(1)

machine into an unintelligible or cipher message on the typewriter over which the cryptographing machine is positioned.

An object of this invention is to provide a cryptographing machine which, when properly positioned over the keyboard of any commercial typewriter, ~~and conjunctioned with a tape transmitter, well known in the art of printing telegraphy, will upon a legible message or communication being written on the keyboard of the cryptographing machine and upon a perforated tape being passed thru the tape transmitter,~~ will function to transform an intelligible message being typed on the keyboard ~~to produce on the typewriter, a cryptogram or cipher message.~~ The production of the cryptographic cryptogram will be automatic and require no special skill or knowledge on the part of the operation, ~~the operator~~ he being ~~in~~ ignorant of any particular letter which will occur as a result ~~between~~ of the action of the cryptographing machine upon the typewriter. ~~keyboard transmitter and the tape transmitter.~~ This cryptogram may then be sent by any of the usual commercial methods, mail, telegraph, cable, or radio, and will be unintelligible to ~~unauthorized persons or~~ persons without the proper means of decipherment. ~~The authorized~~ A person ~~however being~~ provided with a cryptographing machine identical with the one used and with the key applicable, to encipher the message, simply rewrites the cryptogram, letter for letter, on ~~his~~ the keyboard of his cryptographing machine, which produces the legible message on ~~the~~ typewriter with which it is in operative relationship.

A further object of this invention is the application of the printing telegraph tape transmitter, using the five unit code, and using a circular, repeating, celluloid tape, with characters punched haphazardly, to operate in a circuit with a Bandot saw-toothed keyboard transmitter, of well known form, in such a manner that the action of the tape transmitter and the keyboard transmitter will for any given character add or subtract algebraically and the resultant or product will control a combination of slotted Bandot translator bars, also of well known form. As in printing telegraphy the position of the translator bars selects the letter to be printed and such is the case in this application.

A further object of this invention is the unique means ~~provided~~ by which provision of the ~~which the printing of the selected letter on the typewriter is performed.~~ a key of the typewriter keyboard is selected and is then struck to print the cipher or deciphered letter.

These means are that after a letter has been selected, at the proper time a printing impulse occurs thru a magnet which depresses a pertaining plunger. There are thirty two of these plungers which are properly positioned over the keys of any typewriter, and the plungers thereby control the typewriter keyboard. The means of striking the correct plunger, and of operating the typewriter keyboard by these plungers is claimed to be new and novel.

A further object and novel feature of this invention is the indirect control of the keyboard of a standard typewriter by the resultant action of a plural-unit-code tape transmitter upon a plural-unit-code keyboard transmitter. ~~by means of a translator.~~

The many applications of such a device as an automatic cryptographing machine which can be used with any or all commercial typewriters, requiring only to be positioned over the keys of the typewriter and removed as desired, will be readily apparent. Any commercial or military office requisite can employ such a device ~~enterprise in which secret communication is desired in a quick, practical manner~~, without requiring the costly and tedious labors of ~~preparation of the messages by~~ trained cryptographers. ~~enabling time and labor,~~ can use such a device to great ~~advantage.~~

In the drawings accompanying and forming a part of this application Figure 1 is a schematic representation ~~side elevation view~~ of the cryptograph in its relationship to a typewriter keyboard. Figures 2, 3, and 4 show it in its mechanical details. ~~The side frame is shown removed for clearness. The portion of the figure denoted A is the cryptograph whereas B denotes the keys of the typewriter. Fig. 2 is a front view of the cyrptograph it being realized that the typewriter is behind same tho not shown. The location of various features will be now explained but the action will be described hereinafter.~~ Figure 3 is a detail

Starting with the keyboard of the cryptograph shown at 1 in Figs. 1 ~~and 8~~ it will be observed that the keybars are pivoted by a common shaft at 3 in Fig. 1 and held up by individual springs at 4. The keybars control, in the conventional manner, a six bar Bandot saw-tooth keyboard transmitter.

It is believed that an explanation of a schematic representation of our invention will form the best basis for its understanding, and therefore reference will be made to Figure 1. In this figure A represents a front view and D a side elevation of a Baudot keyboard transmitter; B represents a perforated-tape transmitter; C represents a front view, and E a side elevation of a Baudot slotted-bar translator; F represents a side elevation of the keyboard of any typewriter G, bearing the standard keyboard.

The Baudot keyboard transmitter is so well known in the art of printing telegraphy that no detailed description of it is deemed necessary. It is sufficient to indicate that we make use of a six-bar standard transmitter, the bars being designated 0, 1, 2, 3, 4, 5. The bar 0 acts as a "universal bar" and serves a function to be described presently. ~~the bar marked 0 being an addition to the usual five marked 1, 2, 3, 4, and 5. The extra bar 0 serves a function presently to be described.~~

The function of bars 1 to 5 is to control the set of contact levers 6, 7, 8, 9, and 10. These contact levers are normally at the left, but when a bar, for example 3, is displaced toward the right by depressing a keybar 121 of the keyboard transmitter A, the contact lever 8 is moved to the right and closes contact at 16. The five contact levers being independent, it is obvious that the contacts controlled by them can be established in a permutative manner to correspond to the permutations of marking and spacing elements of the well known Baudot five-unit code. The letter A, for example, is represented in this code by the symbol + + - - - or " " where + indicates a marking element, a " " - indicates a spacing element. For our purposes, a " + " will indicate that the transmitter bar has moved to the right and that the contact lever is making contact with its right hand contact; and a " - " will indicate that the transmitter bar has not moved and that the contact lever is making contact with its left hand contact. Thus, as we have arranged it, contact of the ~~contact~~ levers 6, 7, 8, 9, and 10

is made with their left contacts 11, 13, 15, 17, and 19, respectively, when no displacement of the bars takes place, and contact of the ~~contact~~ levers with their right contacts, 12, 14, 16, 18, and 20, respectively, is made when the bars are displaced. Therefore, the contacts set up to correspond with the Baudot code for letter A will be as follows: contact lever 6 closing contact 12; contact lever 7 closing contact 14; contact levers 8, 9, and 10 remaining against contacts 15, 17, and 19, respectively. ~~contact lever 9 closing contact 17, and contact lever 10 closing contact 19.~~

Transmitter bar 0, is, as stated, a universal bar, and has as its function the control of contact 36, which, in conjunction with back contact 37 of a relay 38, controls a magnet 50 that is a part of translator C. The circuit and function of magnet 50 will be explained later. Contact 36 is closed on the depression of any Keybar.

A master contact 39 of A, under control of a universal bar 46, serves to keep the entire system in an inoperative condition until any key of keyboard transmitter A is depressed. A tooth at the right extremity of each bar 0, 1, 2, 3, 4, and 5, will move universal bar 46 to the right and will thus close contact 39 when any one of the bars is displaced to the right. ~~The mechanical arrangements for this action are shown in Figure 4.~~

It is necessary that the sliding bars of the keyboard transmitter A be locked into the positions they assume on the depression of a keybar until all the subsequent operations and functions have been completed. This is accomplished by means of locking bar 48, well known in the art, controlled by armature 49 and of magnet 56, ~~electrical circuit of which~~ is as follows: from positive of battery H through conductor 91, contact lever 83, closed contact 84, conductor 92, closed contact 39, conductor 96, winding of magnet 56, conductors 97, 88, and 87, ~~and 86~~ to negative of battery H. Spring 98 holds armature 49 in its unactuated position. ~~The mechanical operation of the locking bar 48 will be described in connection with Figure 4.~~ The principal parts of the keyboard transmitter A have now been described.

The tape transmitter B is also so well known in the art of printing telegraphy that no detailed description is necessary. Suffice it to say that it has five contact levers 21, 22, 23, 24, and 25, which vibrate between five right-hand or marking contacts 27, 29, 31, 33, and 35, and five left-hand or spacing contacts 26, 28, 30, 32, and 34, under the control of a perforated tape, by means of five finger pins, not shown, which are presented under the tape. As in the case of the keyboard transmitter the right-hand contacts are in our terminology "+" contacts, the left-hand ones "-" contacts. Upon the presentation of a hole in the tape over any of the finger pins the act of the pin rising through the hole allows the pertaining contact lever to move to its right hand contact and therefore makes that contact one that can be designated by the "+" sign. When the pin does not go through a hole in the tape the contact lever makes contact with its left-hand contact, and therefore this can be designated by the "-" sign. The tape is perforated to correspond to the permutations of the Baudot code, and thus there are 32 different permutations of contact levers of B. The finger pins are withdrawn and the tape is stepped forward automatically by magnet 47, after the transmission of the impulses corresponding to the set of + and - contacts denoting a given letter of the Baudot code. Supposing the perforations denoting the letter N, whose code equivalent is "- - + + -", be presented to the pins of B, contact levers 21, 22, and 25 will be against their left-hand contacts 26, 28, and 34, respectively; contact levers 23 and 24 will be against their right-hand contacts 31 and 33, respectively. The principal parts of the tape transmitter B have now been described.

The Baudot translator C is also well known in the art of printing telegraphy. It consists of the usual set of five notched bars 41, 42, 43, 44, and 45, and one additional bar, 40, whose function will be explained later. The five bars 41 to 45 are displaced to the right under the control of the set of magnets 51, 52, 53, 54, and 55. These magnets are controlled jointly by the sets of contacts of the keyboard transmitter A and the tape transmitter

The electrical principle, in brief, is that the circuit through any of these can only be completed when the contact lever in the keyboard transmitter and the controlling contact lever in the tape transmitter are in non-homologous positions as regards their left and right contacts. Thus, in Figure 1, consider

B in a manner well known in the art of printing telegraph cryptographs, so that a brief description will suffice. ~~The electrical principle can be best seen in Figure 6, wherein it will be observed that the circuit for magnet 51 can be completed only when contact lever 6 is making contact at 11, and contact lever 21 is making contact at 27, or when contact lever 6 is making contact at 12, and contact lever 21 is making contact at 26. When both contact levers are in homologous positions, that is, when they are both making contact with either their left hand contacts or their right hand contacts, no circuit through magnet 51 can be completed. If contacts 11 and 12 are considered to be a pair of contacts of the keyboard transmitter, contacts 26 and 27, a pair of contacts of the tape transmitter, the parallelism between Figure 6 and Figure 1 in respect to magnet 51 becomes apparent. Thus, consider~~ magnet 51 of C, the circuit of which is controlled by two contact levers, 6 of A, and 21 of B. Only one of four possible cases with respect to these contact levers can exist at a given moment:

Case 1 — Contact lever 6 makes contact at 11
Contact lever 21 makes contact at 26

When this is the case the circuit for magnet 51 is open. Thus, from positive of battery H through conductor 91, contact lever 83, closed contact 84, conductor 92, closed contact 39, conductor 99, contact lever 6, contact 11, conductor 66 to contact 27 which is open, and hence magnet 51 cannot be energized.

Case 2 — Contact lever 6 makes contact at 11
Contact lever 21 makes contact at 27

When this is the case the circuit as traced directly above remains the same up to the condition of contact 27. This now being closed the current can continue through contact lever 21, conductor 100, winding of magnet 51, conductors 105, 106, resistance 60 and relay 38, conductors 107, and 108, to negative of battery H. Magnet 51 is therefore energized.

Case 3 Contact lever 6 makes contact at 12
Contact lever 21 makes contact at 27

The circuit as described for the two preceding cases is the same here up to contact lever 6, which now being against contact 12 the current continues along conductor 61 to contact 26 which is now open. Hence magnet 51 remains unenergized.

Case 4 Contact lever 6 makes contact at 12
Contact lever 21 makes contact at 26

The circuit under case 3 can now be completed, from contact 26 through contact lever 21, conductor 100, and thence, by path described under case 2, to negative of battery H. Hence, magnet 51 is energized.

It is thus seen that when the homologous governing contact levers are in similar positions no circuit is established through the pertaining magnet of C; only when one contact lever is at the left or minus sign contact, and the other is at the right or plus sign contact will the circuit be completed. It is immaterial which lever is making the plus contact, which the minus contact.

As said before, magnet 51 has four companion magnets, 52, 53, 54, and 55, the circuits for which are similar in character to those described for magnet 51, but are all independent of one another in the control of their respective magnets.

The armatures of magnets 51 to 55 are yoked to translator bars 41 to 45, respectively. When any one of the magnets 51 to 55 is energized it draws the bar to which its armature is yoked to the right and holds it there until, when the circuit through the magnet is broken, a retractile spring at the left extremity of the bar brings the latter back into its normal position.

The various permutative positions assumed by the translator bars of C, Figure 1, determine the selection of the letter to be printed by the typewriter. These bars, ~~as said before,~~ are slotted, the slots being so arranged that, as the bars are displaced to the right under the action of

there will be permutatrine one extremity of the stunt bars. (Side elevation E shows one spring 112)

magnets 51 to 55, for each different arrangement of the translator bars ~~there will be~~ one and only one alignment of slots presented under the set of stunt bars 109, into which a particular stunt bar can drop, being pulled by a spring attached to ~~each there is a stunt bar for each alignment.~~ The stunt bar selected is not permitted to drop into the alignment of slots until a universal bar 110 of C (110' of E) is released under the action of a magnet 57 of E, ~~Figure 1~~, circuit for which is closed by contact 58. This contact 58 is operated by a bar 59 which is displaced to the right when any of the translator bars 41, 42, 43, 44, 45, or the extra bar 40 is pulled to the right. The circuit for magnet 57 is as follows: from positive of battery H through conductor 91, contact lever 83, closed contact 84, conductor 92, closed contact 39, conductor 116, winding of magnet 57, conductor 117, closed contact 58, conductors ~~110~~ 86, 108 to negative of battery H.

When any stunt bar 109 (109' of E) of C drops into position it strikes a crank shaft 114 of C (114' of E), which closes a contact 115 of E, ~~Figure 1~~. This contact controls the printing magnet 73, ~~and its~~ whose armature 74, which swings about an axis 75, ~~and thus~~ actuates the printing drive pin 76. The circuit for magnet 73 is as follows: positive of battery K, conductor 118, winding of magnet 73, conductor 119, closed contact 115, conductor 120 to negative of K. In practice batteries K and H are the same, being shown here as separate only clearness of circuit tracing. Also the batteries are simply to represent a source of E.M.F.; either machine or battery for the equipment can be designed for a range of voltages.

When a stunt bar drops into position it draws down with it drag link 77 presenting the slot in member 78 before the printing drive pin 76. When magnet 73 is energized, member 78 is driven forward operating drive bar 79 by bell crank action about shaft 80. Drive bar 79 in turn operates a plunger 81 which actuates the proper key of keyboard F of typewriter G. When drive bar 79 is practically at the bottom of its stroke it operates crank 82 thereby

moving contact lever 83 from contact 84 to contact 85. This action causes two things to happen: (1) The tape step forward magnet 47 ~~is~~ in tape transmitter B is energized, the circuit being from positive of battery H through conductor 91, contact lever 83, contact 85, conductor 90, winding of magnet 47, conductors 89, 88, and 87, ~~and 86~~ to negative of battery H; (2) When contact 84 is opened the entire system is restored to normal in the following manner: circuit for lock magnet 56 is broken at contact 84, thus releasing the transmitter bars of A and in turn opening master contact 39. When the latter contact opens, the circuit for universal bar magnet 57 of translator C is broken, the return of the universal bar 110 of C (110' of E) under action of spring 71 raising the selected stunt bar 109 of C. Thereupon the translator bars of C return to normal. Crank contact 115 is opened when the selected stunt bar ~~109~~ comes out of the slots, print magnet 73 is deenergized, ~~released~~, armature 75 is retracted by spring 123, and print bar 79 returns to normal. The latter releases crank 82, contact lever 83 is restored to make contact at 84, and the entire system is now in readiness for another operation.

There now remains to be explained the function of magnet 50 of C and its associated parts and circuit. For the purposes of our invention it is essential that the typewriter G make some record for each and every depression of the keybars of the keyboard transmitter A. A consideration of the functioning of magnets 51, 52, 53, 54, and 55 will be energized. In other words, whenever the Baudot combination ~~for a letter~~ set up on A is the same as that set up on B, the resultant is zero, or "blank". It is necessary that the cryptograph make a record of each such case in order that messages may be correctly deciphered. The details of the method we have devised for this recording ~~is as follows~~ follow.

As already explained, the circuit for magnet 50 is completed only when keyboard contact 36 is closed and at the same time the armature 72 of relay 38 is at its back contact 37, ~~and contact 36 closes~~ ~~The latter~~ contact 36 closes each time any key of transmitter A is depressed, under action of transmitter

bar 0, but contact 37 is closed only when none of the magnets 51 to 55 is energized. That is, whenever the resultant of the interaction of transmitters A and B is anything other than zero or "blank", relay 38 is actuated and contact 37 is broken. When, however, the resultant is "blank", then and only then will contact 37 remain closed and magnet 50 energized. The circuit for magnet 50 is then as follows: from positive of battery H through conductor 93, winding of magnet 50, conductor 94, closed contact 36, conductor 95, contact lever 72, contact 37, conductor 87 to negative of battery H. The armature of magnet 50 is yoked to the sixth translator bar, 40, which, like the other translator bars, is drawn toward the right when magnet 50 is energized. Translator bar 40 determines the selection of a stunt bar which in turn causes the printing of a character. In the position shown, occupied by the stunt bar referred to the character printed will be "½", according to the keyboard of a standard typewriter, but it can, of course, be caused to print another, a dash for example.

The reason for the parallel combination of resistance 60 and relay 38 is so that a fairly sensitive relay may be shunted by a resistance of such value that the voltage drop across the combination will not be great enough to interfere with the satisfactory operation of magnets 51 to 55, whether only one operates or whether they all operate. It is necessary that relay 38 be interposed between battery and magnets 51 to 55, but it is optional whether a low resistance relay is used or a high resistance relay shunted by a low resistance unit.

It has been seen that there is no direct relation between the keybar struck on the keyboard transmitter A and the letter that is printed on typewriter G. The relation is only an indirect one, exercised by the tape transmitter B, and specifically by the particular Baudot combination that happens to be set up at B at a given moment. If the perforated tape passing through B consists of perforations representing an entirely random, unintelligible sequence of letters it obviously becomes an enciphering key which may be employed to transform an unintelligible communication into an unintelligible one that will be

secret to all except those possessing the key. Since the tape advances automatically after each printing operation, the enciphering key changes with each letter to be enciphered, and this can be extended indefinitely by making the perforated tape as long as the text to be enciphered.

It will now be assumed that the keybar for letter A is struck on the keyboard transmitter A, and that at the same time the finger pins in tape transmitter B are set up according to the Baudot code for letter N. From what has been said in connection with magnets 51 to 55 it will be clear that the resultant of the interaction of these two letters will be as follows:

Keyboard transmitter	= + + - - -	= A
Tape transmitter	= - - + + -	= N
Translator	= + + + + -	= K

Translator bars 41, 42, 43, and 44 will be drawn to the right under the action of energized magnets 51, 52, 53, and 54, the electrical ~~currents~~ circuits for which are deemed sufficiently well understood from the foregoing description to warrant their tracing being omitted.

The K stunt bar will be the one selected and will drop into the aligned slots on the translator bars upon the energization of the universal bar magnet 57 by closing of contact 58. When the K stunt bar drops into position drag link 77 draws member 78 down, presenting its notch before printing drive pin 76; the K stunt bar also causes crank contact 115 to be closed and print magnet 73 is energized, causing print bar 79 to be driven down, depressing the K plunger, 81, and causing the typewriter G to print the letter K. At the end of the downward stroke of bar 79, crank 82 opens contact 84 and closes contact 85. The results of the operation of the crank 82 have already been set forth, the entire system being cleared and made ready for the next cycle.

Assuming that we have been dealing with a case of enciphering, wherein A is the plain-text letter, N, the key letter for enciphering A, and K the resultant cipher letter, the decipherment requires that the depression of keyboard K on the transmitter A, combined with the setting up of letter N

on tape transmitter B, shall produce A, the original plain-text letter. The interaction may be shown schematically as follows:

Cipher letter K	= + + + + -
Key letter N	= - - + + -
Plain-text letter A	= + + - - -

In this case only magnets 51 and 52 would be energized, the A stunt bar selected, and A printed on the typewriter G. Thus, the reciprocal relationship between the plain-text and cipher letters through the intermediacy of the key letter N has been maintained.

We may now proceed to a description of the apparatus in its mechanical aspects. Figure 2 is a side elevation view of the cryptograph in its relationship to a typewriter keyboard. The side frame of the cryptograph is shown removed, for the sake of clearness. In this figure the portion denoted by A is the cryptograph, and B denotes the keys of the typewriter.

The keybars, 1, are pivoted on a common shaft, 2, and are held up by individual springs, 3. The keybars operate the transmitter bars, 4, which are supported at their extremities by ball and roller bearings. The ~~locking~~ mechanism for locking the transmitter bars into position is shown as consisting of magnet 5 whose armature 6, normally held by spring 7, when attracted causes bar 8 to rock on pivot 9 and lock the bars into position. Magnet 10 is one of the set of six translator-bar magnets, the other five being behind the one shown, each equipped with an armature, 11, bell crank, 12, and coupling, 13, for moving the translator bar controlled by it. The translator bars themselves are shown at 14. At 15 is shown but one of the set of 32 stunt bars, the others being behind it. The stunt bars are pivoted at 16 and are pulled into an alignment of slots on the translator bars 14 under the action of individual springs, 17. Each stunt bar is provided with a drag link 18 which is coupled to a member, 19, at pivot pin 20. Member 18 is provided with a slot 21 and is pivoted and coupled to print bar 22 at pin 23. Print bar 22 operates with a bell crank action about shaft 24 which is common to all the print bars. When member 19 is drawn downward by the action of a translator bar 15, upon drag link 18, it presents its slot 21 before the drive pin 25, which

is common to and runs under all the slotted members of which 19 is but one. Drive pin 25 is under the control of print magnet 26, engages the slot 21 which has been presented to it, and causes the print bar 22 to be driven downward on plunger 27 whose armature 27, held neutral by the pull of spring 28, rocks upon pivot 29. When magnet 26 is energized its armature 27 causes drive pin 25 to engage ~~and strike the~~ slot 21 and strike that member 19 which has been presented to the drive pin, causing print bar 22 to be driven downward upon plunger 30. Plunger 30 and all other print plungers have common bearings at 31 and are held up in normal position by springs such as 32 under pin 33. When the plungers are driven downward their feet, 34, strike the pertaining typewriter keys of B. When print bar 22 has almost reached the end of its downward stroke it operates crank 35 which is crank 82 of Figure 1. This crank is common to, and runs underneath all the print bars, and only one of its bearings is shown at 36. As explained in connection with Figure 1, the function of this crank is to close the circuit for the tape-stepping magnet 47 of Figure 1, as well as to open the circuit of the transmitter-bar locking magnet 56 of Figure 1, two operates which are necessary to restore the machine to normal.

At 37 is shown a crank which corresponds to crank 114 of Figure 1, and controls the contact for the print magnet 26 of Figure 2, 78 of Figure 1.

Figure 3 is a front view of the cryptograph, in which the keys of the keyboard are designated 1. Only one of the pair of transmitter bars is shown, this being the foremost one, designated 2. ~~being yoked to contact lever~~ The manner in which the transmitter bars control their contacts is shown for this bar, wherein it is noted that the bar is yoked to contact lever 10, operating the latter about axis 8, thereby presenting contact 3 to either contact 4, when the bar is at its normal position to the left and held there by spring 9, or to contact 5, when the bar is displaced to the right upon depressing a key which causes this bar to operate. Proper terminals for wiring are arranged for on the insulating supports 6 and 7 as shown at 14 and 15 for the front and back contacts and at 13 for the lever contact by coiled wire 12, it being understood that the lever contact is insulated from the frame at 11. The other five transmitter bars are directly behind the bar 2, each controlling identical contacts, all of which are mounted on the insulating supports 6 and 7. Behind this pair of contacts is the master contact 39 of Figure 1. In Figure 3 only the crank 27 which controls this contact can be seen, but this member and its contacts are shown in detail in Figure 4, which will be discussed later. A shelf, 19, is provided for placing the

tape transmitter (B of Figure 1) into position. The tape transmitter is usually in compact form with nine terminals for external electrical connections. At 16 is shown one of the nine spring clips, equally spaced and mounted upon an insulating block 17 for soldered electrical connections at 18. The nine terminals of the tape transmitter fit under the nine spring clips. A dust cover for the shelf 19 is provided. At 20, 21, 22, 23, 24, and 25 are shown the six translator-bar magnets which actuate the translator bars, of which only one, 26, is shown. In this figure only the ends of the stunt bars 28 are visible. They are connected to drag links 40, and at 41 are shown the slotted members (21 of Figure 1), at 42 are shown the print bars. At 43 is shown the crank (114 of Figure 1, 37 of Figure 2) which operates the contact 29 (115 of Figure 1) controlling the print magnet ~~Not Shown~~ 30, Figure 3 ~~(Not shown on~~ (73 in Figure 1 and 26 in Figure 2). Magnet 30 by its action on armature 36 will be seen to operate drive pin 31 (76 of Figure 1, 25 of Figure 2); pin 31 is provided with bearings 32 and 34 pivoted on common centers 33 and 35. It will be seen that drive pin 31 runs across the machine and under all the slotted members 41. At 37 is shown the crank corresponding to crank 82 of Figure 1, 35 of Figure 2. Crank 37 ~~is also~~ also runs

Figure 4 shows the arrangements for the master contact 39 of ~~con-~~ ~~tact in~~ Figure 1 as associated with the keyboard transmitter contacts. In Figure 4 the transmitter bars 0, 1, 2, 3, 4, 5, are shown in relation to the contact levers of which only three, 7, 8, and 9 are seen; contact lever 7 makes contact at 10 when the bar 1 is in its normal position and held so by spring 6, or at 11 when the bar is displaced to the right. Two terminals 12 and 13 for soldered connections are shown. The crank 14, pivoted at 15, operates contact lever 16, closing contact 17 whenever one or more of the bars ~~1 to 6~~ are displaced to the right.

We claim:

across the machine and under all the print-bars 42, the crank being pivoted at common centers 38 and 39. At 43 is shown the transmitting-bar locking mechanism.

1. A cryptograph to be positioned over the keyboard of an independent typewriter, the said cryptograph comprising essentially a plural-unit-code keyboard transmitter, a plural-unit-code perforated tape transmitter, a plural unit code translator, and means for communicating ~~transferring~~ the action of the said translator to the keys of the said typewriter. ~~over which the said cryptograph is positioned.~~

2. A cryptograph to be positioned over the keyboard of an independent typewriter, the said cryptograph comprising essentially a plural unit code keyboard transmitter upon which a first set of electrical conditions corresponding to a plain message character in the plural unit code is established, a plural unit code perforated tape transmitter upon which a second set of electrical conditions corresponding to an enciphering character in the plural unit code is established, a plural unit code translator under the joint control of the said first and second sets of electrical conditions, whereby an electrical condition resulting from the interaction of the said first and second sets of electrical conditions is translated in terms of movement of one of a set of selectable members, means for communicating the movement of a selected member to one of the set of plungers operating the keys of a typewriter keyboard over which the cryptograph is positioned, and causing the typewriter to print a cipher character to represent the ~~cipher equivalent of the~~ said plain message character.

3. A cryptograph to be positioned over the keyboard of an independent typewriter, the said cryptograph comprising essentially a plural unit code keyboard transmitter upon which a first set of electrical conditions corresponding to a cipher character in the plural unit code is established, a plural unit code perforated tape transmitter upon which a second set of electrical conditions corresponding to a deciphering character in the plural unit code is established, a plural unit code translator under the joint control of the said first

and second sets of electrical conditions, whereby an electrical condition resulting from the interaction of the said first and second sets of electrical conditions is translated in terms of movement of one of a set of selectable members, means for communicating the movement of a selected member to one of a set of plungers operating the keys of the typewriter keyboard over which the cryptograph is positioned, and causing the typewriter to print a plain message character to represent the deciphered ~~equivalent of the said cipher text message~~ character.

4. In a cryptograph, means for causing a first set of electrical conditions representing a message character to interact with a second set of electrical conditions representing a ciphering character, means for translating a third set of electrical conditions resulting from the interaction of the first two sets of electrical conditions into mechanical motion of a selectable member, and means for transferring the motion of the said selectable member to a key of the keyboard of an independent typewriter over which the cryptograph is positioned.

5. In a cryptograph means for communicating the action of a translator to the keyboard of an independent typewriter over which the cryptograph is positioned, the said means consisting of a set of drag link members connected to the stunt bars of the said translator, each drag link member being connected to a slotted connecting link, each connecting link being connected to a print bar, each print bar being connected to a plunger hovering over a key of the said typewriter, a print magnet, a printing drive pin actuated by the said print magnet, all of said means being arranged and associated so that when a stunt bar of the translator is selected the said printing drive pin engages with the slot in the said slotted connecting link pertaining to the selected stunt bar and causes the pertaining print arm to actuate the plunger to which the print arm is attached and to operate a key of the keyboard of the said typewriter.

positioned over the said keyboard, the said cryptograph

6. The method of controlling the keyboard of a typewriter by a cryptograph employing a plural unit code of electrical impulses.

mechanically operated

operated independent mechanically

7. The method of controlling a typewriter through the joint action of a plural unit code keyboard transmitter and a plural unit code perforated tape transmitter upon a plural unit code translator, ~~actuating the keyboard of the typewriter~~, and causing the said translator to operate the said independent typewriter

a cryptograph controlled by

An object of this invention is to provide a cryptographing machine which when properly positioned over the keyboard of any commercial typewriter and conjunctioned with a tape transmitter, well known in the art of printing telegraphy, will upon a legible message or communication being written on the keyboard of the cryptographing machine and upon a perforated tape being passed thru the tape transmitter, will function to produce on the typewriter a cryptogram or cipher message. The production of the cryptogram will be automatic and require no special skill or knowledge of the operation, the operator being in ignorance of any particular letter which will occur as a resultant between the action of the keyboard transmitter and the tape transmitter. This cryptogram may then be sent by any of the usual commercial methods; mail, telegraph, cable, or radio and will be unintelligible to unauthorized persons or persons without the proper means of decipherment. The authorized person however being provided with a cryptographing machine identical with the one used to encipher the message simply rewrites the cryptogram, letter for letter, on his machine which produces the legible message on his typewriter.

A further object of this invention is the application of the printing telegraph tape transmitter, using the five unit code, and using a circular, repeating, celluloid tape, with characters punched haphazardly, to operate in a circuit with a Bandot saw-toothed keyboard transmitter, of well known form, in such a manner that the action of the tape transmitter and the keyboard transmitter will for any given character add or subtract algebraically and the resultant or product will control a combination of slotted Bandot translator bars, also of well known form. As in printing telegraphy the position of the translator bars selects the letter to be printed and such is the case in this application.

A further object of this invention is the unique means provided by which the printing of the selected letter on the typewriter is performed.

These means are that after a letter has been selected at proper time a printing impulse occurs thru a magnet which depresses a pertaining plunger. There are thirty two of these plungers which are properly positioned over the keys of any typewriter, and the plungers thereby control the typewriter keyboard. The means of striking the correct plunger, and of operating the typewriter keyboard by these plungers is claimed to be new and novel.

A further object of this invention is the control of the keyboard of a standard typewriter by the resultant action of a tape transmitter upon a keyboard transmitter by means of a translator.

The many application of such a device as an automatic cryptographing machine which can be used with any or all commercial typewriters, requiring only to be positioned over the keys of the typewriter and removed as desired, will be readily apparent. Any commercial or military enterprise in which secret communication is desired in a quick practical manner, without requiring preparation of the message by trained cryptographers, entailing time and labor, can use such a device to great advantage.

In the drawings accompanying and forming a part of this application Fig. 1 is a side elevation view of the cryptograph in its relationship to a typewriter keyboard. The side frame is shown removed for clearness. The portion of the figure denoted A is the cryptograph whereas B denotes the keys of the typewriter. Fig. 2 is a front view of the cyrptograph it being realized that the typewriter is behind same tho not shown. The location of various features will be now explained but the action will be described hereinafter.

Starting with the keyboard of the cryptograph shown at 1 in Figs. 1 and 2 it will be observed that the keybars are pivoted by a common shaft at 3 in Fig. 1 and held up by individual springs at 4. The keybars control, in the conventional manner, a six bar Bandot saw-tooth keyboard transmitter.

These six bars are properly supported at their extremities by ball and roller bearings as shown at 5 of Fig. 1, Detail 2, being the bars themselves. The manner in which the bars control their contacts is shown for the foremost bar in Fig. 2 detail 2. The bar is yoked to contact lever 10 operating same about axis 8, thereby presenting contact 3 to either contact 4 or 5 depending on whether the bar is progressed to the right or normally to the left and held so by spring 9. Proper terminals for wiring are arranged for on the insulating supports 6 and 7 as shown at 14 and 15 for the front and back contacts and at 13 for the lever contact by coiled wire 12, it being understood that the lever contact is insulated from frame at 11. The other five bars are directly behind bar shown at 2, controlling identical contacts all of which are mounted properly on insulating supports 6 and 7. Behind the six sets of contacts there is one make and break contact controlled by a crank shown Fig. 2 Det. 27. This crank is so arranged that upon any or all bars moving to the right this contact will close. The arrangement of this crank and contact is shown in Fig. 3. As will be seen later until this contact is closed the entire system is not energized. The location and design of what is commonly termed in printing telegraph practice as a Baudot Keyboard transmitter has therefore been described.

In Fig. 1 detail 6 is a locking bar which is arranged to lock the keyboard transmitter bars in the positions determined by depression of any key until after all necessary succeeding operations have been completed. This lock bar is controlled by magnet 8 and armature 9. The operation of the transmitter and lock may best be understood by an examination of Fig. 4. An assignment of letters has been made to move the bars to the right in accordance with one version of the five unit code. Any other assignment will operate equally well.

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The tape transmitter has not been shown in these figures, its form and action being so familiar to those schooled in the printing telegraph art that reproduction is deemed unnecessary. Suffice it to say, for this purpose that a

tape transmitter has five lever contacts which operate between five marking and five spacing contacts under the control of a perforated tape, by means of five finger pins which are presented under the tape. Upon the presentation of a hole in the tape over any of the finger pins the act of the pin rising thru the tape hole makes that particular marking impulse at the marking contact. The tape may therefore be perforated in characters of the so called five unit code allowing thirty two possiblities. Tape step forward and pin withdrawal is arranged automatically. Such a tape transmitter is usually in small conpact form with nine terminals for external electrical connections. In Fig. 2 detail 16 is a spring slip mounted upon an insulating block 17 for soldered electrical connection at 18. There are directly in line behind this spring clip eight other identical clips properly spaced along the insulating block 17, and provided with dust cover 19. This combination is designed for the terminals of the tape transmitter described above and it will be seen that a tape transmitter may be inserted at will. The description hereinafter will tell of how the wiring to the tape transmitter is arranged to make it a part of this cryptograph.

The two transmitters described above control between themselves the six magnets shown in Fig. 2 as 20, 21, 22, 23, 24 and 25 and in side elevation as 30 in Fig. 1. The armature of each of these magnets control one of the translator bars shown Fig. 1, details 11. This control means movement of the bars from normal or to the left position, as one faces the bars, to the right. Therefore, current through any one of the magnets means that the magnet will move its translator bar to the right by the bell crank and coupling 28 and 27, Fig. 1, which arrangement is shown for only the first bar but it must be remembered that the same coupling exists for all magnets and bars. The act of placing certain of the six translator bars at a given time in various positions determines the selection of the letter to be printed. An inspection of Fig. 6, will show how this selection is obtained by means of slots so arranged that if bars, 1, 2, 3, 4, 5, are moved to the right in accordance with the five unit code

thirty-two possible combinations will result with respect to the stunt bars 22. A stunt bar is also shown in Fig. 1, and it will be seen that for any movement of the five bars a slot allignment will result which upon release of the universal bar Fig. 6 detail 21, and Fig. 1 detail 24, will permit one and only one stunt bar to drop in the slots. So much for movement of the bars, but upon no movement which may occur due to certain resultants, the 0 bar is provided. Its action will be to move when none of the rest do and to thereby select the dash character. This will be described more fully later. Such an arrangement of slotted bars will therefore be seen to be the inverse of the keyboard transmitter described above and the arrangement of slotted bars or disks for such a purpose is known as a translator.

For the purpose of this cryptograph the translator is made to perform certain unique, new, and novel functions to be described. The movement of any slotted bar to the right closes a crank contact shown Fig. 1 detail 31, and Fig. 6 detail 7. The arrangement of this crank contact is as shown for the transmitter crank in Fig. 3. The purpose of this contact is to operate a magnet which releases the universal bar under the stunt bars and allows one stunt bar to fall according to the slots in translator. The universal bar is shown in Fig. 1, detail 24. It works about axis 25 under control of armature 26, by magnet 32.

When any one stunt bar drops, it in turn throws another crank shown in Fig. 1, detail 34, in Fig. 2, detail 29, and Fig. 6, detail 6. The manner in which this crank contact acts is shown in Fig. 5. This crank contact closes a circuit which energizes the printing magnet Fig. 1, detail 35. The action of the printing magnet will be described later.

Each stunt bar is provided with a drag link Fig. 1, detail 16. This drag link is in turn coupled to a member 18 at pivot pin 17. Member 18 is provided with a slot as shown and is pivoted and coupled to print bar 19, at pin 36, with a bell crank action about a shaft 20, which is commom to all print bars. When a stunt bar 12 drops, under action of spring 14, into the slots of the translator bar 11, the stunt bars draw down with it the drag link 16, which draws down member 18, about pin 36, as a center. This position then

presents the slot on the under side of member 18, before the printing drive pin 36. It will be observed that this printing drive pin runs across the machine under all the slotted members as shown in Fig. 2, detail 31, and has bearings at 34 and 32, and pivoted on common centers 33 and 35. In Fig. 2, magnet 30 by its action on armature 36, therefore, will be seen to operate drive pin upon being energized. In Fig. 1, another view is shown of this action, 35 being the magnet, 33 the armature, 34 the pivot, and 36 the drive pin. We now have a print punt member 18 in position with its slot before the drive pin 36, and it will be seen that upon energization of the print ~~punt~~ magnet 35, which is caused by crank contact 34, member 18 will be driven forward and punt bar 19 will drive down on plunger 36. Plunger 36 and all other print ~~punting~~ plungers have common bearing at 38, and are held up on normal position by springs such as 22 under pin 39. The plunger is thereby driven down and the feet 23, operate the pertaining typewriter key.

When print punt bar 19 moves down at almost the end of its downward movement it operates a crank 37. This crank is common to all print punting bars and operates a make and break contact arrangement as will be described in the wiring diagram. The method of throw is the same as described before for various other crank controlled contacts. However, the operation of this crank closes a circuit which steps forward the tape of the tape transmitter previously described, and restores the entire circuit to normal preliminary to carrying through another action from the keyboard.

It is believed at this point that the various actions and individual units have been sufficiently described to justify describing a typical operation from pressing a key of the cryptograph to the final print punting of a letter on the typewriter. Reference is therefore made to Fig. 7, to outline an electrical principal of this cryptograph. A, represents the contacts of the keyboard transmitter, and B, the contacts of the tape transmitter. It will be seen that if contact 5, moves over to stop 1, and contact 7 moves to stop 3, magnet 12 will not be energized, the circuit being open at 8 and 2. Again if contact 6 remains at stop 2, and contact 8 remains at stop 4, magnet 12 will not be energized , the circuit being open at 1 and 3. But if contact 5 moves to stop 1, and contact 8 remains at stop 4, magnet 12 will be energized for the circuit is complete from

battery 17, wire 14, contact 8, stop 4, wire 9, stop 1, contact 5, wire 11, magnet winding 12, and by wire 13 return to battery. Magnet 12, therefore, draws up its armature 15, which is yoked to the translator bar 16. Likewise, if contact 7 moves to stop 3, and contact 6 remains at stop 2, the same action will occur due to magnet 12 being energized. This is cited as a typical example of the relationship existing between five sets of contacts of the keyboard transmitter with the five sets of contacts of the tape transmitter. As both tape transmitter and keyboard transmitter function in accordance with the five unit code, a resultant action between the two will occur for any combination of letters.

	Magnets						
	1	2	3	4	5		
Keyboard Transmitter	+	+	0	0	0	=	A
Tape Transmitter	0	0	+	+	0	=	N
Prints on Typewriter	+	+	+	+	0	=	K

Now through the action of the two transmitters the typewriter would print the letter K, whereas N would have been presented in the tape and A have been struck on the keyboard transmitter. The person receiving such a letter, telegram or communication would strike this letter K on his keyboard transmitter of his cryptograph. He would further use an identical tape which he would start in the same place as the enciphering operator. Such a program would be arranged beforehand. He therefore strikes K on his keyboard and his tape transmitter presents N whereas

	Magnets						
	1	2	3	4	5		
Keyboard Transmitter	+	+	+	+	0	=	K
Tape Transmitter	0	0	+	+	0	=	N
	+	+	0	0	0	=	A

and the letter A is that letter which was originally transmitted. This then is the principal upon which this cryptograph enciphers and deciphers, but from the pressing of a key to the printing of a character there are functional devices necessary for such results.

In Fig. 9, A is the keyboard transmitter and B is the tape transmitter. The contacts are wired for resultant action to the magnets controlling the translator bars of the translator which is shown at C. For clearness of wiring, the keyboard transmitter D, translator E, and printer F, have also been duplicated in a schematic side elevation view, and G represents a typewriter.

Assuming a tape to be in the tape transmitter as before, and perforations denoting the letter N presented to the pins. Then lever 8 will be over to contact 16, and lever 9 to contact 18. Assume again that the operator depresses key A of the keyboard transmitter, the saw tooth bars will move in accordance with the five unit code,

0	Bars				
0	1	2	3	4	5
+	+	+	0	0	0 = A

the plus signs representing movement to the right. It will therefore be seen that bar 0, 1 and 2, move while 3, 4, and 5, remain at rest. Now bar 0 does not enter into the five unit code, it is known for the purposes of this description as a universal bar which moves to the right upon pressing any key of the keyboard. As will be described more thoroughly later, if say A is pressed on the keyboard and say A at the same time operates in the tape transmitter the resultant would be zero. This would give the deciphering operator no indication of what had occured at this point. The universal bar circuit is so arranged that when zero is the resultant, a dash will print which will indicate to the deciphering operator that he should strike the dash key.

To resume, key A, having been depressed, it will be observed that the movement of any or all bars to the right causes crank contact, Fig. 9, detail 21, to close. The crank contact was shown by Fig. 3. Now contact 21 is the master contact which energizes the system and until a key of the keyboard is operated there is no drain upon the battery 38.

The condition at this point is that bars 0, 1, 2 are to the right, contact 21 is closed, which throws locking magnet 52 thereby locking key-bars with lock 53, as per Fig. 8, the circuit being from the battery 38 wire 67, 61, 59, 58, through contacts 21, wire 60, contacts 56, 55, and return to battery by wire 66. Also battery is presented to the keyboard transmitter contacts and tape transmitter contacts. In this connection there will be current through the combination bar 1, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68, lever 23, contact 29, to contact 11, through lever 6, wire 69, to magnet 43, wire 77, 76, resistance 40 and relay 39, wire 84, 82, and return to battery; - bar 2, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68,

lever 24, contact 31, to contact 13, through lever 7, wire 70 to magnet 44, wire 78, 76, resistance 40 and relay 39, wire 84, 82, and return to battery;- bar 3, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68, lever 25, contact 32, to contact 16, through lever 8, wire 71, to magnet 45, wire 79, 76, resistance 40, and relay 39, wire 84, 82 and return to battery;- bar 4, battery 38, wire 66, contact 55, contact 56, wire 60, contacts 21, wire 68, lever 26, contact 34 to contact 18, lever 9, wire 72 to magnet 46, wire 80, 76, resistance 40 and

relay 39, wire 84, 82 and return to battery;- bar 5 no circuit inasmuch as both levers 27 and 10 remain at rest under the assumption of A in the Keyboard transmitter and N in the tape transmitter, the tape transmitter being

		levers			
6	7	8	9	10	
0	0	+	+	0	= N

plus again denoting levers to the right.

Now the above detailed description means, in the brief, that magnets 43, 44, 45 and 46 are energized and have drawn their translator bars 1, 2, 3, and 4 to the right by means of the armature being yoked to these bars as previously described. Now this condition effects a selection among the stunt bars ~~85~~ 102. The proper stunt bar ~~fell~~ being in this case stunt bar of letter K. When the translator bars moved to the right, crank contact 49 was closed which released the universal bar holding the stunt bars up. The manner in which the universal bar was released was by energization of magnet 85 thus - battery 38, wire 82, 83, contacts 49 wire 87 magnet 85 wire 63, contacts 21, wire 60, contact 56, contact 55, wire 66 and return to battery.

As stated before the K stunt bar drops in the translator bars slots. The stunt bar draws down with it drag link 88 presenting the member 89 and its slot before the printing drive pin 91. The stunt bar at the same time throws crank 93 which closes crank contacts 94 and a circuit is set up from battery ~~85~~ 95, wire 96 contacts 94, wire 97, printing magnet 86 and wire 98 return to battery. In practice this battery 95 and battery 38 are of course identical being shown individual only for clearness of circuit tracing. Also the batteries are simply to represent a source of E.M.F. either machine or battery for the equipment can be designed for a range of voltages.

Now upon magnet 86 being energized, member 89 is driven forward operating drive bar 90 by bell crank about shaft 100. Drive bar 90 in turn operates the proper plunger 101 which actuates the K key of the typewriter shown at G in Fig. 9. When drive bar 90 is practically at the bottom of its stroke it operates crank 92 and thereby crank lever contact 55, moving lever 55 from contact 56 to contact

57. This action causes two things to happen - the tape step forward magnet 54 is operated, battery 38, wire 67, 61, ~~101~~ 103, 62, contact 57, lever 55 and wire 66 return to battery; - and the opening of contact 56 restores the system to normal by opening the battery supply on the wire 66 side, lock magnet 52 releases permitting transmitter bars 0, 1, and 2 to return to normal, and opening crank contacts 21, universal bar magnet 85 releases and universal bar ~~restores~~ restores the K stunt bar whereupon translator bars 1, 2, 3 and 4 return to normal, crank contact controlling print magnet 86 releases and print bar 90 returns to normal. Crank 92 is restored and contact lever 55 is restored to contact 56 placing the system in readiness for a succeeding operation.

It is necessary now to explain the action of the 0 bars of the K Keyboard transmitter and translator. As before stated when ~~zeor~~ zero is the resultant of the action of the K Keyboard transmitter on the tape transmitter none of the translator magnets 43, 44, 45, 46 and 47 will be operated. At the K Keyboard transmitter A however the 0 bar moves to the right upon pressing any key. This closes contacts 22 and if none of the translator magnets are energized there will be no current thru relay 39, relay 39 contacts 41 will then remain closed. Under these circumstances a circuit is closed from battery 38 wire 67, 64, contacts 41, wire 65, contacts 22, wire 74, magnet 42, and wire 75 return to battery. The energization of magnet 42 moves translator bar 0 to the right and a dash is selected and printed on the typewriter which indicates to the deciphering operat~~ion~~ or that he also shall strike a dash at this point upon decipherment. The necessity of the zero bars is accordingly made apparent. The reason for the parallel combination of resistance 40 and relay 39 is so that a fairly sensitive relay may be used shunted by a resistance of such value that the voltage drop across the combination will not be great enough to affect the satisfactory operation of magnets 43, 44, 45, 46, and 47 whether only one operates or whether all operate. It is necessary that relay 39 be interposed between battery and magnets 43, 44, 45, 46, and 47 but as to whether a low resistance relay is used or a high resistance relay shunted by a low resistance unit is optional.

The purpose of the lock 53 is that after the operator strikes a key all succeeding operations be performed before the keyboard is released. Now while these succeeding operations will be practically instantaneous still the necessity will be apparent for those instances when the operator strikes another key too quickly or inadvertently.

The operation of enciphering a message has therefore been described. The processes of decipherment are the inverse and it is not thought necessary to go into great detail. In the assumption above the communicant receives the letter K in the communication. As the sending operator and the receiving operator have identical tapes, the deciphering operator strikes K on his keyboard, the tape sets up N and the resultant is A which prints upon the typewriter and is the letter desired to be communicated before the enciphering process.

Having made the operation and application of this cryptograph clear we claim:

1. A mechanism which automatically enciphers a communication on the printed page of the typewriter.

2. A mechanism using the five unit code and a circular perforated tape to encipher a communication on the printed page of the typewriter.

3. A unique, new, and novel mechanical and electrical device for combining the resultants of a keyboard transmitter and a tape transmitter to actuate the keyboard of a typewriter.

4. A unique, new and novel method of actuating mechanically and electrically the keyboard of a typewriter after selection.

5. The design of a device which may be placed, in front of, and over the keyboard of the usual commercial typewriter and will upon operation of the device result in performing a cryptogram on the keys of the typewriter and hence compelling the typewriter to print a cryptogram which is automatic and in which the cipher is non-recurrent and therefore does not allow itself to decipherment.

Witnessed: Signed:

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tape transmitter has five lever contacts which operate between five marking and five spacing contacts under the control of a perforated tape, by means of five finger pins which are presented under the tape. Upon the presentation of a hole in the tape over any of the finger pins the act of the pin rising thru the tape hole makes that particular marking impulse at the marking contact. The tape may therefore be perforated in characters of the so called five unit code allowing thirty two possiblities. Tape step forward and pin withdrawal is arranged automatically. Such a tape transmitter is usually in small compact form with nine terminals for external electrical connections. In Fig. 2 detail 16 is a spring clip mounted upon an insulating block 17 for soldered electrical connection at 18. There are directly in line behind this spring clip eight other identical clips properly spaced along the insulating block 17, and provided with dust cover 19. This combination is designed for the terminals of the tape transmitter described above and it will be seen that a tape transmitter may be inserted at will. The description hereinafter will tell of how the wiring to the tape transmitter is arranged to make it a part of this cryptograph.

The two transmitters described above control between themselves the six magnets shown in Fig. 2 as 20, 21, 22, 23, 24 and 25 and in side elevation as 30 in Fig. 1. The armature of each of these magnets control one of the translator bars shown Fig. 1, details 11. This control means movement of the bars from normal or to the left position, as one faces the bars, to the right. Therefore, current through any one of the magnets means that the magnet will move its translator bar to the right by the bell crank and coupling 28 and 27, Fig. 1, which arrangement is shown for only the first bar but it must be remembered that the same coupling exists for all magnets and bars. The act of placing certain of the six translator bars at a given time in various positions determines the selection of the letter to be printed. An inspection of Fig. 6, will show how this selection is obtained by means of slots so arranged that if bars, 1, 2, 3, 4, 5, are moved to the right in accordance with the five unit code

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When any one stunt bar drops, it in turn throws another crank shown in Fig. 1, detail 34, in Fig. 2, detail 29, and Fig. 6, detail 6. The manner in which this crank contact acts is shown in Fig. 5. This crank contact closes a circuit which energizes the printing magnet Fig. 1, detail 35. The action of the printing magnet will be described later.

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presents the slot on the under side of member 18, before the printing drive pin 36. It will be observed that this ~~punt~~print drive pin runs across the machine under all the slotted members as shown in Fig. 2, detail 31, and has bearings at 34 and 32, and pivoted on common centers 33 and 35. In Fig. 2, magnet 30 by its action on armature 36, therefore, will be seen to operate drive pin upon being energized. In Fig. 1, another view is shown of this action, 35 being the magnet, 33 the armature, 34 the pivot, and 36 the drive pin. We now have a ~~punt~~print member 18 in position with its slot before the drive pin 36, and it will be seen that upon energization of the ~~punt~~print magnet 35, which is caused by crank contact 34, member 18 will be driven forward and punt bar 19 will drive down on plunger 36. Plunger 36 and all other ~~punting~~printing plungers have common bearing at 38, and are held up on normal position by springs such as 22 under pin 39. The plunger is thereby driven down and the feet 23, operate the pertaining typewriter key.

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It is believed at this point that the various actions and individual units have been sufficiently described to justify describing a typical operation from pressing a key of the cryptograph to the final ~~punting~~printing of a letter on the typewriter. Reference is therefore made to Fig. 7, to outline an electrical principal of this cryptograph. A, represents the contacts of the keyboard transmitter, and B, the contacts of the tape transmitter. It will be seen that if contact 5, moves over to stop 1, and contact 7 moves to stop 3, magnet 12 will not be energized, the circuit being open at 8 and 2. Again if contact 6 remains at stop 2, and contact 8 remains at stop 4, magnet 12 will not be energized , the circuit being open at 1 and 3. But if contact 5 moves to stop 1, and contact 8 remains at stop 4, magnet 12 will be energized for the circuit is complete from

battery 17, wire 14, contact 8, stop 4, wire 9, stop 1, contact 5, wire 11, magnet winding 12, and by wire 13 return to battery. Magnet 12, therefore, draws up its armature 15, which is yoked to the translator bar 16. Likewise, if contact 7 moves to stop 3, and contact 6 remains at stop 2, the same action will occur due to magnet 12 being energized. This is cited as a typical example of the relationship existing between five sets of contacts of the keyboard transmitter with the five sets of contacts of the tape transmitter. As both tape transmitter and keyboard transmitter function in accordance with the five unit code, a resultant action between the two will occur for any combination of letters.

	Magnets						
	1	2	3	4	5		
Keyboard Transmitter	↓	↓	0	0	0	=	A
Tape Transmitter	0	0	↓	↓	0	=	N
Prints on Typewriter	↓	↓	↓	↓	0	=	K

Now through the action of the two transmitters the typewriter would print the letter K, whereas N would have been presented in the tape and A have been struck on the keyboard transmitter. The person receiving such a letter, telegram or communication would strike this letter K on his keyboard transmitter of his cryptograph. He would further use an identical tape which he would start in the same place as the enciphering operator. Such a program would be arranged beforehand. He therefore strikes K on his keyboard and his tape transmitter presents N whereas

	Magnets						
	1	2	3	4	5		
Keyboard Transmitter	↓	↓	↓	↓	0	=	K
Tape Transmitter	0	0	↓	↓	0	=	N
	↓	↓	0	0	0	=	A

and the letter A is that letter which was originally transmitted. This then is the principal upon which this cryptograph enciphers and deciphers, but from the pressing of a key to the printing of a character there are functional devices necessary for such results.

In Fig. 9, A is the keyboard transmitter and B is the tape transmitter. The contacts are wired for resultant action to the magnets controlling the translator bars of the translator which is shown at C. For clearness of wiring, the keyboard transmitter D, translator E, and printer F, have also been duplicated in a schematic side elevation view, and G represents a typewriter.

Assuming a tape to be in the tape transmitter as before, and perforations denoting the letter N presented to the pins. Then lever 8 will be over to contact 16, and lever 9 to contact 18. Assume again that the operator depresses key A of the keyboard transmitter, the saw tooth bars will move in accordance with the five unit code,

0	Bars				
0	1	2	3	4	5
+	+	+	0	0	0 = A

the plus signs representing movement to the right. It will therefore be seen that bar 0, 1 and 2, move while 3, 4, and 5, remain at rest. Now bar 0 does not enter into the five unit code, it is known for the purposes of this description as a universal bar which moves to the right upon pressing any key of the keyboard. As will be described more thoroughly later, if key A is pressed on the keyboard and key A at the same time operates in the tape transmitter the resultant would be zero. This would give the deciphering operator no indication of what had occured at this point. The universal bar circuit is so arranged that when zero is the resultant, a dash will print which will indicate to the deciphering operator that he should strike the dash key.

To resume, key A, having been depressed, it will be observed that the movement of any or all bars to the right causes crank contact, Fig. 9, detail 21, to close. The crank contact was shown by Fig. 3. Now contact 21 is the master contact which energizes the system and until a key of the keyboard is operated there is no drain upon the battery 38.

The condition at this point is that bars 0, 1, 2 are to the right, contact 21 is closed, which throws locking magnet 52 thereby locking key-bars with lock 53, as per Fig. 8, the circuit being from the battery 38 wire 67, 61, 59, 58, through contacts 21, wire 60, contacts 56, 55, and return to battery by wire 66. Also battery is presented to the keyboard transmitter contacts and tape transmitter contacts. In this connection there will be current through the combination thus-for bar 1, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68, lever 25, contact 29, to contact 11, through lever 6, wire 69, to magnet 43, wire 77, 76, resistance 40 and relay 39, wire 84, 82, and return to battery;-- bar 2, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68,

lever 24, contact 31, to contact 13, through lever 7, wire 70 to magnet 44, wire 78, 74, resistance 40 and relay 39, wire 84, 82, and return to battery;- bar 3, battery 38, wire 66, contact 55, contact 56, wire 60, through contacts 21, wire 68, lever 25, contact 32, to contact 16, through lever 8, wire 71, to magnet 45, wire 79, 76, resistance 40, and relay 39, wire 84, 82 and return to battery;- bar 4, battery 38, wire 66, contact 55, contact 56, wire 60, contacts 21, wire 68, lever 26, contact 34 to contact 18, lever 9, wire 72 to magnet 45, wire 80, 76, resistance 40 and

relay 39, wire 84, 82 and return to battery;- bar 5 no circuit inasmuch as both levers 27 and 10 remain at rest under the assumption of A in the Keyboard transmitter and H in the tape transmitter, the tape transmitter being

		levers		
6	7	8	9	10
0	0	+	+	0 - H

plus again denoting levers to the right.

Now the above detailed description means, in the brief, that magnets 43, 44, 45 and 46 are energized and have drawn their translator bars 1, 2, 3, and 4 to the right by means of the armature being yoked to these bars as previously described. Now this condition effects a selection among the stunt bars 102. The proper stunt bar being in this case stunt bar of letter K.When the translator bars moved to the right,crank contact 49 was closed which released the universal bar holding the stunt bars up. The manner in which the universal bar was released was by energization of magnet 85 thus - battery 38, wire 82, 83, contacts 49 wire 87 magnet 85 wire 63, contacts 21, wire 60, contact 56, contact 55, wire 66 and return to battery.

As stated before the K stunt bar drops in the translator bars slots. The stunt bar draws down with it drag link 88 presenting the member 89 and its slot before the printing drive pin 91. The stunt bar at the same time throws crank 93 which closes crank contacts 94 and a circuit is set up from battery 95, wire 96 contacts 94, wire 97, printing magnet 86 and wire 98 return to battery. In practice this battery 95 and battery 38 are of course identical being shown individual only for clearness of circuit tracing. Also the batteries are simply to represent a source of E.M.F. either machine or battery for the equipment can be designed for a range of voltages.

Now upon magnet 86 being energized, member 89 is driven forward operating drive bar 90 by bell crank about shaft 100. Drive bar 90 in turn operates the proper plunger 101 which actuates the K key of the typewriter shown at G in Fig. 9. When drive bar 90 is practically at the bottom of its stroke it operates crank 92 and thereby crank lever contact 55, moving lever 55 from contact 56 to contact

57. This action causes two things to happen - the tape step forward magnets 54 is operated, battery 38, wire 67, 61, ~~101~~ 103, 62, contact 57, lever 55 and wire 66 return to battery; - and the opening of contact 56 restores the system to normal by opening the battery supply on the wire 66 side, lock magnet 52 releases permitting transmitter bars 0, 1, and 2 to return to normal, and opening crank contacts 21, universal bar magnet 85 releases and universal bar ~~resetres~~ restores the K stunt bar whereupon translator bars 1, 2, 3 and 4 return to normal, crank contact controlling print magnet 86 releases and print bar 90 returns to normal. Crank 92 is restored and contact lever 55 is restored to contact 56 placing the system in readiness for a succeeding operation.

It is necessary now to explain the action of the 0 bars of the K Keyboard transmitter and translator. As before stated when ~~zeor~~ zero is the resultant of the action of the K Keyboard transmitter on the tape transmitter none of the translator magnets 43, 44, 45, 46 and 47 will be operated. At the K Keyboard transmitter A however the 0 bar moves to the right upon pressing any key. This closes contacts 22 and if none of the translator magnets are energized there will be no current thru relay 39, relay 39 contacts 41 will then remain closed. Under these circumstances a circuit is closed from battery 38 wire 67, 64, contacts 41, wire 65, contacts 22, wire 74, magnet 42, and wire 75 return to battery. The energization of magnet 42 moves translator bar 0 to the right and a dash is selected and printed on the typewriter which indicates to the deciphering operat~~ion~~or that he also shall strike a dash at this point upon decipherment. The necessity of the zero bars is accordingly made apparent. The reason for the parallel combination of resistance 40 and relay 39 is so that a fairly sensitive relay may be used shunted by a resistance of such value that the voltage drop across the combination will not be great enough to affect the satisfactory operation of magnets 43, 44, 45, 46, and 47 whether only one operates or whether all operate. It is necessary that relay 39 be interposed between battery and magnets 43, 44, 45, 46, and 47 but as to whether a low resistance relay is used or a high resistance relay shunted by a low resistance unit is optional.

The purpose of the lock 53 is that after the operator strikes a key all succeeding operations be performed before the keyboard is released. Now while these succeeding operations will be practically instantaneous still the necessity will be apparent for those instances when the operator strikes another key too quickly or inadvertently.

The operation of enciphering a message has therefore been described. The processes of decipherment are the inverse and it is not thought necessary to go into great detail. In the assumption above the communicant receives the letter K in the communication. As the sending operator and the receiving operator have identical tapes, the deciphering operator strikes K on his keyboard, the tape sets up N and the resultant is A which prints upon the typewriter and is the letter desired to be communicated before the enciphering process.

Having made the operation and application of this cryptograph clear we claim:

1. A mechanism which automatically enciphers a communication on the printed page of the typewriter.

2. A mechanism using the five unit code and a circular perforated tape to encipher a communication on the printed page of the typewriter.

3. A unique, new, and novel mechanical and electrical device for combining the resultants of a keyboard transmitter and a tape transmitter to actuate the keyboard of a typewriter.

4. A unique, new and novel method of actuating mechanically and electrically the keyboard of a typewriter after selection.

5. The design of a device which may be placed, in front of, and over the keyboard of the usual commercial typewriter and will upon operation of the device result in performing a cryptogram on the keys of the typewriter and hence compelling the typewriter to print a cryptogram which is automatic and in which the cipher is non-recurrent and therefore does not allow itself to decipherment.

Witnessed: Signed:

Witnessed: Signed:

Signed:

~~It will be best to explain Figure 2 in connection with Figure 3, which is a front view of the cryptograph, it being understood that the typewriter is behind the cryptograph though not shown.~~

In Figure 2, the keybars 1 are pivoted on a common shaft, 3, and held up by individual springs, 4. At 5 are shown the transmitter bars, the bars themselves being designated 2. They are supported at their extremities by ball and roller bearings. Referring now to Figure 3, which is a front view of the cryptograph, the manner in which the bars control their contacts is shown for the foremost bar at 2, ~~Figure 3~~, wherein it is seen that the bar is yoked to contact lever 10, operating the latter about axis 8, thereby presenting contact 3 to either contact 4, when the bar is at its normal position to the left and held there by spring 9, or to contact 5, when the bar is displaced to the right upon depressing a keybar. Still referring to Figure 3, proper terminals for wiring are arranged for on the insulating supports 6 and 7 as shown at 14 and 15 for the front and back contacts and at 13 for the lever contact by coiled wire 12, it being understood that the lever contact is insulated from the frame at 11. The other five bars are directly behind the bar shown at 2, Figure 3, controlling identical contacts all of which

are mounted on the insulating supports 6 and 7. Behind these sets of contacts is the master contact 39 of Figure 1 controlled by the crank 27 in Figure 3. This crank and its contact is shown in detail in Figure 4, which will be discussed later. Referring to Figure 2, the locking mechanism for locking the transmitter bars into position is shown as consisting of magnet 8 whose armature 9, normally held by spring 10, when attracted causes bar 6 to rock on pivot 7, and lock the bars into position. ~~The arrangements are better shown in Figure 4, to be discussed later.~~ no PS Magnet 30 is one of the set of translator bar magnets, there being five more magnets behind it, each one equipped with an armature 29, bell crank and coupling, 28 and 27, for moving the translator bar controlled by it. The translator bars are shown at 11. Crank 31 is bar 59 of Figure 1 and operates contact 58 of Figure 1. Crank 34 is crank 114 of Figure 1, controlling contact 115 of Figure 1. At 12, Figure 2, is shown but one of the set of 32 stunt bars, the others being behind it. The stunt bars are pivoted at 13 and are pulled into an alignment of slots on the translator bars under the action of individual springs 14. Each stunt bar is provided with a drag link 16 which is coupled to a member 18 at pivot pin 17. Member 18 is provided with a slot as shown and is pivoted and coupled to print bar 19 at pin 36. Print bar 19 operates with a bell crank action about shaft 20 which is common to all the print bars. When member 18 is drawn downward it presents a slot before the drive pin 36 which runs across the machine under all the slotted members as shown at 31 in Figure 3, where 31 is seen provided with bearings 32 and 34 pivoted on common centers 33 and 35. In Figure 3 magnet 30 by its action on armature 36 will be seen to operate drive pin 31 upon being energized. In Figure 2 another view is shown of this action, 35 being the magnet, 33 the armature, 41 the pivot, and 36 the drive pin. The magnet 35 acts upon its armature against the pull of spring 40, which holds the armature in its neutral position. When magnet 35 is energized drive pin 36 strikes the slotted member 18 that has been presented to it, and print bar 19 will be driven down on plunger ~~36~~ 39. Plunger ~~36~~ 39 and all other print plungers have

common bearings at 38, and are held up in normal position by springs such as 22 under pin ~~39~~ 42. The plungers are thereby driven downward and the feet 23 operate the pertaining typewriter keys.

When print bar 19 moves down at almost the end of its downward stroke it operates crank 37 which is crank 82 of Figure 1. This crank is common to all the print bars, and in Figure 3 at 37 is shown as running across the machine and under all the print bars. In Figure 3 crank 37 is pivoted at common centers 38 and 39. As explained, this crank serves to close the circuit of the tape-step-forward magnet 47 of Figure 1 and also to open the circuit of the transmitter bar locking magnet 56 of Figure 1 (or 8 of Figure 2). ~~which starts all~~ This precedes all subsequent clearing operations to restore the machine to normal.

In Figure 3 a shelf 40 is provided for ~~inserting~~ placing the tape transmitter into ~~position~~. The tape transmitter is usually in compact form with nine terminals for external electrical connections. At 16 is shown one of the nine spring clips, equally spaced and mounted upon an insulating block 17 for soldered electrical connections at 18. The nine terminals of the tape transmitter fit under the nine spring clips. A dust cover 19 is provided. At 20, 21, 22, 23, 24, and 25 are shown the six translator bar magnets which actuate the translator bars of which only one, 26, is shown. In this figure only the ends of the stunt bars 28 are visible. They are connected to drag links 40, and at 41 are shown the slotted connecting links, at 42 are shown the print bars, 43 is a crank that operates the controlling the universal bar 26.
~~28 represents the stunt bars, of which there are 32 in all.~~