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WAR DEPARTMENT  
OFFICE OF THE CHIEF SIGNAL OFFICER  
WASHINGTON

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March 24, 1936

MEMORANDUM FOR: Research & Development Division (THRU: W.P.& T. Div.)

1. Attached hereto is a proposed modification in Converter Type M-134-T1. Although all work on this model has been suspended, pending the development of T2, it is thought that the modification herewith proposed has sufficient merit to warrant consideration in connection with further cipher machine development, and for this reason the modification should be covered by patent to protect the government's interest.

2. At an early date I hope to draw up the specifications for patent application.

*William F. Friedman*  
William F. Friedman.

Attached:

1 Drawing,  
Description.

1st Memo Ind.

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OCSigO, War Plans & Training Division, March 24, 1936 - To: Research and Development Division.

Forwarded.

*W. S. Rumbough*  
W. S. Rumbough,  
Major, Signal Corps.

Attached:  
(no change)

March 12, 1936

## Modification in Converter Type M-134-T1

(U. S. Patent 2,028,772 of January 28, 1936)

1. In U. S. Patent 2,028,772 the ciphering commutator is started and stopped, as controlled by the opening and closing of the comparing circuit (composed of the set of ten contact levers and associated twenty contact points). Since the latter is controlled by the cipher-key tape, the action of the commutator is very irregular. Since the inertia of the commutator is considerable, it is difficult to speed up the operation of the system and still be able to stop the commutator rapidly and accurately in its displacements.

2. When the indicating devices are glow lamps it is of course essential either to stop the commutator long enough for the eye to perceive the character illuminated on the indicating bank or to provide a system of self-locking relays in series with each glow lamp so that if a glow lamp receives a momentary impulse through it, the self-locking relay acts to keep the lamp illuminated long enough to permit of noting the character illuminated. In either case this would complicate the mechanism.

3. I have conceived of a method of operation which not only overcomes the foregoing objections and disadvantages, but also simplifies the system considerably and at the same time simplifies automatic recording of the resultants.

4. The basic principle of the modification is as follows: Instead of employing the comparing circuit to control the starting and stopping of the commutator wheel, let the wheel be kept in constant, regular rotation, and let the comparing circuit merely determine when electric potential is applied at the keyboard. Thus, when a key of the keyboard is depressed no current reaches the indicating bank through the cipher commutator until the comparing circuit is completed. Since the latter event is controlled by the cipher-key transmitter, it is obvious that a result will be indicated on the indicating bank once per revolution of the commutator, but the exact instant when it will be indicated is a function of the character on the cipher-key tape. If the time required for one complete revolution of the cipher commutator is regarded as being divided up into 26 equal intervals, the cipher-key tape merely determines at which of the 26 intervals the comparison circuit will be completed and therefore which of the 26 possible equivalents will be

indicated for the key being depressed during that revolution of the commutator. Since this action can take place instantaneously, the commutator can be rotated quite rapidly, and though the ciphering action is irregular in that successive encipherments take place at irregular instants of the cycle of rotation within successive revolutions of the commutator, the action is so rapidly performed that the operator does not notice the irregularity, and a cadence in keyboard operation is perfectly possible.

5. The modified circuit arrangements are shown in accompanying Fig. 1.

6. Obviously, for this type of control, glow lamp indications are not suitable because the action is too rapid; or if it is slowed down, one loses most of the advantages of this modification. The system is much more suited to automatic recording, by controlling the keyboard of an associated typewriter, or the printing action of a rotating type wheel.

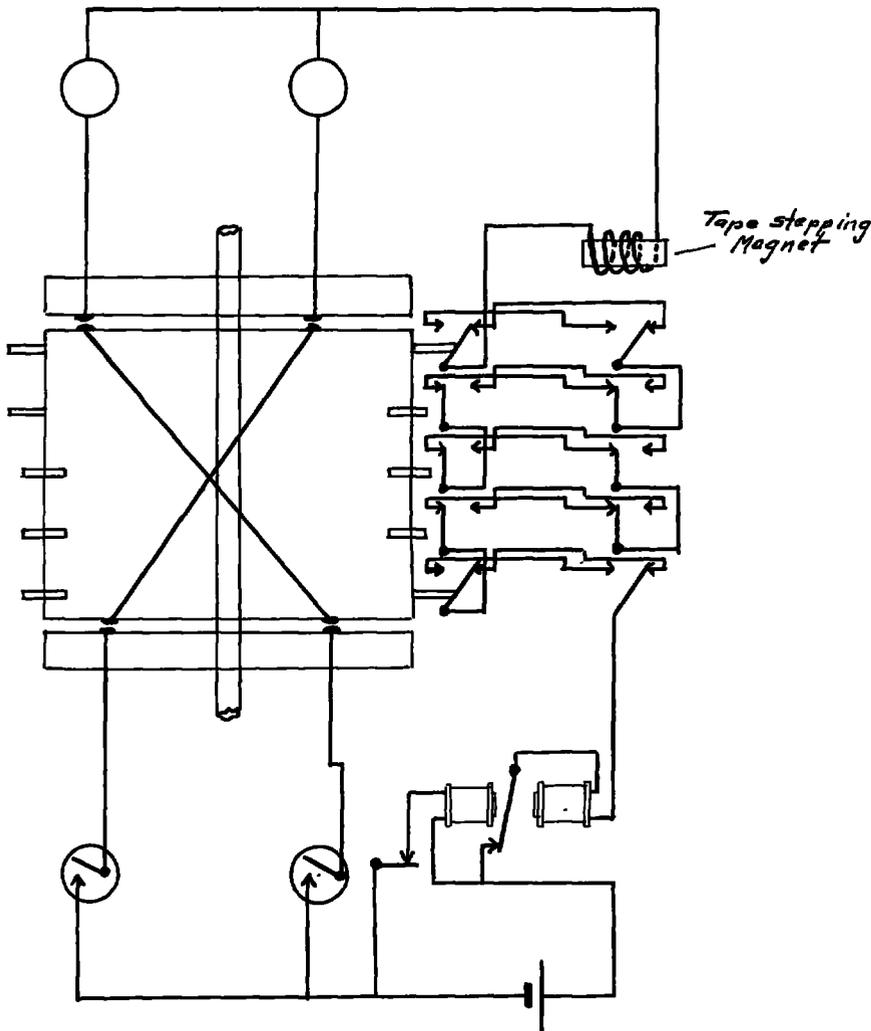
7. If a rotating type wheel is used, the comparison circuit, in addition to including in series with it the tape-stepping magnet, would also include the relay controlling the time of delivery of the printing impulse. The type wheel would have to be rotated synchronously with the cipher wheel.

*William F. Friedman*  
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Witnessed Mar 16, 1936  
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