Dec. 10, 1946. J. A. SPENCER 2,412,301

RANDOM CODE TAPE PERFORATOR

Filed July 23, 1942

Fig. 1.

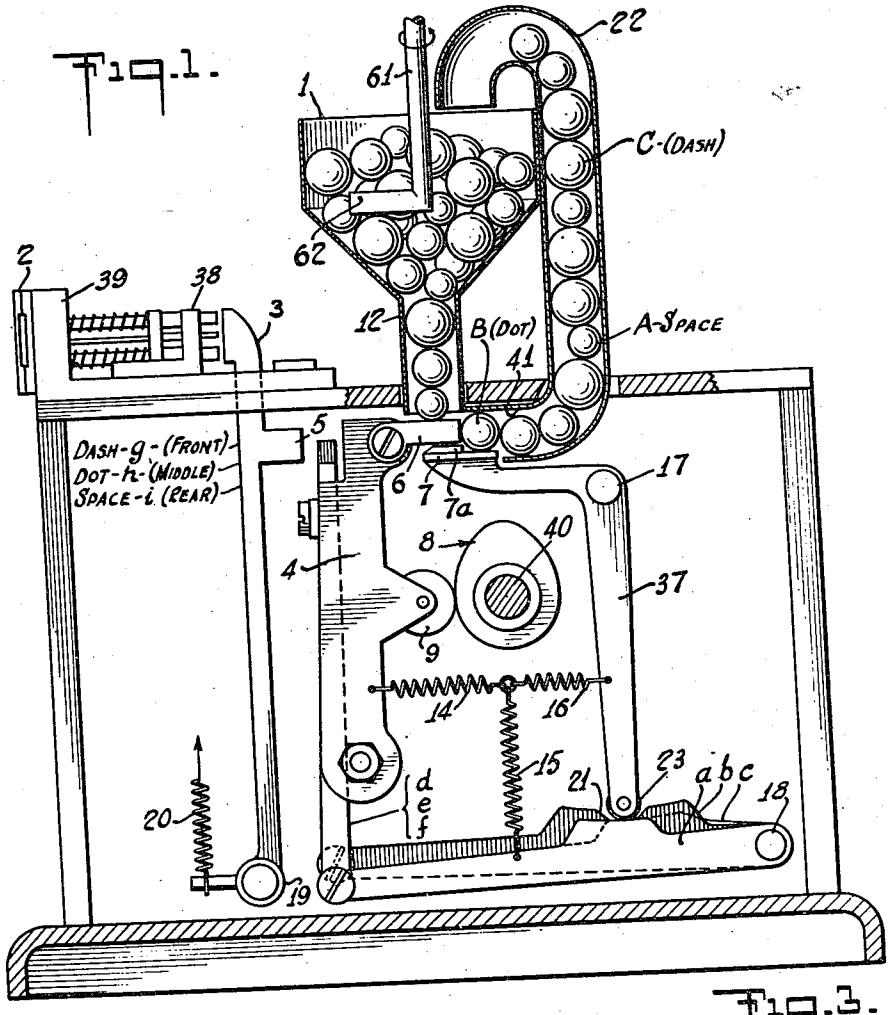


Fig. 2.

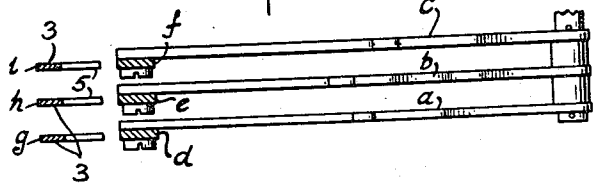
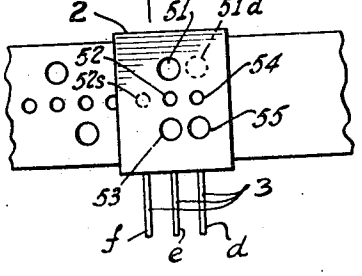


Fig. 3.



INVENTOR
JAMES A. SPENCER.
BY H. S. Brown
ATTORNEY

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RANDOM CODE TAPE PERFORATOR

James A. Spencer, Teaneck, N. J., assignor to Radio Corporation of America, a corporation of Delaware

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10 Claims. (Cl. 164—114)

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This invention relates to telegraph tape perforators and has particularly to do with a device of this character which enables cryptographic tapes to be perforated with random trains of code signals.

In certain telegraphic secrecy devices, the marking and spacing elements of the code signals which are used for the transmission of intelligence are required to be transposed in a random manner so as to render the transmitted signals unintelligible when intercepted at an unauthorized receiving station. The signals can, however, be deciphered by retransposition at an authorized receiving station, use being made of a deciphering tape which is an exact replica of the enciphering tape used at the transmitting station.

A device for preparing duplicate tapes for use in cryptographic telegraphy is disclosed in my copending application Serial No. 451,878, filed July 22, 1942. In that application, however, the duplicate tapes are made in accordance with a previously prepared master tape.

It is sometimes desirable that duplicate tapes be prepared with a random arrangement of marking and spacing code signal perforations without resorting to the use of a master tape. It is a prime object of my invention, therefore, to provide suitable tape perforating apparatus whereby duplicate cryptographic tapes may be prepared with a random train of signals perforated therein.

It is another object of my invention to provide a device for conveniently and automatically perforating coding and decoding tapes in duplicate for subsequent use at two stations which are to send and receive messages by means of cryptographic telegraphy.

In carrying out my objects, I provide a device which is arranged to perforate a series of random dots, dashes, and spaces in accordance with a random feed of metal balls of three different diameters into a controlling position at the outlet of a hopper containing a plurality of such balls.

My invention will now be described in full detail, reference being made to the accompanying drawing, in which:

Fig. 1 shows schematically an elevation view of essential parts comprised in a tape perforator of the class indicated in the foregoing preamble, and

Figs. 2 and 3 show certain details of lever construction necessary to indicate the selective actuation of different punches in response to control by balls of different diameters.

A number of balls, preferably of steel, and of

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three different diameters are placed in a hopper 1 and fed through a tube 12 to a platform 7. This platform is mounted on one arm of a bell crank 37 which is fulcrumed at 17. The opposite arm of this bell crank is provided with a roller 23 which bears against the profiles 21 on each of three levers *a*, *b*, and *c*. These levers *a*, *b*, and *c* are fulcrumed at 18 and are urged to move upward by springs 15. Pivoted at the free ends of the levers *a*, *b*, and *c* are selector fingers *d*, *e*, and *f* which extend upwardly through channels existing in a punch hammer 4. Whenever the fingers *d*, *e*, and *f* are lifted by levers *a*, *b*, and *c* respectively, as permitted by the actuation of the bell crank 37, then the upper ends of said fingers are caused to confront certain projections 5 on a series of punch levers 3, which are individually labeled *g*, *h*, and *i*.

The punch levers 3 are suitably arranged for actuating code punches and feed hole punches which are held in place by punch blocks 38, 39 and cooperate with a die member 2. This die member has a gateway therethrough for feeding a plurality of tapes to be perforated.

The perforator is automatically driven by a motor (not shown) connected to a shaft 40 on which is mounted a cam 8. In cooperation with the cam is a follower roller 9 journaled in bearings on the hammer 4. Pivoted at the top end of the hammer 4 is a feed plunger 6 which extends beneath the tube 12. As the cam 8 rotates and drives the hammer 4 to the left against the tension of spring 14, the feed plunger 6 is withdrawn sufficiently to permit a single ball to drop on to the platform 7. This same movement thrusts the end of one of the levers *d*, *e*, or *f* against projection 5 on one of the levers 3 and this drives the selected punch pins through the tape or tapes inserted in the die member 2.

As the cam 8 continues to rotate, hammer 4 moves to the right under the influence of spring 14. The plunger 6 urges the ball to the right hand end of the platform 7, where it drops over a ledge 7*a*, the latter serving to prevent balls from rolling to the left under the weight of the vertical column of used balls in the return tube 22.

The platform 7 is urged upward by a spring 16, so that the diameter of the entrapped ball determines the angular position of roller 23. The depressions 21 existing on levers *a*, *b*, and *c* are so located that they coincide with the angular displacement of roller 23 in consequence of the passing of balls of different diameters over the platform 7. This part of the device constitutes

substantially a caliper for gaging the diameter of each ball. The diametric measurement is made accurate by virtue of the pressing of each ball between the platform 7 and the upper horizontal wall portion 41 of the return tube 22.

With each stroke of the hammer 4, a ball dropping out of the outlet tube 12 is driven into calipering position and this action results in driving the previously measured balls upwardly through the return tube 22 and through a goose neck at the top for returning the balls to the hopper 1.

The punch assembly consisting of punch blocks 38 and 39, die member 2, and associated punches is conventional and need only be described here with sufficient particularity to indicate that a dash signal may be punched in the tape when lever *d* is actuated; a dot signal may be punched when lever *e* is actuated; and a space signal is punched when lever *f* is actuated.

The levers *g*, *h*, and *i* (looking at them from the nearest to the furthest in Fig. 1) are arranged to cooperate with seven pistons as follows: The front lever *g* is actuated when its corresponding finger *d* is lifted and is engaged with projection 5 by a movement to the left of the hammer punch lever 4 under control of the cam 8 when rotating against the roller 9. Lever *g* is aligned with three pistons 51*d*, 54, and 55. Piston 51*d* is horizontally offset from the upper punch in position 51 and actuates the same as part of the dash signal. Piston 54 controls the punching of the two center holes at positions 52 and 54. Piston 55 is coaxial with its punch on the bottom row and completes the punching of the code signal for a dash. The dash signal is, therefore, formed by code perforations which are offset in the two vertical rows. Automatic mechanism is provided for feeding the tape two spaces.

In response to the lifting of the middle finger *e*, the code signal for a dot is punched by actuation of the punch lever *h*. The punches thus controlled are in a vertical column and include those coaxially disposed with respect to the pistons 51, 52, and 53. The dot signal occupies one space linearly of the tape; therefore, the tape is fed automatically by one space.

When the selector finger *f* is lifted and engaged with projection 5 on punch lever *i*, this lever coacts with a piston 52*s* and thereby operates a single center hole punch in position 52. The tape is thereafter fed one space.

For further details of the preferred construction which I have adopted, reference is made to a publication entitled, "Printing Telegraph Systems and Mechanisms" under the authorship of H. H. Harrison, a publication of Longmans, Green and Co. A tape perforator suitable for punching Morse code signals is illustrated in Fig. 161 on page 162 of that book.

The operation of my improved perforator may be best understood by considering the effects produced in measuring balls of different diameters as follows: Consider that one of the smallest balls A is on the platform 7, then roller 23 is moved furthest to the left and holds levers *a* and *b* depressed. Lever *c* rises under the influence of spring 15 and finger *f* is then moved upward so that its free end is opposed to the lug 5 on the rear punch lever *i*. This punch lever engages with piston 52*s* for actuating one of the small feed hole punches at position 52. The hammer 4 is driven to the left by the rotating cam 8 and delivers the punching stroke.

Consider now that the ball resting on the platform 7 is of medium size as shown at B. The roller 23 then holds down levers *a* and *c* so that only one of the fingers, namely, finger E has its upper end lifted to the lever of projection 5 on the middle punch lever *h*. This middle punch lever acts upon three pistons 51, 52, and 53 each of which is axially aligned with one of the punches for punching the dot signal in the tape.

The largest of the balls, such as ball C, when its diameter is calipered by positioning on the platform 7, causes the roller 23 to be moved furthest to the right. In this position levers *b* and *c* are held down while lever *a* lifts its finger *d* into cooperative relation with projection 5 on the front punch lever *g*. This punch lever acting upon pistons 51*d*, 54, and 55 causes two center holes and off-set upper and lower holes to be punched. The combination of punches so selected corresponds with a dash signal.

The tape feeding device which is required as a part of the complete structure is of conventional design and has not been here illustrated, since it forms no part of my invention. Furthermore, such a tape feeding device is also described in the aforementioned book by H. H. Harrison.

It will be understood that, as a simple mechanical modification of my invention, means may be provided for agitating or otherwise stirring the balls in the hopper 1. Such means may either be motor driven or manually actuated, and its utilization is entirely optional. For the sake of illustration an agitator is shown in Fig. 1 as comprising a rotatable spindle 61 centered coaxially with respect to the outlet tube 12 and having a dasher 62 projecting horizontally from the spindle. The use of an agitator may be found to introduce an additional factor of chance into the random selection of balls of different diameters to be successively dropped through the tube 12.

To those skilled in the art, it will be apparent that various modifications of my invention may be made without departing from the spirit thereof. The scope of the claims is not, therefore, limited to the precise details of construction herein shown and described.

I claim:

1. A cryptographic tape perforator comprising a punch-and-die assembly having code character punches and feed-hole punches, selective means for actuating said punches singly and in predetermined combinations, mechanism operable in continuous cycles for applying power to selected ones of said punches, and selective means cyclically operable for causing said punches to be selected in a random and unpredictable manner.

2. A perforator according to claim 1 and including punch striker members in said selective means, one of said members being arranged, when selected, to cause the sole operation of one of said feed hole punches.

3. A perforator according to claim 1 and including punch striker members in said selective means, one of said members being arranged, when selected, to cause the simultaneous operation of one of said feed-hole punches with two of said code character punches in transverse alignment therewith.

4. A perforator according to claim 1 and including punch striker members in said selective means, one of said members being arranged, when selected, to cause the simultaneous operation of two feed-hole punches and two code character punches, the latter being obliquely disposed with respect to the direction of tape feed through said perforator.

5. The method of preparing a plurality of iden-

tical cryptographic tapes for use in code signaling, where code perforations are to be punched in said tapes in a random train determined by a chance arrangement of balls of different diameters fed successively into a calipering position, said method comprising feeding said tapes simultaneously through a punching position, causing said balls as they reach said calipering position to be graded according to their diameters, causing a single perforation of "space" significance to be punched in each of said tapes in response to the calipering of a ball of one diameter, causing code perforations of "dot" significance together with one feed-hole to be punched in each of said tapes in response to the calipering of a ball of a second diameter, and causing code perforations of "dash" significance, together with two feed holes, to be punched in each of said tapes in response to the calipering of a ball of a third diameter.

6. The method of utilizing balls of different diameters to determine a random arrangement of code perforations which are required to be punched in an identical manner in two telegraph tapes, one for enciphering and the other for deciphering cryptographic messages, said method comprising ejecting said balls successively from a position of storage, calipering each of said balls successively, causing said tapes to be perforated with code perforations having dot and dash significance, also with feed holes having spacing significance, performing said perforating operations cyclically as each successive ball is calipered, and characterizing each perforating operation as a function of the ball diameter.

7. A system for punching two telegraph tapes in an identical manner and with code perforations having a random arrangement such that one tape is useful for enciphering and the other tape for deciphering cryptographic messages, said system comprising a hopper containing balls of three different diameters, an outlet tube connected to the bottom of said hopper, a calipering device, reciprocable means for causing the successive flow of balls from said outlet tube into a position where they are subjected to the operation of said calipering device, a code tape perforator having a punch-and-die assembly the punches of which are arranged to operate upon at least two juxtaposed tapes simultaneously, means for performing each perforating operation so that it has one of three characteristics, namely, to designate a dot, a dash, or a space, and a selective mechanism linking the operation of said calipering device to the operation of the last said means, whereby the sequence of dots, dashes, and spaces punched in the tapes conforms to the random order in which balls of different diameter are calipered.

8. A system according to claim 7 and including means for returning said balls to said hopper after they have been calipered.

9. A system according to claim 7 and including a constantly rotatable cam operating against a cam follower the bearings whereof are lever-supported, said cam and cam follower being comprised in means for actuating said reciprocable means.

10. A system according to claim 7 and including a constantly rotatable cam operating against a cam follower the bearings whereof are lever-supported, said cam and cam follower being comprised in means for actuating said code tape perforator.

JAMES A. SPENCER.