

May 10, 1938.

A. R. NOLL

2,116,733

CODING AND DECODING MACHINE

Filed Aug. 29, 1936

3 Sheets-Sheet 1

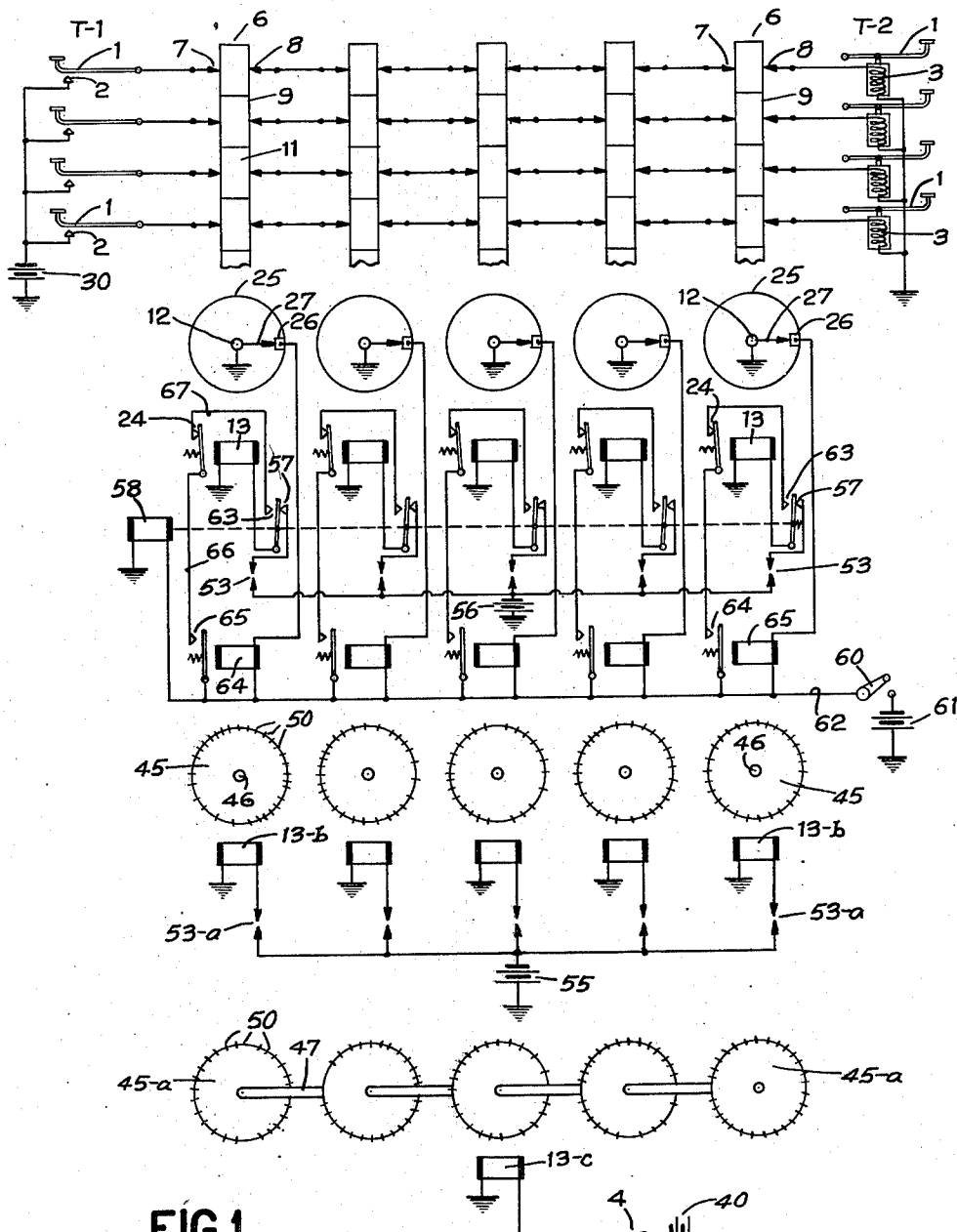


FIG. 1.

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FIG. 3.

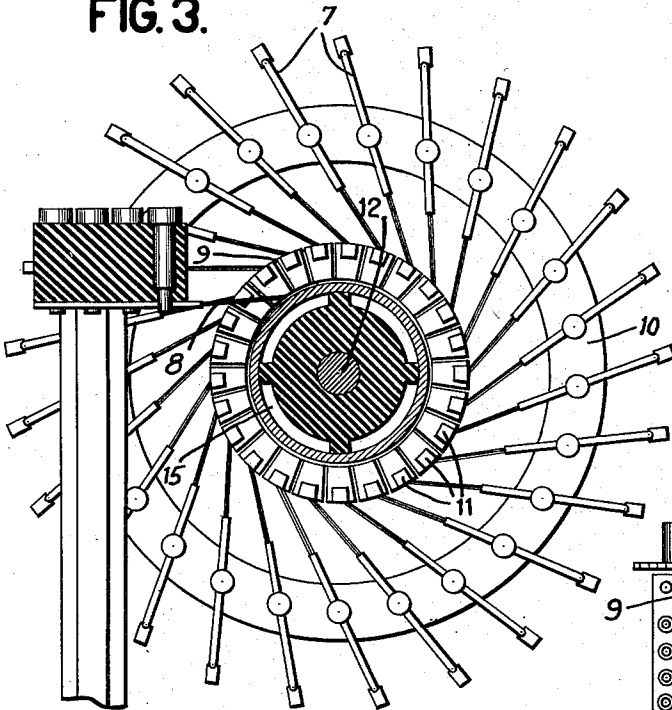


FIG. 2.

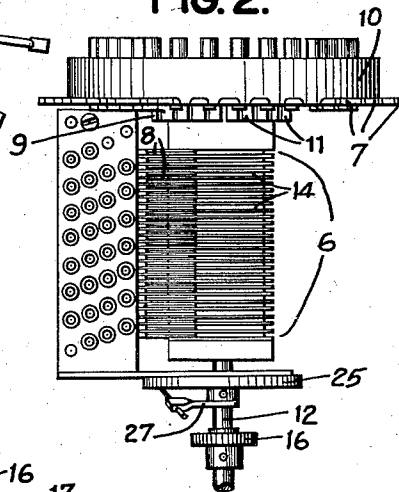
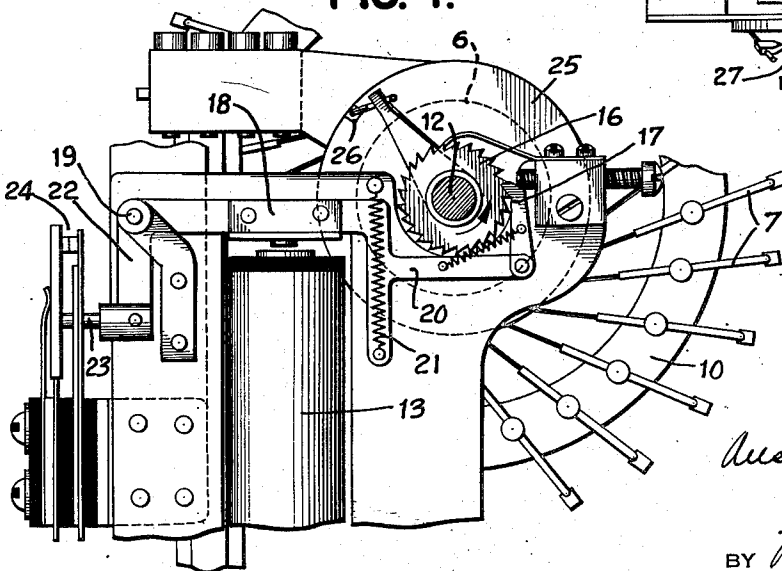


FIG. 4.



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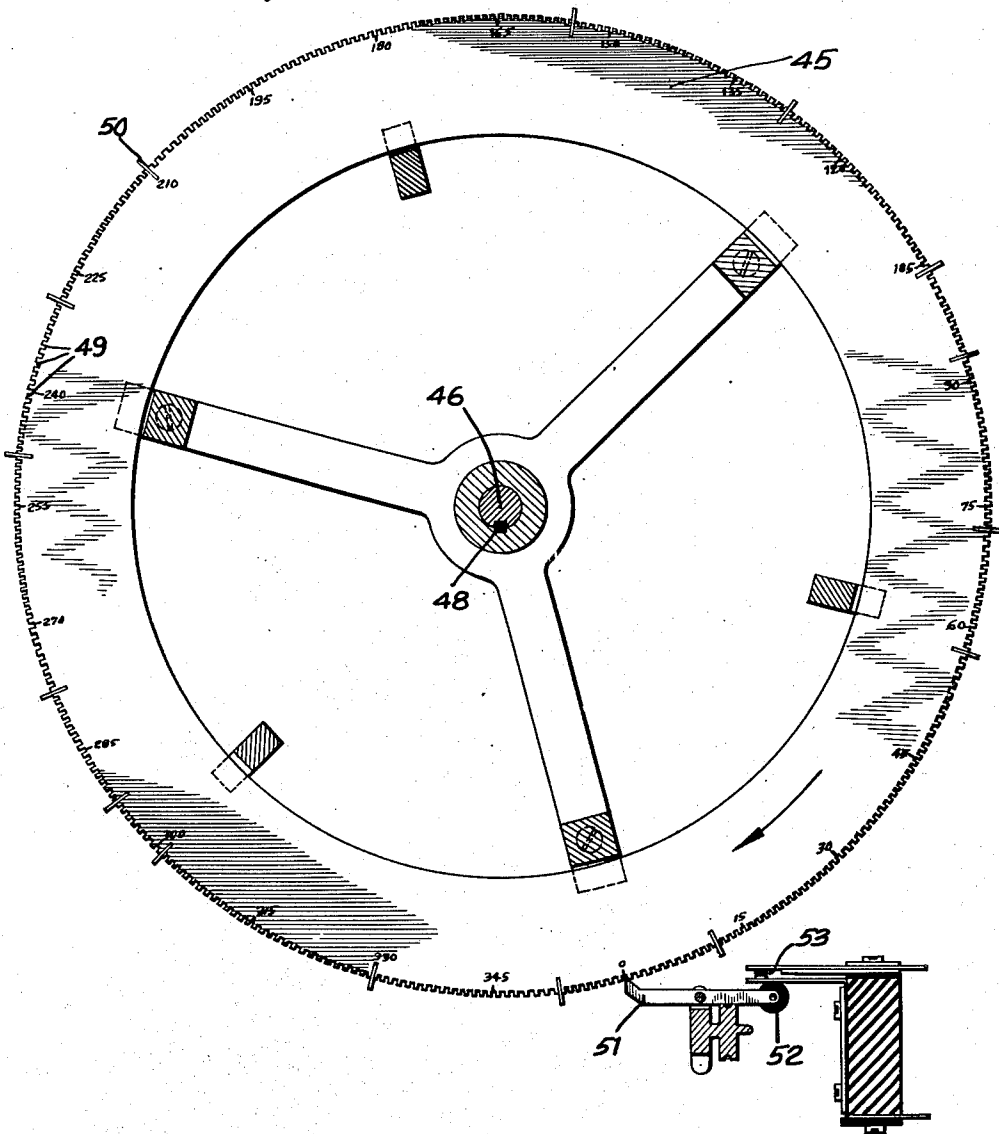
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FIG. 5.



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2,116,733

CODING AND DECODING MACHINE

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Application August 29, 1936, Serial No. 98,439

9 Claims. (Cl. 197-4)

This invention relates to the art of secret writing and more particularly to a new system for transforming language messages into decodable secret code.

An object of the present invention is to provide an improved system for more accurate coding and decoding of characters or signs used in various communications.

Another object of the invention is to prevent periodical recurrences by causing irregularities in the coding process by a new system so as to introduce a new order of complexity of code according to an arbitrary system.

A further object of the invention is to produce a resultant which is most complex but whereby the coding and decoding operations are simplified.

Still another object of the invention is to provide an apparatus which will automatically code a message as a result of the mere typing of the uncoded message, and which will automatically decode the message as a result of the mere typing of the coded message.

Still other objects and features of the present invention are to provide mechanical storing means whereby a perforated sheet used as a control means for positioning coding means jointly and permutatively may be simulated. This invention is an improvement of the copending application Serial No. 98,271, filed August 28, 1936, which discloses one form of coding system employing a perforated tape control to position the coding drums or commutators permutatively. It is the purpose of the present invention to provide a mechanical cam or code wheel system simulating the effects of the combinational code control sheet to control the associated circuits to position the coding means permutatively without introducing a periodic repetition of the pattern of the control circuits.

Various other objects and advantages of the invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and useful features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 shows diagrammatically the circuit connections embodying one form of the present invention.

Figs. 2, 3, and 4 show detailed views of the coding units and positioning means therefor.

Fig. 5 is a detailed view of one of the control disks and contacts operated thereby.

Referring now to Fig. 1, the primary and secondary machines are designated generally T-1 and T-2. For purposes of illustration the machines are shown to represent standard typewriting machines having the usual keyboards

comprising a plurality of key bars 1, of which only several have been shown. Associated with the key bars are individual contacts 2 for the purpose of transmitting a coding impulse through the associated circuits upon selection and depression of the associated key bar 1, thereby recording the selected character and transmitting the coding impulse. Associated with the key bars of the secondary machine are shown the solenoids 3 which upon energization are adapted to operate or depress the associated key bar to operate the associated type bar in the usual manner to record the corresponding character. Provision is made at one of the machines, let it be assumed to be the primary machine T-1, that each operation of any key bar operates a common set of contacts 4. The method of providing common operated contacts for a typewriter keyboard is well known and requires no detailed description. One method commonly used is to have a common bail or rod disposed beneath the key bars of the keyboard so that the depression of any one key bar depresses the common bail which in turn operates, in this example to close the associated contacts 4.

Interposed between the machines T-1 and T-2 is a plurality of coding units or circuit changing devices 6. These coding units are of the usual segmented commutator type which are well known in the art and need no detailed description. The arrangement which may be embodied in the present invention is shown in Patent No. 1,502,376, issued to Damm, July 22, 1924. Another arrangement of the coding units is shown in the Patent No. 1,510,441 issued to Hebern, September 30, 1924, which may be embodied in the present invention. Both types of coding units employ contacts or brushes 7 and 8 associated with a segmented section 9. Referring to Figs. 2, 3, and 4, a form of the coding units will be described briefly. A stationary insulating ring member 10 is provided to support a plurality of individual brushes 7 arranged to engage individual insulated conducting segments 11. The commutator section, comprising segments 11, is secured to shaft 12 and adapted to be rotated thereby upon operation of the motor magnet 13. The number of brushes and conducting segments provided is to correspond to the number of characters desired to be included in the alphabet. Individual slip rings 14 insulated from one another are provided to be engaged by associated brushes 8. The slip rings are connected separately to a corresponding segment 11 and are secured to shaft 12 so as to be rotated thereby. The connecting wires (not shown) may be disposed in the transverse channels 15. A ratchet 16 is secured to the shaft 12 and adapted to be stepped ahead by the pawl 17 upon operation of the motor magnet 13. It is obvious that upon energiza-

tion of the magnet the armature 18 is attracted and due to being pivoted at 19 the extension arm 20 of the armature is moved downwardly carrying with it the pivoted pawl 17. Upon deenergization of the magnet, the spring 21 restores the arm 20, armature 18 and pawl 17 to the normal position shown in the figure, thereby advancing ratchet 16 and shaft 12. It is also seen that upon energization of the magnet 13 and the attraction of the armature 18, the extension arm 22 is urged outwardly so that the attached pin rod 23 is adapted to open the normally closed contacts 24. Also secured to the shaft 12 is a rotary contact arm 27 associated with a commutator 25 having a single conducting segment 26, the purpose of which will be understood as the description progresses.

The coding units or drums 6 are arranged to be wired in a reciprocal arrangement, the general principle of which is to produce the result that when a given character is struck in coding a substitute character is produced on the secondary machine and that when the substitute character is struck in decoding the original character is produced upon the secondary machine. This arrangement makes it possible to spell words in cipher and by copying the cipher words to return them or translate them into their true meaning, and this method is well known in the art and therefore it is believed requires no further description. A detailed arrangement thereof is shown in Fig. 20 of the Hebern patent cited hereinabove.

Therefore, it is evident that upon depression of a selected character key bar 1, a circuit is completed as follows: from grounded battery 30 through the selected contact 2 and key bar 1, the associated circuits connected to brushes 7 and 8 of the coding units 6 to the associated grounded solenoid 3, energizing said solenoid to depress and operate the corresponding key bar of the secondary machine T-2 to record the substituted character.

In addition to energizing the solenoid and operating the key bar or translating instrumentality to record the substitute character upon depression of a key bar or operating instrumentality of the primary machine, it is remembered that the common contacts 4 associated therewith are also operated. Operation of contacts 4 causes battery 40 to energize motor magnet 13-c to position a series of control disks which are effective to control the positioning of associated coding units in certain selected combinations. The combinations effected may be in accordance with the Baudot combinational code system or any similar combination code system depending upon the number of control units and coding units employed in the system. It is obvious that the code may be expanded by increasing the number of control disks and associated coding units. The manner of controlling the coding units will now be described.

Referring now to Figs. 1 and 5, the control disks 45 are shown mounted on individual shafts 46 and secured thereto by a fixed key 48. The disks are notched as shown generally at 49, at equally spaced intervals about their entire circumference to receive pins or plugs 50 which are adapted, as the disk is advanced, to engage the pivoted arm 51 provided at one end thereof with a follower roller 52, depressing said arm and raising the roller to close the associated spring contacts 53. In Fig. 1, for simplicity, the contacts are generally shown as indicated. The control

motor magnets 13-b associated with each of the disks 45 are adapted to advance the shaft and disk upon operation thereof, and are similar to the motor magnets 13 described hereinbefore. Two sets of control disks are provided, the individual disks 45 mounted on individual shafts and adapted to be positioned individually to control the associated coding unit motor magnet 13. Disks 45-a which are similar to disks 45 but are mounted on a common shaft 47 which is advanced by motor magnet 13-c in a manner described hereinbefore. It was mentioned upon operation of a key bar 1 at the primary machine the common contacts 4 are operated, thereby operating the motor magnet 13-c associated with the control disks 45-a. The pins 50 are arranged in any order upon the disks to operate the associated contacts 53-a. In this manner the contacts 53-a are operated in certain combinations and due to the fact that five control disks are employed, the contacts may be operated similarly as if controlled by a tape perforated in accordance with the Baudot or similar code. Upon advancement of the disks 45-a certain contacts 53-a are closed to connect the grounded battery 55 to the individual motor magnets 13-b to advance the disks 45 individually and simultaneously in accordance with the associated contacts 53-a operated. The pins 50 are arranged at random on the disks 45 to operate the associated contacts 53 which upon closure connect grounded battery 56 through the normally closed contacts 57 of relay 58 to the motor magnets 13 associated with the coding units 6 to advance them, altering the circuit connections between the machines T-1 and T-2. Due to the described arrangement, the individual contacts 53 may be operated at a different time than the contacts 53-a and at different periodicities. Therefore, it is evident that since the disks 45-a are all advanced in common and the pin arrangements on the individual disks are varied to advance the disks 45 individually and jointly which also have a varied pin arrangement on the disks, that the contacts 53 controlling the coding units 6 are operated permutatively and jointly and in such a manner that the combinations formed by the contacts 53 are not repeated periodically upon each revolution of the disks 45 and 45a.

It was mentioned hereinbefore that the coding units 6 are arranged to be wired in a reciprocal arrangement so that when the substitute character recorded on the secondary machine during coding is selected on the primary machine during decoding and the original character is produced upon the secondary machine. However, before the decoding operation, the coding units and control disks must be returned or positioned to the normal starting or home position occupied at the beginning of the coding operation. To effect this operation, the switch 60 is operated to connect grounded battery 61 to the common conductor 62 thus energizing the relay 58 causing the associated contacts 57 to be opened and contacts 63 to be closed. In this manner, grounded battery 56 is removed from the circuits leading to the motor magnets 13 thereby preventing faulty operation of the magnets during the positioning of the control disks to home position. It was described hereinbefore that the rotary contact arms 27 were secured to the individual coding drum shafts 12 and that a single conducting segment 26 is disposed on a commutator 25 representing the home or starting position. When

the coding units occupy the home position the grounded contact arm 27 engages the segment 26 to complete a circuit through the associated relay 64 to grounded battery 61, thereby energizing the said relay opening the associated contacts as shown in the figure, disconnecting the said battery from conductor 66. However, whenever the coding units occupy any position other than the home position, the associated relay 64 is deenergized permitting battery 61 to be impressed upon the conductor 66, normally closed contacts 24 associated with the motor magnet 13, conductor 67, contacts 63 now closed to motor magnet 13, energizing the said magnet and opening the contacts 24 to deenergize it thereby advancing the associated coding unit and rotary arm 27 step by step until the home position is reached when relay 64 is operated to disconnect the battery from the said conductor 66. The control disks 45 may be provided with a commutator and associated contact arm similar to the ones designated 25 and 27 to automatically advance the disks to the normal home position. The control circuits associated with the motor magnets 13—b are exactly as shown and just described in connection with the coding units. Similarly, the disks 45—a may be returned to the normal home position just as described. In order to simplify the disclosure these circuits have not been duplicated since the description and application thereof in connection with the coding units equally applies to the control disks. When all the control units are in home position, switch 60 is opened and the system is then in condition for further coding or decoding operations.

It has been shown from the description just set forth that mechanical control means such as the control disks are provided in such an arrangement as to control the positioning of the coding units jointly and permutatively, that is, in various combinational groups, and that the combinations formed simulate the combinational code perforations of a control sheet so that periodic recurrences of the combinations are avoided. Wherever set forth in the claims, the term "mechanical control means" is meant to refer to the control disks or similar means, differentiating from perforated tape control means and the contacts associated therewith in that respect.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, a plurality of coding means comprising movable circuit changing devices interposed between and interconnecting the machines, and mechanical control means to control the positioning of the coding units jointly and permutatively.

2. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, a plurality of mechanical control means, a plurality of switching devices controlled by the said control

means, and means whereby the said control means operate the said switching devices permutatively to control the permutative positioning of said coding means.

3. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, a group of individual control disks and associated controlled switching devices, individual positioning means for said control disks to advance the disks thereby controlling the associated switching devices, a second group of individual control disks and associated controlled switching devices, and common positioning means for said second group of control disks to control the associated switching devices, said switching devices associated with the said groups of control disks arranged to control the positioning of the control means at irregular intervals.

4. In a coding and decoding machine, a primary machine comprising operable instrumentalities, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, and mechanical control means controlled permutatively independently of the selected instrumentalities to control the permutative positioning of the coding means.

5. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, mechanical control means and associated switching devices operated thereby, and means to advance the mechanical control means to operate the said switching devices in different combinational code groups upon each advancement of the said control means to control the permutative positioning of the coding means.

6. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, a plurality of movable coding units interposed between and interconnecting the coding units, a plurality of control elements to control the positioning of said coding units, one control element for each coding unit, and means to advance the said control elements to control the positioning of said coding units permutatively.

7. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, movable coding means interposed between and interconnecting the said machines, and mechanical control means to initiate code groups of impulses to control the positioning of the coding means.

8. In a coding and decoding machine, a primary machine comprising operable instrumentalities, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, and a plurality of mechanical control elements to initiate different combinations of code groups of impulses upon operation of the instrumentalities thereby controlling the positioning of the said coding means.

9. In a coding and decoding machine, a primary machine, a secondary machine operable from the first, movable coding means interposed between and interconnecting the machines, and a plurality of control elements and advancing means therefor to initiate different combinations of code group impulses upon each advancement thereof to control the positioning of the said coding means.

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DISCLAIMER

2,116,733.—*Austin R. Noll*, New York, N. Y. CODING AND DECODING MACHINE.
Patent dated May 10, 1938. Disclaimer filed February 24, 1943, by the
assignee, *International Business Machines Corporation*.
Hereby enters this disclaimer to claims 1, 4, 6, 7, 8, and 9 in said specification.
[*Official Gazette March 16, 1943.*]