

November 7, 1935.

Preliminary Proposals for Converter Type [A-161.]

1. The basic cryptographic principle of the machine. - a. Use rotatable commutators (cipher wheels) arranged according to scheme outlined in Figures 1 and 2 of accompanying draft specifications (Enclosure 1) covering joint invention of Frank B. Rowlett, and the undersigned. Have five interchangeable commutators, three of which serve as substitution commutators, two as control commutators.

b. The two control commutators acting upon the three substitution commutators will yield an enciphering key of considerable length, varying between a lower limit of 17,576 and an upper limit of almost 12,000,000 characters. (The exact length is a function of a number of variable factors.) For each different arrangement of commutators upon the shaft there will be a different key of length indicated above.

c. The speed, accuracy and cryptographic security of such a device will certainly be far greater than that of the present Division Field Code, thus meeting the requirements of Paragraph 1 of "Military Characteristics" set up for this device. (Encl. 2 was MC's)

2. The keyboard. - 1 typewriter keyboard controlling a bank of 26 single-pole, double-throw switches controls the machine. The keyboard is manually operated in the usual manner. The arrangement of the keys corresponds to that of the standard keyboard but the keys may be smaller, closer together, and operate directly downward on the contact levers, as in the Enigma cryptographic device recently forwarded to the Signal Corps Laboratories at Fort Monmouth.

3. The recording mechanism. - a. The most important requirements in this connection are that the recording mechanism be small, rugged in construction, and operate on very little power. There is nothing on the market or in course of development which now meets these requirements and such a mechanism will have to be developed for the purpose.

b. It is recommended that commercial organizations skilled in the construction of typewriting, calculating, and adding machines be contacted in regard to this phase of the project.

c. A revolving type wheel seems to offer best possibilities. This would probably result in tape-recording rather than page-printing.

4. Other features. - a. The weight of entire machine ought not to exceed 15 pounds, including carrying case.

b. Power requirements. - For enciphering and deciphering circuits $4\frac{1}{2}$ volts (2A-9) will suffice. For controlling magnets or relays associated with the cipher-wheel displacement mechanism, a small amount of electric power will be required (about $4\frac{1}{2}$ volts). Power required for actually displacing the cipher-wheels and the control wheels, and for operating the recording mechanism can be supplied by a hand lever or by a clock-spring drive, or a

Encl 1 was space + drawings that labels were used in Pat App. on Sec. Area
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combination of both. It is recommended that an attempt be made to design the apparatus so as to make it possible to operate the entire mechanism by a combination of two or three dry cells (BA-9) and a hand or foot-operated lever.

William F. Friedman.

Office of the Chief Signal Officer,
Washington, D. C.

November 7, 1935.

Preliminary Proposals for Converter Type M-151.

1. The basic cryptographic principle of the machine. - a. Use rotatable commutators (cipher wheels) arranged according to scheme outlined in Figures 1 and 2 of accompanying draft specifications (Enclosure 1) covering joint invention of Frank B. Rowlett, and the undersigned. Have five interchangeable commutators, three of which serve as substitution commutators, two as control commutators.
- b. The two control commutators acting upon the three substitution commutators will yield an enciphering key of considerable length, varying between a lower limit of 17,576 and an upper limit of almost 12,000,000 characters. (The exact length is a function of a number of variable factors.) For each different arrangement of commutators upon the shaft there will be a different key of length indicated above.
- c. The speed, accuracy and cryptographic security of such a device will certainly be far greater than that of the present Division Field Code, thus meeting the requirements of Paragraph 1 of "Military Characteristics" set up for this device.
2. The keyboard. - A typewriter keyboard controlling a bank of 26 single-pole, double-throw switches controls the machine. The keyboard is manually operated in the usual manner. The arrangement of the keys corresponds to that of the standard keyboard but the keys may be smaller, closer together, and operate directly downward on the contact levers, as in the Enigma cryptographic device recently forwarded to the Signal Corps Laboratories at Fort Monmouth.
3. The recording mechanism. - a. The most important requirements in this connection are that the recording mechanism be small, rugged in construction, and operate on very little power. There is nothing on the market or in course of development which now meets these requirements and such a mechanism will have to be developed for the purpose.
- b. It is recommended that commercial organizations skilled in the construction of typewriting, calculating, and adding machines be contacted in regard to this phase of the project.
- c. A revolving type wheel seems to offer best possibilities. This would probably result in tape-recording rather than page-printing.
4. Other features. - a. The weight of entire machine ought not to exceed 15 pounds, including carrying case.
- b. Power requirements. - For enciphering and deciphering circuits 4½ volts (BA-9) will suffice. For controlling magnets or relays associated with the cipher-wheel displacement mechanism, a small amount of electric power will be required (about 4 volts). Power required for actually displacing the cipher-wheels and the control wheels, and for operating the recording mechanism can be supplied by a hand lever or by a clock-spring drive, or a

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combination of both. It is recommended that an attempt be made to design the apparatus so as to make it possible to operate the entire mechanism by a combination of two or three dry cells (RA-9) and a hand or foot-operated lever.

William F. Friedman.

Office of the Chief Signal Officer,
Washington, D. C.

Preliminary Proposals for Converter Type M-161

1. The basic cryptographic principle of the machine. - a. Use rotatable commutators (cipher wheels) arranged according to scheme outlined in Figs. 1 and 2 of accompanying draft specifications (Enclosure 1) covering joint invention of Frank B. Rowlett, and the undersigned. Have five interchangeable commutators, three of which serve as substitution commutators, two as control commutators.

b. The two control commutators acting upon the three substitution commutators will yield an enciphering key of considerable length, varying between a lower limit of 17,576 and an upper limit of almost 12,000,000 characters. (The exact length is a function of a number of variable factors.) For each different arrangement of commutators upon the shaft there will be a different key of length indicated above.

c. The speed, accuracy and cryptographic security of such a device will certainly be equal to that of the present Division Field Code, and probably be much better, thus meeting the requirements of Par. 1 of "Military Characteristics" set up for this device in memorandum of September 10, 1935. (Enclosure 2)

2. The keyboard. - A typewriter keyboard controlling a bank of 26 single-pole, double-throw switches controls the machine. The keyboard is manually operated in the usual manner. The arrangement of the keys corresponds to that of the standard keyboard but the keys may be smaller, closer to ether, and operate directly downward on the contact levers, as in the Enigma machine.

3. The recording mechanism. - a. The most important requirements in this connection are that the recording mechanism be small, rugged in construction, and operate on very little power. There is nothing on the market or in course of development which now meets these requirements and such a mechanism will have to be developed for the purpose. Several types are briefly outlined in the accompanying enclosure 3.

b. Which of the schemes shown in Enclosure 3 will be most practicable for development should be determined after conference with Signal Corps Laboratories or with personnel skilled in recording mechanisms.

4. Other features. - a. The weight of entire machine ought not to exceed 15 pounds, including carrying case.

b. Power requirements. - For enciphering and deciphering circuits 4½ volts (BA-9) will suffice. For controlling magnets associated with the cipher wheels and the mechanism, a small amount of electric power will be required (about 4½ volts) but most of power required for actually performing these functions can be supplied by a hand lever or by a clock-spring drive, or a combination of both. It will probably be possible to

operate the entire mechanism by a combination of two or three dry cells (BA-9) and a hand or foot operated lever, or it may be necessary to have a storage battery.

William F. Friedman.

Office of the Chief Signal Officer,
Washington, D. C.,
October 4, 1935.