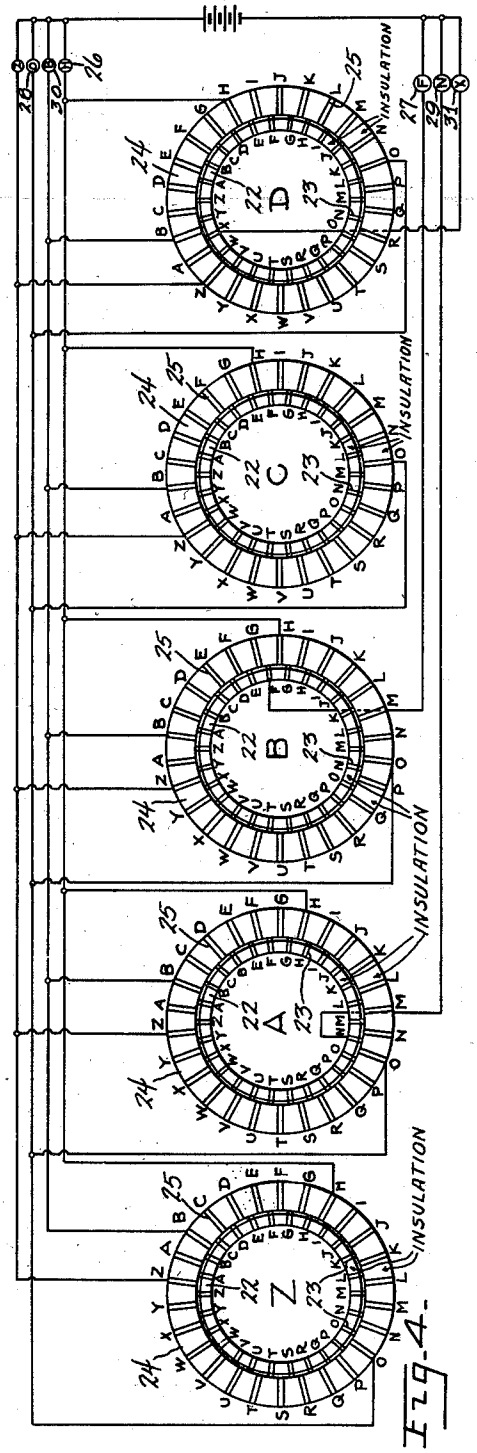


Fig. 4.

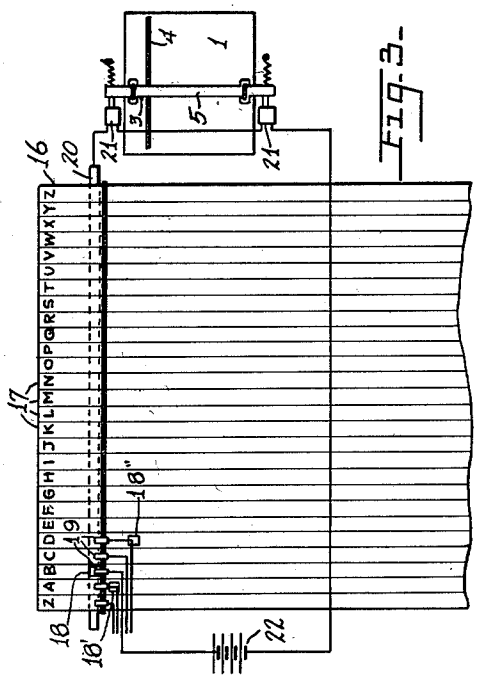


Fig. 3.

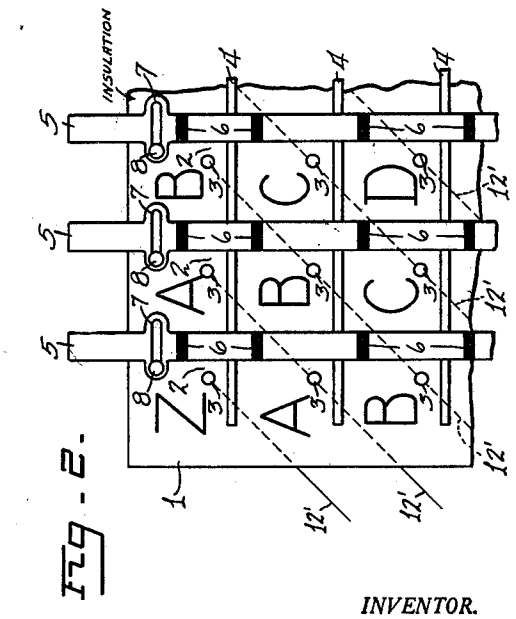


Fig. 2.

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Patented Sept. 29, 1936 2,055,702

UNITED STATES PATENT OFFICE

2,055,702

ELECTRICAL CIPHERING AND DECIPHERING DEVICE

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Application December 15, 1934, Serial No. 757,739

7 Claims. (Cl. 35—4)

My invention relates to improvements in electrical ciphering and deciphering devices, and it consists of the combinations, constructions and arrangements hereinafter described and claimed.

An object of my invention is to provide an electrical ciphering and deciphering device in which I make use of a plurality of electrical circuits closed in any predetermined manner for translating a message into a code. The code can be transmitted in any manner desired, such as by printing it on a paper and mailing it, or sending it by wire, radio, wireless, or by an electrically operated typewriter. In fact, any manner for transmitting the code comes within the purview of this invention.

The electrical circuits are so arranged that a different code character will be sent out even though the same character of the message is repeatedly used. For example, if the letter "A" in the message appears frequently therein, the code will not have a corresponding character appearing the same number of times as the letter "A" appeared in the message. In this way the deciphering of the code is practically made impossible. Although I have shown letters used in the present drawings, it is obvious that numbers or even characters can be used without changing the nature of the invention.

I further provide means for permitting the person receiving the coded message to quickly decode the message. This means relies upon a key word or a series of characters forming the key which both the sender and receiver know. This key word or series of characters can be changed as often as desired, and in this simple way the entire code can be changed at will, even though the same message may be sent, first using one key word, and then subsequently using a second key word or series of characters. It will be seen, therefore, that one of the principal features of the invention is the absolute freedom afforded the operator in choosing any key character desired for each character of the message that is being deciphered.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming a part of this application, in which

Figure 1 is a schematic view of one means for closing the switches in a predetermined manner, and shows the wiring mechanism for this particular means;

Figure 2 is an enlarged detail of a portion of the device shown in Figure 1;

Figure 3 is a diagrammatic view of a slightly modified form of the device in which certain of the switches are electrically closed and controlled in a predetermined manner instead of being manually closed; and

Figure 4 is a schematic view similar to Figure 1, but showing the parts arranged in the form of a cylinder instead of in the form of a flat surface.

In carrying out my invention I provide a plurality of rows or gangs of switches. In order to make the invention easier to understand, I have labeled the twenty-six switches in each row constituting a gang of switches, with letters of the alphabet from A to Z inclusive. It is obvious that other characters or even foreign alphabets may be used, the number of rows or gangs and the number of switches in each row or gang being fixed and determined by the number of characters used. In the case now being considered, which is based upon the English alphabet, the twenty-seven rows of switches not only each contain twenty-six switches, but the initial switch in each row, beginning at the top, is given a different identifying character, and Figure 1 shows these characters starting with the letter Z and ending with the letter Z, the rows in between being lettered from A to Y inclusive. The reason for having duplicate rows of switches starting with the letter Z will be set forth hereinafter.

Any construction for supporting the switches or for actuating them may be devised, and I do not wish to be confined to the particular construction shown. However, in order to set forth in detail one form of the invention I provide a board 1 made of insulating material, and this board has twenty-seven rows or gangs of switches vertically arranged in the drawings, and these rows are indicated by the reference numeral 2. Each switch includes a terminal 3 that is in the form of a pin, see Figure 2, and this pin extends through the board 1. Adjacent to each pin 3 I dispose conducting strips 4 which are arranged horizontally in Figures 1 and 2. These strips extend through the entire width of the board 1 as shown.

On top of the strips 4 I dispose conducting rods 5 that are arranged vertically in Figure 1. In actual practice the rods 5 will lie in a plane parallel with the surface of the board 1, and will contact with the strips 4. The rods 5 extend at right angles to the strips 4, and are normally

spaced from the terminals 3. Each rod has insulating portions 6 and operates a gang of switches. The insulating portions are so arranged that when the rod is moved to the left in Figure 2 so as to contact with the terminals 3, the gang of switches is closed and the energizing of any one of the terminals in the manner hereinafter described will cause an electric current to flow only to the strip 4 associated with the energized terminal.

A simple means for closing all of the switches in one of the rows consists of a slot 7 provided at each end of the rod and a pin 8 slidably received in the slot and connected to the board 1. The operator can grasp the top and bottom ends of the left hand rod 5, in Figures 1 and 2, for example, and can move the rod to the left in these figures, and this will cause the rod to contact with all of the terminals 3 since these terminals project a sufficient distance above the top of the board 1 to be engaged by the rod 5 when the rod is so moved. If it is desired to open the switches, it is merely necessary to grasp both ends of the rod 5, and to move the rod to the right in Figures 1 and 2, and this will separate the rod from its associate terminals 3. Any means for closing the switches can be used. In the present instance each switch comprises a terminal 3, a portion of the rod 5, and the strip 4.

In Figure 1 I have shown a standard typewriter keyboard indicated at 9. The keys do not have to be arranged in the manner indicated. In fact other characters than those shown can be used. I have shown these keys as constituting electrical finger-board switches, and all are connected with a source of current such as a battery 10. Wires 11 lead from the key switches and extend across the under surface of the board at an angle of forty-five degrees as clearly shown in Figures 1 and 2. The lead wires extending across the under surface of the board are electrically connected to the terminals 3. As an illustration, take the key switch Q. It will be noted that the wire 11 leading from this switch extends to a diagonal wire 12, that runs beneath the board 1, and this wire is connected to all of the terminals 3 on the board 1, which are in line with the wire. A second branch of the wire 11 connects to a second diagonal wire 12', and this second diagonal wire extends across the under surface of the board and is connected to all of the terminals 3 that are in line with this wire. It is obvious that the diagonal wires 12 and 12' can be imbedded in the board if desired, or can even be placed on top of the board so long as they are insulated from the strips 4 and the rods 5. The wires 11, 12 and 12' constitute message wires or initial character-representing wires over which the plain text message characters are sent from the finger-board switches 9.

In actual practice the board itself will not be lettered in the manner shown in Figure 1, but in order to aid in the understanding of the invention these letters have been placed on the board. The strips 4 are connected by wires 13 back to the source of current 10, and have electrically actuated means associated therewith for sending the desired code message. For simplicity I have merely shown a plurality of signal lights 14 in series with the wires 13, and I have lettered these lights Z and A to Y inclusive. The signal lights may be circuit-closing switches which, in turn, can actuate any manner of sending device. In fact the characters themselves can be changed. The strips 4 and wires 13 constitute code wires or character-representing wires over which the code characters are sent.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

Suppose it is desired to send the plain text message word HOBART as a code, and that the key word is BAD. I will follow through with three of the letters of the message word HOBART, namely H, O and B, and this will suffice for the illustration. The operator moves the rod 5 of the B row or gang of switches to the left in Figure 1, and this rod is the third one from the left in the figure. The reason for closing the B rod 5 is that the letter B is the first one appearing in the key word. The rod will, therefore, close all of the terminals 3 in the B row. The operator now depresses the key switch H because this is the first letter of the plain text message he is sending. The circuit thus closed includes the message wire 11 leading from the H key, the diagonal message wires 12 and 12' on the board 1 connecting all of the H terminals 3, the code character-representing strip 4 associated with the "H" terminal in the column "B", lettered 15, the code character-representing wire 13 connected with the "live" strip 4, the code character-representing signal light 14 lettered "F", the source of current 10, and back to the switch "H".

It will be noted that the letters on the board are so arranged that each letter of the alphabet will appear in a diagonal row extending clear across the board, and that there are two of such rows for each letter. The code letter sent out will be "F", and this code letter will stand for the first letter of the message "H". After the H switch has been momentarily closed the rod 5 in the vertical B row will be moved to the right and will open all of the gang switches in this row.

In like manner when sending out the next letter "O" in the message the rod 5 associated with the vertical row of switches A will be moved to the left. This rod is the second one appearing from the left in Figure 1. The key switch "O" is now closed, and this will energize two diagonal rows of terminals 3 associated with the letter O and it will be seen that a second circuit is closed and that the code letter "N" will be sent out. The rod 5 associated with the vertical A row of switches is now opened.

In sending the message letter "B" the rod 5 associated with the D row of the key word is closed and this is the fifth rod from the left in Figure 1. The key switch B is closed, and this will energize the terminals arranged in diagonal rows and bearing the letters "B". Since the rod D has been closed the terminal next to the bottom in the vertical row D will be energized and will close the circuit to the strip 4 associated therewith and the code letter "X" will be sent out by the third circuit thus closed. Coding of the remainder of the message continues in the same manner, a key letter having first been chosen for each letter throughout the message, these key letters designating the movements of the gang switch bars as shown in the foregoing example. Passages from printed books make convenient keys, because such books may lie about unprotected without arousing suspicion. Or if the operators of the machines desire, they may prepare keys wherein the letters follow in haphazard sequence, forming no words at all. Thus the key letters B—A—D of the illustration are seen to be only the first three letters of a continuous key equal in length to the message.

I will now briefly describe how the code is deciphered at the receiving end. The receiver has the key word "BAD" and has received the code letters "F N X". In decoding the receiver reverses the manner of closing the rods 5. By this I mean that where the rod B is closed in sending the message, and this rod is the third from the left in Figure 1, the receiver closes the rod which is the third from the right in the same figure, and it will be seen that this rod is X. After the rod X is closed the code letter "F" received is depressed on the key board. The key switch F energizes two diagonal rows of terminals 3 bearing the letter F, and the rod that closes the X vertical row will be the third one from the right, and it will be seen that this will close a circuit which will flash the signal light 14 lettered H. In other words, the receiver has now deciphered the first letter in the message.

The rod X is opened, and in deciphering the next letter, the rod Y will be closed. This rod is the second from the right and is the complement of the second rod A from the left corresponding to the second letter in the key word "BAD". The second code letter N will now be depressed on the key board and the terminal N in the vertical row Y will be energized, and this will close the second deciphering circuit which will flash the signal light 14 lettered "O".

Finally, the rod Y will be opened and the rod V corresponding in number to the rod D from the opposite side of the board will be closed. The key switch X, which is the third letter in the code, will be closed and this will energize the terminal X in the V row. This terminal will close the third deciphering circuit and the signal light 14 lettered B will be energized. It will thus be seen that the receiver has decoded the message received.

In actual practice the operator will, however, not locate the complemental rows in the manner just described but will simply head the columns with a secondary series of letters in which the order of sequence reads in the opposite direction from that used in coding. He then uses the original key word direct without counting from left to right and right to left etc.

In Figure 3 I show a slightly modified form of the device. This form of the device works exactly the same as the form already described, except that the rods 5 are electrically moved into closed position and not manually moved. A strip of paper or other material 16 is used, and this has a row of columns 17 corresponding to the vertical rows of switches. The paper has perforations or openings 18 cut therein in a predetermined manner, and these openings correspond with the key word. For example, the top opening 18 in Figure 3 is in the B column and corresponds with the first letter of the key word "BAD". The opening 18' disposed directly below the first opening 18 is in the A column, and the next opening 18'' disposed below the opening 18' is in the D column. If the key word "BAD" were the only one used, these openings would repeat themselves indefinitely along the length of the paper 16. A finger 19 is arranged above each column 17, and these fingers electrically contact with a conductor rod 20 should an opening be provided between the fingers and the rod. The rod 20 is in electrical circuit with a pair of solenoids 21, and these in turn are in electrical connection with a source of current 22, and with the fingers 19.

When sending a message with this form of the device the opening 18 being in registration with the rod 20 will close the circuit so that the solenoids 21 connected with the rod 5 of the B column will have moved the rod to the left and closed the gang terminals 3. The striking of the key switch H now follows, and will close the ciphering circuit which will give the code letter F in the manner indicated. The same movement in striking the key switch H mechanically advances the paper 16 (by any means, not shown) so that the opening 18' now overlies the rod 20. The key switch O of the message is now closed, and a second ciphering circuit will be closed which will give the code letter "N". The depressing of the key switch O again advances the paper 16 mechanically, and the operator is now ready to send the code letter "X" which corresponds with the message letter "B".

When the receiver has the message "F N X" and he wishes to decode it, he reverses the paper 16, and then positions the paper so that the uppermost perforation or opening 18 overlies the conductor rod 20. The finger in the X column, which is the complement of the B column, would therefore be in electrical connection with the conductor rod 20. The circuit is now closed to the solenoids 21, which are associated with the rod 5 of the X column. The rod 5 is moved to the left and closes the terminals 3 in the manner already described, and closing of the key switch F by the operator will close the deciphering circuit and will flash the signal light 14 representing the letter H. Any means, not shown, may be actuated by the release of the operator's key to advance the sheet 16 one opening so that the opening in the Y column will now be above the rod 20. The solenoids 21 associated with the Y row will now be actuated and will move their rod 5, thus closing this gang switch preparatory to the next closing of a deciphering circuit by the operation of an operator's key switch.

The key switch N is now closed because the next letter of the code is N, and the flashed signal light energized by the second deciphering circuit will show O, which will be the second letter in the decoded message. The depression and release of the key switch N again advances the paper one opening, and the opening 18'' will now be in the V column, and will electrically connect the V rod 5 so that the switches in the V column will be closed.

The closing of the key switch X corresponding to the third code letter will close the third deciphering circuit and will flash the signal light 14 bearing the letter B. It will therefore be seen that for decoding the message it is merely necessary to turn the paper 16 upside down, and to feed it through the device in the manner described.

The means for advancing the sheet 16 is left to the user's option because, in one case, it may be advisable to incorporate this control device with the operator's keyboard as a single unit, whereas, in another case, it may best serve as a part of the final unit, being attached to a printing or transmitting device. The propelling movement and power can, then, originate in another machine.

I deem any device to fall within the spirit and intent of my invention which advances the sheet 16 at the time and to the distance which I have specifically set forth in these specifications.

There are a number of devices already developed and in use on typewriters and adding

machines which are readily adaptable to the purposes of this invention and thus I offer the user of my device the fullest flexibility in convenient adaptation to his own needs.

In the determination of the correct rod 5 for deciphering which will be the complement of the one used for ciphering, the count from left or right must include the same base row of switches which I have lettered Z in the drawings. It will now be seen that the switch board 1 must either have twenty-seven vertical rows, or the sheet 16 must have twenty-seven columns, and be punched with openings 18 in both marginal columns whenever one is used because reversal of the sheet for deciphering, when punched in only one marginal column, would throw this opening 18 outside the bounds of a switch board of but twenty-six vertical rows of switches.

The advantages of the complete device consisting of the switch board, the key board, and the paper record of the cipher key are as follows:

1. The sheet 16 may be of any length to make a continually changing key for the longest messages, and can be conveniently managed in the form of a roll.

2. It places no limit on ingenuity in the preparation of cipher keys as openings 18 may be punched at random from column to column thus avoiding any system which might be retraced by any who should intercept a message.

3. The recorded key opening acts automatically and obviates all necessity for preliminary clerical arrangement of message and key before the actual work of ciphering or deciphering is undertaken.

4. The entire action is instantaneous, the operator merely striking the key board in the same manner and at the same speed as is done in ordinary typing.

5. The present invention is intended to provide the electrical circuits and all of the switches and special mechanisms for the control of the currents traversing said circuits, the whole forming a coding attachment or adjunct to other devices such as typewriters, teletype, telegraph, radio, etc. The electrical nature of my device permits its mechanical structure to be separated into three units: the finger key board; the control sheet and switches; and the final switch board. Successful operation of the device may be attained with these three units widely separated from each other with only wire connections between for the circuits.

A second modified form of the invention is shown in Figure 4. In this form, the board 1 carrying the terminals 3 is formed into a cylinder indicated at 22 in Figure 4. The five sectional drawings of the cylinder 22 appearing in Figure 4 represent five sections through a single cylinder, each section carrying one of the twenty-seven switch rings described herein, and these sections are shown separately so that the wiring may be easily traced. If all of the sections were shown it would necessitate the showing of twenty-seven circles. It is thought that the showing of five will suffice. This cylinder carries twenty-six conductor strips 23 which extend throughout its length and are shown in end section in the drawings. These conductor strips correspond exactly and their function is identical with the conductor strips 4 on the flat board 1 shown in Figure 1 and are lettered in the same manner. Around this stationary cylinder 22 I dispose twenty-seven rings 24. I have shown but five of them in the drawings, the five shown corresponding to the first five vertical rows of switches counting from the left in Figure 1, and each ring is shown in the drawings as mounted on an end section delineation of the stationary cylinder 22. These rings 24 carry contacts 25 which correspond to terminals 3 in Figure 1 in function and are wired and lettered differently on each ring exactly as are terminals 3 in Figure 1.

Any means, not shown, may be used for rotating the ring 24 of the desired column so as to close all of the contacts 25 in this column with the corresponding contacts 23 in the cylinder 22. This means may include for example, the sheet 16, the finger switches 19 and the circuits and solenoids shown in Figure 3. The solenoids would be connected to the rings in any suitable manner for actuating them.

For example, take the message "HOBART" and the key word "BAD". In sending the code letter for the message letter H, the B ring 24, which is the third one from the left shown in Figure 4, is rotated slightly so as to close all of the contacts 25 in this ring with the conductor strips 23 in the cylinder 22. The key switch H shown at 26 in Figure 4 is now closed, and this will close the circuit through the H contact 25 in the row B, and then the F conductor strip in the cylinder 22 will be energized and will close the circuit to the F signal 27 in Figure 4. In like manner, after the B ring 24 has been rotated to open the switches in this ring, the A ring is closed and the O key switch 28 in Figure 4 is closed. This will energize the light N indicated at 29 in Figure 4. Finally the A ring is opened and the D ring is closed, and then the B key switch 30 is closed and will energize the light 31 bearing the letter X.

The receiver in decoding the message with a similar machine will cause the complemental rings X, Y and V to the rings B, A and D, to be successively closed and opened, and with each closing of the ring, the code letter will be depressed on the key board, with a result that the message "H O B" will be given.

It is obvious that the key word can be of any length, and also that even a number of characters can take the place of a word. I have simply used the key word "BAD" in order to simplify the illustration.

While I have shown only the preferred forms of my invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. An electrical ciphering and deciphering device comprising a number of circuits equal to any predetermined number of characters, each circuit adapted to represent one of the characters at one point in the line and another character at another point in the line, the points constituting switches that are adapted to represent all of the characters, each circuit emanating from a source of power and including a fingerboard switch adapted to represent one of the characters, the current then passing along the character-representing switches, means for closing one of the switches corresponding to a key character, the circuit also including a terminal wire connected with the closed switch and leading back to the source of power, this terminal wire adapted to represent one of the characters that comprises the code message being sent.

2. In an electrical ciphering and deciphering device using a plurality of gang switches, electrically actuated means for closing all of the switches in any desired gang, said means including a sepa-

rate electric control switch for each gang switch, and means for closing said control switches one after another in any desired order of sequence in conformity with any pre-arranged plan called a cipher key.

3. An electrical ciphering and deciphering device comprising a plurality of circuits equal in number to the characters used and each having a finger-board switch adapted to represent a different character of those used, a plurality of branches for each circuit equal in number to the characters used and each adapted to represent one of the characters, a plurality of gang switches, each gang when closed, electrically connecting one branch in each set of branches with its associate circuit, whereby the closing of one of the gangs of switches and the subsequent closing of a finger-board switch will close a circuit through one of the branches for representing a code character of the message being sent.

4. In an electrical ciphering and deciphering device using a plurality of gang switches, electrically actuated means for closing all of the switches in any desired gang, said means including a separate electric control switch, and means for closing said control switches in a predetermined manner, said means including a strip of perforated material for controlling the closing of the control switches.

5. In an electrical ciphering and deciphering device, a circuit having a finger-board switch therein adapted to represent a character, a plurality of branches for the circuit, each branch adapted to represent a different character, a plurality of switches, each switch being permanently associated with one branch and the circuit, and means for closing a switch of the desired branch to the circuit.

6. In an electrical ciphering and deciphering device, a plurality of initial wires adapted to represent characters over which the plain text message characters are sent, an equal number of wires adapted to represent final characters over which the code characters are sent, closable connections between each wire in the final set and each wire in the initial set coupled into a plurality of gangs of connections, means for closing any desired gang in accordance with a key character for connecting each final code wire with a predetermined initial message wire, and a finger-board switch for each initial message wire, a circuit being closed through a message and a code wire by the successive closing of a gang switch, and a finger-board switch.

7. An electrical ciphering and deciphering device comprising a plurality of circuits adapted to represent characters and equal in number to the number of characters used, a finger-board switch for each circuit and each switch adapted to represent a different plain text character, each circuit also having a set of switches equal to the number of characters, all of the switches in the set in any one circuit adapted to represent the same plain text character as the finger-board switch in the same circuit, the sets of switches also being arranged in groups, each group consisting of one switch out of each set, so that each group will comprise a gang of switches adapted to represent one each of the plain text characters, each gang of switches adapted to represent a different key character, means for simultaneously closing all of the switches in any desired key character gang, terminal wires forming a part of the circuits and being equal in number to the plain text finger-board switches, each terminal wire being connected to one switch in each gang of switches and adapted to represent a character in the code to be sent, whereby an initial closing of any one of the key character gangs of switches and a subsequent closing of a plain text finger-board switch will cause a current to flow through the circuit including the closed finger-board switch, the closed key character group switch associated with the finger-board switch, and the terminal code wire connected to the energized key character group switch, the terminal wire adapted to represent a code character of the plain text finger-board switch character.

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