HAGELIN-CRYPTOS

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No. 3035 b

The "Hagelin" Cryptographer, Type CX-52

(Condensed Instructions)

A. Introduction.

The machine type CX-52 is successor to the type C-machines, which have been on the market for nearly 20 years. It is externally similar to the machine type C-446A, but presents both cryptographically and structurally important improvements and advantages. It also offers the all-important advantage of permitting correspondence with the old type machines.

The main improvements cryptographically are:

1. Keywheels:
   The keywheels have divisions up to 47 (the maximum in the old machines is 26) and their stepping is irregular, and 12 different keywheel units can be chosen from when the machine is purchased and their position in the machine can be changed at will.

2. Bar drum:
   There are 32 easily interchangeable bars (the maximum in the old machines is 27).

3. Type wheel unit:
   The indicating disk and the typewheels are easily removable and a wide choice of different alphabet combinations and styles is available. - It is also possible to have typewheel units with rearrangeable letters and types, so that any desired sequence can be obtained.

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These features complicate the ciphers obtained on these machines to such an extent that even if through faults, committed by the correspondents occasional cipher messages are decrypted by an adversary, this will not allow him to reconstruct the inner (secret) settings (arrangement of drum bars, pinwheel and type-wheels) of the machine, which was possible with the old type machines.

The improvements from a practical point of view are numerous and stem from many years of experience with the manufacture and maintenance of the old type machines. Apart from a very refined manufacturing technique used in the manufacture of these machines, the most important advantages of the new design are the following:

1. The indicating disk is stationary and is placed in the type-wheel cover. The indication is effected with the aid of a movable index, which is coupled to the operating knob on the left side of the machine. This feature facilitates materially the location of the letters, especially in such cases when the letters on the indicating disk are arranged in sequences other than normal.

2. The keywheel units are removable from the machine and the pin disks can be detached from the keywheel units. The rearrangement of the positions of the keywheels in the machine is equivalent to the change of the lug arrangement of the drum bars, but is much more easy to effect. By being able to remove the pin disks from the machine, the pins can be much more easily rearranged than when they are fixed in the machine. The pins cannot be moved by the simple application of pressure from a finger, which eliminates risk of accidental disarrangement of the pins. A simple tool for the rearrangement of the pins is supplied with each machine.

3. Only a single paper roll is used, lodged in the base of the machine. The tape is automatically cut into two separate tapes

when operating the machine. The use of a single paper roll simplifies the handling and calls for less spares.

4. The design of the machine is such that it can be transformed into an electrically driven keyboard operated machine, by the addition of an electric drive unit, designated B-52, which comprises keyboard, setting and driving mechanisms. When an electrically operated machine is required, only the outer cover of the CX-52 machine is removed, and the machine is slid on to the B-52 base and locked into place. The advantages of this design are that the same ciphering machine is used both for the hand and the electrically operated versions, and that due to a rational execution of the B-52 unit economies in price are obtained in comparison to the old type electrically operated machine BC-543.

B. General Remarks.

The machine type CX-52 is purely mechanical in function, has very small dimensions and is relatively simple in construction, but offers nevertheless many of the advantages of larger and more expensive machines.

1. The overall dimensions are * 21,5 x 13,5 x 11 cm and the weight * 3,7 kgs. The machine can be carried either with the handle strap or on a strap over the shoulder. It will stand shocks and can be used under the most primitive conditions.

2. The same machine can be used both for ciphering and for deciphering.

3. The machine is provided with a printing mechanism which prints both the primary and the secondary texts at the same time. (Primary: clear text when ciphering, cipher when deciphering: Secondary: cipher when ciphering, clear text when deciphering).

*) 8 ½ x 5 3/8 x 4 3/8"; 8 1/8 lbs

Both texts are rendered on the same tape, the primary text under the secondary. When the tape leaves the feed rolls it is automatically divided into two bands, one with the primary, and the other with the secondary text. As the two texts are always printed in exact juxtaposition to another, checking (letter by letter) is conveniently done. It is to be noted that when ciphering, both texts are divided into five letter groups, to give the cipher, which is to be transmitted, its conventional grouping. The corresponding clear text will here also contain the letter used to designate "space". When deciphering, the cipher text will appear with its letters in an unbroken sequence, while the resulting clear text will be rendered with the proper spaces between the word.

4. The operating speed is high for a hand operated machine. Between 30 and 60 letters per minute can be ciphered or deciphered, depending on the skill of the operator. The use of a movable index and a stationary alphabet ring contribute materially to the operating speed, especially when alphabets with random sequence are used.

5. The operation is most simple and the routine work can be learnt in a short time. The construction is as foolproof as can be, and interlocking devices contribute to the correct use of the machine.

6. From a cryptographical point of view, the machine produces a very high class of cipher. Provided a suitable cipher service is established and the service rules are rigidly followed, then the cipher messages produced on the CX-52 machines will be absolutely secure.

7. The machine can be fitted with the F-V knob accessible without removing the side cover as shown on picture 2 (34). In our standard model this knob is placed inside the side cover in order to prevent accidental operation.

C. Short description (see encl. pictures).

Picture No. 1 shows the machine in its closed position.

1. The baseplate
2. The main cover
3. Carrying strap
4. Keys.

   Note: When a key with one notch in the grip is used, only the main cover can be opened, when releasing the catch (5). With the key with two notches, both the main cover and the inner cover (32) can be opened.

5. Catch for the main cover
6. Bottom cover (protects the paper roll).

Picture No. 2 shows the machine with the main cover (2) opened. This cover can be opened with any one of the two different keys which are provided for each machine. After having turned the key in the keyhole, press the catch (5) to open the cover.

We find inside the cover of the machine:

7. Oil can
8. Receptacle for spare ink rolls
9. Screwdriver
10. Tool for the rearrangement of the bar lugs and for the typewheel types
11. Receptacle for spare letters for the alphabetring.

We see, from the left to the right of the machine:

12. Operating knob
13. Alphabet ring
14. Index for indicating letters
15. Index for indicating numbers
16. Positioning point
17. Typewheel lid
18. Button "O" to open the lid (17)
19. Button "R" to set relative position between primary and secondary typewheels.
20. Paper feed roll

21. Paper tape (divided)
22. Release latch for the bottom cover (6), which gives access to the paper roll in the machine
23-28. Six pin disks
29. Shaft, which carries the typewheel and keywheel units
30. Operating lever.
31. Lever handle (30), in retracted locked position.

Picture No. 3 shows the machine with the lid (32) opened. This lid can be opened only when the key with two notches in its grip is used. This key opens both the main cover (2) and the lid (32).

We see, from the left to the right, in addition to the parts also mentioned on picture 2:

32. Inner lid
33. C-D knob
34. F-V knob (see item 7)
35. Reset knob for counter
36. Paper feed knob
37. Typewheel unit, in one piece with the knob (12)
38. Transfer gearwheel (for operation of the index (14)
39. Index gearwheel (inside the typewheel lid (17)
40. Ink rolls
41-46. Keywheel units with pin disks (23-28)
47. Bar drum
48. Bar lugs
49. Locking hole for lever handle (31).

The lever (30) is shown with the handle in operating position.

Picture No. 4 shows the machine from below, with the bottom cover (6) removed:

51. Paper roll
52. Paper tape
53. Tape tension regulator
54. Tape transfer slot.

D. Instructions for Setting and for Operation.

In order to make correspondence between two or several machines possible, it is necessary to have all variable organs arranged identically, to use identical starting positions of the keywheels and to have the same relative position between the primary and secondary type wheels. These settings are of two kinds: the inner settings, which can be made only with the inner cover (32) opened, and which cannot be identified when this cover is closed, and the outer settings which can be effected by the operator even if the cover is locked.

1. Inner Settings.

These comprise the grouping of the slide bars used and the arrangement of the lugs on these bars, the order in which the keywheel units are placed in the machine and the arrangement of the pins in the pin disks, all in accordance with agreement between the correspondents.

a) The different kinds of slide bars are numbered and can be identified by these numbers. Normally, once a certain setup of bars has been chosen, this is not changed for a certain interval. To put the lugs in position, the tool (10) is used as a pair of tweezers. The right hand drum disk carries the numbers 1 to 32 for each bar, and the numbers 1 to 6 on the locking bar in front of the drum indicate the six positions in which the lugs can be placed on each bar. With these two sets of numbers, the arrangement of the lugs can be defined.

b) The keywheels carry for identification a number, both on the pin disk and on the journal plate, giving the number of the divisions. This permits the placing of the key wheels in the machines according to agreement and facilitates the identification of the pin disks. The keywheel units are liberated when the shaft (29) which locks them into their places and also carries the typewheel unit, is withdrawn towards the right.

On the right hand side of the pin disks reference numbers for the pins are engraved, for instance on the disk "47" (with 47 pins) the numbers from 01 to 47. To arrange the pins according to agreement, the disk is removed from its unit and placed in the tool provided for this purpose, first with the side carrying the reference numbers downwards and then all the pins which protrude on the upper side are pushed down as far as they go, one after another, with the aid of the lever. Then the disk is reversed so that the numbers become visible, and those pins which are to become inactive are pushed downwards with the lever as far as they go. The disks are then put back into their units and the complete keywheels are put into the machine in the desired sequence.

Note: When putting the keywheels back into the machine, be careful to place the individual disks in a position where the feeler arm presses against an active pin, otherwise it will be difficult to get the keywheel properly into place.

2. Outer Settings.

These comprise the arrangement of the alphabets on the indicating disk and the typewheels, the relative position between the two typewheels and the starting position for the keywheels.

a) Alphabets:

To arrange them according to agreement, the lid (17) has to be opened. To do this, press the button "0" (18) and turn the knob (12) counterclockwise until stopped by a catch, then the button (18) can be released and the lid (17) is unlocked. After opening the lid, first press on the pin immediately to the right of the gearwheel (39) which releases the alphabet ring (13) on top of the lid (17). Then remove the typewheel unit (37) after having withdrawn the carrying shaft (29). The letter disks on the alphabet ring (13) can now be rearranged and also the types on the typewheels (37). To rearrange the letter disks

a suitable tool can be provided, and for the types the plastic tip of the tool (10) is used. First move all the types into the slots of the retaining ring and then - by turning this ring the proper distances - move the types back, one after another, into the prescribed places. In order to facilitate the positioning of the types, a reference alphabet is engraved over the main type-slots.

Note: The letter which has been chosen to denote space between words, must always be placed under the reference letter A. After having put the typewheel unit back into the machine, push the carrying shaft (29) back as far in as it will go. Before closing the lid (17) first push the button "0" (18) and turn the knob (12) until stopped. Then having placed the alphabet disk back into the lid correctly where it registers with a positioning pin, be careful - before closing the lid - to put the index in the position where the point (15) registers with the positioning point (16): only in this position the index will be correctly placed in relation to the type wheel unit. To be sure, check this by pressing the button "0" (18), when the lid (17) is closed, and turn the button (12) counterclockwise until stopped: the index (15) must then point against the positioning point (16) and the index (14) point against the letter chosen to represent space.

b) The Relative Position between the primary and secondary alphabet: Press the button "R" (19) and turn the knob (12) counterclockwise until stopped. Then pull out the knob (12) towards the left and turn it, in its pulled out position, until the index (14) points against the letter which has been agreed on to define the relation between the primary and secondary alphabet for the message in question, then let the knob go back to its original position and release the knob.

Note: The knob "F-V" (34) on the left hand side of the machine allows two modes of operation: with the knob set in position "F", the relative position once established between the type wheels

remains the same until changed again in the way just described. With the knob in position "V", the primary and secondary alphabets will be disengaged immediately after each primary letter has been printed, then the primary alphabet will be locked and remain stationary during the rest of the operating cycle: thus with the knob in position "V", the relative position will change for every operation, and care must be taken when a message is to be checked that the initial relative position is re-established before starting to decipher the message.

c) Starting Position for the keywheels.

The pin disks are marked on their crowns with reference letters or numbers, one for each position. The disks can be moved by hand, in either direction, and are turned into those positions where the letters or numbers agreed on register with the index line across the six slots, through which the pin disk crowns protrude.

E. Operation.

Provided the inner settings have previously been arranged according to agreement (the inner settings are changed only at certain intervals which can be of different duration, depending on the amount and nature of the correspondence), the outer settings have to be set before starting the ciphering or deciphering of a message. Of these the arrangement of the alphabets can be considered to be the same class as the inner settings and need only be changed at certain intervals. The relative positions between primary and secondary alphabets and the starting positions of the key wheels must however be different for every single message of normal length, otherwise the security of the correspondence will be jeopardized.

When the relative position for the typewheel unit and the starting positions of the pin wheels have been set, put the counter in position "000" by using the reset knob (35).

If a message is to be ciphered, put the knob (33) in position "C" which causes the texts to be printed in groups of five letters each, with a space between the groups.

For deciphering, the knob (33) is put in position "D" which suppresses the printing of the letter representing space in the secondary, clear text, so that the resultant clear text will be printed with correct spaces between words.

The ciphering or deciphering of each single letter is effected in the following way:

First turn the knob (12) until the index (14) points towards the letter on the alphabet ring (13) which is to be ciphered, and then pull the lever (30) with the handle (31) forwards-downwards as far as it will go, after which the lever is allowed to return to its vertical position. The primary letter will be printed at the beginning of the movement and the secondary letter will be printed towards the end, when the paper will be advanced. Repeat the above for all the letters in the text.

Note: If, as a result of a foregoing operation the index (14) points against a letter which is to be ciphered or deciphered next, be sure to move the index slightly from this position and back again, before operating the lever (30), as otherwise the movement will be blocked. To use force under such circumstances might damage the mechanism. While the machine will stand a very fast and hard operation of the lever (30), the best results - and the least tiring for the operator - will be obtained if the lever is operated with a uniform and moderate movement.

Ciphering of Numbers.

In such texts where numbers are not written out in full with letters, they can be ciphered in the following manner. A letter with low frequency is agreed on to indicate that numbers follow in the text. After having ciphered this letter, use the index (15) and point this against the numbers, one after another, which are

engraved in the lid (17) inside the alphabet ring (13) and then operate the machine as per above. When the numbers have been ciphered, cipher again the letter which indicates "numbers". When deciphering, the text will of course contain only letters. Those letters, which will be found between two "number"-letters correspond to the ciphered numbers and their values will be found as follows: Put the index (14) against these letters on the ring (13) and for each position read off the corresponding number against the index (15). Or make out a table for the correspondences for the numbers 1 to 0.

F. Remarks.

When the machine is not used or when it is to be transported from one place to another, be sure to keep the cover (2) locked. For use in the field it is recommended to use a carrying case for same.

When using the machine, keep the cover (2) locked in its open position with the help of a stay, which is found on the left hand side of the machine.

To renew the paper roll, pull the release latch (22) and remove the bottom cover (6). Turn the paper feed knob (36) until the remains of the tape are removed. Place the new roll in its place. Draw the free end of the tape around the guard holder and the tension regulator (53), and feed it into the transfer slot (54), until it becomes visible between the typewheel and the printing hammers. Insert end of tape between feed rollers and advance tape by knob. Be careful to place the tape exactly as shown on the picture No. 4.

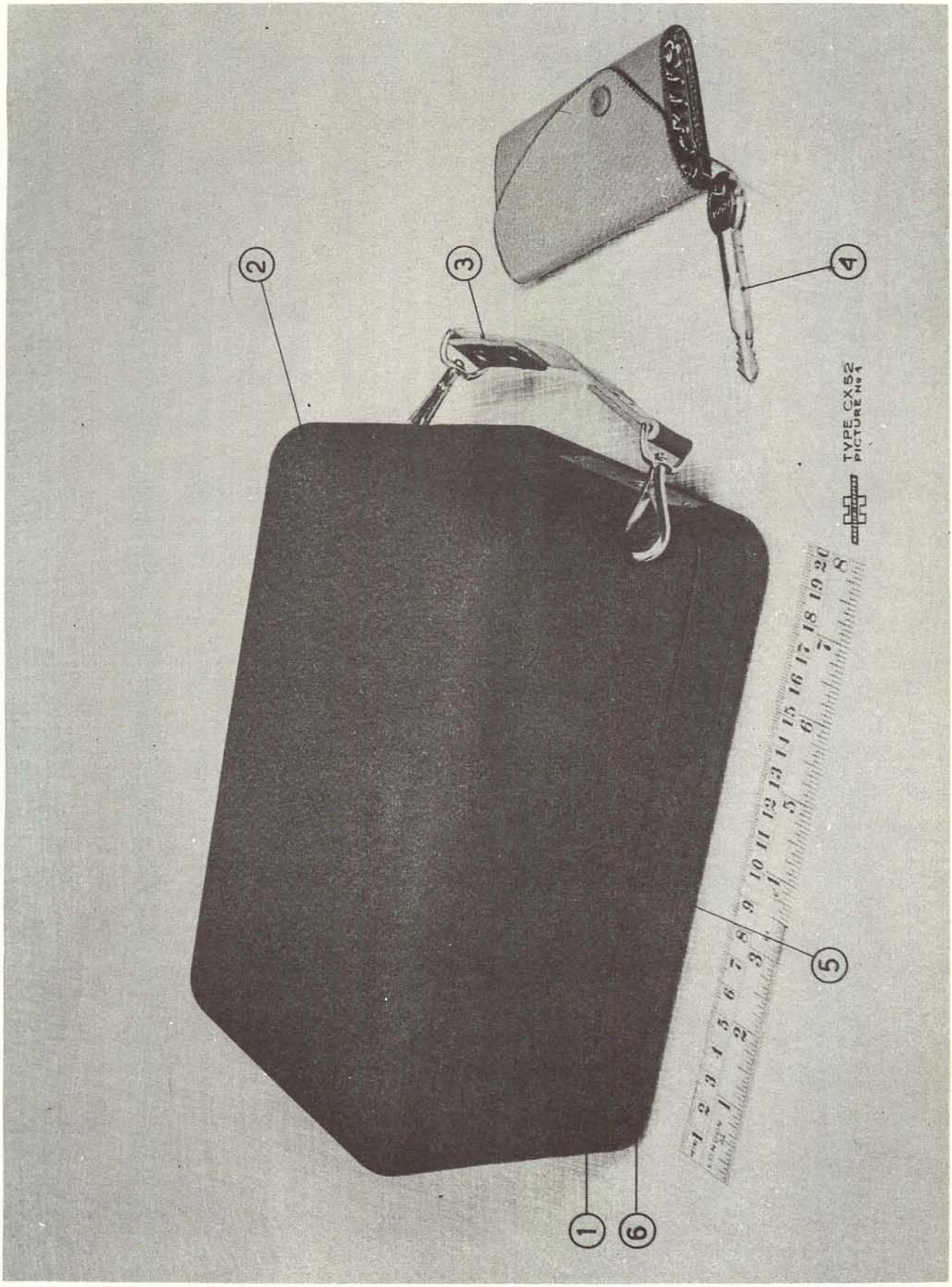
The reason for the two different keys (4) for each machine is the following: In certain cases the inner settings of the machines are arranged by special personnel and it is then not desired that the operator has access to these settings. In such

cases the persons in charge of the inner settings keep the keys with two notches, which open both the main cover (2) and the lid (32) of the machine, while the operator is given the key with one notch which opens only the main cover (2).

The machine is normally delivered with one indicating disk, alphabet wheel unit, six keywheel units, 50 lugs for the bars, oil can, screw-driver, tools for the rearrangement of pins and lugs, receptacle with spare ink rolls, carrying strap and two sets of keys.

Attached:
4 pictures No. 035/1-4.

BH/BE
November 1957.



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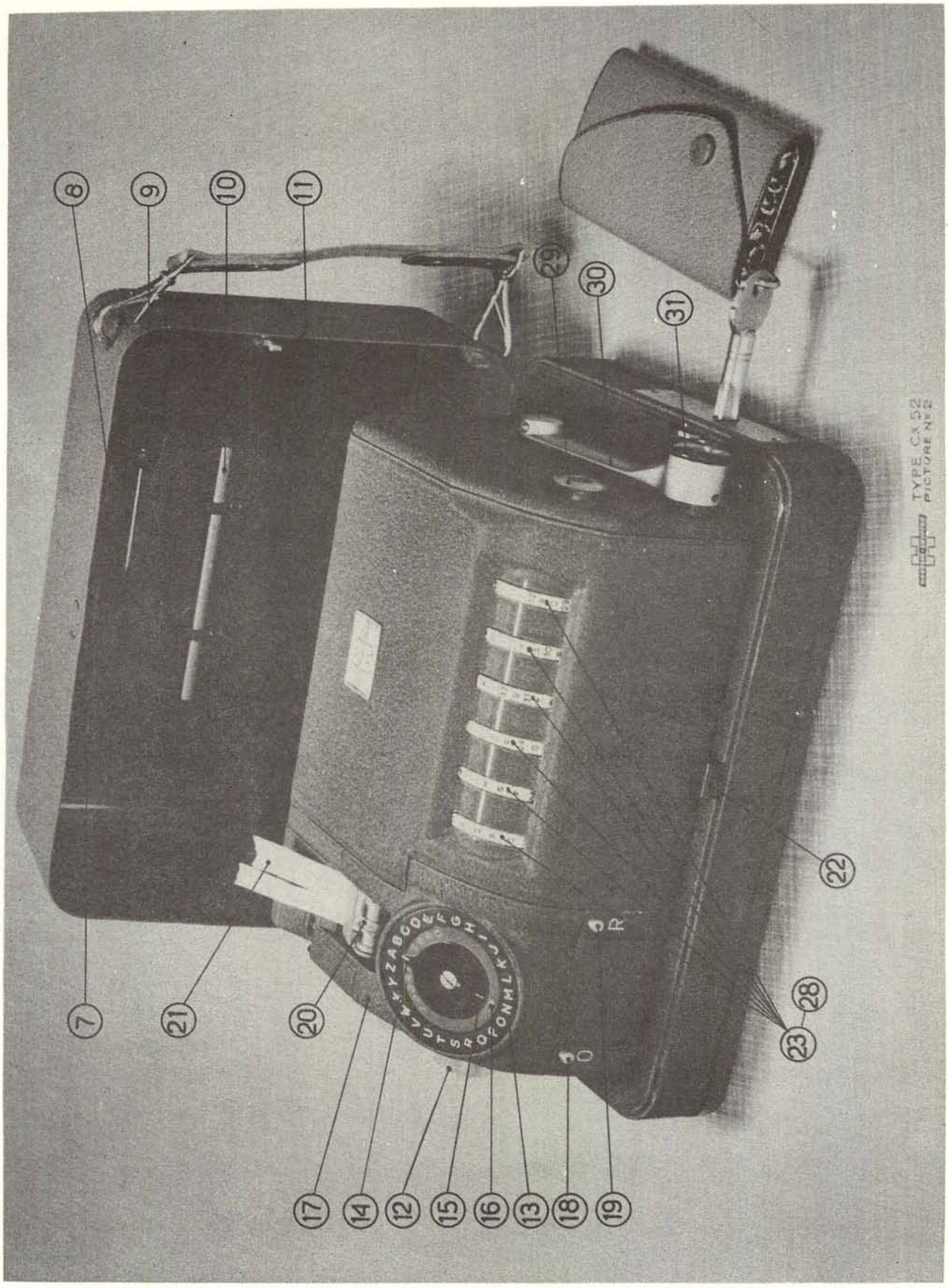

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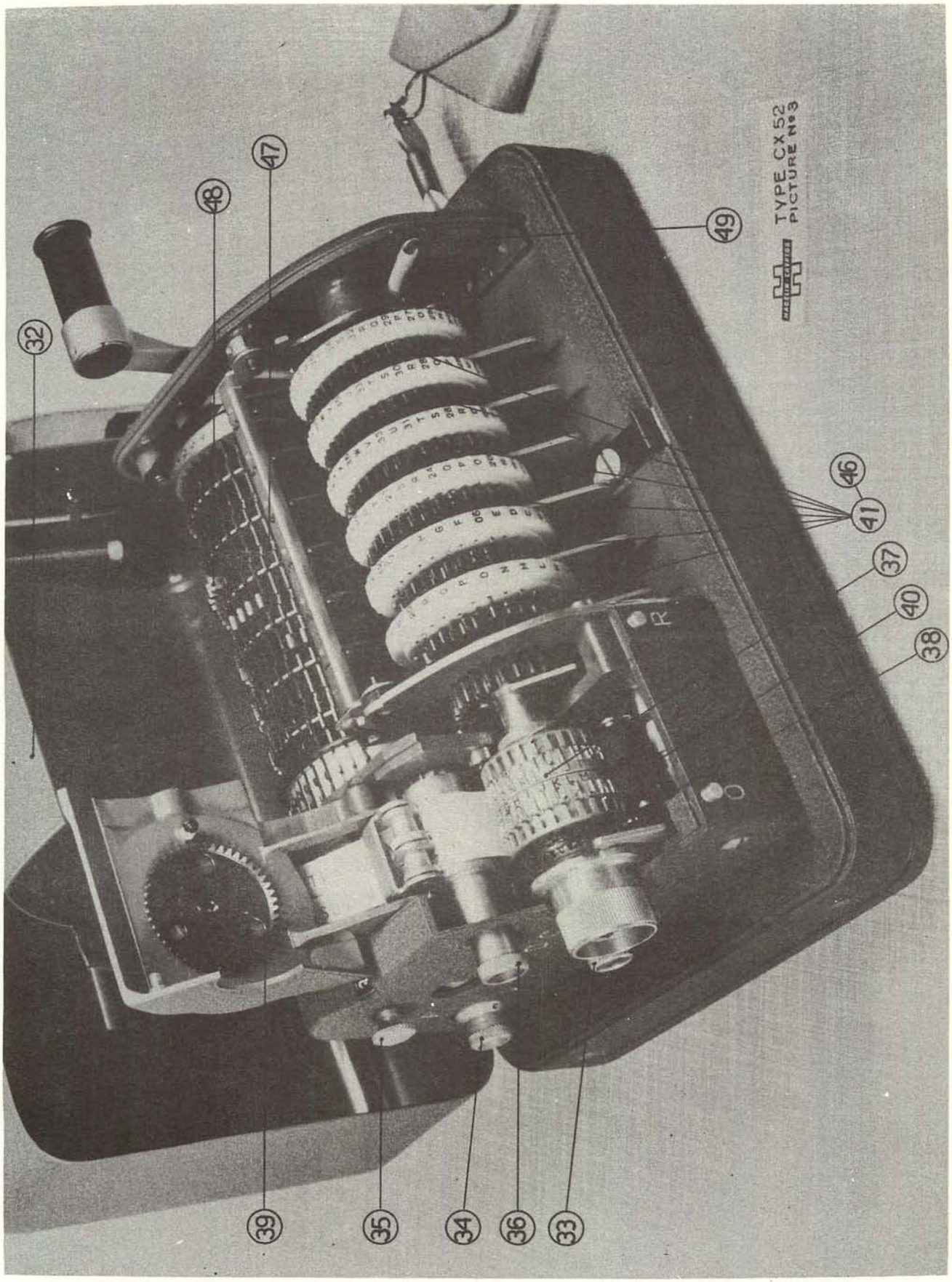
CRYPTO AG. ZUG (Schweiz)		May 1956



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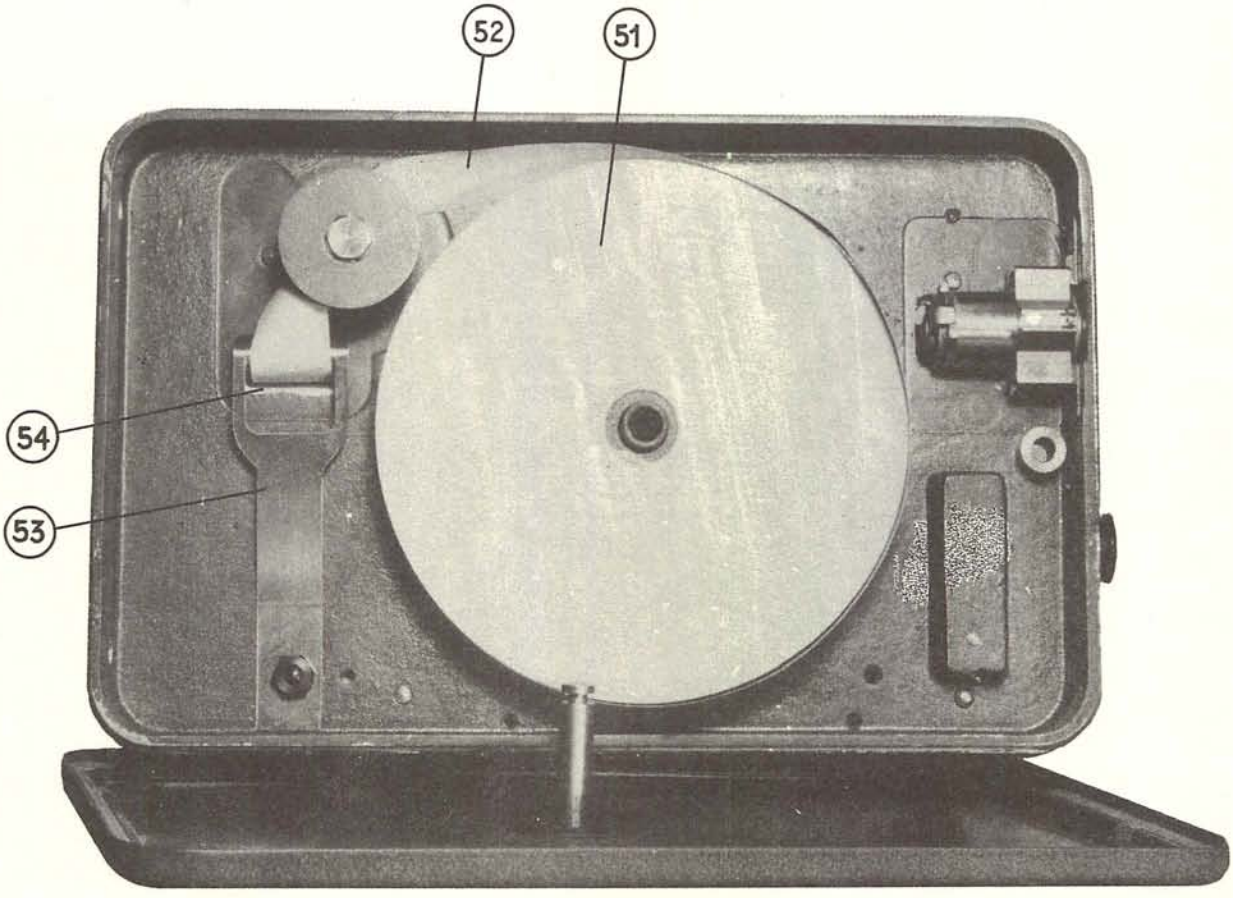

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