

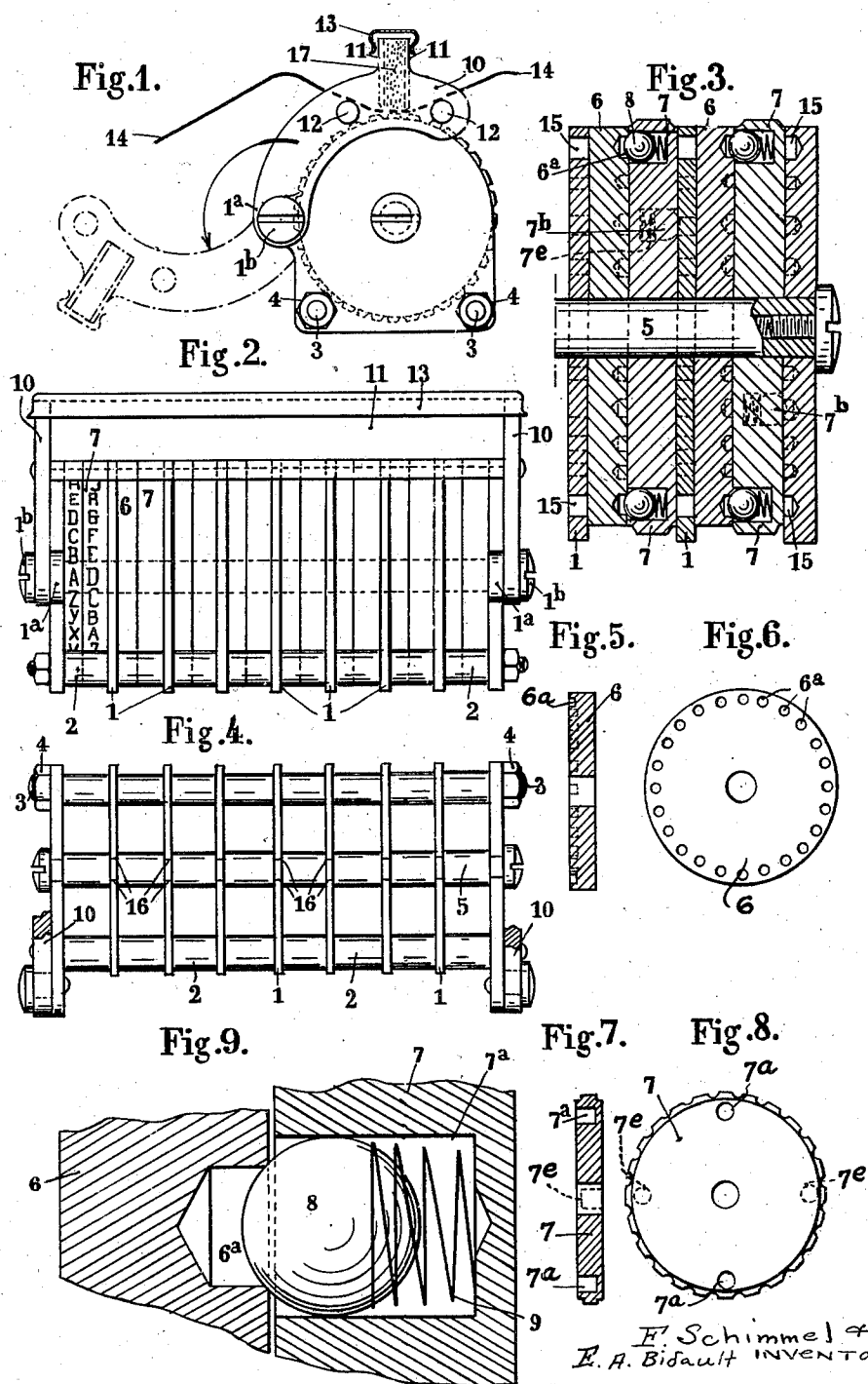
Aug. 8, 1933.

F. SCHIMMEL ET AL
CRYPTOGRAPHIC PRINTING APPARATUS

1,921,327

Filed Aug. 26, 1930

2 Sheets-Sheet 1



F. Schimmel &
E. A. Bidault INVENTORS

By: *Marks & Clark*
ATTORNEYS

Aug. 8, 1933.

F. SCHIMMEL ET AL

1,921,327

CRYPTOGRAPHIC PRINTING APPARATUS

Filed Aug. 26, 1930

2 Sheets-Sheet, 2

Fig.10.

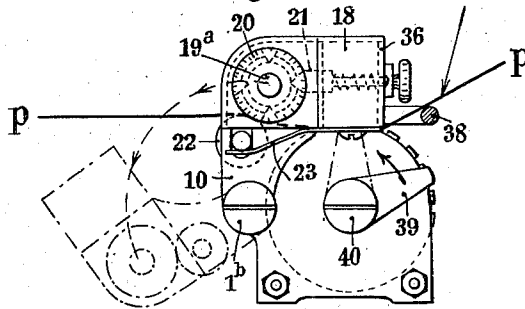


Fig.11.

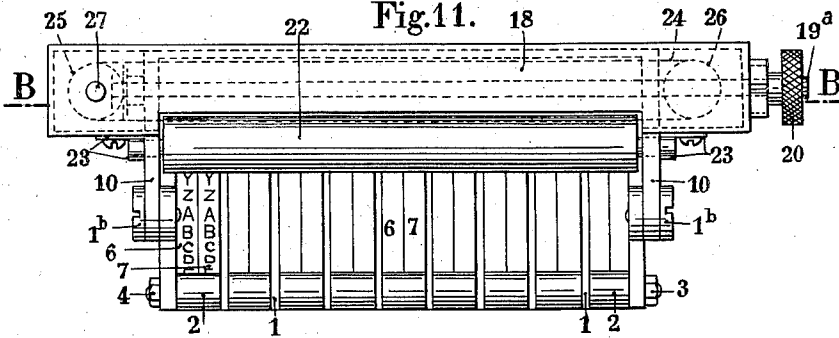


Fig.12.

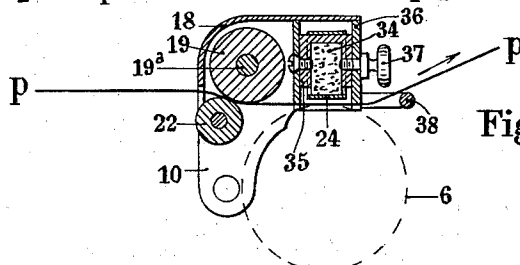
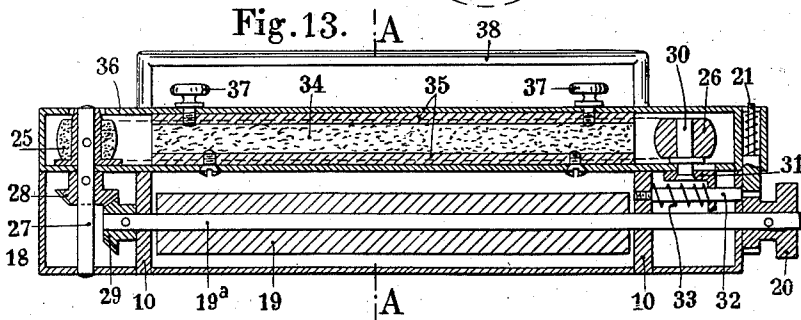


Fig.13.



F. Schimmel &
E. A. Bidault INVENTORS

By: *Morris H. Lee*
ATTORNEY

UNITED STATES PATENT OFFICE

1,921,327

CRYPTOGRAPHIC PRINTING APPARATUS

Francois Schimmel, Aulnay - Sous - Bois, and
Eugène Auguste Bidault, Paris, France

Application August 26, 1930, Serial No. 477,902,
and in France September 4, 1929

8 Claims. (Cl. 197-4)

This invention has for object to provide a cryptographic apparatus which can be of so small a size that it can easily be carried in the pocket, and capable of printing the results of transformation of plain language into cipher language, or of cipher language into plain language on a paper tape or strip.

For ciphering the message to be sent, the sender will adjust his apparatus in accordance with the key agreed upon and the apparatus will then give him, in cipher language, the words and sentences he desires to send. The apparatus is combined in such a manner that a letter, for instance an A, may have a different signification every time it appears in a different column or for each of the elements with characters. Consequently deciphering is absolutely impossible for persons not provided with the apparatus and even for those who, possessing the apparatus, do not know the key. The cipher message, transmitted to the receiver by broadcasting, or by another means, is repassed through the apparatus of the receiver, who will previously have adjusted it according to the key agreed upon, and the apparatus will give him the message printed in plain language, that is to say deciphered.

For obtaining absolute secrecy, it suffices to destroy the printed paper and to unset the apparatus, operation which requires but a few seconds.

The invention is illustrated, by way of example only, in the accompanying drawings in which:

Fig. 1 is a side view of the apparatus.

Fig. 2 is a front view of the same apparatus.

Fig. 3 is a cross section, on an enlarged scale of two pairs of discs and of the partitions separating them.

Fig. 4 is a plan view of the frame, the discs being removed.

Figs. 5 to 8 are sections and side views of the discs removed.

Fig. 9 is an enlarged detailed view of the ball coupling arrangement.

Fig. 10 is a side view of the entire apparatus provided with the new printing device.

Fig. 11 is a front view of the entire apparatus.

Fig. 12 is a section made through the printing apparatus according to line A—A of Fig. 13.

Fig. 13 is a section made according to line B—B of Fig. 11.

As illustrated in the drawings, the apparatus is composed of a number of metal plates 1 separated by spacing tubes 2, Fig. 4, and connected together by studs 3 and nuts 4. Through the center of these plates 1 passes a central shaft 5 carrying, between the separations formed by

the plates 1, discs 6 and 7. Each disc 6 carries, on its periphery, the alphabet and the digits, or the alphabet alone, which are engraved. Each disc 7 carries the same signs, but in relief so that they can be printed. These digits slightly extend beyond the peripheral surface of the disc carrying the engraved letters, as shown in Fig. 3. For convenience and for limiting the weight, the number of pairs of discs is limited to eight, arranged one pair beside the other. The discs carrying the engraved alphabets serve for composing the message in plain language and the discs with the letters in relief give this message in cipher, when it is the sender who utilizes the apparatus. On the contrary, it is on the discs having engraved letters that the receiver composes the cipher message he has received and it is the discs having letters in relief which give the message in plain language.

The disc 6 is moreover provided, on its side facing the disc 7, with small holes or recesses 6^a, Fig. 6, located below the letters or digits, not far from the edge. The disc 7, Fig. 8, is provided, on its side facing the disc 6, with two holes 7^a only, formed at the same distance from the center, so that these two holes are always opposite two holes or recesses of the disc 6 and in this position any two digits or letters of two discs 6 and 7 are opposite each other. A steel ball 8 arranged in each hole 7^a and pushed by a spring 9, yieldably maintaining this relative adjustment. By causing the disc 7 for instance to rotate on its shaft 5 by means of the fingers, the disc 6 also rotates, being rendered rigid with the disc 7 by the balls 8 fitted in two of the recesses 6^a. Normally, by acting on one or the other of both discs, they always rotate together. But, when it is desired to change the relative position of the digits or letters, one of the two discs is held stationary and the other is caused to rotate until the two desired letters are opposite each other. By the pressure exerted on both discs, the two balls 8 are forced out from the two recesses 6^a where they were fitted, completely entering their respective holes 7^a by compressing their springs and enter again two other recesses which correspond to the desired adjustment of the discs. This constitutes the adjusting operation of the apparatus according to a key agreed upon and is effected only at the beginning of the ciphering or deciphering operation, as well as at the end of these two operations for clearing off the position which has served. This adjusting operation can be effected by hand without any tool. Thus, the unset apparatus does not provide any

trace of the key which alone allows the composition or reading of the cryptogram.

Obviously, it is necessary that both apparatus should be previously adjusted according to the same key, that is to say, the eight discs carrying the engraved alphabet should be placed in a definite position relatively to the discs carrying the letters in relief. For that purpose, a definite word, sentence or position is chosen for the first discs, for instance, the word "Bordeaux" which happens to be composed of eight letters, but this is not compulsory. The discs having the engraved letters will therefore be set in alignment (by causing them to rotate with the fingers of the hand) with the letters composing the word "Bordeaux". The discs having the letters in relief which must form the cryptogram will also be set in a definite position agreed upon between the persons who are to correspond. This may be another word, another sentence or one or more simple letters or digits. Let us assume that the eight discs carrying the letters in relief have been set at the letter S. The apparatus thus adjusted should therefore appear as follows: B/S O/S R/S D/S E/S A/S U/S X/S. The eight S in relief will therefore represent the word "Bordeaux", and if for instance the word "Bordeaux" should be transmitted to the receiver, the latter would receive on the despatch only the eight S. Nobody would be able to discover that the eight S represent this word, considering that each S represents a different letter of the alphabet.

On the discs is provided a dash serving to divide or space the words. Thus, if "a Bordeaux" is coded the cryptogram R4C46VC7B1 is obtained as follows:

One set of the discs having been set for the key word BORDEAUX and the letters S having been set up on the other discs, as above described, the signs on the pairs of discs will appear in part as follows:

I	II	III	IV
8 O 9 P 10 Q A R B S C T D U E V F W G X H Y I Z J — K 1 L 2 M 3 N 4 5	N O P Q R S T U V W X Y Z — 1 1 2 2 3 3 4 4 5	Q R R S S T T U U V V W X Y Z — 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10 A A B B C C D	A P B Q C R D S E T F U G V H W I X J Y K Z L — M 1 N 2 O 3 P 4 5

When it is then desired to transmit the words, A BORDEAUX, the letter A in code appears as R on the first pair of discs. In the second pair of discs, opposite to the dash representing a space appears the cipher 4; in the third pair, opposite to B we have C; in the fourth pair, opposite to O we see 4, and so on. Thus, there is obtained the cryptogram R4C46VC7B1.

In like manner innumerable other cryptograms may be evolved.

If then, the discs are placed to translate the word BORDEAUX, the cryptograms will be:

BS. OS. RS. DS. ES. AS. US. XS.

And for the translation of the words A BORDEAUX:

AR. -4. BC. O4. R6. DV. EC. AF. UB. X1.

and for the translation of the words DE BORDEAUX:

DU. EI. -1. BQ. O3. RO. DB. EA. AR. UZ. XY.

Variations to infinity can be obtained by means of this apparatus by modifying the key, that is to say, the relative position of the letters on both discs or by changing the order of the letters and digits on the various pairs of discs.

For setting the letters in alignment, the plates 1 carry two lines or dashes 16 between which the letters forming the message are aligned.

The plates 1 are also provided with recesses 15, Fig. 3, in which enter the balls 7^b mounted in recesses 7^a of the disc 7. These recesses 15 being not quite so deep or having a smaller diameter than the recesses 6^a, the balls 7^b enter therein to a lesser extent and, whilst ensuring the position of the pairs of discs, allow by causing one of the discs to rotate to change the position of the pair of discs without the relative position of the two discs of the pair being altered. In other words, the coupling between the plates 1 and the discs 7 is not so strong as the coupling between the discs 6 and 7.

It will be noted that the walls 1 have for effect to isolate the pairs of discs from each other and to prevent a pair being driven by an adjacent pair when it is caused to rotate for setting it in the required position. The pairs of discs thus remain in the position which has been given to them, this avoiding any error in the composition of the message.

In order to print the line which has been set, the outer plates 1 each carry a lug 1^a, Fig. 1, on which are secured, by screws 1^b, the segments 10 which form a part of a frame composed of the said segments, of lamellae 11 and of two rods 12, rivetted on either side in the segments 10. The lamellae 11 are soldered at their ends to the segments 10 and form with the latter a small oblong reservoir extending above the series of 8 pairs of discs constituting the apparatus. In this reservoir is introduced a felt strip 17 impregnated with ink, the said reservoir being held in position by a cover 13. A paper strip 14 is inserted between the rods 12 and the underside of the felt strip. When the frame 10, 11 is placed in the position indicated, Fig. 1, and the cover 13 is lightly pressed upon, the projecting letters of the disc are printed on the paper. The frame has simply to be turned over in the position indicated in dotted lines and the paper strip is pulled to an extent corresponding to the spacing of a line and when the line is set, the frame is again turned over for printing the second line, and so on. During composition of the text by means of the discs, the printing frame remains in the position shown in dotted lines and does not hinder the operation in any way. The printing apparatus can be constructed in any other suitable manner without departing from the principle of the invention.

It may not be provided with an inking felt strip, the printing being then effected by means of carbon or like paper.

The non-printing discs can be provided with type which are not engraved, but of flat form.

The very simple form of construction of the printing device of the apparatus, such as above indicated, is sufficient for experienced persons. In certain cases, however, it is preferable to render its manipulation easier. For that purpose, the invention further comprises an improved arrangement in which the printing device is completed by an inking ribbon and two rollers causing the paper to move, both rollers being actuated by means of a milled knob. By causing the knob to rotate after each impression, the paper advances to the extent of one line, uncovers the newly printed line, and the inking ribbon moves at the same time to a certain extent, in order that the same portion of the ribbon will not always supply the ink for printing purposes. The lines previously printed remain constantly visible as on a typewriter in which the writing is visible. In this improved arrangement carbon paper can be used for making one or more copies when necessary. The inking ribbon comes in contact with the paper and does not touch the engraved letters; consequently the engraved discs always remain clean and will not soil the fingers of the person manipulating them.

In the form of construction illustrated in Figs. 10 to 13, the segments or side arms 10 (Figs. 10 and 11), which embrace the frame composed of the members 1, 2, 3 and 4, carry a box 18. These arms are pivoted on two screws 1^b provided with shoulders, so that the box 18 may be moved backward to avoid interference in the manipulation of the engraved discs 6 and 7. In the box 18, longitudinally thereof, is mounted a roller 19 lined with rubber (Fig. 13) or like material. On one side, the shaft 19^a of this roller extends beyond the box 18 and carries a milled knob 20 which, on its left-hand portion, is provided with notches into which enter a pawl 21, (Figs. 10 and 13). A second roller 22 (Fig. 10) is pressed against the driving roller 19 by two small flat springs 23 acting on its ends. By this means it is possible, by causing the roller 19 to rotate to the extent of one or two notches and by causing the paper to correspondingly advance, to obtain printed lines regularly spaced as on a typewriter. The paper sheet *p* passes between the lower part of the box 18 under an endless inking ribbon 24 (Fig. 12) and the printing discs. The ribbon 24 passes over guide rollers 25 and 26 (Fig. 13), one of which 25 is actuated by its spindle 27 on which is secured a bevel pinion 28, the other roller 26 being loosely mounted. The pinion 28 meshes with another pinion 29 rigidly secured on the end of the shaft 19^a of the roll 19 (Fig. 13). By causing the milled knob 20 to rotate, the bevel pinion 29 transmits the rotary movement to the pinion 28 and to the roller 25 rigidly secured on the common spindle or shaft 27. The spindle 30 of the roller 26 is carried by a small right-angular member, and is guided by a slot provided in the inner wall of the box 18 (Fig. 13). The right-angular member 31 in which is riveted the spindle 30, is itself guided on a shaft 32 and can move to the right and to the left. It is pushed by a spring 33 and drives with it the spindle 30 and the roller 26, so that the inking ribbon 24 is subjected to the necessary tension.

The printing is effected by closing the box 18 down on to the engraved discs 6 and 7, as previously described. By this closing down movement, the paper sheet comes in contact with the discs carrying the letters in relief (Figs. 10 and

12). These letters sink into the paper *p* supported by a bed member 34 owing to the pressure exerted upon the box 18 and form projections on the paper on the side of the inking ribbon. This sinking is facilitated by the resiliency of the ribbon and by the constitution of the bed member which is composed of a strip 34, made of leather, felt or rubber (Figs. 12 and 13). This resilient material 34 is arranged in a support 35, in the shape of an inverted U, secured on the inner wall of the box 18 so as to be housed between the upper and lower sides of the inking ribbon 24. The ribbon thus moves under this bed member 34 when the knob 20 is turned and presents, upon each new impression, another inked portion.

On the support 35 is moreover secured, on the front side, a cover 36 attached by means of milled screws 37. This cover gives access to the ribbon 24 for facilitating its replacement. In order that the paper sheet *p* should not fall back on to the apparatus and should allow an easy reading of the printed lines, it is guided at the point where it issues, by a guide 38 (Figs. 10, 12 and 13); the line last printed is located on the paper at the place indicated in Fig. 10 by the point of the arrow.

When the apparatus is not in use, it is necessary that the inking ribbon and the engraved discs should not be in contact with the paper. The inking ribbon is usually placed in the position indicated in full lines (Fig. 10) where these inconveniences unavoidably take place. For avoiding the said inconveniences, the apparatus is provided on either side with tongues 39 which are secured on the central shaft 5 by screws 40. In the position illustrated in Fig. 10, the tongues 39 are spaced from the lower closed portion of the box 18 which can therefore move the ribbon and the paper towards the engraved discs for effecting the printing. By raising the tongues 39 to the position indicated in dot and dash lines, the box 18 instead of coming quite near the engraved discs is moved away therefrom to a certain extent by the tongues 39 and no longer touches them. In this way, the ink of the ribbon cannot be absorbed by the paper when the apparatus is at rest, and the discs cannot be soiled by the ribbon when the paper is lacking. Before resuming the operation, the tongues are simply lowered to the position shown in Fig. 10.

The operation of the apparatus is very simple: A sheet of paper is inserted between the rolls 19 and 22; the milled knob 20 is caused to rotate to the required extent and, after having placed the engraved disc at the required sentence, the box 18 is closed down on to the discs. The box 18 is slightly lifted, the knob 20 is turned for causing the paper to advance and for moving the ribbon, and the box is moved backward for avoiding any hindrance in the setting of the following line which is then printed as the preceding one.

The above arrangements are of course given by way of example only; the forms, details, accessories, materials and dimensions may be varied without departing thereby from the scope of the invention.

We claim:—

1. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, signs on the periphery of the said discs, a coupling interposed between the two discs of each pair for permitting change of the sign combina-

tions on the discs, means for stopping the pairs of discs, partitions between the said pairs of discs for separating and insulating them and constituting bearings for the said stop means.

5 2. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, signs on the periphery of the said discs, a coupling interposed between the two discs of each pair for permitting change of the sign combinations on the discs, a coupling between the pairs of discs and the frame of the apparatus, the last mentioned coupling not being as strong as between the discs of each pair.

3. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, signs on the periphery of the said discs, balls pushed by spring for coupling together the two discs of each pair, recesses in the said discs and in which the said balls enter, a printing device mounted for rocking movement toward and away from the discs for allowing their rotation and moved towards the said discs for printing.

4. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, signs on the periphery of the said discs, balls pushed by spring for coupling together the two discs of each pair, recesses in the said discs and in which the said balls enter, a printing device mounted for rocking movement toward and away from the discs for allowing their rotation and moved toward the said discs for printing.

5. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain

language and the other disc for cipher language, and signs on the periphery of the said discs, a rocking printing device, containing a bed member provided with a resilient lining, an inking ribbon, rolls for causing the paper to advance.

6. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, and signs on the periphery of the said discs, a rocking printing device, containing a bed member provided with a resilient lining, an inking ribbon, rolls for causing the paper to advance, means for producing an exactly determined advance of these rolls.

7. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, and signs on the periphery of the said discs, a rocking printing device, containing a bed member provided with a resilient lining, an inking ribbon, rolls for causing the paper to advance, an operating knob rigidly secured on one of the rolls feeding the paper, a ratchet rigid with the said knob, and a pawl engaging with the said ratchet.

8. Apparatus for coding and decoding messages, comprising a shaft, a series of discs mounted on the said shaft, these discs being grouped in pairs, a disc of each pair being used for plain language and the other disc for cipher language, and signs on the periphery of the said discs, a rocking printing device, containing a bed member provided with a resilient lining, an inking ribbon, rolls for causing the paper to advance, and operating knob rigidly secured on one of the rolls feeding the paper, a ratchet rigid with the said knob, and a pawl engaging with the said ratchet, transmission gears driving one of the rollers carrying the inking ribbon.

F. SCHIMMEL.
E. BIDAULT.

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150