E7944 OR 1,533,252

April 14, 1925. 1,533,252

H. A. KOCH

CODING AND DECODING MACHINE

Filed Sept. 18, 1920 3 Sheets-Sheet 1

Fig. 1.

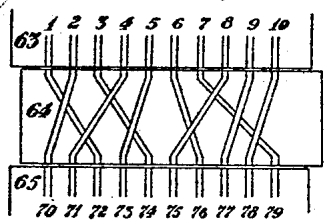


Fig. 2.

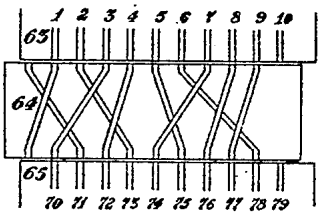


Fig. 3.

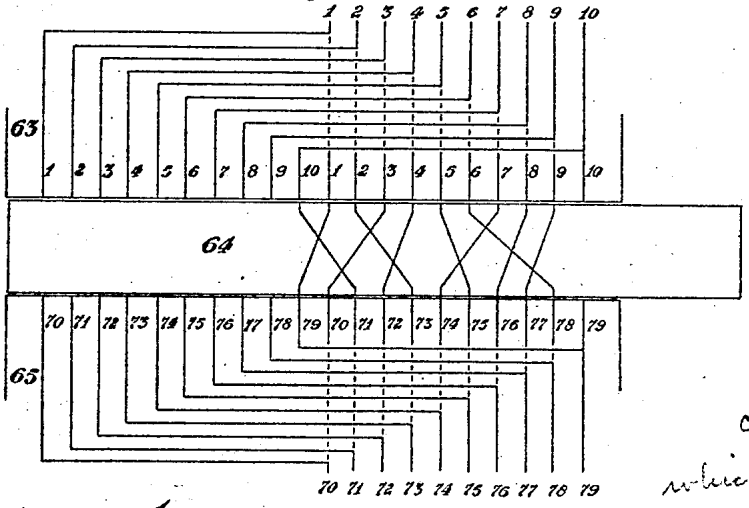


Fig. 4.

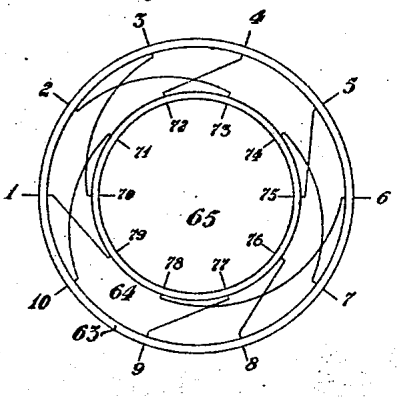
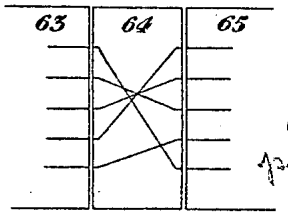


Fig. 5.



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CODING AND DECODING MACHINE

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Fig. 6.

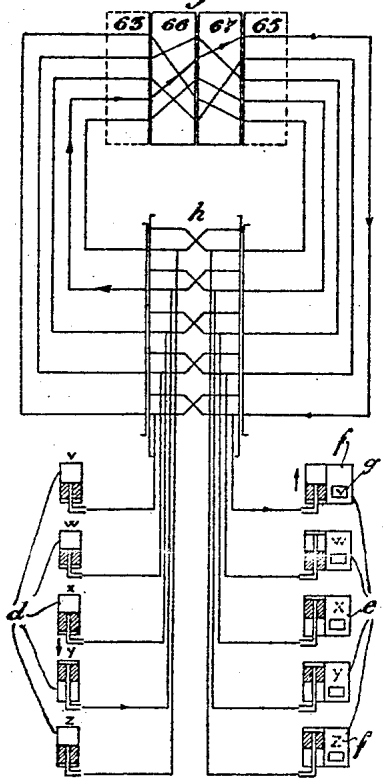


Fig. 7.

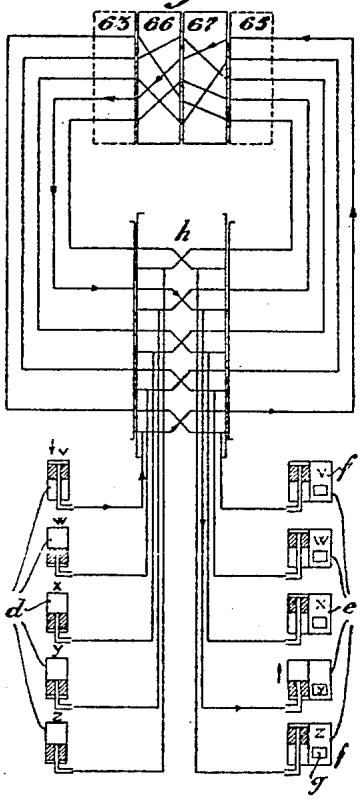
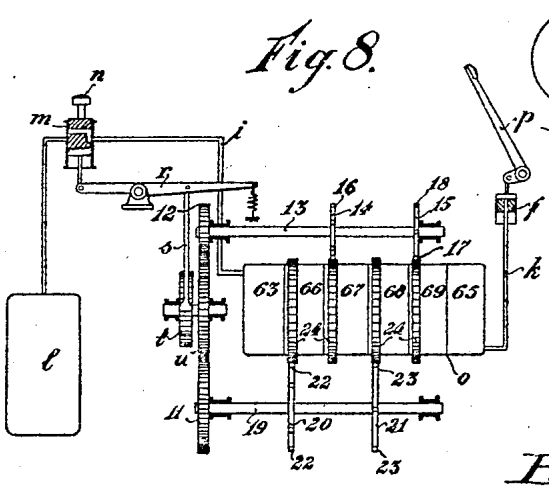


Fig. 6 & 7 Pneumatic coding mechanism only

Fig. 8.



type lever pneumatic, roots changing typewriter

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CODING AND DECODING MACHINE

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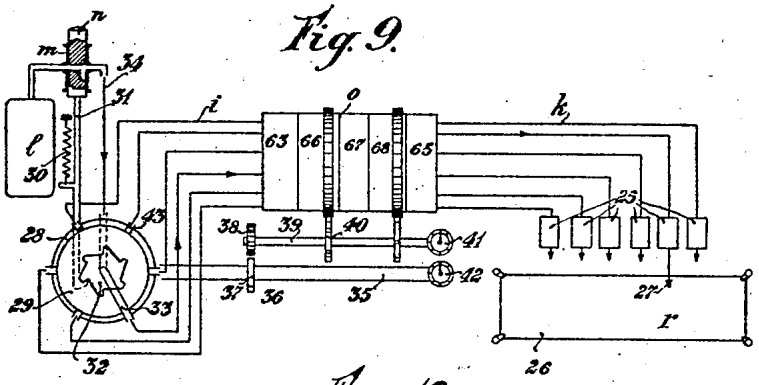
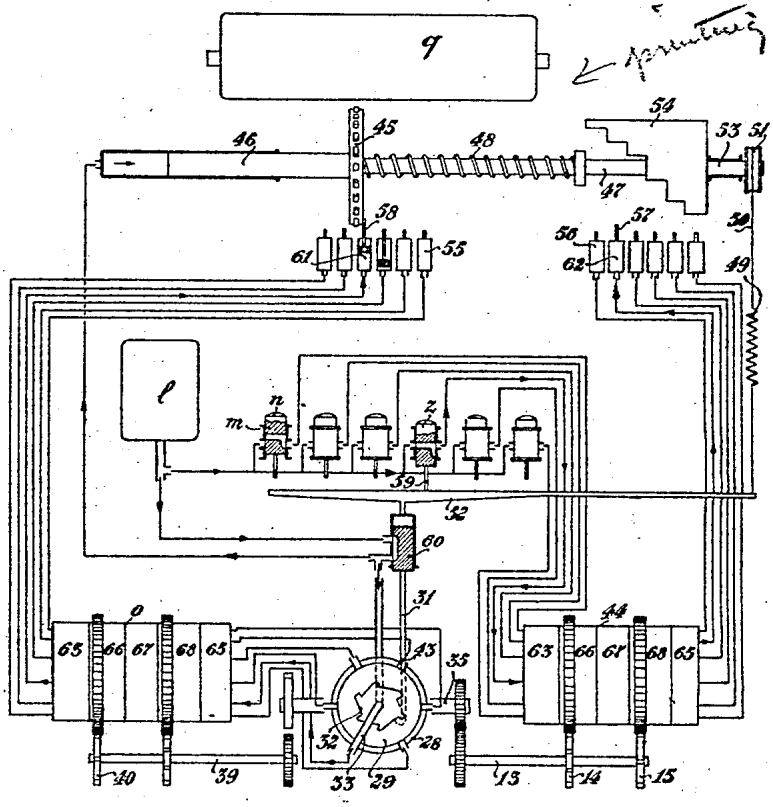
Fig. 9.



more coding machine (pneumo

Fig. 10.



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Patented Apr. 14, 1925. 1,533,252

UNITED STATES PATENT OFFICE.

HUGO ALEXANDER KOCH, OF THE HAGUE, NETHERLANDS, ASSIGNOR TO NAAMLOOZE VENNOOTSCHAP INGENIEURSBUREAU "SECURITAS," OF AMSTERDAM, NETHERLANDS, A COMPANY OF THE NETHERLANDS.

CODING AND DECODING MACHINE.

Application filed September 18, 1920. Serial No. 411,229.

To all whom it may concern:

Be it known that I, HUGO ALEXANDER KOCH, a subject of the Queen of the Netherlands, residing at The Hague, Netherlands, have invented certain new and useful Improvements in Coding and Decoding Machines, of which the following is a specification.

The present invention relates to coding and de-coding machines.

The object of a coding and de-coding machine is to change plain script in the shortest possible time into a series of letters or signs in such a manner as to make it impossible to discover therefrom the original plain script. The script, thus changed into code, has to be changed back again quickly and simply by the same or a similar machine into the original plain script.

In order that it may not be possible to solve the secret script, it is necessary for the machine to be capable of being set in a great number of arbitrary ways and for the key to be varied during the writing, so that even any one conversant with the machine will not be able to discover the plain script from the secret script by calculation, trial or any other method.

These conditions must be fulfilled by the simplest possible means.

The coding machines known up to the present only partly comply with these requirements, while the present invention fulfils all the above conditions.

In the accompanying drawing wherein an approved embodiment of the invention is illustrated:—

Figures 1 and 2 are diagrammatic views of a form of multiple valve forming part of the invention, showing the movable part of the valve in different positions.

Figure 3 is a diagrammatic view of a modification of the multiple valve.

Figures 4 and 5 are diagrammatic views respectively, of disc and cylinder type multiple valves constructed according to the invention.

Figures 6 and 7 are diagrammatic views of a complete coding apparatus showing, respectively the coding and decoding positions thereof.

Figures 8, 9 and 10 are diagrammatic views of various forms of coding machines constructed in accordance with the present invention.

The invention is based on the multiple valve shown in Fig. 1, which allows of the connection of a considerable number of tube connections being completely and quite irregularly exchanged in a single movement. Figure 1 shows a tube system consisting of the three parts 63, 64 and 65. In the two outer parts 63 and 65 the tubes are parallel, while in 64 they connect in any desired way the apertures of the tubes of 63 and 65. Starting e. g. from 4 on part 63, the path leads by way of the part 64 to 71 on part 65. Similarly 2 3 4 5 6 7 8 9 on part 63 lead to 70 74 71 73 76 79 75 77 on part 65. If in front of all the tubes on part 63 valves or small cylinders are fitted, which each bear, for instance, one letter of the alphabet (as shown in Fig. 6 to the left hand) and behind each tube on part 65 there is fitted a small cylinder with a piston, each of which for example bears a letter, and exposes this letter, when the piston is forced out (in the manner shown in Fig. 6 to the right hand), it is possible to code with such a device. In place of each letter depressed at the left hand pistons a certain other letter will appear under the slides of the right hand pistons (Fig. 6). Such coding can, however, easily be read. For this purpose, according to the proposal made above, the key is to be made capable of being repeatedly altered in a simple manner. With this object the intermediate part 64 is made displaceable. In Fig. 2 this part is shown as having been displaced by one division. The positions 2 3 4 5 6 7 8 9 on part 63 are now changed to 73 70 72 75 78 74 76 77 on part 65 as shown in Fig. 2. In a similar manner the coding key is altered by each further displacement of the intermediate part 64.

For the purpose of de-coding, the tubular paths in Fig. 1 need only be connected to the valves and pistons in such a manner that the two are exchanged the one for the other. The numeral 4 was for instance changed to the numeral 71. Taking the latter number and following the path in the reverse direc-

tion, the original numeral 4 is obtained. If the intermediate part was displaced, it must be moved in the same way for de-coding.

In order not to leave some of the tube paths unconnected, which is the case, for instance, in Fig. 2 with tubes 1 and 10, various methods may be adopted.

In Fig. 3 in 63 and 65 similarly marked tubes are connected together. The intermediate tube carrier 64 is the same and is in the same position as in Fig. 2. The tube 1 on 63 is connected with the tube 79 on 65 and the tube 10 on 63 with the tube 71 on 65 so that no tube is without a connection, even if the intermediate carrier be displaced still further to the right. If part 64 be assumed to have got to the end to the left, it must in the arrangement according to Fig. 3 be slid back again.

In Fig. 4 the parts 63, 64 and 65 are constructed as circular discs. With this arrangement the displacement may be continuous in one direction and on parts 63 and 65 there need only be the same number of tubes as on the intermediate tube carrier.

Instead of the tube system, as in Fig. 4, being constructed in the form of discs, it may be arranged, as in Fig. 5 on the mantle of a cylinder.

In order to increase the number of keys, preferably several intermediate carriers are fitted one behind the other, as is shown in Figs. 6 and 7. In this case two such intermediate tube carriers are fitted one behind the other. By displacing one or more intermediate tube carriers the key is changed. If on parts 63 and 65 there are, for instance, 10 tubes corresponding to the 10 numerals, with one intermediate carrier 10 key settings are possible, with two intermediate tube carriers there will be $10 \times 10 = 100$ and with three intermediate carriers $10^3 = 1000$ keys etc. Ten intermediate path carriers would give $10^{10} = 10{,}000$ millions key settings.

The construction indicated has a number of advantages, the combination of which results in an apparatus particularly suitable for coding. The most important advantage consists in a number of key settings being obtainable, that may be increased to any extent. The change-over apparatus is exceedingly simple, as there are no movable tubes and the change-over of all the tubes is effected in one movement.

It is particularly important for the changing over to be easily effected for the reason, that it is necessary, in order to make an undecipherable code, to change the key during coding very frequently, and preferably after each letter.

A very important advantage of the multiple-path change-over device resides in the fact, that, besides the enormous number of possible settings of the separate machines, there is such an enormous number of possibilities for the construction of each separate machine. Even if only machines with exactly the same operation of the multiple-path change-over devices were constructed, the enormous possibilities of variations, according to which the separate tubes may be connected in the intermediate path carriers, would provide an enormous variation. But even if in one machine a single path only differs from that of another machine, there is no possibility of an unauthorized decoding, even if all the keys are known. With path systems of 25 paths and 10 intermediate path systems, no fewer than about $2.10^{31} = 20$ quintillion machines of different construction may be built.

The initial position of the intermediate path carriers 66, 67 etc. is preferably made so that it may be set optionally. Hence with 10 intermediate carriers, each with 10 tubes, it is possible to choose from among 10,000 millions possibilities.

The arrangements described above of the carriers of the tube ends with one or more intermediate tube carriers includes the essence of the invention. It is however pointed out particularly, that the above arrangements are only to be regarded as examples. For instance, it is immaterial, as regards the nature of the invention, which substance flows in the tubes, whether it is air, water, oil, etc. The use of tubes is also not essential as regards the invention. In the end plates or the like and in the intermediate plates or the like it is only necessary for there to be conductors or paths of energy in the manner shown above. The paths of energy may for example be formed quite mechanically by steel wires running on pulleys, or by levers or by electrical conductors or by rays of light or by any other forms of energy, in which case the valves at 63 and the cylinders at 65 (Figs. 6 and 7) must, of course, be replaced by other releasing and indicating means corresponding to the form of energy employed.

Hence the paths of energy are not shown in Figs. 3 to 5 as tubes, but as simple lines, in order to indicate, that the paths of energy may be of any kind, the form of energy or the means of transmission of the energy and the construction of the paths of energy being quite immaterial. The substance of the invention is formed by the geometrical arrangement in space of the paths of energy and carriers of energy, as described.

The same applies to all the following arrangements which are given as examples.

In Figs. 6 and 7 a complete coding apparatus is shown. 63 and 65 are the end tube carriers (end path carriers), 66 and 67 the intermediate tube carriers (intermediate

path carriers). *d* are the transmitting cylinders and *e* the receiving cylinders. When, for instance, the transmitting cylinder *y* in Fig. 6 is depressed, the receiving cylinder *v* is pushed. To the receiving cylinders are fitted discs *f* having each a window *g*, which displays the corresponding letter. Between the transmitting and receiving cylinders there is also a change-over valve *h*, which has the purpose of effecting the following two tube connections: 1. The transmitting cylinders *d* are connected to the tube carrier 63 and the receiving cylinders *e* to the tube carrier 65, as shown in Fig. 6. 2. The transmitting cylinders *d* are connected to the tube carrier 65 and the receiving cylinders *e* to the tube carrier 63, as shown in Fig. 7. Thus Fig. 6 represents the coding and Fig. 7 the corresponding de-coding position. By following the connections it will be seen that, on depressing the transmitting cylinder *v* in Fig. 7, the letter *y* will appear at the receiving cylinder *e* in Fig. 7, in the reverse manner to Fig. 6.

Instead of using one single device for coding and decoding in the manner described, one device for coding and another device for decoding may be used, the change-over device *h* being dispensed with. Each of both devices is capable of serving as a decoding device for a message coded by the other device.

It is specially pointed out that it is immaterial as regards the nature of the invention, whether the transmitters and receivers bear letters or numerals. The arrangement might, for instance, be such that the transmitters bear letters and the receivers numerals. The tube or path carriers may be constructed with 10 tubes corresponding to the 10 numerals, or with 25 tubes corresponding to the 25 letters, or with 35 tubes corresponding to numerals plus letters or with 90 tubes corresponding to large plus small letters plus numerals plus punctuation signs plus spacing signs or with any other number of tubes. For special purposes both transmitters and receivers may be marked with syllables, words or short sentences. Caps may also be employed covering the movable parts of the transmitters or receivers for making it possible to use the same apparatus for instance both for the coding of letters and for the transposition of whole words. If electric lamps are used as receivers which light up when pushing the transmitters, a transparent covering sheet bearing numerals, letters or words, above the lamps may be used and this covering sheet may be changed for another covering sheet bearing other inscriptions.

The multiple valve described above or the multiple path controller for coding purposes or for the construction of a coding machine can be used both as regards its technical aspect and as regards its construction in various different ways.

Several constructional examples are given below.

In Figure 8, 63, 66, 67, 68, 69, 65 show a multiple valve *o* as described above. Leading-in tubes *i* and leading-out tubes *k* are connected to this multiple valve. There are 10 each, for instance, of the tubes *i* and *k*. In order that the drawing may be clear only one of each is shown. *l* is a vessel filled with compressed air. *m* is a valve, of which there are also ten, which admits air from the vessel *l* into the tube *i* by depressing the knob *n*. The air enters through the multiple valve *o* to any one of the ten cylinders *f* which thereby operates its type lever *p* (of these levers there are of course also ten) and strikes the corresponding letter on the paper roller *q*. In order that, on the next letter valve being depressed, the same key will not be set by the multiple controller *o*, all ten valves *m* act on the lever *r*, and the latter acts by means of the pawl *s* on the toothed wheel *t*. This wheel is fixed along with the toothed wheel *u* on the same shaft. The toothed wheel *u* engages with the toothed wheels 11 and 12, and the latter drive the shafts 19 and 13. On these latter shafts are fitted the wheels 14 and 15 and the wheels 20 and 21, respectively. The toothed wheels 11 and 12 have different numbers of teeth, so that the shafts 13 and 19 have a different number of revolutions. The wheels 14, 15, 20 and 21 are provided with drivers 16, 18, 17, 22 and 23 respectively. The number of teeth or drivers fitted to the wheels can be different for each wheel, and their distribution around the circumference can be arranged in any manner and can be different on the various wheels. Intermediate tube carriers 66 to 69 are rotatably fitted on one shaft and are provided with teeth 24. The intermediate tube carriers are displaced by means of the drivers. The mode of operation described has a number of advantages. In the first place, the de-coding by unauthorized persons is made much more difficult by the completely irregular method of drive. By the provision of two actuating shafts (13 and 19) having different numbers of revolutions the period after which the same setting again occurs is considerably lengthened, so that even in a long telegram the same key is not repeated. The wheels 14, 15, 20 and 21 are preferably mounted so as to be rotatable on their shafts (13 and 19). By this means the manner in which the intermediate tube carriers are displaced can be considerably varied. For de-coding correctly it is then necessary to know the relative setting of the driver wheels. By this means the number of adjustable keys may be increased to 100,000

times and the de-coding by unauthorized persons made correspondingly difficult. For setting the keys it is of course necessary to provide marks on the driver wheels 14, 15, 20 and 21 and on the intermediate tube carriers 66 to 69, which marks are not shown in Figure 8.

The drive shown in Fig. 8 is only given by way of example and can be effected in a totally different manner. Only the following is of importance for this kind of drive. It must be such that it can be varied in very many ways, and besides this the coding of as great a number of signs as possible is necessary in order to arrive at the initial setting, that is, at the same key.

In the apparatus shown in Fig. 9, the multiple valve described above is used technically for quite a different method of coding. In this case the separate letters are not replaced by others, but the letters remain as such and are only changed about as regards their sequence. The fundamental part of the invention, the multiple valve (the multiple-path controller) on the other hand does not change its form in any way and the displacement of this controller can be effected in a similar manner, as shown for instance in Fig. 8.

In Fig. 9, *o* (63, 66, 67, 68, 65) again represents the multiple valve. In this case the intermediate tube carriers 66 and 68 are rotated automatically, while 67 remains generally stationary and only serves for setting the key. On the receiver side six cylinders with pistons are shown at 25. When air is admitted through one of the tubes *k* into one of the cylinders 25, the mark 27 appears. On the transmitter side a single valve *m* is fitted, which receives air from the compressed air vessel *l*. By a depression of the knob *n* (compare the position shown) compressed air is supplied to the middle part 29 of the ring valve 28. On the knob *n* being released the spring 30 pulls by means of the pawl 31 and the ratchet wheel 32 the inner part 29 of the ring valve 28 forward by one division so that, on the knob *n* being again depressed the compressed air vessel *l* supplies air by way of valve *m*, conductor 34, and the valve channel 33 to that one of the tubes *i* which is the next on the periphery. The coding is carried out as follows: The knob is depressed, whereupon the compressed air follows the direction of the arrows. Should the plain script commence with the letter *r*, then this letter is written by hand as shown in the figure under the mark 27 on the paper 26 stretched in front of these marks. *n* is then depressed for the second time. The second letter of the plain script is then written below the mark now appearing, and so on until the first six letters fill the first row. On releasing the knob *n*, after these six letters have been written, the shaft 35 has revolved once completely. The driver 36 of the wheel 37 then engages the toothed wheel 38, and rotates the shaft 39, thus causing the driver wheels 40, the intermediate tube carrier 66 or 67, or both, to be rotated in any manner. This causes the complete change-over of the conections between the tubes *i* and *k*, so that when writing the next line and the 7th to the 12th letters, the arrangement of the letters is a totally different one to that in the first row. The second row is written accurately behind the first, and so on. 41 and 42 represent counting mechanisms. The counting mechanism 41 counts the number of coded letters. The counting mechanism 42 counts the number of coded lines. The counting mechanism serves a double purpose.

When it is desired to check, if one of the coded letters has been coded correctly after the coded matter is complete, the shaft 35 is rotated backwards until the number of the lines appears at 42 and the number of the letters in the second line at 41. The knob *n* is then depressed, and the position of the doubtful letter will be recognized in the code script.

The counting mechanism may also be used for setting a key, by first setting the key for 66, 67 and 68 and by a numeral being given which indicates, that, after the setting of the said keys, the shaft 39 must be rotated until the counting mechanism 41 indicates this numeral. This setting will then be the initial setting.

In Fig. 9 only 6 tubular conductors *i* and *k* are shown. Of course considerably more, for instance 20 or 40 tubular conductors, can be used, in which case the ring valve 28 must naturally have a corresponding number of connecting points 43, and the number of cylinders 25 must be correspondingly increased.

In Fig. 10 a further example of a coding machine is given, which from a technical point of view represents another new system, in so far as it shows a combination of the coding system of Figure 8 and that of Figure 9. By the machine according to Figure 10, on the one hand, the separate signs as such are interchanged, while the signs thus interchanged are also mixed up as regards their sequence in the text. These two functions are effected by the machine by a simple depression of a finger key. The machine prints the coded matter directly on paper as in a normal typewriter but without moving along the paper carriage. In Fig. 10, two separate multiple valves *o* and 44 are used. *o* serves for mixing up the sequence of the signs, and 44 for interchanging the signs. *m* are valves, each of which is provided with a sign. *q* is a roller carrying the paper, and 45 is a type-wheel bear-

ing the same number of types as there are valves *m*. The type-wheel is mounted on the shaft 47 in such a manner that it must rotate with this shaft, but that it can be displaced relatively to the shaft by means of the piston 46 against the spring 48. The shaft 47 is rotated by depressing the cross-bar 52 by means of the cord 50, and the cord pulley 51. In the cord 50, a spring 49 is inserted, the one end of which is fixed to the bearing 53 and causes the shaft 47 to rotate backwards when the pull on the cord 50 is released. The step-wheel 54 is keyed to the shaft 47. Near the step-wheel there are cylinders 56 with pistons, which have stops 57. On the step-wheel being rotated by means of the cord 50 it will strike against one of the stops 57, thus causing the shaft 47, and along with it, the type-wheel 45 to be rotated more or less. This causes one of the signs of the type-wheel to come into position opposite the roller *q*, when it can be printed on the paper. The paper roller *q* does not move along as in an ordinary typewriter, but is rotated only after all signs of a set, six in the present instance, are printed on the paper. During printing of one set, the paper roller remains stationary in order to prevent the different signs from being printed one upon the other on the same spot. Owing to the fact that the tooth wheel on the shaft 35 (Fig. 10) acting upon the tooth wheel at the right end of the shaft 39 has only one single tooth, rotation of the valves O takes place only when the whole set of six letters are printed. During this operation the valves O remain stationary. Since the connecting pins 43 of the ring valve 28 correspond in number to the number of letters of a set and are connected one by one in succession to the energy path 33, when any one of the transmitters is pushed, the position of the type-wheel 45 must vary during printing one line characters and two characters cannot be printed on one spot. When any one of the transmitters is acted upon, the cross bar 52 is depressed by one of the six extension pieces 59 and moves the pawl 31, which latter when returning, rotates the ring valve 28 one step. Thus, the ring valve 28 is rotated regardless of which one of the six transmitters is pushed or in what succession the transmitters are acted upon, each of the transmitters moving the cross bar 52 by its extension piece 59. Consequently, the longitudinal position of the type wheel will not remain the same, although the same transmitter is acted upon twice, because each of the connecting pins 43 is connected to one particular spot 58 by way of the multiple valves O, the latter being stationary for one set of characters. The cylinders 55 with stops 58 regulate the axial displacement of the type-wheel and thereby the sequence of the printed signs.

The coding of a letter is effected as follows: The knob *z* is depressed. This causes compressed air to flow from the vessel *l* by way of 44 to the cylinder 62. The piston rises and with it the stop 57. The cross-bar 52 is depressed by the extension piece 59. The valve 60 allows compressed air to pass into the ring controller 28, the air passes in the direction of the arrows to the cylinder 61, and raises the stop 58. The shaft 47 revolves, and at the same time by the opening of the valve 60 the piston 46 is displaced to the right and with it the type-wheel 45, only one of the steps of the stepped wheel 54 striking against the stop 57 and the type-wheel against the stop 58. The paper roller *q* is pressed by a cylinder, not shown, against the type-wheel, thus causing the coded letter to be impressed on the paper at a certain point. The multiple valves can be set in a similar manner as was described above in connection with Figs. 8 and 9. The paper can be advanced automatically after a line has been finished, whereupon writing can proceed without interruption. When the same machine has to de-code something coded by itself, two change-over valves according to Figure 6 must be provided, one for the multiple valve *o* and one for the multiple valve 44. The machine can, however, work with a correspondingly set machine without change-over valves, according to Fig. 10.

It has been particularly pointed out that the machines shown in Figures 8 to 10 are only examples, and that for obtaining the same result generally and in detail totally different means can be used. It may be mentioned in this connection that in Figure 10, in place of the type-wheel, type levers may of course be used, and that in place of the type-wheel, the paper roller can be axially displaced, or rotated, and that in carrying out the method the only important point is the relative movement between the place where the type is impressed and the paper.

The complication of the coding could be taken one step further, by at the same time displacing the type-wheel axially and rotating the paper roller by a similar method, whereby not only a mixing up of the separate signs within one line would be obtained, but also of one line with regard to another.

The advantage of the coding machine described, especially that according to Figs. 8 to 10, resides, besides in other points, in the enormous increase of the speed of coding as compared with hand-written methods. When telegraphing texts in code this time can be considerably reduced by building the coding apparatus into the transmitting and receiving apparatus of the telegraphic apparatus with or without wires. At the transmitting station this may be done in a

most simple manner by substituting for the type levers (*p* Figure 8) perforated rods which bear the finished Morse perforations for a certain Morse sign. When in this case any letter is depressed, the Morse sign of another letter will appear in the paper strip to be perforated. At the receiving station the writing can be normally decoded with an ordinary coding apparatus according to Figure 8, but the de-coding can also in this case be done automatically by building in a correspondingly set apparatus in the receiving apparatus.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A coding and decoding machine comprising in combination a transmitter and a receiver, an energy transmission path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter, and having transfer places for the energy at the other side arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides, arranged in a circle of the same radius as with the fixed disc, the transfer places on one side being in contact with the transfer places of the fixed disc, irregular inter-connections for the energy, connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a fixed disc at the other side of the rotatable discs, having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, and means for rotating the rotatable discs successively.

2. A coding and decoding machine comprising in combination a transmitter and a receiver, an energy transmission path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter and having transfer places for the energy at the other side, arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides, arranged in a circle of the same radius as with the fixed disc, the transfer places on one side being in contact with the transfer places of the fixed disc, irregular interconnections for the energy, connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a fixed disc at the other side of the rotatable discs having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, a source of energy, means for rotating the rotatable discs successively, a change-over valve changing the direction of the entrance and exit of the energy into the fixed and rotatable discs.

3. A coding and decoding machine comprising in combination a transmitter and a receiver, an energy transmission path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter, and having transfer places for the energy at the other side arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides, arranged in a circle of the same radius as with the fixed disc, the transfer places on one side, being in contact with the transfer places of the fixed disc, irregular interconnections for the energy connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a fixed disc at the other side of the rotatable discs having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, a source of energy, a printing mechanism associated with the receiver and a support for the printing sheet.

4. A coding and decoding machine comprising in combination, a transmitter and a receiver, an energy transmission path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter, and having transfer places for the energy at the other side arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides arranged in a circle of the same radius as with the fixed disc, the transfer places on one side being in contact with the transfer places of the fixed disc, irregular interconnections for the energy connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a fixed disc at the other side of the rotatable discs, having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, a source of energy, means for rotating each rotatable disc in an irregular manner and independent from each other, and a printing mechanism associated with the receiver.

5. A coding and decoding machine comprising in combination, a transmitter and a receiver, an energy transmission path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter, and having transfer places for the energy at the other side arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides, arranged in a circle of the same radius as with the fixed disc, the transfer places on one side, being in contact with the transfer places of the fixed disc, irregular interconnections for the energy connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a

fixed disc at the other side of the rotatable discs having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, means for rotating the rotatable discs connected to the transmitter, shafts rotated by these means when the transmitter is acted upon, wheels with irregular single teeth on said shafts, tooth wheels fixed to the rotatable discs and meshing with the single teeth of said wheels, and a printing mechanism associated with the receiver.

6. A coding and decoding machine comprising in combination a transmitter and a receiver, an energy transmision path between the transmitter and the receiver, fixed discs on one side taking up the energy paths from the transmitter and having transfer places for the energy at the other side arranged in a circle, rotatable discs adjacent to the fixed discs having transfer places for the energy on both sides, arranged in a circle of the same radius as with the fixed discs, the transfer places on one side being in contact with the transfer places of the fixed disc, irregular interconnections for the energy connecting the transfer places of the two sides of the rotatable discs in the interior of the same, a fixed disc at the other side of the rotatable discs, having transfer places in contact with the transfer places of the last rotatable disc and leading the energy to the receiver, means for rotating the rotatable discs connected to the transmitter, shafts rotated by these means when the transmitter is acted upon, wheels with irregular single teeth on said shafts, tooth wheels fixed to the rotatable discs and meshing with the single teeth of said wheels, a source of energy, a ring valve interposed between the set of fixed and rotatable discs and the transmitter, means for rotating said ring valve at each actuation of the transmitter, counting devices indicating the number of coded signs and lines, and a printing mechanism associated with the receiver.

7. In combination, a set of transmitters, a source of energy, a set of fixed and rotatable discs, the latter having irregular interconnections, means for rotating the rotatable discs in an irregular manner, energy paths between the transmitters and the set of discs, a set of stop mechanisms each connected with the set of discs, a shaft carried type wheel shiftable in its longitudinal direction and adapted to be stopped during shifting by said stop mechanisms, a stop wheel keyed on the shaft, abutments on said stop wheel, a coiled spring acting upon the shaft, a cord pulley on the shaft, a cross bar connected with the cord pulley and adapted to be displaced at each actuation of a transmitter, a ring controlling valve controlled by the cross bar, a second set of fixed and rotatable discs, a second set of stops connected with the second set of discs limiting the rotation of the type wheel shaft and a paper roller.

8. In combination, a set of transmitters, a source of energy, a set of fixed and rotatable discs, the latter having irregular interconnections, means for rotating the rotatable discs in an irregular manner, energy paths between the transmitters and the set of discs, a set of stop mechanisms each connected with the set of discs, a shaft with a type wheel shiftable in its longitudinal direction and adapted to be stopped during shifting by said stop mechanism, a stop wheel keyed on the shaft having abutments, a coiled spring acting upon the shaft, a cord pulley on the shaft, a cross bar adapted to be displaced in response to each actuation of a transmitter, resilient connection means between the cord pulley and the cross bar, a valve for the energy controlled by the crossbar, a ring controlling valve governed by the crossbar, a second set of fixed and rotatable discs, a second set of stops connected with the second set of discs limiting the rotation of the type wheel shaft, and a paper roller.

9. In combination, a single transmitter, a source of energy, a set of fixed and rotatable discs, the latter having irregular interconnections, means for rotating the rotatable disc in an irregular manner after one set of characters is printed, energy paths between the transmitter and the set of discs, a ring valve rotated at each actuation of the transmitter, receivers connected to the last fixed disc, and an indicating device.

10. In combination, a set of transmitters, fixed discs having electrical contacts arranged in a circle, each contact being connected with one of the transmitters by means of wires, a similar fixed disc electrically connected with a set of receivers, rotatable discs between the said fixed discs, contact places on both sides arranged in a circle on the rotatable discs, irregular interconnecting wires in the interior of the rotatable discs, the contact places of the fixed discs and of the rotatable discs being in contact with each other, means for irregularly rotating the rotatable discs, a source of electricity, electrical wires connecting all members, and means connected with the receivers for indicating the coded signs.

11. In combination, a set of transmitters, a source of electrical energy, a set of fixed and rotatable discs, the latter having irregular interconnecting wires between contact places on either side, shafts carrying toothed wheels with irregular teeth for rotating the rotatable discs in irregular time, a set of electromagnetical stop mechanisms being connected to a contact place of the

last fixed disc by separate wires, a shaft with a type wheel shiftable in its longitudinal direction and able to be stopped during shifting by said stop mechanism, a stop wheel with abutments keyed on the shaft, a cord pulley on the shaft, a cross bar connected with the cord pulley and adapted to be displaced at each actuation of a transmitter, an electrical ring valve governed by the named cross bar, another set of fixed and rotatable discs, another set of electromagnetical stop mechanisms, each being connected to one of the contact places of the last fixed discs for limiting the rotation of the type wheel shaft and a paper roller.

In testimony whereof I affix my signature.

HUGO ALEXANDER KOCH.