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CRYPTOGRAMMIC CODING AND DECODING APPARATUS

Boris Caesar Wilhelm Hagelin, Zug, Switzerland, assignor to Anstalt Europäische Handelsgesellschaft, Vaduz, Principality of Liechtenstein

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The present invention relates to a cryptogrammic coding and decoding apparatus.

One general object of the invention is to provide a coding and decoding apparatus which is suitable for uses for which the existing coding and decoding machines are too cumbersome and expensive. The apparatus according to the invention is particularly suitable for such uses in diplomatic service in which it has been preferred to up now to code and decode messages without resorting to mechanical devices, on account of the comparatively small number and volume of the messages to be transmitted and of the difficulty of transporting the conventional elaborate coding and decoding machines while keeping them under the personal control of the user when travelling.

A more specific object of the invention is to provide a coding and decoding apparatus of small weight and small overall dimensions, which may for instance be carried by the user in his coat pocket.

A further object of the invention is to provide an apparatus of the said kind in which the code key is continuously transmuted in way which cannot be derived from the coded messages even by the most refined methods, whereby such apparatus affords a high or even absolute degree of secrecy.

Still another object of the invention is to provide an apparatus having a high degree of reliability in operation.

Further objects and advantages of the invention will appear from the description now to follow, in which reference will be had to the accompanying drawings, of a specific embodiment of the invention, which is given by way of example only.

In the drawings:

Fig. 1 is a view from above of the said preferred embodiment of the apparatus according to the invention, the cover of its housing being removed to show the internal parts,

Figs. 2, 3 and 4 are cross-sections through the apparatus, taken on lines II—II, III—III and IV—IV of Fig. 1, respectively,

Fig. 5 is a view from above of the lowermost, stationary disc of the transmuting mechanism which the apparatus comprises,

Fig. 6 is a similar view of a rotatable disc of said transmuting mechanism,

Fig. 7 is an axial section through the stationary disc and a number of rotatable discs of the transmuting mechanism,

Fig. 8 is a view from above of the apparatus with its cover partly broken away and certain parts of the key disc mechanism removed to show one of the key discs from above,

Fig. 9 is a view from above of certain parts of the transmuting mechanism in their positions at the beginning of a transmuting operation, and

Fig. 10 shows some details of the apparatus comprising the key mechanism operated by a key tape.

The coding and decoding apparatus shown in the

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drawings is equipped with an alphabet wheel for direct reading. Instead of the latter, a printing type wheel could be used without departing from the scope of the invention. Other possible departures from the embodiment shown in the drawings will be indicated after the description of that embodiment.

The apparatus shown in the drawings generally comprises a rotatable character disc, a transmuting mechanism for positioning that character disc, a key disc mechanism, a set of driving wheels for the latter, a key strip mechanism, separate sensing means for the key wheel and the key tape mechanisms, a common manual drive for the transmuting mechanism and for both said key mechanisms, and a counter mechanism.

The moving parts of the apparatus are supported on a number of shafts each fixed in the bottom 1 of the housing of the apparatus. This housing preferably is of rectangular shape with rounded corners and of such size that it can conveniently be lodged in the pocket of a coat. The said bottom 1 has an integral flange 2 of small width extending upwards from its periphery. The remainder 3 of the peripheral wall of the housing is integral with the cover 4 and is connected by hinges 5 to one side of the bottom flange 2. The cover 4 has a circular recess 6 accommodating a character ring 7 and a character disc 8 rotatable within said character ring. The character ring 7 which in the embodiment shown carries a set of alphabet characters is not rotatable but is readily removable for substitution of another ring bearing a different set of characters. As shown in Fig. 8, the character ring 7 and the character disc 8 each bear a set of ordinary letters alphabetically arranged in opposite directions on the ring and on the disc, but this is only one example of the sets of characters which may be used. The alphabets may be of any desired nature and the sequence of the individual letters in each alphabet may be as desired. For instance, the letters on the ring 7 may be each on a removable plate so that their sequence can be varied at will.

The rotatable alphabet disc 8 is removably supported by the uppermost one 9 of a series of toothed discs which hereinafter will be referred to as transmuting discs. Connection between the alphabet disc 8 and the uppermost transmuting disc 9 is established by means of a few pins 10 fixed to the transmuting disc 9 and engaging corresponding bores in the alphabet disc when the latter is mounted on the machine. The alphabet disc is maintained in engagement with the pins 10 by means of an annular spring 11 lodged in a circumferential groove of the alphabet disc. The uppermost transmuting disc 9 is secured to the upper end of a hollow shaft 12 which is rotatably supported on a stationary bush 13. The bush 13 is welded at its lower end to a toothed disc 14 which is spaced from the bottom 1 of the housing by a number of tubular projections 16 on which it rests and to which it is secured by screws 15. The said stationary bush 13 also supports an inner tubular shaft 17 which extends through the whole length of the bush 13. At its upper end, above that of the bush 13, the tubular shaft 17 carries a radial arm 19 which serves as a unidirectional coupling member for rotating the transmuting disc 9. At its lower end, below that of the stationary bush 13, the tubular shaft 17 carries a gear wheel 18 for rotating the said shaft 17. The coupling arm 19 cooperates with an upwardly extending lug 20' of a disc 20 which is rigidly connected to the transmuting disc 9 and which together with the latter forms a housing for a spiral spring 21, the inner end of which is fastened to the stationary bush 13 and the outer end of which is fastened to one of the pins 10.

Between the uppermost transmuting disc 9 and the stationary disc 14, a number of intermediate transmuting discs (five in the present embodiment) 22, 23, 24, 25 and

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26 are rotatably supported above each other on the hollow shaft 12. The hollow shaft 12 may be supported on a portion of reduced diameter of the stationary bush 13. The stationary disc 14 is shaped as shown in Fig. 5, and the intermediate transmuted discs 22-26 are shaped as shown in Fig. 6. All these discs are provided with teeth on the major part of their periphery; however, the uppermost transmuted disc 9 has no teeth. At a short distance from the last tooth (counted in the anti-clockwise sense as seen in Fig. 6) each of the said intermediate transmuted discs 22 to 26 has a peripheral lug 27 which is bent downwards at an angle, as shown in Figs. 6 and 7. A similar lug (not shown) is provided at the corresponding place of the uppermost, untoothed transmuted disc 9. The portion 28 of each intermediate transmuted disc the periphery of which is not occupied by teeth or by the lug 27 projects radially and serves as a support for a latch 33. A similar projecting portion 28 is also provided by the stationary disc 14 as will be seen from Fig. 5. The projecting portion 28 has an aperture 29 for reducing its weight and for another purpose which will appear later on, and two bores 30 and 31 on opposite sides of the aperture 29. The bore 30 receives a pivot pin 32 on which the latch 33 is pivoted (see Fig. 1), and the bore 31 is engaged by one end of a spring 34 the opposite end of which is hooked to a lateral arm of the latch 33. The active arm of the latch 33 extends clockwise from its pivot 32 and is adapted to be engaged by the bent-down lug 27 of the upwardly adjacent transmuted disc. Fig. 1 shows such a lug 27 engaging the represented latch 33. In order that the lug 27 may engage the latch when the transmuted disc carrying the latch and the upwardly adjacent transmuted disc are angularly displaced in relation to each other in such a way that the lug 27 of the latter approaches the latch 33 on the former, such latch has an inclined guiding face 35 against which the lug 27 will abut, thereby rocking the latch 33 outwards in such a way that the nose of the latch will thereafter fall in behind the lug. The latch has a rear arm, the end portion 36 is bent downwards and extends into the aperture 29 of the corresponding transmuted disc and thereby limits the angular motion of the latch under the effect of the spring 34.

Moreover, the intermediate transmuted discs 22 to 26 and the stationary disc 14 each carry a ring 37 which is concentric with and rotatable on the respective disc and which has an integral radial arm 38 projecting beyond the toothed periphery of the disc. The end of that arm is bent downwards for engagement with any desired tooth gap of the disc, as shown in Figs. 1 and 2. The projecting end of the arm 38 also is in the path of the bent-down lug 27 of the upwardly adjacent transmuted disc.

Whenever the bent-down lug 27 of an upper transmuted disc is engaged by the nose of the latch 33 carried by the adjacent lower transmuted disc, the two discs are angularly coupled with each other on one hand by the said engagement between the lug 27 of the upper disc and the latch 33 of the lower disc, and on the other hand by the lowermost part of the said lug 27, which extends downwards in a direction parallel to the common axis of the transmuted discs, contacts the abutment 39 formed on the lower disc at the place where the latter's own lug 27 has been bent down out of the plane of the disc, as shown in Fig. 7.

The transmuted mechanism thus far described is actuated by a toothed segment 40 engaging the gear wheel 18 on the lower end of the rotatable inner tubular shaft 17 and formed on a manually operable actuating lever 41 which is rotatably supported on the shaft 50 of the key disc mechanism. The actuating lever 41 extends through a slot in the lateral wall of the housing as shown in Figs. 1 and 3 and outside the housing has a handle 42 by which it can be operated by means of the thumb and index finger of one hand, preferably the left hand.

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The key disc mechanism shown in axial section in Fig. 3 comprises a certain number of key discs which are rotatably supported on shaft 50, a bushing 51 being interposed between the shaft and the discs. Each key disc is associated with a gear wheel for rotating the disc. As shown in Fig. 3, there are six key discs numbered, from bottom to top, 52, 53, 54, 55, 56, 57. Their associated gear wheels are designated by 58, 59, 60, 61, 62, 63, respectively. Preferably, the gear wheels have different tooth pitches, and the key discs are provided at their circumferences with radial slots of the same angular pitch as the teeth of their associated gear wheels. In each of these slots a lug 64 in the shape of a small plate is supported on a tangential pin 65. In Fig. 3, a few of these lugs 64 are shown. They are swingable on their supporting pins between an inner position in which they extend inwardly and lie entirely within their respective radial slot in the key disc without projecting beyond the periphery of the disc, and an outer position in which they project beyond the said periphery of the disc. In Fig. 3, three lugs 64 carried respectively by the discs 52, 53 and 56 are shown in their outer position, and one lug 64 carried by disc 54 is shown in its inner position. The inner position will be designated as the inactive position and the outer position as the active position of each lug 64. The width of each lug 64 corresponds to the axial distance between adjacent gear wheels, so that the lugs are retained by the gear wheels of the key discs in their active or inactive positions in which they have been set in assembling the mechanism. In the embodiment shown in the drawings, the diameters of the gear wheels decrease from the lowermost one upwards.

Each gear wheel of a key disc meshes with a toothed driving wheel fixed on a shaft 70 the axis of which is parallel to the axis of the key disc mechanism. In Fig. 4, these driving wheels are designated, from the lowermost upwards, by 71, 72, 73, 74, 75 and 76. In addition to these driving wheels 71 to 76, the shaft 70 carries a ratchet wheel 77 by which the shaft 70 can be rotated from the actuating lever 41 by means of a pawl 78 pivoted on the hub of lever 41 and engaging the ratchet wheel 77. Moreover, the shaft 70 carries a gear wheel 79 which by means of an idler gear wheel 80 drives a further gear wheel 81 keyed to the input shaft of a conventional counter mechanism 82. The motion of the pawl 78 is limited by a pin 83 on the hub of the actuating lever 41.

Feeler arms 92 which cooperate with the key discs 58 to 63 serve to control the latches 33 of the transmuted mechanism, one such feeler arm being provided for each key disc and one disengaging arm 93 associated with one of the feeler arms being provided for each latch 33. The feeler arms are swingably supported on a common shaft 90 and each of them is acted upon by a spring 91 which tends to swing it towards the periphery of the corresponding key disc. The disengaging arm 93 either may be integral with the corresponding feeler arm 92 as shown in Fig. 9, or it may be rigidly fixed thereto.

As indicated above, the apparatus in addition to the key disc mechanism also comprises a key mechanism controlled by a perforated tape. 100 designates a tape store comprising a roll of perforated tape 101. This roll is supported by a shaft 102 fixed in the bottom of the housing. From the roll 100 the key tape runs over a guiding roller 103 from which it leaves the apparatus through a slot in the adjacent side wall of the housing, as shown in Fig. 1. The guiding roller 103 is rigidly connected to a ratchet wheel (not shown) which can be moved step by step by means of an actuating pawl 104 pivoted on the hub of the actuating lever 41. That hub also carries a pin 105 which limits the angular displacement of the pawl 104. Both pawls 78 and 104 pivoted on the hub of lever 41 are pressed towards their respective motion-limiting pins 83, 104 by springs.

A number of feeler arms 106 each integral with a disengaging arm 108 and acted upon by a spring 107 co-

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operate with the perforated tape 101. These feeler arms 106 and disengaging arms 108 are swingably supported on the same shaft 90 as the feeler arms 92 and disengaging arms 93 of the key disc mechanism. Thus, each latch 33 cooperates with two disengaging arms 93, 108, the first of which is controlled by one of the key discs and the other of which is controlled by the perforated key tape. Either of the two disengaging arms can be used at will by arresting the other of these arms. For this purpose, each feeler arm 106 of the tape mechanism is provided with a notch 109 adapted to be engaged by a common locking member 95 pivoted at 94 and cooperating with all feeler arms. This locking member 95 also serves for arresting the feeler arms 92 of the disc mechanism, each of which feeler arms for this purpose is connected to a further arm 96 in which a notch 97 for receiving the locking member 95 is provided. In the position shown in Fig. 1 the locking member 95 arrests the feeler arms 106 of the tape mechanism and their corresponding disengaging arms 108, while the feeler arms 92 and the disengaging arms 93 of the disc mechanism remain free. By rotating the locking member 95 into engagement with the notches 97 associated with the feeler arms 92 of the disc mechanism, the arms 106 of the tape mechanism are freed while the arms 92 of the disc mechanism are maintained out of operation.

Below the hub of the actuating lever 41, a cam segment 110 carrying a cam 111 is rotatably supported on the shaft 50 of the key disc mechanism. The cam segment 110 is provided with an arcuate slot 112 concentric with the axis of shaft 50. This slot is engaged by a pin 113 fixed in the hub portion of the actuating lever 41 and which is so positioned thereon that it moves the cam segment along with the actuating lever 41 in both end portions of its motion, as will be explained later on. The contour of the cam segment cooperates with one arm 114 of a bellcrank lever 114, 115 swingably supported on the shaft 90 and the opposite arm 115 of which forms a common abutment for all disengaging arms 93 and 108 both of the key disc and the key tape mechanisms.

In the following, the operation of the apparatus under the control of the key disc mechanism will be described, while its operation under the control of the key tape mechanism will be dealt with subsequently, either of these key mechanisms being adapted to act on the transmuting mechanism.

Normally, the actuating arm 41 is in its position shown in Fig. 1, in which its handle 42 projects from one, preferably the left-hand, side wall of the housing in such a way that it can easily be seized with the thumb and index finger of the left hand of the operator. In this position of the actuating arm 41, the transmuting mechanism is not in its initial position but already provides a transmuted reading. This is taken by means of the two alphabets on the stationary alphabet ring 7 and the angularly displaced alphabet disc 8, for instance by selecting the letter on the alphabet ring 7 which corresponds to the letter of the text to be coded (or decoded), and by reading the letter on the alphabet disc 8 which is just opposite the selected letter on ring 7. The letter thus read on disc 8 is the required corresponding letter in the coded (or decoded) text. This kind of reading will be used if the letters are arranged in the same sequence but in opposite directions on the ring 7 and on the disc 8 as shown. However, if the letters are in arbitrary order, the reading in decoding must be taken from the inner alphabet if in coding it was taken from the outer alphabet, and inversely. If now the actuating lever 41 is swung from its position shown in Fig. 1 in the direction of the arrow A, the toothed segment 40 will rotate the gear wheel 18 and the inner hollow shaft 17 anti-clockwise as seen in Fig. 1. The coupling member 19 on shaft 17 then imparts its rotation to the uppermost transmuting disc 9 and to the alphabet disc 8, whereby the spiral spring 21 becomes tensioned. As the uppermost transmuting disc 9 is thus

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rotated, its bent-down lug 27 sooner or later, depending on the previous setting of the transmuting mechanism, engages the latch 33 of the downwardly adjacent transmuting disc 22. That lug 27 then slides along the inclined guiding face 35 of the latch until it contacts the abutment 39 of the lower disc 22 and the nose of the latch 33 falls in behind it, whereby the upper disc 9 and the lower disc 22 become angularly coupled and the lower disc 22 partakes in the continued rotation of the upper one 9. The disc 22 then in a similar way will carry along its downwardly adjacent disc 23, the latter will carry along the disc 24, and so on, until all the discs 9 and 22 to 26 are in the same angular position with their latches 33 just above each other and opposite their respective disengaging arm 93. When the lowermost intermediate transmuting disc 26 is similarly arrested by the latch 33 of the stationary disc 14, all the transmuting discs are arrested in the same position, which is their actual reset or initial position for the next transmuting operation. Meanwhile, the spiral spring 21 has been fully tensioned. When the actuating lever 41 is released, it returns to its original position under the action of a resetting spring not shown in the drawing. Thereby, it releases the spiral spring 21 which then is enabled to rotate the disc 9 clockwise. As the actuating lever 41 returns to its initial position, the coupling member 19 becomes disengaged from the lug 20 of disc 9 and no longer controls the rotation of the latter.

At the beginning of the working stroke of the actuating lever 41, the cam segment 110 is in the position shown in Fig. 1, whereby its cam 111, by engaging the arm 114, maintained the abutment arm 115 in a position in which the latter prevents the disengaging arm 93 and 108 from engaging their respective latches 33. Towards the end of the said working stroke of the lever 41, the pin 113 meets the right-hand end of the arcuate slot 112 and from then on causes the cam segment 110 to rotate along with the actuating lever 41. The segment 110 thereby is rotated so far that the cam 111 is disengaged from the arm 114 and the latter drops onto the lower portion of the contour of the cam segment 110. Therefore, the abutment arm 115 releases all the disengaging arms 93 and so that they are enabled to swing towards their respective latches 33 provided that their associated feeler arms 92 and 106 are free as well. Insofar as the feeler arms 106 of the key tape mechanism are concerned, it has already been assumed that this mechanism first will be considered as inoperative; these arms 106 therefore are arrested by the common locking member 95 engaging their notches 109, and these arms 106 need not be considered for the moment. On the other hand, disengagement of each latch 33 by the corresponding disengaging arm 93 depends on whether the latter's associated feeler arm 92 does or does not meet an active lug 64 of the corresponding one of the key discs 52 to 57 when moving under the action of its spring 91. Those feeler arms 92 which abut active lugs 64 prevent their associated disengaging arms 93 from moving towards their corresponding latches 33 to such an extent as to cause disengagement of these latches. On the other hand, those disengaging arms 93 the associated feeler arms 92 of which do not meet an active lug 64 of their corresponding key disc will move farther towards the transmuting discs and will engage and displace the latches 33 so as to disengage them from the lugs 27. Thus, when the actuating lever 41 has completed its working stroke, certain of the transmuting discs 9 and 22 to 26 will be released by the latches of the downwardly adjacent discs, while the remaining transmuting discs remain arrested on their downwardly adjacent discs, the latches of which have not been disengaged.

When the actuating lever 41 returns to its original position, the uppermost transmuting disc 9 is rotated in clockwise direction as already mentioned. If the latch 33 on the downwardly adjacent disc 22 has not been

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disengaged from the lug 27 of disc 9, the latter carries the disc 22 along with it in its clockwise rotation. However, if the latch 33 on disc 22 has been disengaged from the lug 27 of disc 9, the latter first rotates alone until its bent-down lug 27 meets the projecting end of the adjustable radial arm 38 carried by the lower disc 22 and only thereafter carries that disc along in its continued rotation. In a similar way, the disc 22 carries the downwardly adjacent disc 23 along in its rotation, either by means of its latch 33 through the full angle by which it is rotated, or by means of the radial arm 38 of disc 23 through the angle of its rotation left after its engagement with that arm. Similarly, all the remaining transmuting discs down to the lowermost disc which has been released from engagement with the latch 33 of its downwardly adjacent disc, will be rotated in a similar way; that downwardly adjacent disc may be the stationary disc 14 itself or any other disc maintained stationary by the latch 33 of the disc 14 or of another disc which is similarly maintained stationary. If none of the latches 33 has been disengaged, all the transmuting discs remain in their said reset or initial position which they occupy at the end of the working stroke of the actuating lever 41. Thus, the positions of the discs of the transmuting mechanism are varied at each return stroke of the actuating lever, and this results in a new position of the rotatable alphabet disc 8, i. e. in a transmutation of the code. When this transmutation is completed, that is, when the actuating lever has returned to its original position, the coded or decoded letter can be read. For each letter of the text, a reading of this kind is taken, and the actuating lever is moved to and fro once before every reading.

With each double stroke of the actuating lever 41, a rotation of the key discs is effected due to the fact that the pawl 78 rotates the ratchet wheel 77 by one step and thus rotates the shaft 70 and the driving wheels 71 to 76 through a corresponding angle. These driving wheels transmit their rotation individually to the several key discs 52 to 57 by means of their associated gear wheels 58 to 63. Simultaneously, the counter mechanism 82 is advanced by one step by the gear wheels 79, 80 and 81.

To change the setting of the lugs 64 of the key discs, these key discs must be removed from their shaft 50 and bushing 51. For this purpose, the key discs can easily be withdrawn from the bushing 51 after removal of a cover disc 120 placed on the upper end of the shaft 50. At the same time as the key discs are placed on the shaft 50 and bushing 51, the corresponding driving wheels are placed on their shaft 70 and the corresponding bushing. In assembling the key disc mechanism, one first places the driving wheel 71 on the bushing of the shaft 70, then one places the gear wheel 58 and the key disc 52 on the bushing 51, making a mark on the key disc, which indicates the initial position thereof, to register with a fixed marking; moreover, care must be taken to bring the gear wheel 58 into mesh with the driving wheel 71. In a similar way, the remaining driving wheels and the remaining key discs with their gear wheels are mounted on their respective shafts and bushings. When all the driving wheels and key discs are in place, the driving wheels are secured against axial displacement by mounting a ring 121 on the shaft 70, while the key discs and their gear wheels are similarly secured by the abovementioned cover disc 120. Each key disc preferably carries reference number, and for coded communication between two or more stations using similar apparatuses it is of course necessary that the corresponding key discs of the several apparatuses are mounted in the same initial position and bear the same reference number. In order to increase the possibilities of variation it is recommended to supply with each apparatus a plurality of sets of various driving

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wheels and various key discs with their corresponding gear wheels.

In the transmuting mechanism, various possibilities of mutual rotation of the transmuting discs 22 to 26 and 14 can be obtained by varying the angular positions of the adjustable radial arms 38 on the several discs. For instance, these radial arms 38 could be set to obtain a relative rotation of the uppermost disc 9 by one division, corresponding to the angular distance between two adjacent letters on the alphabet disc 8, whenever the disc 9 is disengaged from the latch 33 on disc 22, to obtain rotation of the disc 22 in relation to disc 23 by two divisions, whenever the disc 22 is disengaged from the latch on disc 23, and so on.

In the described mode of operation, the disengagement of the latches 33 is controlled by the key disc mechanism through the feeler arms 92 and the disengaging arms 93. Meanwhile, the feeler arms 106 and their associated disengaging arms 108 are maintained inoperative by the locking member 95 engaging the notches 109 of the feeler arms 106, as shown in Fig. 1. If it is desired to switch over to the key tape mechanism for disengaging the latches 33, one disengages the locking member 95 from the notches 109 and one brings it into engagement with the notches 97 of the arms 96. Where the key tape as usual has five rows of perforations, it is only necessary to provide five feeler arms 106. Then only five transmuting discs can be disengaged from each other and partake in the transmuting operations. Care must then be taken that these five discs are sufficient for obtaining all the desired transmutations. Of course, for communication between two or more stations using the described apparatus with key tape operation, it is necessary to use strictly identical key tapes and to give them strictly identical initial positions for each message to be transmitted. If each key tape or each portion of a key tape is used only once, one obtains absolute secrecy of communication provided that the perforation of the key tape is unknown to the persons from whom the message is to be concealed. The key tape is advanced by one step for each full cycle of operation, this being obtained by the action of pawl 104 on the ratchet wheel connected to roll 103. As soon as the end of a feeler arm 106 penetrates into a perforation of the tape 101 at the moment it is released by the common abutment arm 115, the corresponding disengaging arm 108 is swung towards the transmuting mechanism whereby it disengages the corresponding latch 33 from the bent-down lug 27 of the upwardly adjacent transmuting disc. If on the other hand the end of the feeler arm 106 meets an unperforated spot of the tape, the disengaging arm 108 remains in its inoperative position and the corresponding latch 33 continues to arrest the said lug 27. Therefore, no relative angular displacement between the transmuting disc carrying the latch and the upwardly adjacent one carrying the lug can occur in this instance.

Whether the disengagement of the latches be controlled by the key disc mechanism or by the key tape mechanism, the cam 111 of the cam segment 110 always maintains the arm 114 and thus also the disengaging arms 93 and 108 in their locked positions during the major part of the working stroke of the actuating lever 41; only at the end of that working stroke it permits the arm 114 to fall in onto the lower portion of the contour of the cam segment, whereby the abutment arm 115 is allowed to release the disengaging arms 93 and 108. During the return stroke of the actuating lever 41 the arm 114 remains in its inner position until the cam segment 110 is carried along with the pin 113 shortly before the end of the return stroke of lever 41, this time in anti-clockwise direction. The cam segment then follows the lever 41 through such an angle that the cam 111 again lifts the arm 114 and thus forces the abutment arm 115 back to its locking position, whereby it keeps the disengaging arms 93 and 108 inoperative as shown in Fig. 1.

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Although a specific embodiment of the invention has been described above, it is evident that the invention is not limited to this embodiment. As already mentioned, the apparatus may comprise either the key disc mechanism, or the key tape mechanism, or both of them. Instead of, or in combination with, the alphabet disc a type printing wheel can be provided for printing the resulting text. The character wheel, that is in the described embodiment, the alphabet disc 8, may carry two rows of characters, for instance two concentric alphabetic series of letters. In such an embodiment, the disc before each transmuting operation may be positioned with reference to an index so that the letter to be coded is just opposite the said index. After the transmuting operation, the resulting letter is read from the other row of letters, either opposite another index or opposite the index first used. In this arrangement, the mutual angular position of the two rows of characters may be adjustable. With this arrangement, a stationary character-carrying ring is redundant.

The stationary character-carrying ring such as 7 in the described embodiment can be made easily removable, so that another ring carrying characters in a different sequence can be substituted for it. However, one could also provide the character-carrying ring with individually removable tablets each carrying one letter or other character. This would permit to change the sequence of the characters at random. The position of the rotatable character-carrying disc, such as the alphabet disc 8 in the described embodiment, could be angularly adjustable with respect to its supporting transmuting disc such as 9, so that the initial position of the rotatable character-carrying disc with respect to the stationary character-carrying ring could be varied as desired.

I claim:

1. A cryptographic coding and decoding apparatus comprising a shaft, a series of transmuting discs coaxially supported on said shaft and including a stationary terminal disc at one end of the series, a rotatable terminal disc at the opposite end of the series, and individually rotatable intermediate discs between said terminal discs, a series of self-engaging latches movably supported each on one of said stationary terminal discs and intermediate discs and adapted to engage an adjacent one of said intermediate and rotatable terminal discs for angularly coupling said adjacent disc to the disc on which the latch is mounted, means for rotating said rotatable terminal disc in one direction to produce successively its engagement by the latch mounted on the intermediate disc to which it is adjacent and the engagement of each intermediate disc by the latch mounted on the intermediate or stationary terminal disc to which it is adjacent, means for rotating said rotatable terminal disc in the opposite direction, a key mechanism for individually and selectively disengaging said latches each from its said adjacent disc to permit relative rotation of the latter in the said opposite direction, abutment means associated with each of said stationary terminal and intermediate discs for limiting said relative rotation of its said adjacent disc in said opposite direction, and a character-carrying member angularly coupled to said rotatable terminal disc.

2. Apparatus as claimed in claim 1 in which said means for rotating the rotatable terminal disc in said one direction comprise a manually operable drive mechanism and a unidirectional coupling device between said drive mechanism and said rotatable terminal disc, and in

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which said means for rotating the rotatable terminal disc in said opposite direction comprise a spring device acting on said rotatable terminal disc.

3. Apparatus as claimed in claim 2 in which said manual drive mechanism comprises a toothed segment and gear wheel meshing therewith, said gear wheel being mounted on said shaft and said shaft being connected to said unidirectional coupling device.

4. A cryptographic coding and decoding apparatus as claimed in claim 1, in which said key mechanism comprises a shaft, a series of key discs each rotatably supported on said shaft, each of said key discs having at least one controlling lug, and a series of swingable feeler arms each cooperating with one of said key discs and adapted to abut said controlling lug.

5. A cryptographic coding and decoding apparatus as claimed in claim 1, in which said key mechanism comprises a perforated tape having a plurality of rows of perforations, and a series of swingable feeler arms each adapted to abut said tape for control of the motion of said arm by the presence or absence of a perforation at the point of abutment.

6. In a cryptographic coding and decoding apparatus, a transmuting mechanism for changing the position of at least one rotatable character-carrying member comprising a shaft, a series of discs coaxially supported on said shaft and including a stationary terminal disc at one end of the series, a rotatable terminal disc at the opposite end of the series, and a plurality of individually rotatable intermediate discs between said terminal discs, cooperating abutment means on each two adjacent discs for limiting their mutual angular displacement between two limit positions, a series of self-engaging latches each movably mounted on one of said discs and adapted to engage an adjacent one of said discs as the latter and the disc on which said latch is mounted reach one of said two limit positions of their mutual angular displacement on relative rotation in one direction of that one of them which is nearer to the said rotatable terminal disc of the series, means for rotating said rotatable terminal disc in said one direction, a key mechanism for selectively and individually disengaging said latches each from its said adjacent disc, and means for rotating said rotatable terminal disc in the opposite direction, said rotatable character-carrying member being coupled to said rotatable terminal disc.

7. In a cryptographic coding and decoding apparatus a transmuting mechanism as claimed in claim 6 in which said abutment means comprise an abutment member mounted in adjustable angular position on the one of said two adjacent discs and adapted to cooperate with the other of said two discs for limiting their mutual angular displacement on relative rotation in the said opposite direction of that one of them which is nearer to said rotatable terminal disc of the series.

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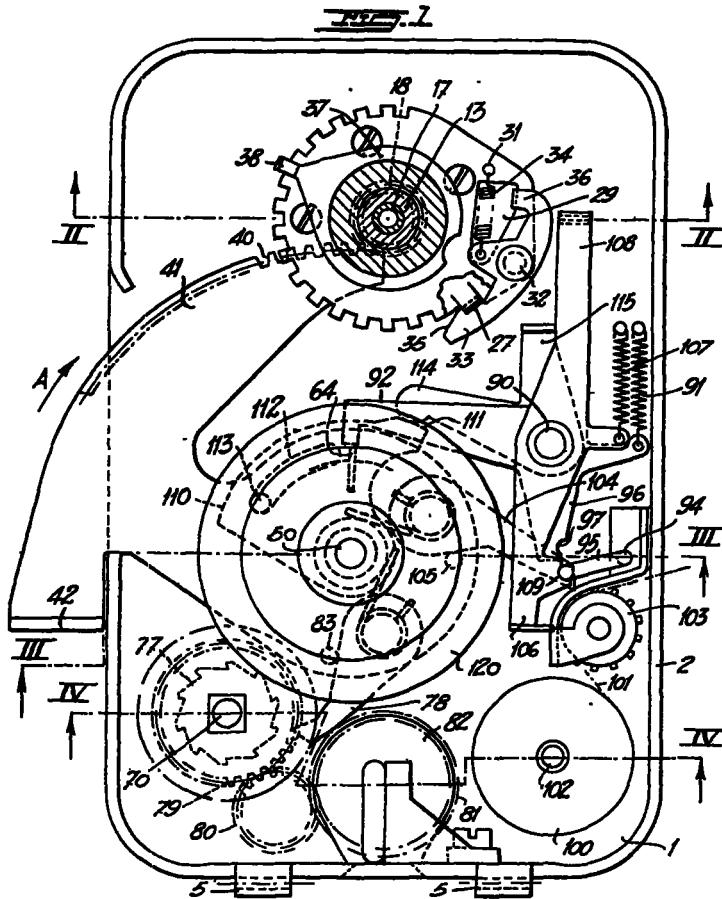
B. C. W. HAGELIN

2,851,794

CRYPTOGRAMMIC CODING AND DECODING APPARATUS

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4 Sheets-Sheet 1



INVENTOR:
BORIS CAESAR WILHELM HAGELIN
BY *Polcare, Johnston
Smythe & Robertson*
ATTORNEYS

Sept. 16, 1958

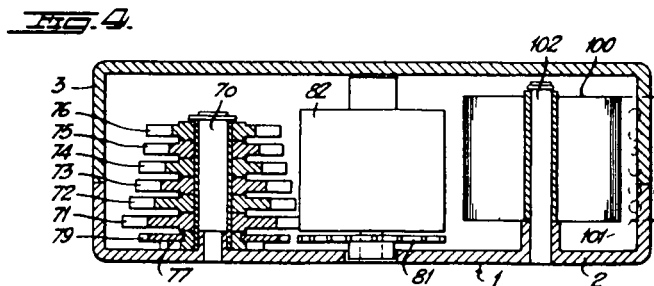
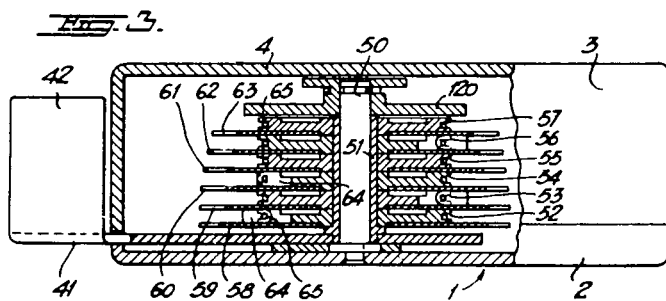
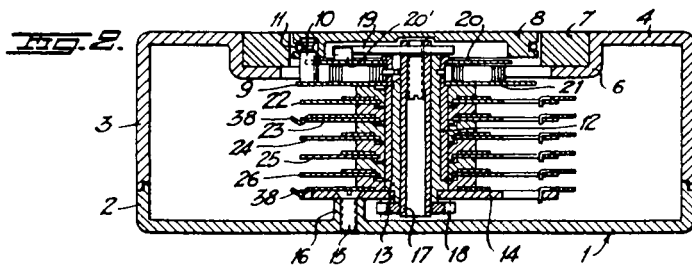
B C W HAGELIN

2,851,794

CRYPTOGRAMMIC CODING AND DECODING APPARATUS

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4 Sheets-Sheet 2



INVENTOR
 BORIS CAESAR WILHELM HAGELIN
 BY *Poleward, Johnston
 Smythe & Robertson*
 ATTORNEYS

Sept. 16, 1958

B. C. W. HAGELIN

2,851,794

CRYPTOGRAMMIC CODING AND DECODING APPARATUS

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4 Sheets-Sheet 3

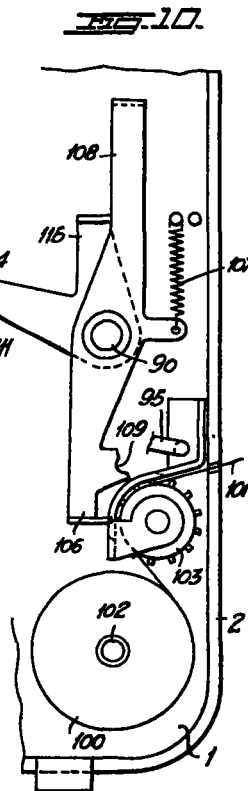
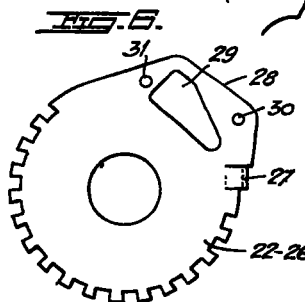
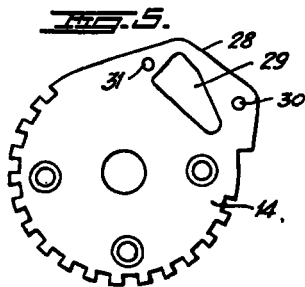
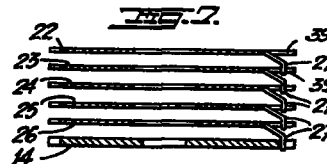
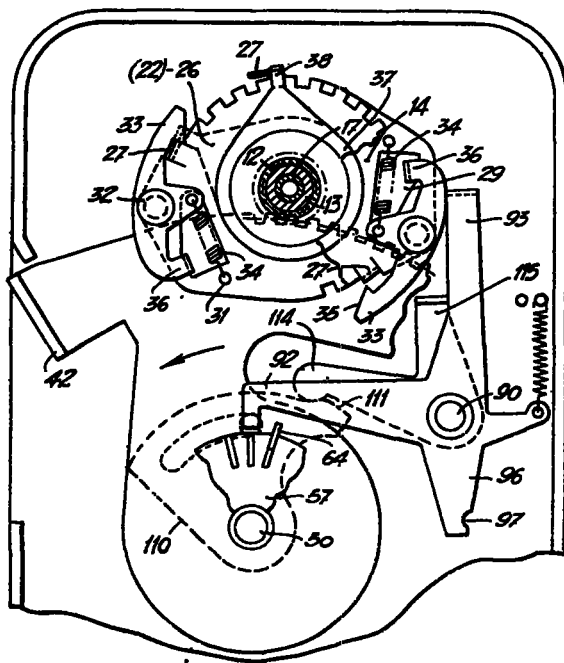


FIG. 9



INVENTOR:
 BORIS CAESAR WILHELM
 HAGELIN
 BY *Rolland Johnston*
Smith & Robinson
 ATTORNEYS