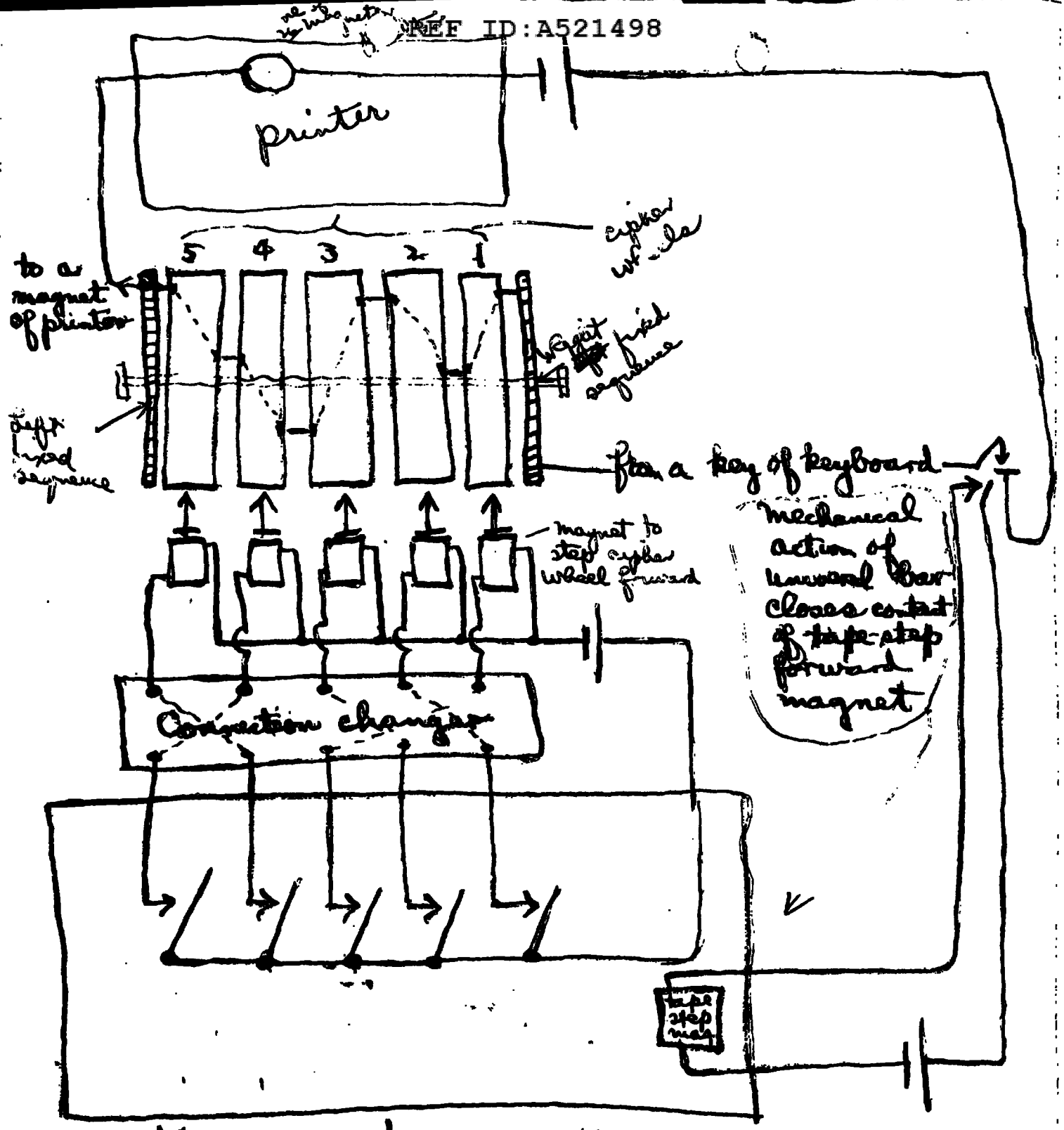

Key tape transmitter.

Disclosed to us on April 23, 1932 at Washington, D.C.

Solomon Kullback
Frank Rowlett
Abraham Sinkov

Inventor:
William F. Friedman
Office of the Signal Corps, Washington, D.C.

This is to make a record of the date of conception of the following modification in the Navy Cipher Machine being studied in this office at the present time:

1. Let there be added a Baudot tape transmitter employing the usual type of perforated tape. Let this tape be used for a running key, except that only the following six permutations are employed on it: - - - - -, + - - - -, - + - - -, - - + - -, - - - + -, and - - - - +. The tape may be of a finite or infinite length.

2. Let the key-tape transmitter be used to control the action of five magnets each of which in turn controls the movement of one of the five cipher wheels. Thus, by use of the key tape, an absolutely irregular series of displacements of the set of cipher wheels would be brought into play, instead of a limited number of displacements, regular in character, as is the case in the present machine.

3. Assume the five cipher wheels to be in a given initial position. Let the arrangements be such that with each depression of a key of the keyboard the tape step-forward magnet of the key-tape transmitter is actuated to move the key tape forward one step. Suppose this next setting of the tape brings up a perforation in position number 2; this would cause cipher wheel number 2 to step forward one place. Thus, perforations 1, 2, 3, 4, 5 control, respectively, the displacements of cipher wheels 1, 2, 3, 4, 5. No perforation (blank) in the tape (permutation - - - - -) causes no wheel to be displaced. But this respective relationship is not essential; for by interposing a switchboard of the type covered in my U.S. patent number 1,522,775 of January 13, 1925, the transmitter pins could control the cipher-wheel magnets in any relationship arbitrarily set up upon the switchboard.

4. With a movement of the sort indicated in paragraph 3, the maximum length of the enciphering cycle for <u>each</u> possible initial setting of the five cipher wheels can, by proper selection of tape characters, be made equal to 26 times the length of the key tape. If the tape is finite in length and consists of 1,000 characters, the cycle would then be 26,000 letters. Since there are 26^5

possible initial settings of each of the five cipher wheels, the machine thus would afford 26^5 enciphering cycles each 26,000 characters in length.

5. There is nothing in the foregoing which prevents the use of any of the variable factors now available, such as interchange of cipher wheels, wiring of the latter, wiring of left and right fixed sequencies, etc.

6. There is no reason why the action of the tape should be limited to displacements of a single wheel at a time; it is perfectly possible that one, two, three, or even all five wheels should be simultaneously displaced, depending upon the permutation of perforations on the tape presenting itself at a given moment. Whether such a system of multiple displacements would have any advantages over that of single displacements is not apparent at this time. The possibility is merely mentioned for the sake of completeness of description.

7. It is also possible that two key tapes of different length be used simultaneously, in two transmitters, interacting to produce a latent resultant running key, as in the original A.T. & T. system. The disadvantages from a cryptographic point of view in this case are either entirely absent or, at most, are not nearly so serious in consequence as was the case in the original A.T. & T. system.

8. Attached is a rough sketch to cover the simple use of one key-tape transmitter as discussed above, paragraphs 1 to 6 inclusive.

Attached:
Rough sketch.

William F. Friedman,
Cryptanalyst,
Office of the Chief Signal Officer.

Witnesses:
Disclosed to us on April 23, 1932,
at Washington, D. C.:

Solomon Kullback 1900 F Street, N. W., Washington, D. C.

Frank B. Rowlett 2121 New York Avenue, N. W., Washington, D. C.

Abraham Sinkov 1412 Chapin Street, N. W., Washington, D. C.