Jan. 21, 1930. A. VON KRYHA 1,744,347

CODING MACHINE

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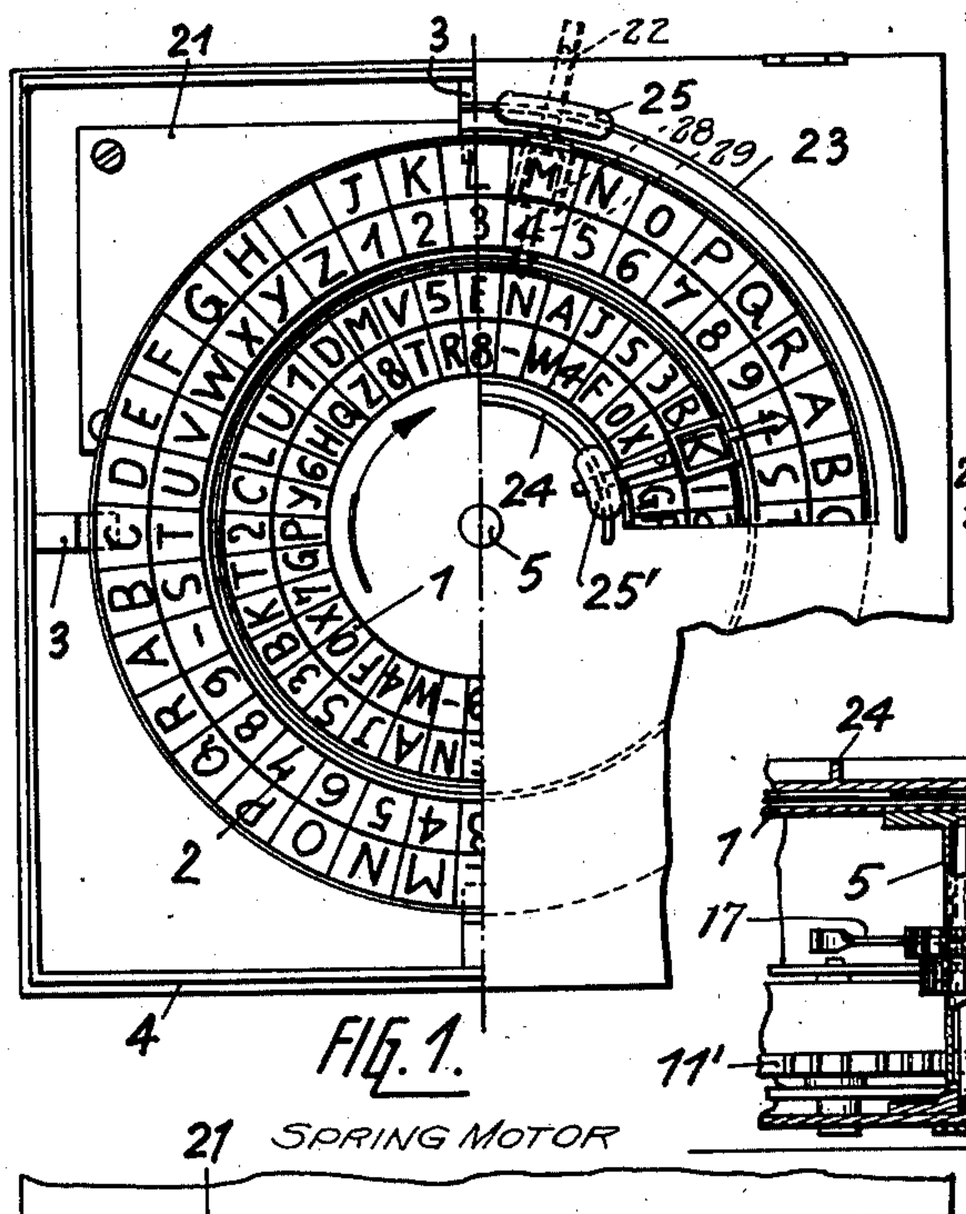

FIG. 1.

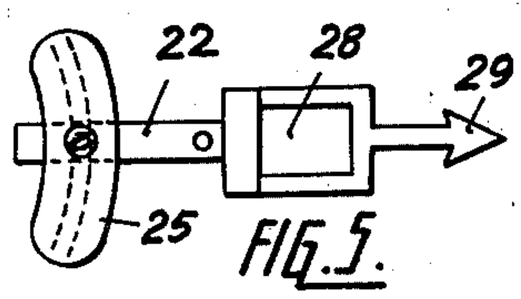

FIG. 5.

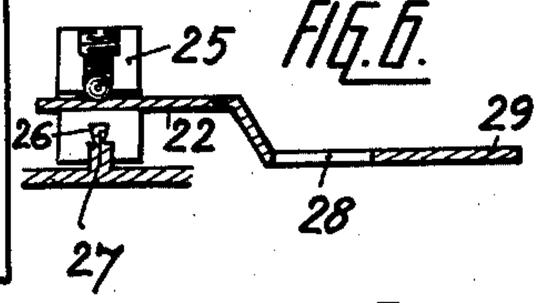

FIG. 6.

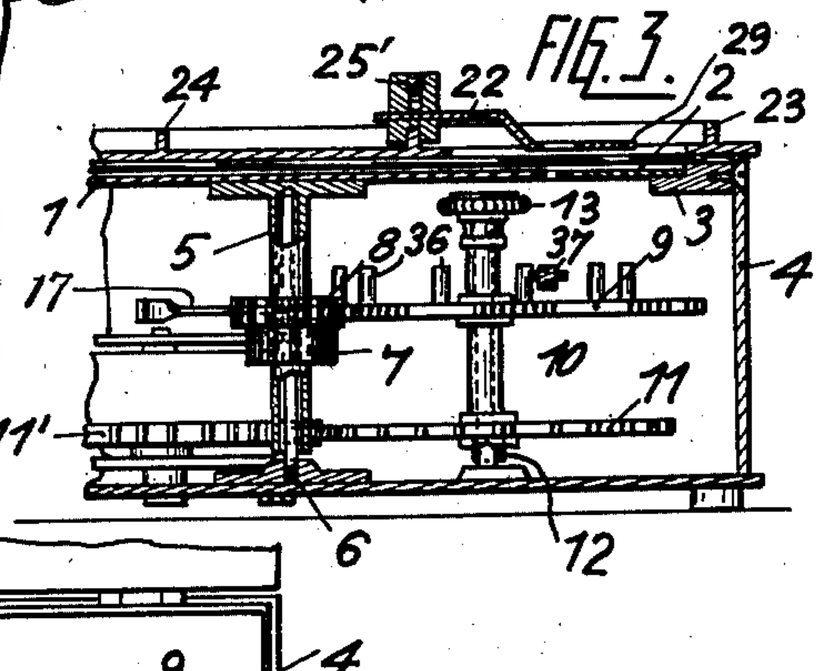

FIG. 3.

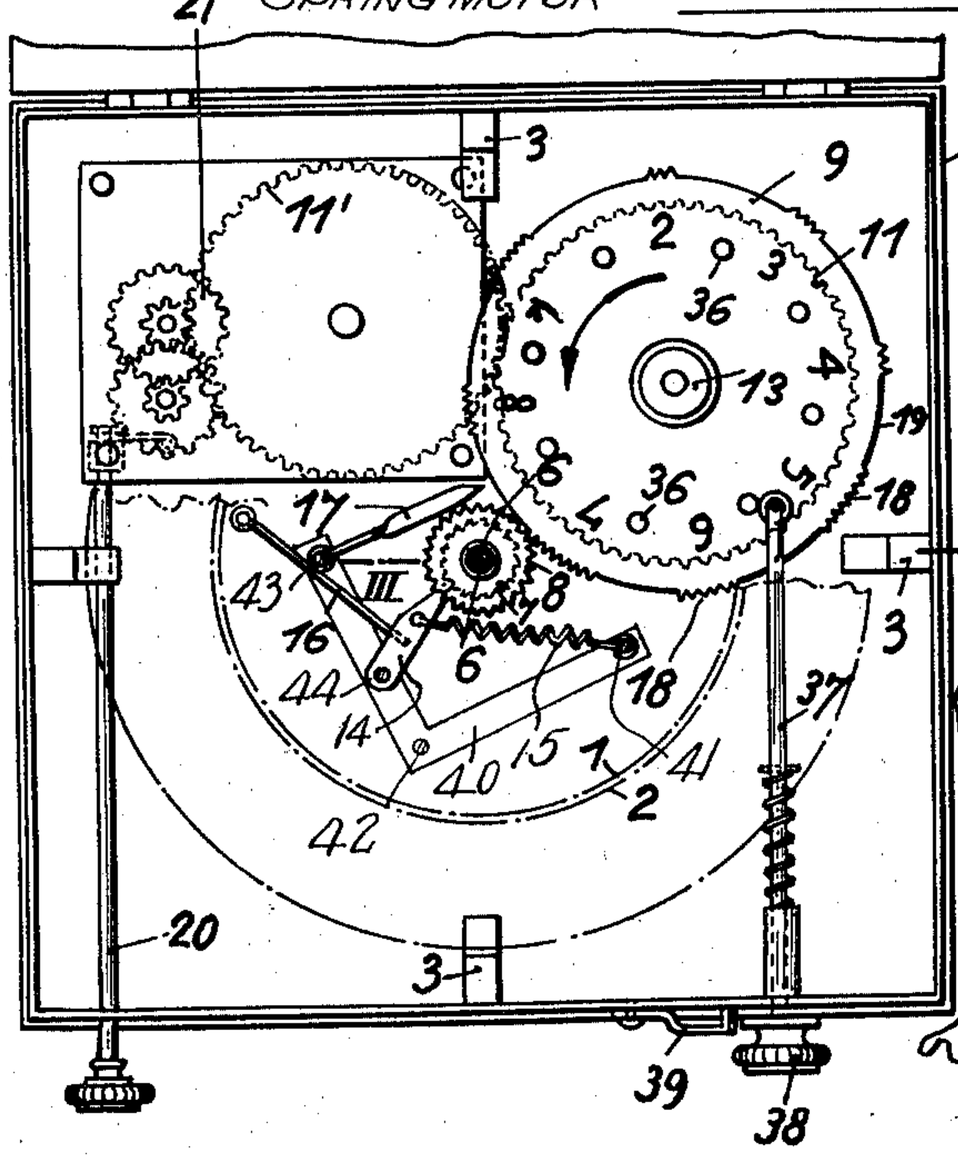

FIG. 2.

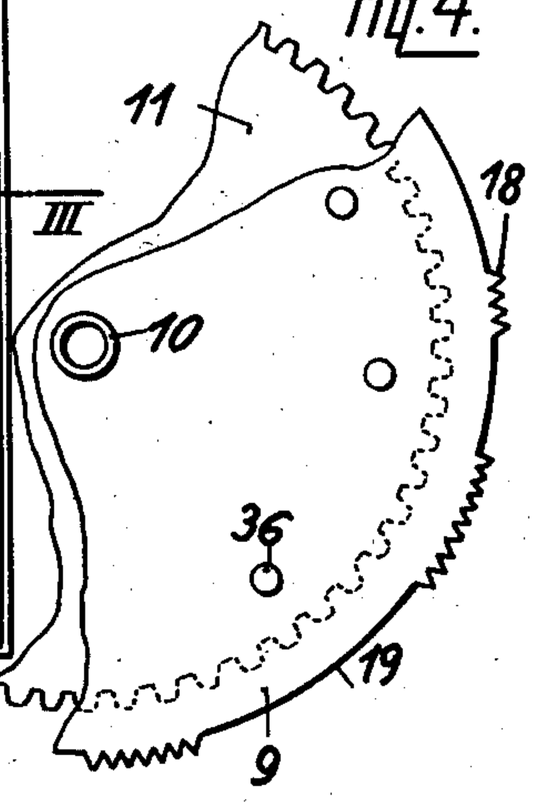

FIG. 4.

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FIG. 7.

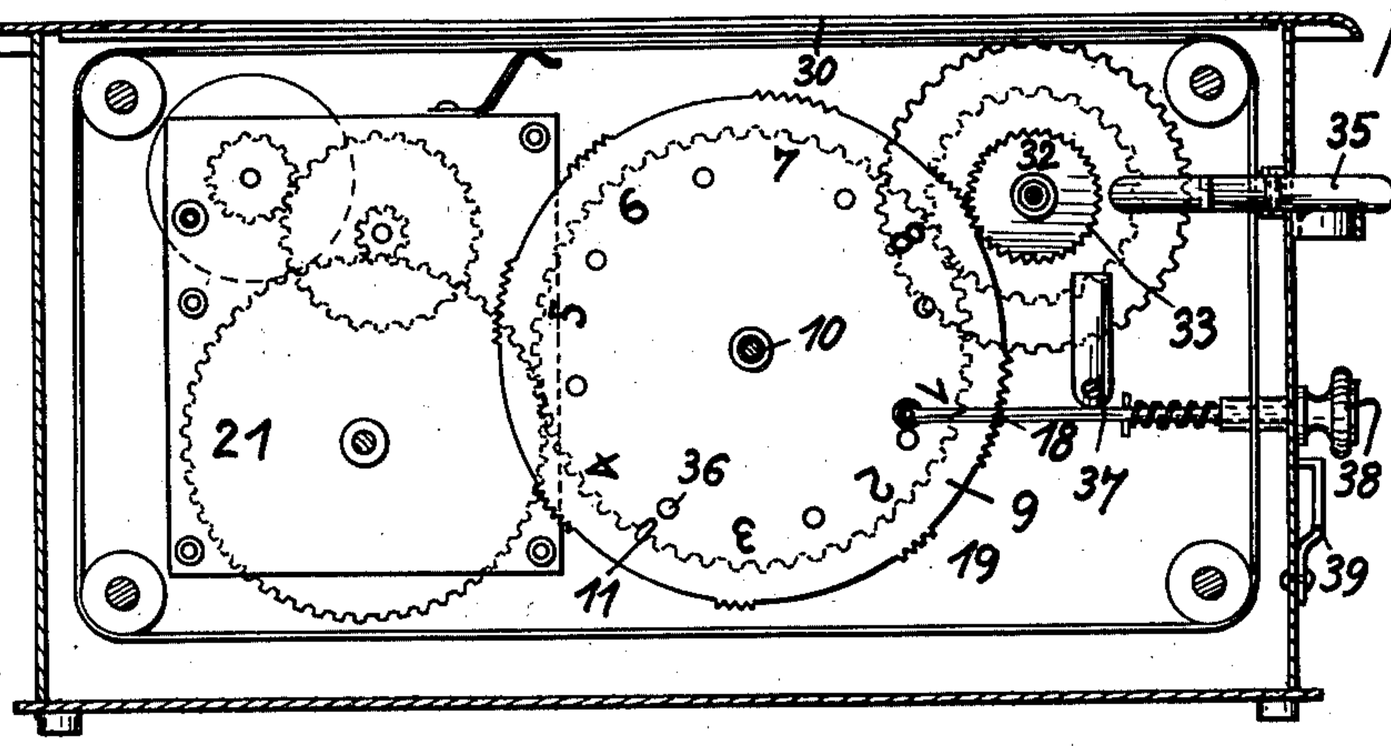


FIG. 8.

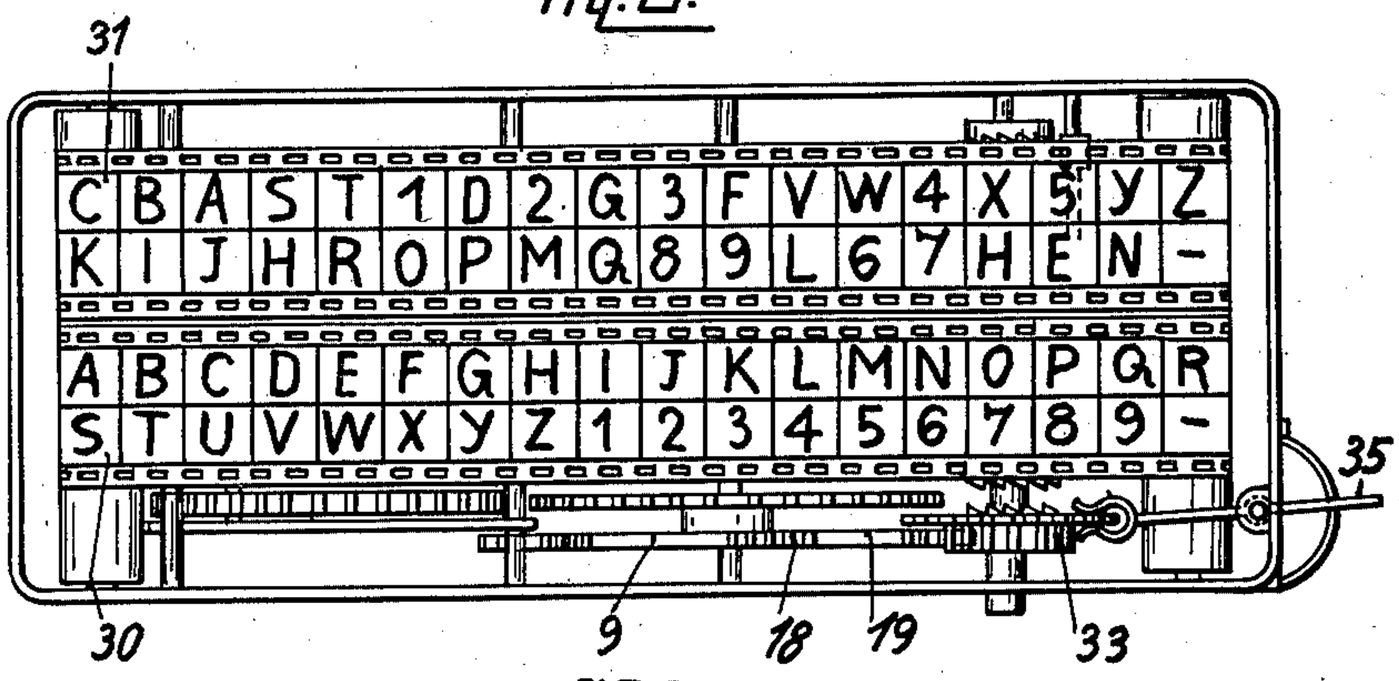
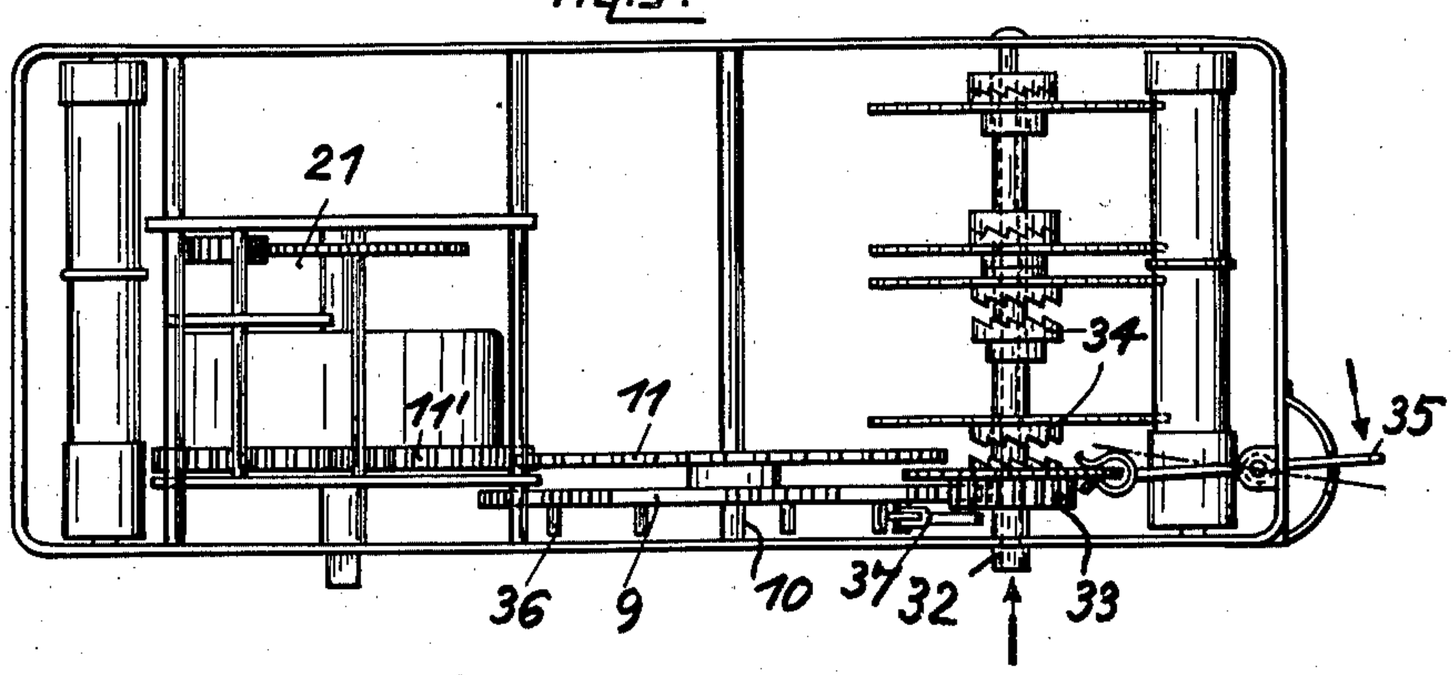


FIG. 9.



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UNITED STATES PATENT OFFICE

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CODING MACHINE

Application filed February 20, 1925, Serial No. 10,638, and in Germany December 31, 1924.

The invention relates to a coding machine which is characterized by a separate or special spaced gear wheel drive, which periodically shifts and stops one of two relatively arranged series of letters, whereby, during the pause, each letter can be transferred from the public into the secret script.

It is old in coding machines to utilize two relatively arranged series of letters. Such series are used either in endless form, for example, placed on two concentric discs, or also in such manner that one series of letters, for example, the inner disc, is carried by a manually operated shift mechanism, before the beginning of the coding, into a predetermined position with respect to the other series of letters, for example, the outer disc. Subsequently a certain letter of the secret script remained for each letter of the public script for the duration of the coding, so that by reason of the frequent repetition of the letters of a given language the secret script is decoded with relative ease.

Coding machines with numerous gear drives are also known, among them being those in which the drive gear has peripheral spaces thus transmitting its movement to the adjacent gear only intermittently. Such gear trains have heretofore been used in such manner that after the release or disengagement of two groups of gear wheels a key word is set up on one shaft and a portion of the text to be coded on the other shafts, so that each disengaged gear group is again connected and a main drive shaft is rotated forwardly for an increased number of revolutions. In decoding the operation is reversed, the drive shaft being rotated in the opposite direction. Such apparatus are complicated and not absolutely reliable, by reason of the large number of gear groups in which operating disturbances easily occur.

In accordance with the invention there is used, in combination with the above mentioned relatively arranged series of letters, only a single spaced gear wheel drive, and in which, each time the driven series of letters comes to a standstill, a reading takes place. In order that the readings may be made at equal intervals of time caution is observed that the peripheral length which each tooth group occupies on the gear provided with spaces together with the following or the preceding tooth space or together with half of the preceding and the following spaces, amounts to a fraction of the circumference of the gear wheel equal for all tooth groups.

Two constructional forms of the invention are illustrated by way of example in the accompanying drawings, wherein:

Figure 1 is a plan of the machine, with the cover partially removed;

Figure 2 a plan with the surfaces showing the letters removed;

Figure 3 a section of Figure 2 on the line III—III some of the parts being shown in elevation;

Figure 4 a view of a part of the ciphering wheel on an enlarged scale;

Figure 5 a plan of a pointer;

Figure 6 a section thereof;

Figure 7 a side view of a second constructional form;

Figure 8 a plan of this constructional form without a cover; and

Figure 9 a plan of the gearing.

According to the constructional form shown in Figures 1 to 6, the letters and figures are applied to two concentric surfaces 1 and 2. The surface 2 is in the form of a ring, which surrounds the surface 1. This ring rests upon suitable supports 3, which are fitted in the wall of the casing 4. The surface 1 is mounted on an axle 5, which is constructed as a hollow shaft, and can be set upon a pivot 6 in the casing. The hollow shaft 5 carries two toothed wheels 7 and 8. The toothed wheel 8 is in mesh with the actual ciphering wheel 9, which is likewise keyed to a hollow shaft 10. On the same hollow shaft is mounted a second toothed wheel 11, which meshes with the toothed wheel 11′ of the driving mechanism. The hollow shaft 10 is set upon a pivot 12, which is attached to the bottom of the casing, and secured in its position by means of a nut 13. The toothed wheel 7 serves merely as a ratchet and cooperates with the pawl 14, which is subjected to the action of the spring 15. 16

is a handle which serves to bring the pawl 14 into the correct position when setting the hollow shaft 5. 17 is a pointer which enables the type wheel 9 to be adjusted. The pawl 14 is for the purpose of preventing the surface actuated by the wheel 9, from being rotated in opposition to the driving mechanism. This danger is present particularly when the gear comes out of engagement with one of the tooth groups of the wheel 9 and opposite a space 19 in said wheel. If the wheel 9 is driven in the direction shown on Fig. 2, then the pawl 14 slides tooth-wise over the ratchet wheel 7, which is mounted rigidly on the shaft 5 and directly connected with the latter surface 1. Rotation of the surface 1 opposite the drive direction is thus impossible, whether or not the gear 8 meshes with a tooth group 18′ of the wheel 9 or is opposite a space 19.

By means of the handle 16 the pawl 14 is brought into the desired position with reference to the gear 8 mounted on the hollow shaft 5, and the wheel 9 adjusted with the indicator 17. The pawl 14, with the spring 15 and the handle 16, and also the pointer 17, are secured in a special frame, which consists of four pins and angular members correspondingly laid thereover. The wheel 9, by loosening the nut 13, accessible through an opening in the side wall of the casing, may be raised from the teeth of the wheel 8 (Fig. 3) and be separately adjusted. This essentially increases the difficulty of unauthorized decoding.

The frame consists of an angular ground plate 40 which is fixed by means of pins 41, 42 and 43 in the casing 4. On the pin 43 the pointer 17 is attached and this pointer serves to adjust the tooth segment wheel 9 relative to the tooth wheel 8. The tooth segments of the segment wheel 9 are numbered in series by the numbers 1–8. Opposite the pointer 17 the desired number is placed and this corresponds to the adjustment of the tooth segment of the tooth wheel 9. Incidentally the pointer points in Fig. 2 of the drawing to the tooth segment with number 8. Therefore the pointer is necessary for the preliminary adjustment of the apparatus which must take place besides the timing or adjustment of the apparatus discs 1 and 2. On the pin 44 a pawl 14 is pivoted which engages the teeth of wheel 7 and is held in this position which in its turn is fixed on pin 41 of the ground plate 40. The handle 16 is fixed on the pawl 14 and serves to withdraw the pawl against the tension of the spring 15 from the teeth of the ratchet wheel so that the teeth of the adjustment of the segment wheel can be made in such manner that the pointer 17 points to the tooth segment agreed upon, for instance, the number 8.

The ciphering wheel 9, as will be seen from Figure 4, is set with any desired number of groups of teeth 18 and spaces 19 situated between the groups of teeth 18. The number of teeth in these individual groups is optional, but it is preferable to give each group a different number of teeth and such a number that adjacent groups may differ from one another as much as possible in their number of teeth, so as to give rise to a far-reaching lack of regularity. Between the separate groups of teeth there are spaces 19 not provided with teeth. 20 is the handle of a brake, of the kind generally employed in connection with the driving mechanism of talking machines. 21 is the driving mechanism, which in the selected example includes a spring. In the spaces 19 between the groups of teeth there are on the ciphering wheel 9 pegs 36, against which bears the end of a resiliently controlled rod 37, which can be actuated by means of a knob 38. 39 is a pawl, which can be interposed between the knob 38 and the wall of the casing, whereby the end of the rod 37 may be kept permanently out of engagement with the pegs 36. 22 is a pointer which can be moved on two concentric circles 23 and 24 on the cover. Neither of the rings or circles 23 and 24 is completely closed, so that the indicator 22 can be shifted from one to the other ring. The part 25 is provided with a groove 26, which engages in the correspondingly constructed rails 27 on the cover, the pointer comprises a window or aperture 28 and an arrow head 29.

The constructional form according to Figures 7 to 9 is distinguished from the one according to Figures 1 to 6 by the fact that the mutually associated surfaces are strip-shaped. One band 30 is stationary during working, while the band 31 is moved by the ciphering wheel. The transmission of the motion from the ciphering wheel 9 to the band 30 is effected by means of a wheel 33, which is mounted fast on the shaft 32. Now on this shaft are provided clutches 34, which can be actuated by means of a handle 35. By means of this clutch the wheel that moves the strip 30 can be engaged, and on the other hand by means of this wheel, when the band 30 is at rest the band 31 can be adjusted.

The apparatus operates in the following manner:

At the beginning of the deciphering or decoding the surfaces 1 and 2 are brought into such a position relatively to one another that two figures are located in the correct relative positions. It is preconcerted between the users of the machine which two figures are to be associated with one another in the initial position. Similarly the ciphering wheel 9 is so adjusted by means of the nut 13 that the group of teeth operates first for which this has been prearranged. To simplify the adjustment of the ciphering wheel the individual groups of teeth may be distinguished by consecutive numbers, as shown in Figure 2.

If the change is to be made from open script into cipher, first of all the two surfaces 1 and 2 are adjusted relatively to one another by shiftir ; the surface 2 in such a way that the two figures, which by agreement are to be associated with one another when the work begins, are correctly related to one another.

For example, according to Figure 1, let it be prearranged that the letter "M" of the outer series is to correspond to the letter "N" of the inner series. It is to be seen that the window 28 of the pointer encloses the letter M and the extremity of the pointer indicates the letter N. Then the ciphering wheel is so adjusted that the prearranged group, 8 in the example illustrated in Figure 2, operates first. Then the first letter is picked out on the surface 1 driven by the ciphering wheel and the associated letter is ascertained on the outer surface. The driving mechanism 21 is now started by releasing the brake, the locking lever 37 is drawn out, and thereby an advance of the inner surface is brought about corresponding to the number of teeth in the working group of teeth on the ciphering wheel. On the outer surface or disc is hereupon ascertained the letter which corresponds in open script to the letter on the inner surface or disc, and so on. It is also possible however to work in such a way that the locking piece 37 is held by the pawl 39 permanently out of engagement with the pegs 36, and the reading off must then be effected while the ciphering wheel is running from one group of teeth to the other, for instance when the driving mechanism 21 is still in operation the surface 1 comes to a standstill, and until the space has passed behind the tooth group 8 to the gear 8 driven by the wheel 9. The beginner can, during this pause, hold back the driving mechanism by means of the brake until, with the aid of the indicator, he has translated the letters. For those skilled in the art the pause is sufficient to read off the surface 1 without the use of the indicator or translating, so that the driving mechanism operates continuously and is held up only when the operation of deciphering or decoding is disturbed, for example, by an alarm, telephone call or the like.

When transmitting ordinary text during the pause or stand still the operator looks for the respective letter on the open disc of the inner disc 1 and then reads off on the outer disc 2, the character (which may be a letter or numeral) corresponding to the position of this letter, whereupon this last read off or ascertained character is written down and forms the coded text.

The brake 37 serves for holding the coding wheel in position after each operation until the reading off has taken place. The brake member 20 serves for stopping or rendering inoperative the clock work mechanism whereby the whole machine is put out of action. The latter is essential when a new adjustment of the machine for a new text has to take place. In this case the coding wheel 9 is taken out so that the brake 37 which acts against the pegs 36 of this coding wheel cannot operate. Otherwise the clock work mechanism or spring would then continue to run without hindrance and an adjustment would be impossible. The re-adjustment of the machine is also necessary when, during decoding, it is found that the ascertained open text has no intelligible meaning. This is the sign that the machine is wrongly adjusted.

When deciphering or decoding, the pointer is set upon the inner guiding curve 24. The relative positions of the two surfaces which existed at the beginning of the ciphering are then reproduced and the group of teeth of the ciphering wheel which first became operative during the ciphering is also adjusted. Then the first letter of the cipher script is sought on the outer surface and the associated letter ascertained on the inner surface. The driving mechanism is now operated until one group of teeth has worked, and is then stopped. Then the letter of the cipher text is looked for on the outer surface, and the letter associated therewith is ascertained on the moved inner surface. This is then the letter in open script. The second constructional form operates fundamentally exactly in the same manner. It is to be noted that in deciphering as well as in decoding the entire mechanism runs forwardly. Reversal of the direction of rotation by means of a reverse drive and couplings is thus unnecessary. Nor is the reversal or shifting of the indicator or passage from deciphering to decoding necessary except for the beginner. All the conditions make for simplicity of the entire apparatus. The retaining device 20 is also used in decoding when a meaningless combination of letters is given and it is suspected that there has been a mistake, for example, omission of a letter, in the decoding. By means of the brake 20 the apparatus in operation is stopped in order that it may be adjusted again in a proper manner. Whenever a meaningless combination of letters is given this proves that an error has been made when adjusting the code word.

It is obvious that in this way the ciphering or coding, and also the deciphering or decoding, can be effected in an absolutely reliable manner, so that this work can be carried out even by inexperienced workers in a comparatively short time. The new machine accordingly constitutes a substantial advance in this branch of technology.

I claim:

1. In a coding machine having two relatively movable letter carrying elements, a

ciphering wheel provided with alternately arranged spaces and groups of teeth for moving one of the elements, and manually operable means for facilitating the movement of the other elements into the desired initial position.

2. A ciphering machine as claimed in claim 1, wherein each group of teeth and the following or preceding space of the ciphering wheel occupy the same fraction of the periphery of the wheel, substantially as and for the purposes set forth.

3. In a coding machine having two relatively movable letter carrying elements and driving mechanism, a wheel provided with alternately arranged spaces and groups of teeth for moving one of the elements, another wheel arranged in engagement with the driving means, and manually operable means for facilitating the adjustment of the other elements into the desired initial position prior to the operation of the machine.

4. A ciphering machine including a ciphering wheel, two surfaces each marked with a series of characters, one of said surfaces remaining stationary during the normal working of the machine and the other of said surfaces being displaceable relatively to the stationary surface during such working by means of the ciphering wheel, two fixed rail guides each concentric with the two said surfaces, and a pointer movable along either of the said rail guides said pointer being formed with a window between its ends through which can be seen a character on one of said surfaces when the pointer is mounted on one of said rail guides.

5. A ciphering and decoding machine as claimed in claim 3, wherein a pawl and ratchet device is associated with the section of the disc which engages the driving means to prevent the movable element from operating in the wrong direction when the machine is started.

6. A machine as claimed in claim 3, wherein stop means are mounted at suitable intervals on the section of the ciphering wheel having alternate spaces and groups of teeth and manually operable resiliently controlled means associated with the stop means for checking the movement of the device when desired.

7. In a ciphering machine, two members having rows of characters, a gearing for periodically displacing and bringing to a standstill one of the two members whereupon during the standstill each character may be translated from the plain script to the secret script or vice versa.

8. In a ciphering machine having two relatively movable letter carrying elements, a ciphering wheel provided with alternately arranged spaces and groups of teeth for moving one of the elements, each group of teeth and the following or preceding space of the ciphering wheel occupying the same fraction of the periphery of the wheel, and manually operable means for facilitating the movement of the other elements into the desired initial position.

In testimony whereof, I have signed my name to this specification.

ALEXANDER v. KRYHA.