

Sept. 11, 1928.

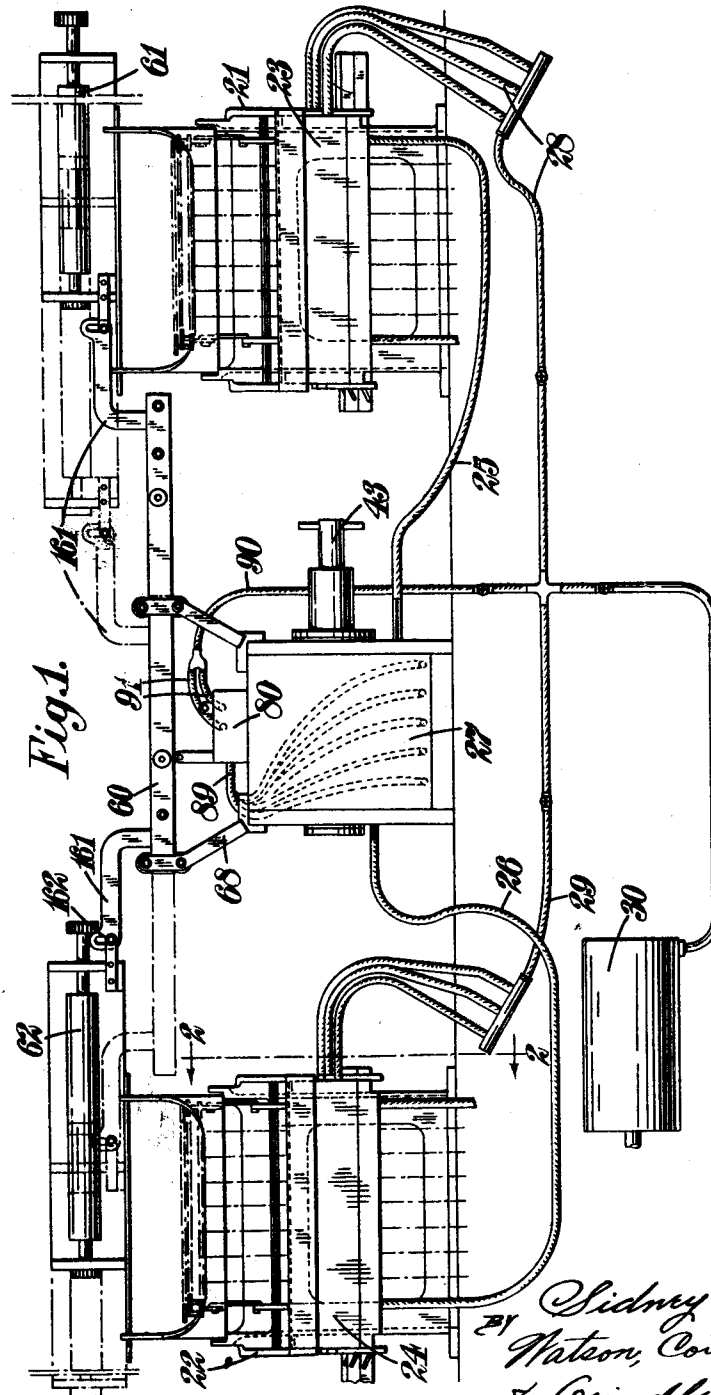
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1,684,028

CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

Filed March 4, 1927

8 Sheets-Sheet 1



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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

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8 Sheets-Sheet 2

Fig. 2.

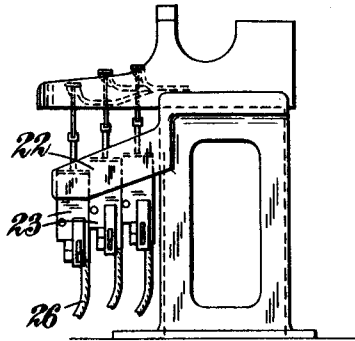


Fig. 13.

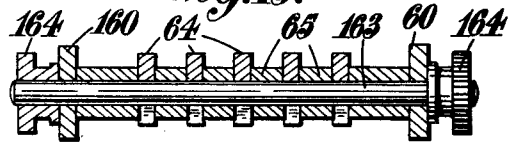


Fig. 15.

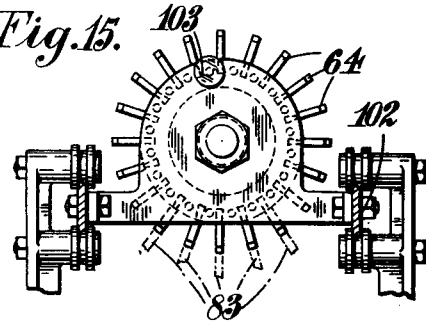


Fig. 14.

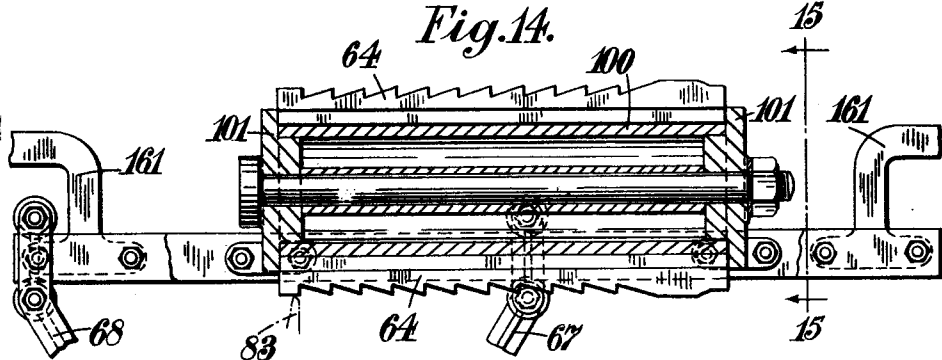
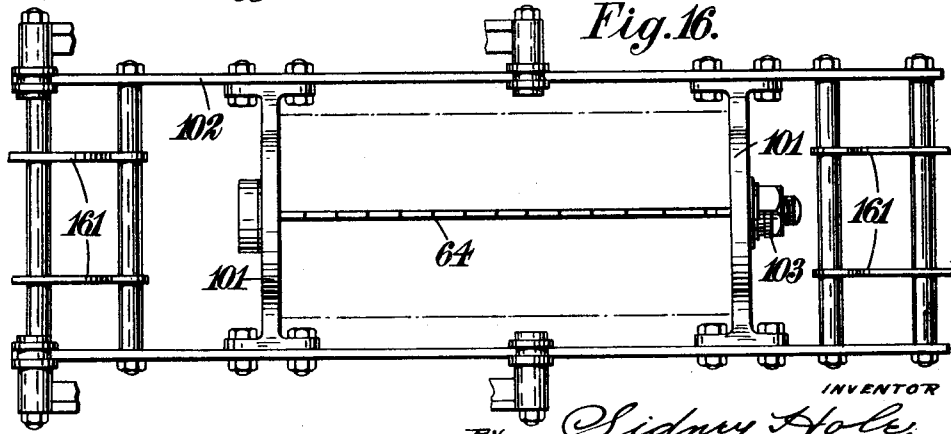


Fig. 16.



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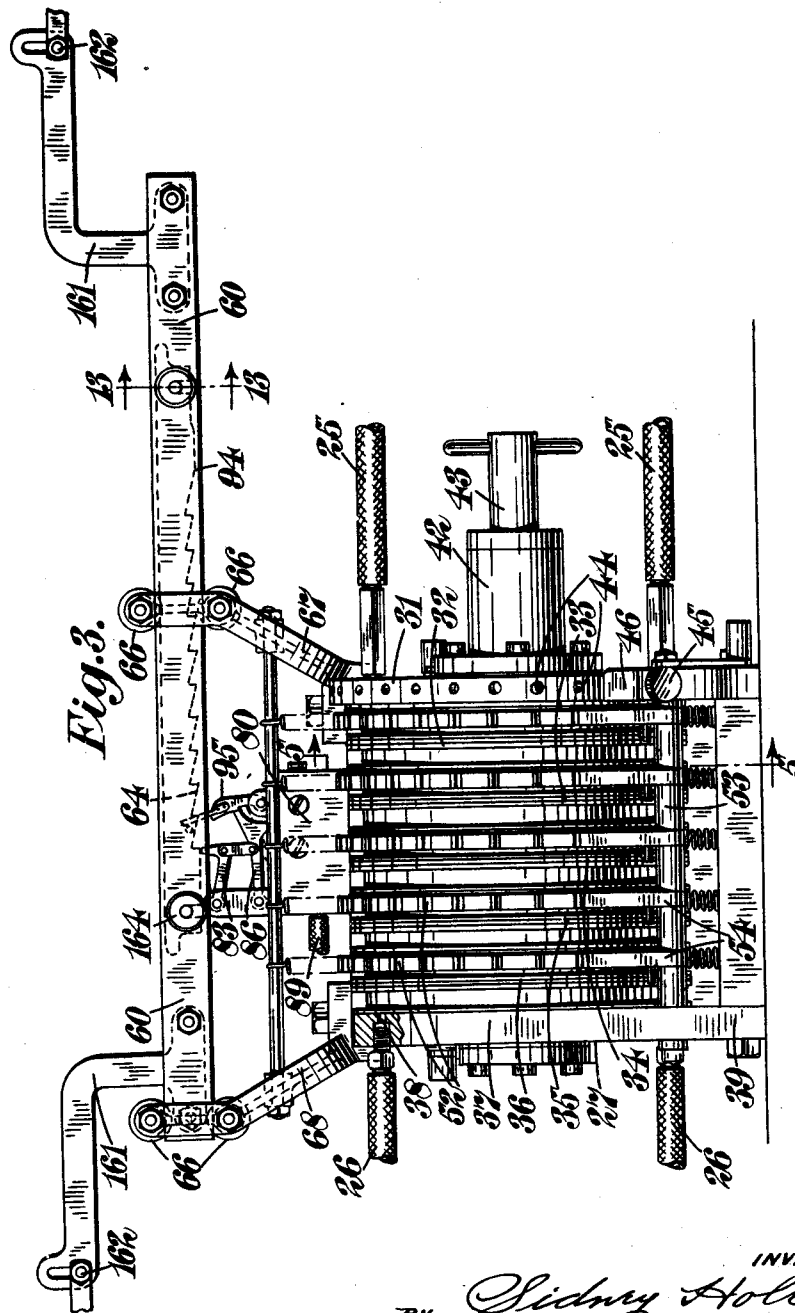
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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

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8 Sheets-Sheet 3



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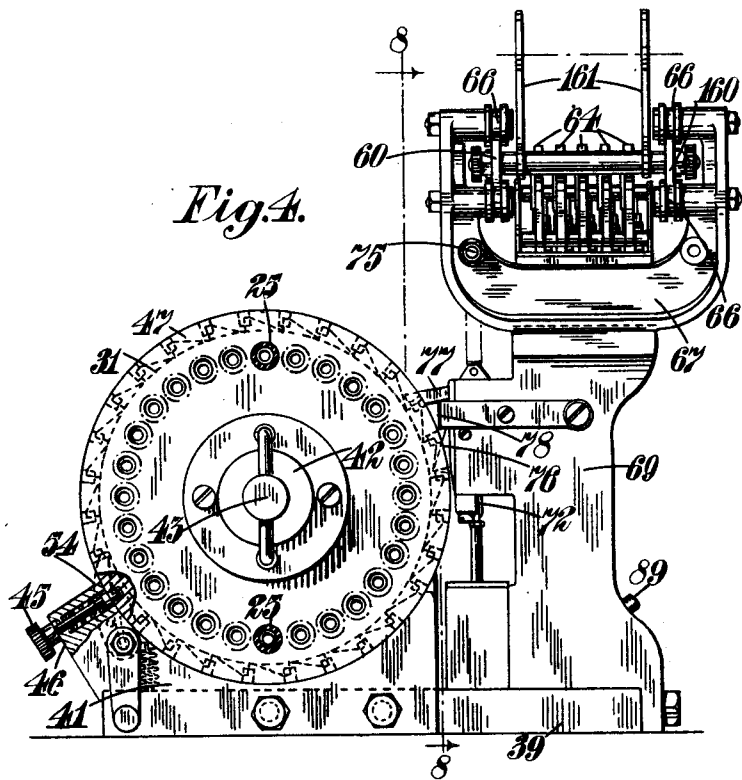
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8 Sheets-Sheet 4



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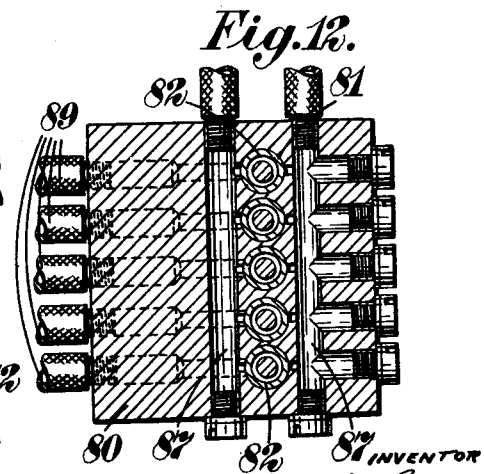
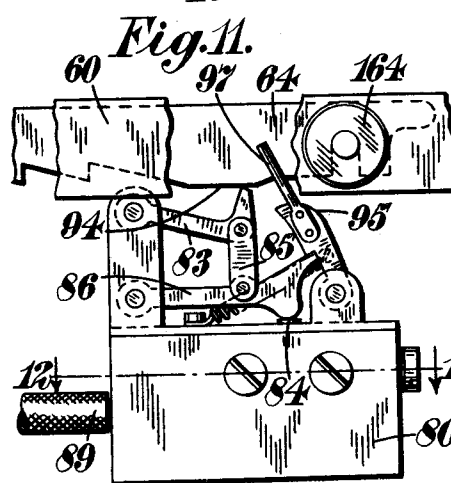
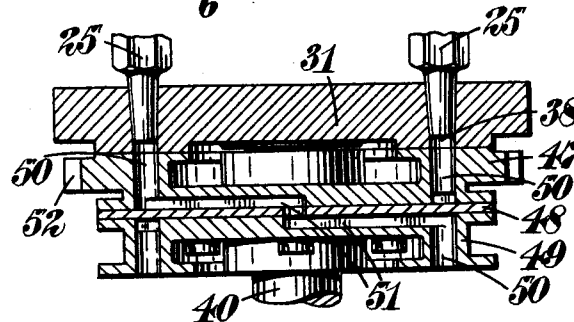
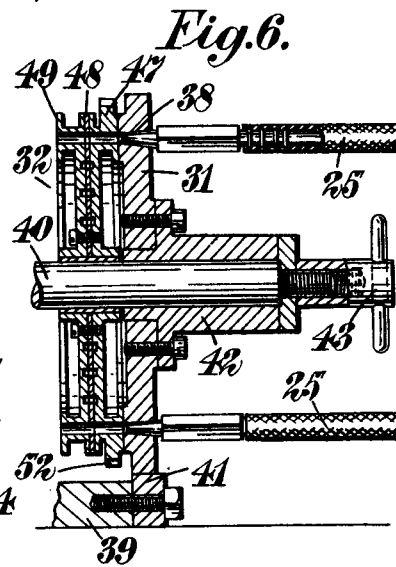
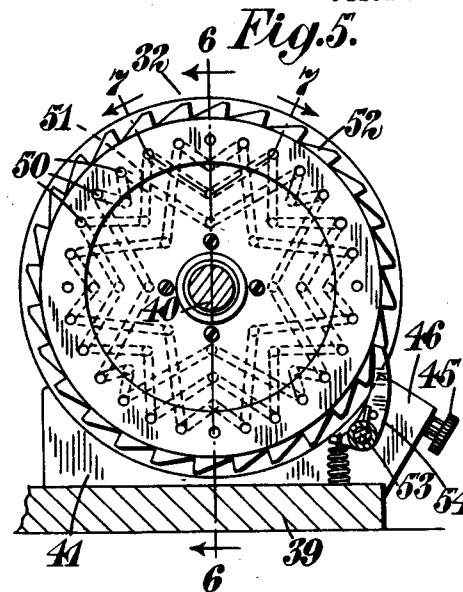
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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

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8 Sheets-Sheet 5



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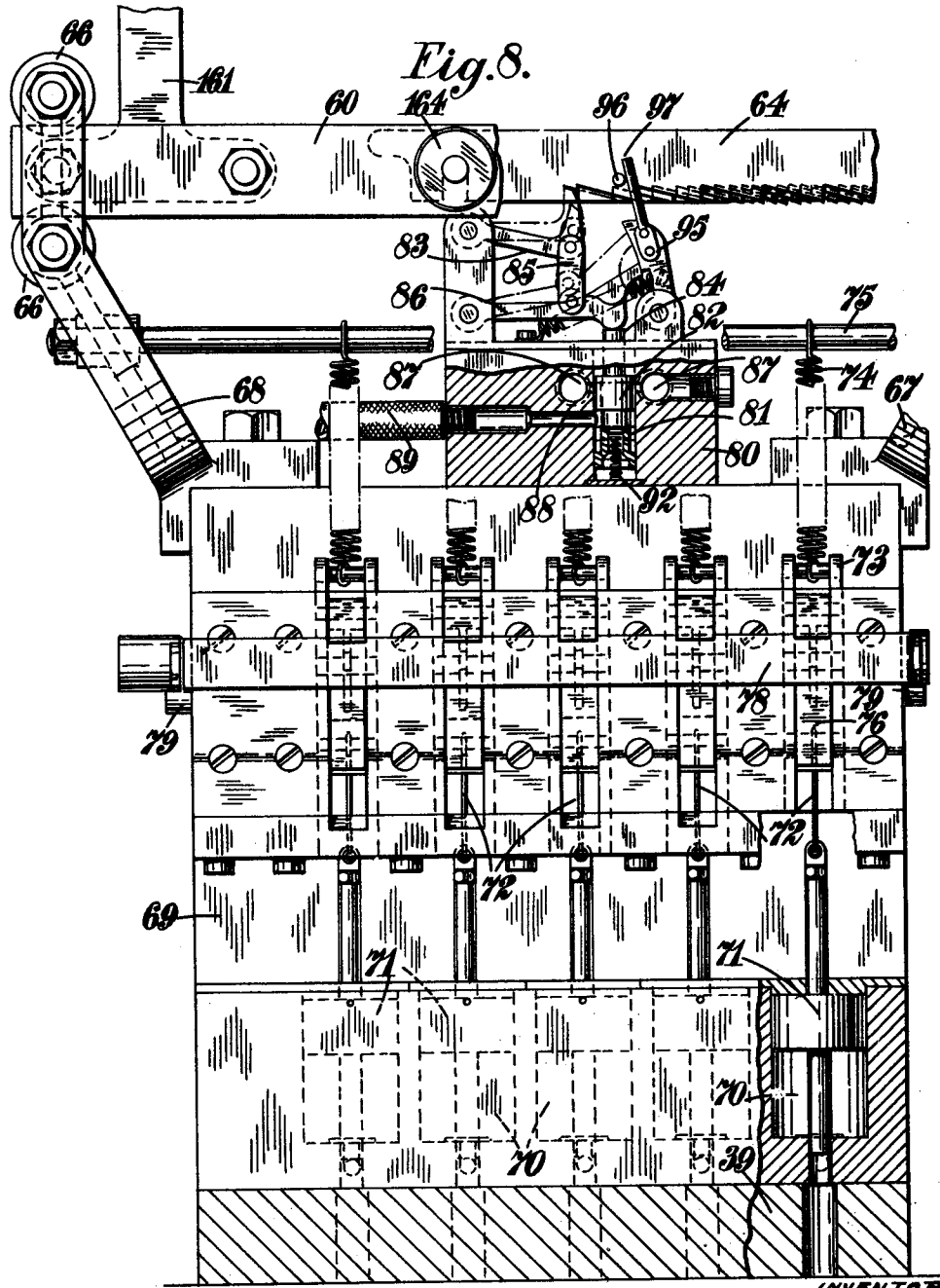
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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

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8 Sheets-Sheet 6



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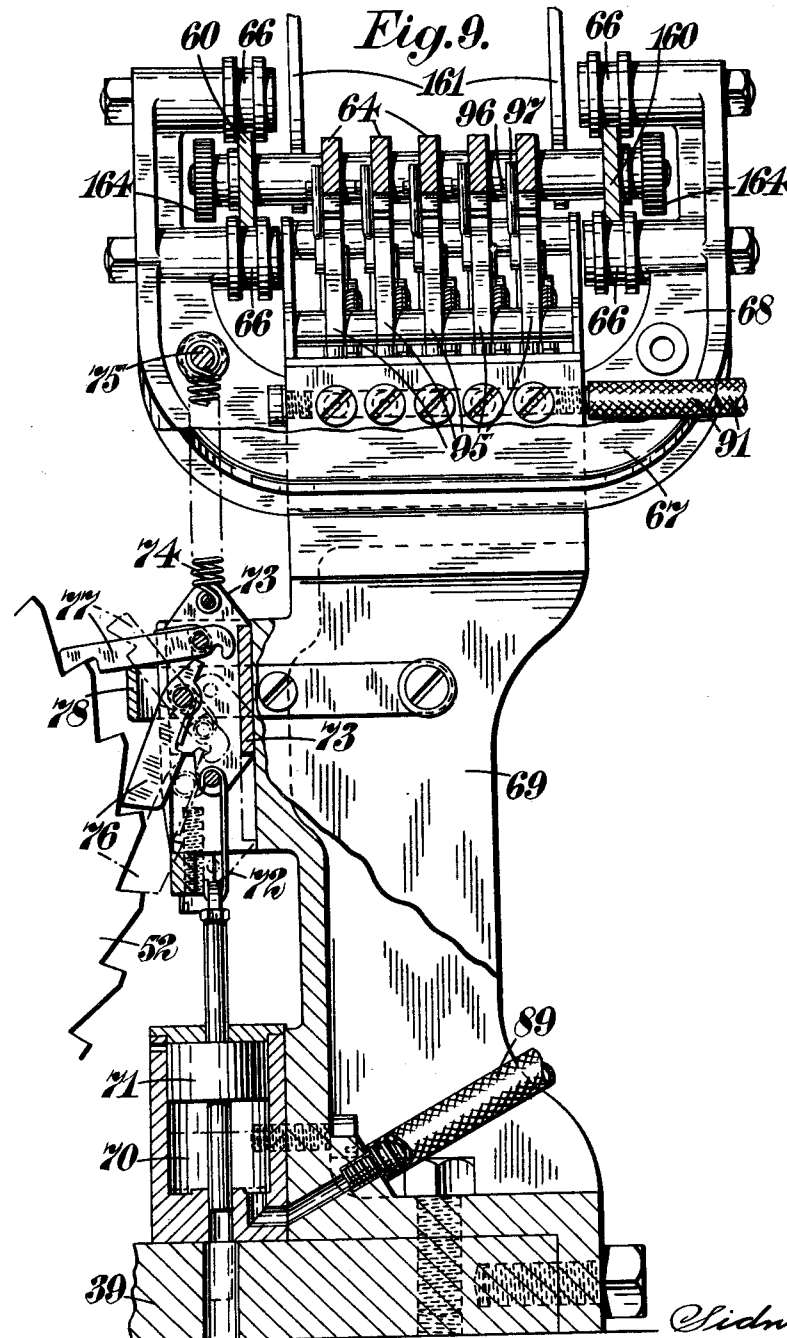
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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

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8 Sheets-Sheet 7



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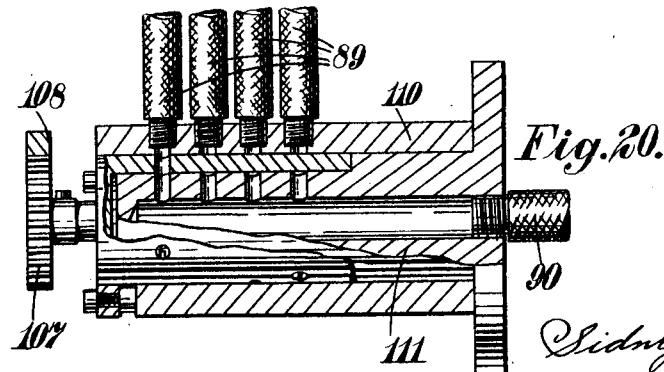
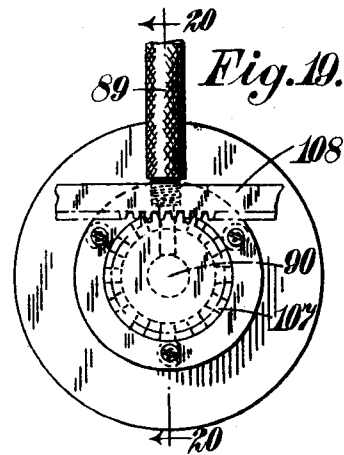
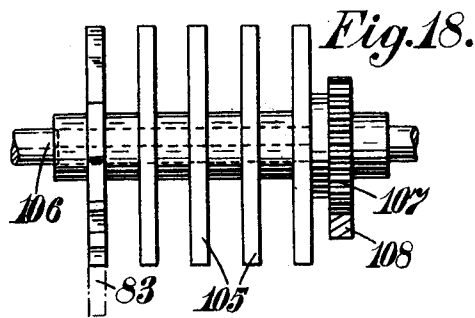
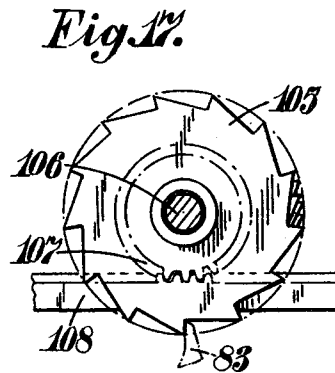
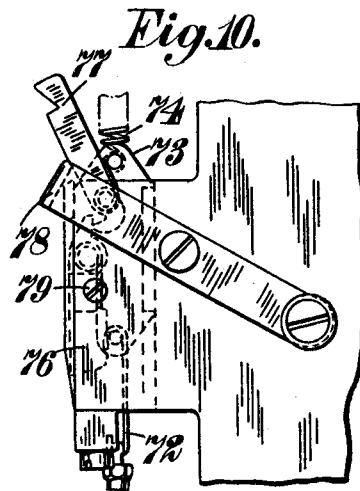
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CODING AND DECODING APPARATUS AND CODE CHANGING DEVICE THEREFOR

Filed March 4, 1927

8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE.

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CODING AND DECODING APPARATUS AND CODE-CHANGING DEVICE THEREFOR.

Application filed March 4, 1927, Serial No. 172,916, and in Great Britain March 5, 1926.

This invention relates to coding and decoding apparatus and to code-changing devices therefor, and the type of apparatus concerned is that wherein one set of sign-
 5 keys is operatively connected to a second set of sign-keys constituting writing-keys through a code-changing device comprising at least two transmission members whereof one is movable in relation to the other, and
 10 each has transmission points one for each key, operative means is provided passing through the transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of
 15 the other set, and the said transmission points of one member are arranged all to register simultaneously with those on the other and are so spaced that when one transmission member is stepped one space relatively to
 20 the other each transmission point of one member will be advanced to the preceding one of the other member, with the result that the pairs of keys will be changed, that is individual keys in one set will now co-operate
 25 with different individual keys in the other set, and wherein automatic means arranged to be actuated by the operation of one of the sets of keys (for example the first said set of sign-keys) is provided for moving the movable transmission member of the code-changing
 30 device so as to change the pairs of keys.

One example of code-changing device of the type referred to is described in my prior British Letters Patent No. 207,257. A code-
 35 changing device of the type referred to may comprise two terminal transmission members whereof each has a plurality of transmission points connected together by means of one or more coupling transmission members situated
 40 between them, each of which coupling members has two sets of transmission points on opposite faces, some or all of the points of one set being cross-connected to those of the other set of the same coupling member.

45 The invention has for its main object to provide apparatus of the type described above comprising an improved construction of automatic means such that practically unlimited variations of code are produced during the operation of coding a message, but
 50 without necessitating any complex changing of parts, so that the code may be changed if desired with every letter or a given number of letters of the words making up the message. Another object is to provide that certain
 55 controlling parts of the automatic means aforesaid can be readily exchanged for other parts that function correspondingly but in a different manner, and a further object is to provide an improved construction of code-
 60 changing device such that a coded message shall be rendered still more secret and that it shall be still more difficult than heretofore for an unauthorized person to decode the coded matter.

65 According to an important feature of the invention there is provided coding or decoding apparatus of the type described wherein the code-changing device comprises two or more movable transmission members where-
 70 of at least one has a set of transmission points connected in a "mixed" order with another set thereon, (e. g. one or more movable coupling members between two terminal members whereof one may be movable),
 75 characterized in that the automatic means comprises a plurality of code-changing control members (e. g. a bar provided with teeth), one allotted to each movable transmission member, which control members are
 80 arranged to be moved step-by-step (e. g. endwise) by the operation of one set of keys and thereby move their allotted transmission members, for the purpose of changing the "setting" of the code during the production
 85 of the coded message.

This construction of code-changing device enables the "setting" of the code to be readily
 90 changed by moving one or more coupling members forward or backward one or more units of space between the two terminal members during the coding of the message. The term "mixed" order is intended to indicate that the transmission points of one set
 95 on the coupling member are not all connected each with the corresponding transmission point of the other set on the same coupling member, but at least one or more points of the one set are cross-connected with one
 100 or more points of the other set to which they do not correspond when considered in relation to the transmission points on the terminal members. For example, assuming that two sets of points on opposite faces of a ro-

5 tary coupling member in the form of a disc
6 are lettered consecutively A-Z, the five let-
7 ters A-E of one set may be cross-connected in
8 order to the five letters F-J in the other set,
9 the five letters F-J of the first set may be cor-
10 respondingly connected to the five letters
11 A-E of the second set, and the remaining let-
12 ters of the first set may be connected in order
13 directly each with the same letter of the
14 second set. Obviously, the number of let-
15 ters of the two sets that are cross-connected
16 may be increased or decreased as desired.
17 Thus all of the letters of the one set may be
18 cross-connected each to a different letter of
19 the second set in any regular or irregular
20 manner. Thus A of one set may be cross-
21 connected to M of the second set, B of the
22 first set to X of the second, C to D, D to O,
23 and so on.

24 According to another feature of the in-
25 vention, the said automatic means comprises
26 a plurality of feed mechanisms, each con-
27 trolled by one of said control members (e. g.
28 by teeth thereon) and allotted each to one of
29 said movable transmission members for feed-
30 ing the same.

31 According to a further feature of the in-
32 vention, the movable transmission members
33 are rotary members having each a ring of
34 teeth on its periphery spaced apart to corre-
35 spond to the stepping required for single-step
36 changes of the said transmission points or
37 multiples thereof, and the control members
38 are provided each with teeth (e. g. ratchet
39 teeth), and ratchet feed mechanisms, one op-
40 erative on each ring of teeth, are arranged to
41 be actuated each by the teeth of one of said
42 control members.

43 Conveniently, each said control member
44 has a row of teeth (e. g. in the form of a
45 toothed rack) and controls feed mechanism,
46 one for each control member, for moving a
47 movable transmission member step-by-step,
48 a cam at one end of each row of teeth on the
49 control member is so shaped and disposed as
50 to co-operate with the feed mechanism and
51 disengage the same from the control member
52 when the latter is at or towards one end po-
53 sition, a detent is provided which automatical-
54 ly retains said feed mechanism in the disen-
55 gaged position to which it is brought by the
56 cam, and a stop on the control member at or
57 towards the other end of the row of teeth is
58 so disposed as to release said detent from the
59 feed mechanism when the control member
60 is at or towards the other end position, for
61 the purpose of enabling the toothed control
62 members to be returned into their starting
63 position.

64 According to another feature of the in-
65 vention the control members are so shaped or
66 arranged as to differ one from another in
67 their operation on their allotted transmission
68 members, for the purpose of complicating the
69 "setting" of the code still further.

70 Conveniently, the rows of teeth of the sev-
71 eral control members differ one from an-
72 other in length of the row, or in number or
73 position of the teeth in the row, or in the
74 spacing of the teeth, or the length of the in-
75 dividual teeth, for the purpose of introduc-
76 ing still further complication.

77 Preferably, one or more of the code-chang-
78 ing control members are operatively con-
79 nected to and actuated by the carriage of a
80 typewriting machine comprising one of the
81 sets of keys aforesaid.

82 The toothed control members aforesaid
83 may, according to another feature of the in-
84 vention, be in the form each of a rotatable
85 ratchet wheel, which may be operated by
86 rack-and-pinion mechanism, for example by
87 a carriage of a typewriting machine.

88 According to yet another feature of the
89 invention, each of said control members is
90 so mounted as to be readily removable from
91 its support and/or to be readily replaced by
92 another control member.

93 According to another important feature
94 of the invention, there is provided in or for
95 a coding or decoding apparatus of the type
96 described, a code-changing device wherein
97 a pair of terminal transmission members
98 (e. g. end discs) are arranged facing one
99 another and have each a plurality of trans-
100 mission points (e. g. ports) whereof the
101 points on one said member lie opposite those
102 of the other said member, one or more cou-
103 pling transmission members having each
104 two sets of transmission points (e. g. ports)
105 are arranged co-axially between said termi-
106 nal members and connect the points on the
107 latter together, which coupling member or
108 members are rotatable relatively to said ter-
109 minal members and have each the transmis-
110 sion points of one of its sets connected in a
111 "mixed" order with the transmission points
112 of the other set, characterized in that at
113 least one terminal member is rotatable in re-
114 lation to its adjacent coupling member, and
115 each coupling member is formed or provided
116 with means (e. g. a toothed periphery) for
117 engagement by feed mechanism for rotating
118 the same.

119 Conveniently, each coupling member and
120 one terminal member are each in the form
121 of discs mounted on a shaft fast on the other
122 terminal member, which shaft is provided
123 with means (e. g. a nut) for holding the
124 members together.

125 According to yet another important fea-
126 ture of the invention, there is provided in or
127 for a pneumatic code-changing device for
128 use in a coding or decoding apparatus of the
129 type hereinbefore described, a coupling mem-
130 ber having sets of transmission ports on op-
131 posite faces thereof, characterized in that
132 ducts connect some or all of the transmission
133 ports of the one set in a "mixed" order
134 with the transmission ports of the other set.

A coupling member as set forth in the preceding paragraph comprises in combination, according to another feature of the invention, two end plates and an intermediate plate arranged face-to-face, which end plates have each a set of transmission ports in an outer face and grooves in an inner face that communicate each with one of said ports; and said intermediate plate has perforations arranged to connect the grooves in one end plate each with a groove in the other end plate.

Other features of the invention relating, amongst others, to the feed mechanism, and other forms of control device for the movable transmission members aforesaid will be described hereinafter and pointed out in the claims.

The invention is illustrated diagrammatically and by way of example in the accompanying drawings, wherein—

Figure 1 is a front elevation of one form of coding or decoding apparatus comprising two typewriting machines and one form of code-changing device actuated by one form of control device according to the invention, and

Figure 2 is an end elevation of one typewriting machine, some parts being omitted;

Figures 3 and 4 are front elevation and end elevation, respectively, illustrating the code-changing device and control device therefor shown in Figure 1;

Figure 5 is a section taken on the line 5—5 in Figure 3;

Figure 6 is a section taken on the line 6—6 in Figure 5, and

Figure 7 is a section taken on the bent line 7—7 in Figure 5 illustrating the code-changing device;

Figure 8 is a vertical sectional elevation taken on the line 8—8 in Figure 4 showing feed mechanism for the code-changing device and the control device of the feed mechanism;

Figure 9 is an end elevation, partly in section of the parts shown in Figure 8, and

Figure 10 is a detail view of part of the feed mechanism in a different position;

Figure 11 is a detail front elevation of part of the feed mechanism, and

Figure 12 is a horizontal section taken on the line 12—12 in Figure 11.

Figure 13 is a vertical section taken on the line 13—13 in Figure 3. Figures 7—13, inclusive, are drawn on a scale larger than that of the other figures.

Figure 14 is a front elevation of a modified form of control device for the code-changing device;

Figure 15 is an end elevation taken on the line 15—15 in Figure 14, and

Figure 16 is a plan view of the same, parts being omitted for the sake of clearness;

Figures 17 and 18 are end elevation and

front elevation, respectively, of another form of control device, and

Figure 19 is an end elevation of a modified form of rotary control device, and

Figure 20 is a sectional elevation taken on the line 20—20 in Figure 19.

Like reference numerals designate like or corresponding parts throughout the figures of the drawings.

The apparatus shown in Figures 1 and 2 comprises two standard typewriting machines 21, 22, respectively, having valve-boxes 23, 24, respectively, connected by sets of tubes 25, 26, respectively (whereof only one of each set is shown in Figure 1) to a code-changing device 27, and by other tubes 28, 29, respectively, to exhaust apparatus 30, as described in my prior patent aforesaid. The code-changing device 27 instead of being actuated manually, however, is operated automatically by one of the typewriting machines and comprises a plurality of movable members for changing the code.

Referring to Figures 3—7, the code-changing device 27 comprises seven transmission members 31 to 37, whereof terminal transmission members 31 and 37 are in the form of end plates or discs and have ports 38 connected to the tubes 25, 26, and the members 32, 33, 34, 35, 36 are coupling members arranged in sequence and constructed as described hereinafter. The end plate or disc 37 is rigidly mounted on or integral with one end of a horizontal base 39 and non-rotatably carries one end of a horizontal shaft 40. The five coupling members 32 to 36 are threaded on the shaft 40 which carries at its other end the other end plate or disc 31 that bears with its periphery on a curved support 41 provided for it on the adjacent end of the base 39. A sleeve 42 on the shaft 40 carries the disc 31, and a nut 43 in the form of a cap is screwed on the free shouldered end of the shaft 40 and holds the transmission members just so tightly together that each of them, except the end plate 37, is rotatable about the shaft independently of the others without permitting material passage of air between their adjacent faces. The disc 31 has holes 44 in its periphery, corresponding in number to the number of tubes 25, and a spring-controlled pin 45 mounted on a bracket 46 formed on the support 41 serves to hold the end disc 31 in its position of adjustment. The end plates 31 and 37 and also the coupling members between them are provided each with a mark or marks for setting them in a zero position.

All the coupling members may be constructed alike so that the description of one of them will serve for the others. Referring to Figures 5, 6 and 7, the coupling member 32 comprises three plates 47, 48, 49 secured face-to-face one on another, whereof the two outer plates 47, 49 have transmission points

in the form of ports 50 arranged as described above, which connect each with a groove 51 formed in a regular or irregular manner in the inner face of each outer plate, and the inner plate 48 has perforations arranged to connect two grooves in the outer plates with one another, so that the allotted transmission ports in the outer plates are cross-connected together. The two outer plates 47, 49 may be castings with the grooves in one arranged similarly to or different from those in the other, and the middle perforated plate 48 constituting a jointing plate may be made of malleable or compressible material, such as metal, vulcanized fibre or the like. As illustrated, the grooves 51 in one plate are arranged exactly the same as the grooves in the other plate, but some of the ports 50 do not open into grooves and are directly connected together by a perforation between them in the middle plate. One of the outer plates, namely 47, has a ring of teeth 52 or other means for use in moving the coupling member step by step.

It will be observed that the grooves 51 in one plate are connected by the perforations in the middle plate with the grooves in the other plate at points situated on radial lines, but some other arrangement may be used if desired. Also, the coupling members instead of comprising a plurality of plates may be each in the form of a wheel having spokes which enable tubes to be used as cross-connections lying all in the general plane of the wheel.

A horizontal rod 53 supported on the base carries spring-pressed pawls 54 for engaging the teeth 52 and permitting the coupling members to rotate in one direction only. This construction of code-changing device enables the "setting" of the code to be readily changed by moving the one or more coupling members that are cross-connected in a "mixed" order one or more units of space between the two end discs during the coding of the matter to be coded. By moving each of these coupling members one after another in any order a number of different "settings" of the code are obtained in succession which render the coded message very secret and difficult to decode, because not only will the same or equivalent coupling members have to be used for this purpose, but they will have to be moved relatively to one another and to the terminal members 31 and 37 in the same manner when decoding as when coding.

Various forms of control device for use in automatically feeding the coupling members will now be described.

A bar 60 positively connects the two carriages 61, 62 of the two standard typewriting machines together so as to cause them to move in unison, for the purpose of ensuring that when the carriage of one typewriting

machine is moved by the depression of a key, the carriage of the other typewriting machine will also move even if, for some reason, the code-changing device is inoperative and does not transmit the movement of a key of the first to the second typewriting machine. If no such transmission occurs a letter will not be written on the second typewriting machine, but a space will occur instead. Such a space will facilitate correct decoding by an authorized person as it will prevent the error due to a missing letter from influencing the following letters in the coded message when they come to be decoded in the machine. In this construction the escapement of the second machine is inoperative and its carriage is free to move even if a key of that machine is not depressed. The bar 60 has at each end an angle-piece 161 connected each by a pin-and-slot connection 162 to the adjacent carriage permitting slight angular movement of the bar 60 in relation to either carriage.

This bar 60 forms one longitudinal member of a frame of the control device for the code-changing device, which frame comprises a second bar 160 held parallel with the first by detachable cross-bars 163 (Figure 13) in the form of rods carrying milled nuts 164 at each end. Five toothed racks 64, having ratchet teeth are detachably carried by the rods 163 spaced in parallel relation by distance-pieces 65 threaded on the rods, one rack 64 being allotted each to a coupling member aforesaid. This frame with its toothed racks is mounted to move endwise between rollers 66 journaled in supports 67, 68 of inverted U shape provided one at each end of the frame 69 of feed mechanism described hereinafter.

As shown in Figures 8 and 9, this feed mechanism for the coupling members is arranged below the detachable racks 64 and comprises five vertical cylinders 70 each having a piston 71, one for each coupling member, whereof the piston rods are connected each by a wire 72 to a hollow three-sided sliding block 73 movable each in a vertical guide in the frame 69. Springs 74 attached at one end to a rod 75 carried by the supports 67, 68 have their other ends attached each to a block 73 and tend to hold the pistons 71 in their upper end positions. Each of these blocks pivotally carries a spring-pressed pawl 76 cooperating each with the teeth 52 of a coupling member in such a manner that when the blocks are pulled downwards the pawls 76 feed the coupling members one step so as to change the communication between the end plates 31, 37 of the code-changing device. Five holding pawls 77, one for each coupling member, prevents the latter from rotating in the opposite direction. In their operative position shown in full lines in Figure 9 each pawl 77 bears on a horizontal bar

78 pivoted by means of two arms on the frame 69, which arms normally rest on stops 79 on the frame 69. In order to release the feed mechanism from the code-changing device, for example in order to facilitate removal of the coupling members and replacing them on the shaft 40 in a different position, the holding pawls 77 can be racked upwards by the bar 78 into the position shown in Figure 10, thereby rocking the feed pawls 76 into their inoperative position shown in that figure.

A block 80 (Figures 8, 9, 11 and 12) comprises five valve boxes 81 having each a valve 82 controlling the suction each to one of said cylinders 70. This block is arranged between said feed mechanism and said toothed racks 64 one valve below each rack. Valve-operating means (Figures 3, 4, 8 and 9) comprises five pawls 83, one above each valve spindle 84 that extends above the top of the block 80. These pawls 83 which co-act each with one of the detachable racks 64 and are controlled by the latter, are connected to a parallel linkage 85 whereof the lower link 86 bears with one end on the top of the spindle 84 of the allotted valve 82. In the position of the pawls 83 shown in Figures 8, 9 and 11, each valve 82 closes the connection between the suction supply ducts 87 in the block 80 and the ducts 88 which lead by way of the tubes 89 each to one of the cylinders 70. A tube 90 (Figure 1) has two branches 91, connecting the exhaust apparatus 30 with the supply ducts 87 whereof only one may be provided if desired, although two are preferred in order to balance the suction action on the valves. When the valves 82 are in their extreme upper position connection is established between the tubes 91 and the tubes 89. When the toothed racks 64 are moved endwise from right to left as viewed in Figures 1, 3 and 8 by the operation of the typewriting machine 21, the pawls 83 are depressed against the action of springs 92 below the valves 82, and are released in turn, thereby causing the feed mechanism aforesaid to feed the coupling members in turn. As clearly shown in Figure 8, the racks are arranged with their teeth in staggered relation so as to cause the valves 82 to be operated successively. The length of each tooth may be equal to the space travelled by a carriage during the writing of five letters. Alternatively, each tooth may be longer or shorter as required. After a valve 82 has been opened by the depression of one key it will be closed by the feed of the carriage due to the depression of the next key. If only one rotatable coupling member is provided between two terminal members, one or both of which may also be rotatable, then the arrangement of the teeth will preferably be such that a valve 82 controlling the feed of the coupling member will be opened momen-

tarily and then closed again whilst the carriage is moving one step on the release of a key and before a second key is depressed. This will enable a change of "setting" of the coupling member by the depression of each key.

In order to return the carriages 61, 62 to their initial position corresponding to the beginning of a line of typewritten matter, each rack 64 has a cam 94 at the end of its row of teeth nearest the carriage 61 of the machine used for coding the matter. At the end of a line of typewritten matter when the carriages are in the position shown in broken lines in Figure 1, each cam 94 will co-operate with its allotted pawl 83 and depress it so far that a spring-controlled detent 95 (Figure 11) can snap over the adjacent end of the link 86, and hold the pawl 83 out of reach of the toothed rack 64. The racks 64 are thus free to be returned to the first end position and in so doing a stop 96 carried by each of them co-acts each with an arm 97 of the detents 95 and releases the pawls 83 so that they can return to their operative position against the racks 64.

When the keys of the typewriting machine 21 are depressed the sign-keys of the typewriting machine 22 will be operated in the same manner as described in the prior patent aforesaid, but the code-changing device will be actuated not manually as in that machine, but automatically by the operation of the keys. When a key of the typewriting machine 21 is depressed the carriage 61 moves one step in the usual manner and drives the racks 64 of the control device endwise. Assuming that the code-changing device 27 has been zeroized and that the control device is in the position shown in Figures 3, 4, 8 and 9, i. e. in its initial position at one end of its travel with the pawl 83 close to the first tooth of the front rack 64, when the first key is depressed the pawl 83 will snap up into the bottom of the first gap and in so doing will operate the valve 82 so as to open communication between the tubes 91 and 89, thereby admitting suction to the cylinder 70 of the feed mechanism allotted thereto. The piston 71 will descend and cause the coupling member 32 to be fed one space by the pawl 76. When a second key is depressed the valve 82 is closed and the piston 71 is returned to its upper position by the spring 74, and the holding pawls 77 and 54 prevent rotation of the coupling member 32 in either direction. The setting of the code is thereby changed automatically, immediately one key has been depressed. When the same or another key is depressed for the second letter the second toothed rack 64 becomes operative in a like manner and causes the second coupling member 33 to be fed one space, and so on with the other toothed racks 64 and coupling members allotted thereto, a

change of "setting" of the code being made at each letter owing to the length of each tooth corresponding to the feed of the carriage 61 for five letters. At the end of a line the cams 94 become operative and permit the carriages to be returned to their initial position.

Instead of starting the coding of the matter with the code-changing device at zero, any one or more of the movable transmission members 31 to 36 may be given some initial "setting" away from zero. Also, the end disc 31 may be rotated by hand at any convenient intervals during the coding of the matter, say one or more units of space at the end of each line, which will add further complication.

To decode the coded matter the machine 22 will have its keys depressed and its carriage 62 will drive the carriage 61. The manually-operated valves of the valve boxes 23, 24 will be reversed as described in the prior patent aforesaid when, by starting with the initial code as originally arranged and the code-changing device and control device therefore in the same positions as they were when coding was started (for example at zero), a decoded message will be written on the typewriting machine 21 which in every respect will correspond to the message previously written thereon when coding it.

It will be appreciated that in order correctly to decode matter written with the apparatus as described above it will be necessary to have available not only a code-changing device 27 constructed similarly to that used when coding the message, but also to operate that device by control members, such as toothed racks 64, similar to those used when coding the message, both the code-changing device and control device being moved in the same manner when decoding as when coding. In this way very greatly increased secrecy of the coded matter is ensured, and it is believed that it is quite impossible to decode such matter without having available both the code-changing device and the control device therefore used when producing the coded matter, as well as the code. If it is desired to introduce still further complication, the sequence of the coupling members 32 to 36 may be changed during the coding operation, for example at the end of a page of coded matter. Each coupling member in itself forms a "key" and the order in which the coupling members are used constitutes an additional "key".

Further, the control members 64 constitute apart from the coupling members, a "key" for the correct operation of the decoding machine. When the control members are removed and until a similar "key" is applied to a similar or the same mechanism there are no means for deciphering the particular matter which was coded by means of the particular "key". When the control members are de-

tached they can be transmitted in safety to a person authorized to decode the matter for use with a corresponding code-changing device and like sets of keys. Any one of these "keys" thus constitutes a removable "master key" which may confine the entire use of the apparatus to particular individuals. Further, if, say, five different toothed racks are used with five coupling members of a single code-changing device, the order of the racks can be changed from time to time and replaced in the machine in a new order, say at the end of a page of coded typewritten matter.

In order to facilitate changing the toothed racks 64, a number thereof greater than the number of transmission members co-operating with them may be arranged to rotate so as to bring different racks into operation in turn at will. As illustrated in Figures 14, 15 and 16, four sets of five such toothed racks 64, i. e. twenty such racks, are detachably mounted parallel to one another on a cylindrical support 100 rotatable between end brackets 101 mounted on a frame 102 arranged to be connected to the carriages 61, 62 by angle-pieces 161 at the ends of the frame. One bracket 101 carries a pin 103 movable into and out of holes in the end of the cylinder 100 for holding any desired set of racks 64 or parts of two adjacent sets in line with the pawls 83 which in this case are disposed at an angle to one another. In this way a large number of different "settings" of the control device can be readily obtained by rotating the cylinder 100 say at the end of a line or page of typewritten matter. Also, the cylinder 100 with its racks 64 can be readily detached and despatched either in part or complete for use by a person authorized to decode the coded matter. In some cases the support may be of angular cross-section, say rectangular, pentagonal, hexagonal, or the like, with several racks 64 on each face, the arrangement being such that the support can be rotated when the racks are disengaged from the pawls 83.

Another form of rotary control device shown in Figures 17 and 18 comprises ratchet wheels 105 slidably mounted on an axle 106 of hexagonal section arranged to be driven by a pinion 107 and toothed rack 108 moved endwise by a carriage of a typewriting machine. These ratchet wheels 105 function in substantially the same manner as the toothed racks 64, and their teeth may be arranged in an analogous manner. A one-way clutch will be provided between the pinion 107 and shaft 106 to permit the carriage 61 to be returned to its starting position.

The teeth of these ratchet wheels 105 and also the teeth of the racks 64 may differ from one another in length, or in number or position of the teeth in a wheel or row, or in the spacing of the teeth. Also, mutilated ratchet wheels 105 and toothed racks 64 may be used

in some cases. Also, the length of the rows of teeth on the racks 64 may differ from one another.

In an alternative construction of pneumatic control device for actuating the code-changing device of the kind described comprising four coupling members, four tubes 89 are connected at one end each to one of the cylinders 70, and at their other ends to four ports lying in a line in a side wall of a cylindrical valve chamber 110 containing a hollow rotary cylindrical valve 111, as shown in Figures 19 and 20. This valve 111 carries outside one end of the valve chamber a pinion 107 which meshes with a toothed rack 108 operatively connected with the carriage 61. This valve 111 has in its side wall twelve holes so arranged spirally in three sets of four that when the valve is rotated each tube 89 is placed in succession into communication with the interior of the valve three times during one revolution of the valve. Suction applied through a tube 90 through the other end of the valve chamber is thus applied in succession to the tubes 89 and operates the pistons 71 in their cylinders 70, whereby the coupling members are stepped forward in turn. The valve 111 may have its ports arranged in various ways and constitutes a "key" for controlling the operation of the apparatus. This construction could be operated electrically if transmission points in the form of contact-pieces are substituted for the ports and wires and solenoids are substituted for the tubes and cylinders. Also, instead of rotating the valve by the rack and pinion described, it could be rotated in some other manner, say mechanically, under the control of the keys of a typewriter.

Although the end disc 31 has been described above as adjustable by hand, it may be provided with a ring of teeth, say ratchet teeth, and be operated in a manner analogous to that described with reference to the coupling members 32 to 36. Also, both end plates or discs 31 and 37 may be rotatable. If desired, provision may be made for returning either or both of the end plates or discs 31 and 37 to their zero position after they have rotated a predetermined angular distance, for example one revolution, for example in the manner described in the prior patent aforesaid. These and other modifications may be made in the details of construction described above without departing from the scope of the invention. For example, the code-changing transmission members need not rotate relatively to one another, if provision is made that when one member moves over the face of another the desired change of code can be effected; thus one transmission member could be made to slide horizontally relatively to another and be stepped by suitably arranged pawl-and-ratchet mechanism. Also the movement of the control device and/or the

movable parts of the code-changing device when actuated by the carriage of a typewriting machine may be assisted by some means, such as a spring, so as to relieve the carriage spring of the typewriter; such an auxiliary spring may be tensioned intermittently in the same manner as the carriage spring. Further the toothed control members 64 shown in Figures 14 and 15 may be made from blanks of round section instead of rectangular to facilitate moving the racks into and out of their operative position.

I claim:

1. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising a plurality of transmission members arranged face-to-face, whereof at least two are movable one in relation to an adjacent one, and each said transmission member has a plurality of transmission points, one for each key of a said set of sign-keys, at least one of which movable transmission members situated between two others has a set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, operative means passing through said transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one member are arranged to register simultaneously with those on an opposed face of an adjacent member and are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of an adjacent member, so that the pairs of keys will be changed, and automatic means comprising a plurality of code-changing control members operatively allotted each to one of the movable transmission members, and adapted to be moved step-by-step by the operation of one set of keys and thereby move each its allotted transmission member.

2. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising a plurality of transmission members arranged face-to-face including at least one movable coupling transmission member between two terminal transmission members, each of which terminal transmission members has a plurality of transmission points, one for each key of a said set of sign-keys, and each coupling member has a like set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, operative means passing through said transmission members, by way of said transmission points and connecting the keys

in pairs, one of one set to one of the other set, which transmission points on one face of one member are arranged to register simultaneously with those on an opposed face of an adjacent member and are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of an adjacent member, so that the pairs of keys will be changed, and automatic means comprising a plurality of code-changing control members operatively allotted each to one of the movable transmission members, and adapted to be moved step-by-step by the operation of one set of keys and thereby move each its allotted transmission member.

3. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising a plurality of transmission members arranged face-to-face including one coupling transmission member movable between two terminal transmission members whereof one is movable in relation to the said coupling member, each of which terminal transmission members has a plurality of transmission points, one for each key of a said set of sign-keys, and each coupling member has a like set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, operative means passing through said transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one member are arranged to register simultaneously with those on an opposed face of an adjacent member and are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of an adjacent member, so that the pairs of keys will be changed, and automatic means comprising a plurality of code-changing control members operatively allotted each to one of the movable transmission members, and adapted to be moved step-by-step by the operation of one set of keys and thereby move each its allotted transmission member.

4. In a machine of the character described, the combination with a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and at least one coupling transmission member movable in relation thereto, and having each two sets of transmission points, one point for each key of a set of sign-keys, which points are connected together in a "mixed" order and are arranged to co-operate respectively with transmission

points on an adjacent transmission member, which points are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of the co-operating member, means interconnecting the sign-keys of said sets of keys respectively each with one of the transmission points of said terminal members, said means including one connection only extending from each key to the code-changing device, and automatic means comprising a plurality of code-changing control members equal in number to the number of said coupling transmission members, operatively allotted each to one of the latter, and adapted to be actuated each by the operation of one of said sets of sign-keys and thereby move each its allotted transmission member.

5. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising a plurality of transmission members arranged face-to-face, whereof at least two are movable one in relation to an adjacent one, and each said transmission member has a plurality of transmission points, one for each key of a said set of sign-keys, at least one of which movable transmission members situated between two others has a set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, operative means passing through said transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one member are arranged to register simultaneously with those on an opposed face of an adjacent member and are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of an adjacent member, so that the pairs of keys will be changed, and automatic means comprising a plurality of code-changing control members operatively allotted each to one of the movable transmission members aforesaid and adapted to be moved step-by-step by the operation of one of said sets of keys, and a plurality of feed mechanisms, each controlled by one of said control members and operatively connected each to one of the movable transmission members for feeding the same.

6. In a machine of the character described, the combination with a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and at least one coupling transmission member movable in relation thereto, and having each two sets of transmission points, one point for each key

of a set of sign-keys, which points are connected together in a "mixed" order and are arranged to co-operate respectively with transmission points on an adjacent transmission member, which points are so spaced that when one member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of the co-operating member, means inter-
 10 connecting the sign-keys of said sets of keys respectively each with one of the transmission points of said terminal members; said means including one connection only extending from each key to the code changing device, and automatic means comprising a plu-
 15 rality of code-changing control members equal in number to the number of said coupling transmission members, operatively allotted each to one of the latter, and adapted to be actuated each by the operation of one
 20 of said sets of sign-keys, and a plurality of feed mechanisms, each controlled by one of said control members and operatively connected each to one of the movable transmission members for feeding the same.

7. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and at least one rotary coupling transmission member movable between the terminal members, each of which coupling transmission
 35 members has two sets of transmission points connected together in a "mixed" order, one point in each set for each key of a set of sign-keys, arranged to co-operate each with a set of transmission points on an adjacent transmission member, means interconnecting the
 40 keys of one set each with a key of the other set by way of the transmission points of the code-changing device, each coupling member having a ring of teeth spaced apart to correspond to the setting required for changes of the transmission points, at least one toothed control member, one for each rotary coupling
 45 member, and at least one ratchet feed mechanism, one operative on each ring of teeth, and adapted to be actuated each by the teeth of one of said control members.

8. In coding or decoding apparatus of the character described, the combination of a code-changing movable transmission member, having a plurality of transmission
 55 points, feed mechanism for moving the transmission member step-by-step, a control member having a row of teeth adapted to control said feed mechanism, a cam at one end of said row of teeth so shaped and disposed as to co-
 60 operate with the feed mechanism and disengage the same from the control member when the latter is situated at one end position, a detent arranged automatically to retain said feed mechanism in the disengaged position to

which it is brought by said cam, and a stop on said control member situated at the other end of the row of teeth and arranged to release said detent from the feed mechanism when the control member is at the other end position.

9. In coding or decoding apparatus of the character described, the combination of a code-changing device comprising a plurality of movable code-changing transmission mem-
 75 bers having each a plurality of transmission points, a plurality of feed mechanisms allotted each to one of said movable transmission members for moving the latter step-by-step, a plurality of control members ar-
 80 ranged each to control one of said feed mechanisms, which control members are so arranged as to differ one from another in their respective operation on their allotted transmission members.

10. In coding or decoding apparatus of the character described, the combination of a code-changing device comprising a plurality of movable code-changing transmission mem-
 90 bers having each a plurality of transmission points, a plurality of feed mechanisms allotted each to one of said movable transmission members for moving the latter step-by-step, a plurality of control members having
 95 each a row of teeth and arranged each to control one of said feed mechanisms, the rows of teeth of which control members differ from one another in the length of the row.

11. In coding or decoding apparatus of the character described, the combination of a
 100 code-changing device comprising a plurality of movable code-changing transmission members having each a plurality of transmission points, a plurality of feed mechanisms allotted each to one of said movable trans-
 105 mission members for moving the latter step-by-step, a plurality of control members having each a row of teeth and arranged each to control one of said feed mechanisms, the rows of the teeth of which control members differ
 110 from one another in the number of teeth in the row.

12. In coding or decoding apparatus of the character described, the combination of a code-changing device comprising a plurality
 115 of movable code-changing transmission members having each a plurality of transmission points, a plurality of feed mechanisms allotted each to one of said movable transmission members for moving the latter step-by-
 120 step, a plurality of control members having each a row of teeth and arranged each to control one of said feed mechanisms, the rows of teeth of which control members differ from one another in the spacing of the teeth in
 125 the row.

13. In coding or decoding apparatus of the character described, the combination of a movable transmission member of a code-changing device, a control member operable
 130

by a set of sign-keys, and a pneumatically-actuated feed-mechanism, for said transmission member, which feed mechanism comprises a cylinder, a piston movable in the latter and operatively connected with said transmission member for feeding the same, a valve controlling the pressure in said cylinder, and means controlled by said control member and arranged to control said valve.

14. In coding or decoding apparatus of the character described, the combination of a plurality of movable transmission members of a code-changing device, a plurality of control members, one for each movable transmission member, operable each by a set of sign-keys, and a plurality of pneumatically-actuated feed mechanisms, one allotted to each control member and adapted each to actuate one of said movable transmission members, which feed mechanisms comprise each a cylinder, a piston movable in the latter and operatively connected with a transmission member for feeding the same, a valve controlling the pressure in said cylinder, and valve-actuating means controlled by a control member and arranged to control said valve, which control members are adapted to operate their co-operating valve-actuating means one after another.

15. In coding or decoding apparatus of the character described, the combination of a plurality of movable transmission members of a code-changing device, a plurality of toothed control members, one for each movable transmission member, operable each by a set of sign-keys, and a plurality of pneumatically-actuated feed mechanisms, one allotted to each control member and adapted each to actuate one of said movable transmission members, which feed mechanisms comprise each a cylinder, a piston movable in the latter and operatively connected with a transmission member for feeding the same, a valve controlling the pressure in said cylinder, and valve-actuating means controlled by the teeth of a control member and arranged to control said valve, which control members have the teeth on one member arranged differently relatively to those on another and are adapted to operate their co-operating valve-actuating means in succession.

16. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a code-changing control member operatively connected to and actuated by the movement of the carriage of one of said typewriting machines and arranged to actuate said movable code-changing transmission member.

17. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a code-changing control member operatively connected to both carriages of said typewriting machines and arranged to actuate said movable code-changing transmission member.

18. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of movable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a plurality of code-changing control members operatively connected each to a carriage of one of said typewriting machines and arranged each to actuate one of said movable code-changing transmission members in succession.

19. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and a plurality of intermediate coupling transmission members arranged face-to-face between said terminal members, each of which terminal transmission members has a plurality of transmission points, one for each key of a said set of keys, and each coupling member has a like set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, at least one of which terminal members is movable in relation to its adjacent coupling member; operative means passing through said transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one transmission member are arranged to register simultaneously with those on an opposed face of an adjacent transmission member and are so spaced that when one transmission member is stepped one space relatively to another each transmission point of one transmission member will be advanced to the preceding one of an adjacent transmission member so that the pairs of keys will be changed, and

20. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and a plurality of intermediate coupling transmission members arranged face-to-face between said terminal members, each of which terminal transmission members has a plurality of transmission points, one for each key of a said set of keys, and each coupling member has a like set of transmission points on one face connected in a "mixed" order with a second set on an opposite face, at least one of which terminal members is movable in relation to its adjacent coupling member; operative means passing through said transmission members by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one transmission member are arranged to register simultaneously with those on an opposed face of an adjacent transmission member and are so spaced that when one transmission member is stepped one space relatively to another each transmission point of one transmission member will be advanced to the preceding one of an adjacent transmission member so that the pairs of keys will be changed, and

automatic means comprising a plurality of code-changing control members operatively allotted each to one of said coupling transmission members and adapted to be moved step-by-step by the operation of one set of keys and thereby move each its allotted transmission member.

20. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first set, a code-changing device comprising two terminal transmission members and a plurality of intermediate coupling transmission members arranged face-to-face between said terminal members, each of which terminal transmission members has a plurality of transmission points, one for each key of a said set of keys, and each coupling member has a like set of transmission points on one face connected in a "mixed" order with a second set on an opposite face at least one of which terminal members is in the form of a disc rotatable in relation to its adjacent coupling transmission member, and means for holding the rotatable terminal member in various angular positions of adjustment, operative means passing through said code-changing device by way of said transmission points and connecting the keys in pairs, one of one set to one of the other set, which transmission points on one face of one transmission member are arranged to register simultaneously with those on an opposed face of an adjacent transmission member and are so spaced that when one transmission member is stepped one space relatively to another each transmission point of one member will be advanced to the preceding one of an adjacent member so that the pairs of keys will be changed, and automatic means comprising a plurality of code-changing control members operatively allotted each to one of said coupling transmission members and adapted to be moved step-by-step by the operation of one set of keys and thereby move each its allotted transmission member.

21. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a support adapted to be moved step-by-step by the operation of one of said sets of keys, and a code-changing control member so mounted on said support as to be readily removable therefrom and arranged to actuate said movable transmission member.

22. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a

second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a support adapted to be moved step-by-step by the operation of one of said sets of keys, and a code-changing control member rotatably mounted on said support and arranged to actuate said movable transmission member.

23. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of movable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a support adapted to be moved step-by-step by the operation of one of said sets of keys, and a plurality of code-changing control members mounted on said support and arranged each to actuate one of said movable transmission members.

24. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of movable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a plurality of code-changing control members exceeding the number of said movable transmission members, which control members are adapted to be moved step-by-step by the operation of one of said sets of keys and are arranged to be so moved bodily into and out of operative driving relation with said movable transmission members as to place the said movable transmission members in association each with a different control member by their bodily movement.

25. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of movable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of feed mechanisms having each a feed-control pawl allotted each to one of said movable transmission members, and a plurality of code-changing control members each in the form of a toothed bar for co-operating with the pawls of said feed mechanisms and exceeding in number the number

of said movable transmission members, which control members are adapted to be moved step-by-step by the operation of one of said sets of keys and are mounted parallel to one another and rotatable bodily about an axis lying in the direction of their length so as to be movable into and out of operative driving relation with said pawls and thereby to place the said movable transmission members in association each with a different control member by the bodily movement of the control members.

26. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a pair of terminal transmission members arranged facing one another and having each a plurality of transmission points whereof the points on one member lie opposite those of the other member, a plurality of coupling transmission members having each two sets of transmission points arranged co-axially in sequence between said terminal members and connecting the points on the latter together, which coupling members are rotatable relatively to said terminal members and have each the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, at least one of which terminal members is rotatable in relation to its adjacent coupling member, and each coupling member is adapted for engagement by feed mechanism for rotating the same.

27. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a pair of terminal transmission members arranged facing one another and having each a plurality of transmission points whereof the points on one member lie opposite those of the other member, a plurality of coupling transmission members having each two sets of transmission points arranged co-axially in sequence between said terminal members and connecting the points on the latter together, which coupling members are rotatable relatively to said terminal members and have each the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, at least one of which terminal members is rotatable in relation to its adjacent coupling member, and each coupling member is adapted for engagement by feed mechanism for rotating the same, which rotatable terminal transmission member has a plurality of stops arranged in a circle and a catch arranged to engage with and be disengaged from said stops for holding the rotatable terminal transmission member in the position to which it is angularly adjusted.

28. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a shaft, a termi-

nal transmission member fixed at one end thereof, a second terminal transmission member rotatable on the other end of said shaft, which terminal members face one another and have each a plurality of transmission points whereof the points on one member lie opposite those of the other member, one or more coupling transmission members having each two sets of transmission points arranged rotatably on said shaft between said terminal members and having each the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, and means on said shaft for detachably holding said rotatable transmission members rotatably together face-to-face.

29. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a base having a bearing, a terminal transmission member fixed on the base at a situation spaced away from said bearing, a shaft carried by said terminal member and extending in the direction of said bearing, a second terminal member in the form of a circular disc rotatable on said shaft and supported at its periphery by said bearing, which terminal members face one another and have each a plurality of transmission points whereof the points on one member lie opposite those of the other member, one or more disc-shaped coupling transmission members having each two sets of transmission points arranged rotatably on said shaft between said terminal members and having each the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, each coupling member having means adapted for engagement by feed mechanism for rotating the same, and means on said shaft for detachably holding said rotatable transmission members rotatably together face-to-face.

30. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a pair of terminal transmission members arranged facing one another and having each a plurality of transmission points whereof the points on one member lie opposite those of the other member, a plurality of coupling transmission members having each two sets of transmission points and arranged co-axially in sequence between said terminal members and connecting the points on the latter together, which coupling members are rotatable relatively to said terminal members and have each a toothed periphery and have the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, in combination with feed pawls, one arranged to engage the toothed periphery of each coupling member for feed-

ing the same, and means for holding each pawl out of engagement with its allotted coupling member.

31. In coding or decoding apparatus of the character described, a code-changing device comprising in combination a pair of terminal transmission members arranged facing one another and having each a plurality of transmission points whereof the points on one member lie opposite those of the other member, a plurality of coupling transmission members having each two sets of transmission points and arranged co-axially in sequence between said terminal members and connecting the points on the latter together, which coupling members are rotatable relatively to said terminal members and have each a toothed periphery, and have the transmission points of one of its sets connected in a "mixed" order with the transmission points of the other set, in combination with feed mechanism comprising a plurality of feed pawls, one arranged to engage the toothed periphery of each coupling member for feeding the same, and a member arranged to hold all said feed pawls simultaneously disengaged from said coupling members.

32. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and means so connecting the two carriages of the typewriting machines together as to cause them to be stepped endwise in unison by the operation of one of said sets of keys.

33. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and means positively connecting the two carriages of the typewriting machines together in the direction of their feed movement.

34. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a bar connecting the two carriages of the typewriting machines together.

35. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and means so connecting the two carriages of the typewriting machines together as to cause them to be stepped endwise in unison by the operation of one of said sets of keys, which means comprise a code-changing control member operatively connected with said code-changing device for shifting the latter.

36. In coding or decoding apparatus of the character described, the combination of a typewriting machine having a set of character-producing sign-keys, a second typewriting machine having a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a bar connecting the two carriages of the typewriting machines together, and a code-changing control member that is carried by said bar and is operatively connected with said code-changing transmission member for shifting the latter.

37. In a pneumatic code-changing device, a coupling transmission member having sets of transmission ports on opposite faces thereof and having ducts that connect some of the ports of one set in a "mixed" order with the ports of the other set.

38. In a pneumatic code-changing device, a cross-connected coupling transmission member comprising in combination two end plates, and an intermediate plate arranged face-to-face, which end plates have each a like set of transmission ports in an outer face and grooves in an inner face that communicate each with one of said ports, and said intermediate plate has perforations arranged each to connect a groove in one end plate with a groove in the other end plate.

39. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a movable code-changing transmission member, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, and a rotary code-changing control member operatively connected to and actuated by the movement of one of said sets of keys and arranged to actuate said movable code-changing transmission member.

40. In coding or decoding apparatus of the

character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of rotary code-changing control members operatively connected each to one of said rotatable transmission members and adapted to rotate the same, and means operatively connected with and actuated by the movement of one of said sets of keys and arranged to rotate said control members.

41. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of rotary toothed wheels operatively connected to one of said sets of keys and arranged to be rotated thereby, and a plurality of feed mechanisms, one allotted to each rotary transmission member, controlled each by one of said toothed wheels.

42. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of rotary ratchet wheels, a pinion for rotating the latter, a toothed rack meshing with said pinion and adapted to be shifted endwise by the operation of one of said sets of keys, and a plurality of feed mechanisms, one allotted to each rotary transmission member, controlled each by one of said ratchet wheels.

43. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a rod of non-circular cross-section, a plurality of rotary control members removably threaded on said rod, a pinion adapted to rotate said rod, a toothed rack meshing

with said pinion and adapted to be shifted endwise by the operation of one of said sets of keys, and a plurality of feed mechanisms, one allotted to each rotary transmission member, controlled each by one of said rotary control members.

44. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of feed mechanisms, one for each said rotatable transmission member, for rotating the same, a plurality of transmission means connected each at one end to one of said feed mechanisms, and a movable control member having a plurality of transmission points adapted selectively to control the connection of the other ends of said transmission means with a source of power, and driving means operatively connecting said control member with the one of said sets of keys and arranged to move the transmission points of the control member into and out of operative connection with said transmission means for intermittently actuating the feed mechanisms.

45. In coding or decoding apparatus of the character described, the combination of a set of character-producing sign-keys, a second set of sign-keys which is a duplicate of the first, a code-changing device comprising a plurality of rotatable code-changing transmission members, operative means controlled by said code-changing device and connecting said keys in pairs, one of one set to one of the other set, a plurality of feed mechanisms, one for each said rotatable transmission member, for rotating the same, a plurality of transmission means connected each at one end to one of said feed mechanisms, a rotary control member having a plurality of transmission points adapted selectively to control the connection of the other ends of said transmission means with a source of power and driving means so operatively connecting said control member with one of said sets of keys as to impart intermittent angular movement to it when one of the keys of that set is depressed, for moving the transmission points of the control member into and out of operative connection with said transmission means for intermittently actuating the feed mechanisms.

In testimony whereof I affix my signature.

SIDNEY HOLE.