R. GUZMÁN M.

CRYPTOGRAPHIC METHOD AND APPARATUS.

APPLICATION FILED NOV. 7, 1917.

1,285,567.

Patented Nov. 19, 1918.

3 SHEETS—SHEET 1.

FIG. 1.

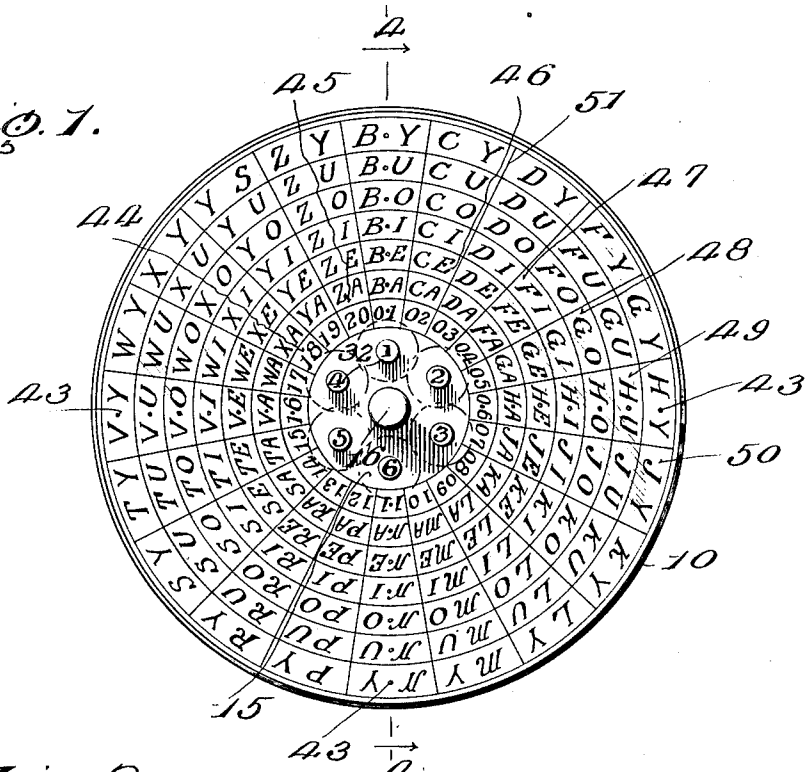
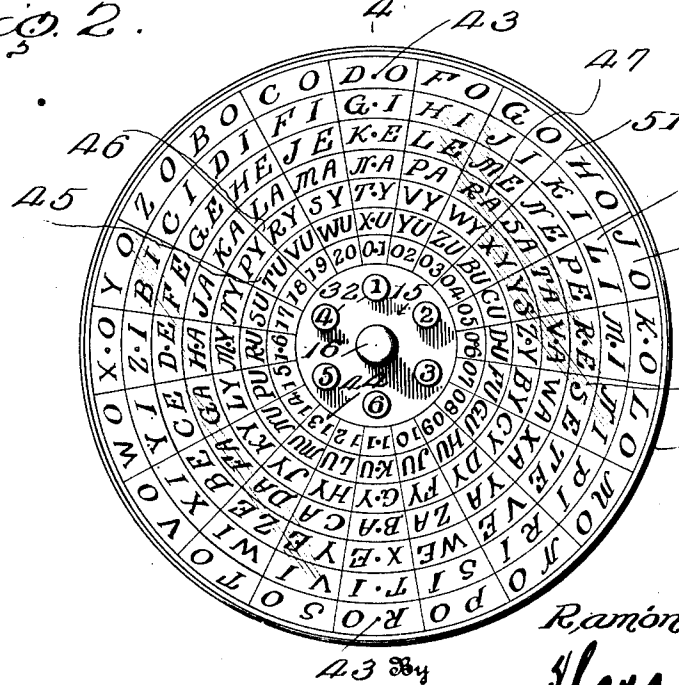


FIG. 2.



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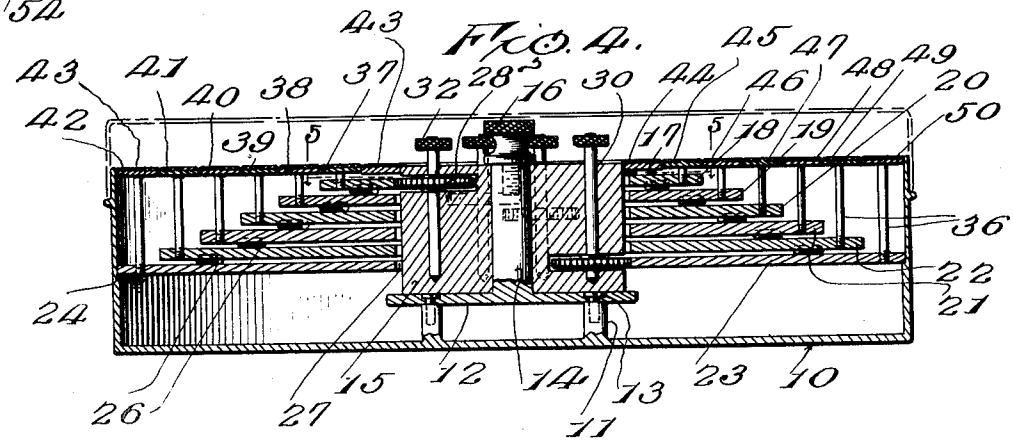
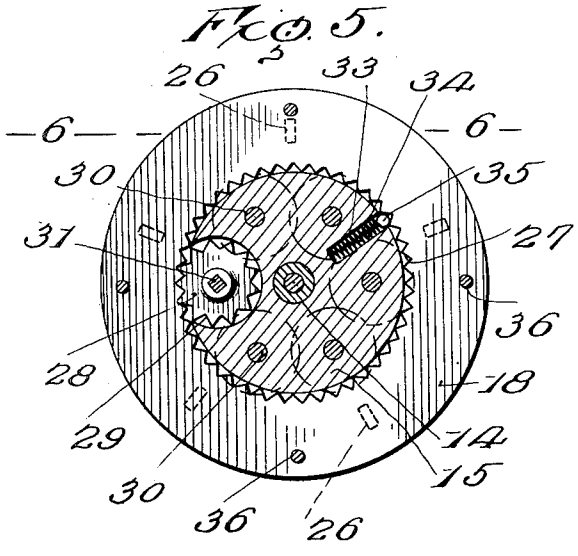
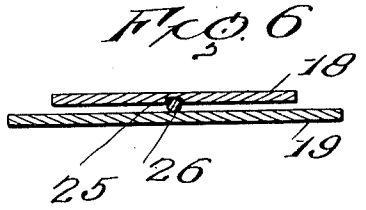
3 SHEETS—SHEET 2.

FIG. 3.

Bases.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
1st Disk.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
2nd Disk.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
3rd Disk.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
4th Disk.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
5th Disk.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
6th Disk.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	0	00	000







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3 SHEETS—SHEET 3.

FIG. 7.

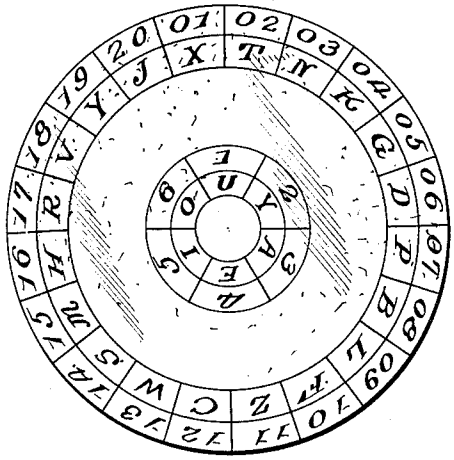


FIG. 8.

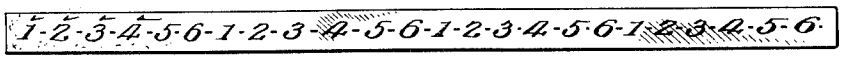


FIG. 9.

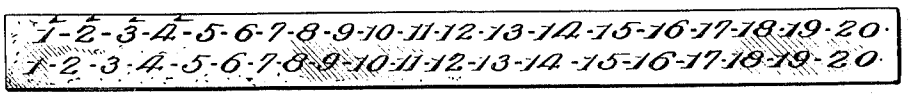
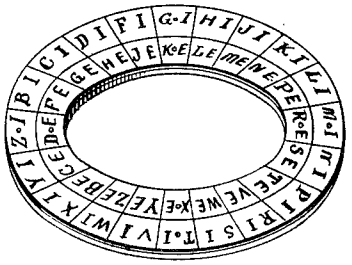


FIG. 10.



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UNITED STATES PATENT OFFICE.

RAMÓN GUZMÁN M, OF TEGUCIGALPA, VIA PUERTO CORTES, HONDURAS.

CRYPTOGRAPHIC METHOD AND APPARATUS.

1,285,567. Specification of Letters Patent. Patented Nov. 19, 1918.

Application filed November 7, 1917. Serial No. 200,816.

To all whom it may concern:

Be it known that I, RAMÓN GUZMÁN M, a citizen of Honduras, Central America, residing at Tegucigalpa, via Puerto Cortes, Honduras, have invented certain new and useful Improvements in Cryptographic Methods and Apparatus, of which the following is a specification.

My invention relates to new and useful improvements in cryptograms, cryptographic apparatus for coding and de-coding purposes in connection with cryptograms and a method of coding and de-coding messages by use of the apparatus, and has for its primary object the provision of a cryptographic apparatus which may be employed in connection with a single table and by which messages may be coded and de-coded in practically an infinite number of ways each of which can be known only to those familiar with the order or sequence of the particular message with respect to previous messages and also familiar with a predetermined plan of employment of the apparatus.

At the present time many messages, if not of a secret nature, are sent by any one of a number of well-known code systems such as the A. B. C. code, in which a complete phrase or sentence is expressed by a number, usually of several digits, five digit numbers being most commonly employed, and the numbers seldom if ever containing more than five digits, as a number of five digits is as large as the telegraph and cable companies will accept as a single word. At the same time the telegraph and cable companies will accept as a single word a coined or non-dictionary word having any number of letters up to and including ten providing the word is made up of readily pronounceable syllables.

One of the chief objects of my present invention consists in providing an apparatus and method for transposing the numerical words, of any desired code, into alphabetical words and in transmitting the alphabetical words so constructed by wire or cable as the message.

In this connection a further object of my invention resides in accomplishing this in such a manner that only approximately half as many alphabetical words are required as numerical words for conveying the same message.

Obviously in the transmission of either numerical or alphabetical words mistakes are apt to occur, and another object which I have in view is the provision of a check upon the message, as regards its accuracy, the check being such that it will not materially lengthen the message.

Another object of my invention consists in providing an apparatus having a plurality of relatively movable annular charts in which all of the charts are divided into the same number of divisions and in which the divisions of one chart are inscribed with numbers, preferably arranged in sequence for the sake of convenience and in which all of the other charts are inscribed with some two-lettered syllable always beginning with a consonant and ending with a vowel.

A further object of my invention consists in providing in connection with this apparatus a chart which may be considered as a coordinate chart, in which the chart is divided into a plurality of series of alined divisions containing numbers in chronological order and in which the ordinate for the various divisions, reading one way of the chart, is a number and in which the ordinate of the same division reading the chart at right angles to the first direction corresponds to one of the disks previously mentioned. In this connection each of the disks is preferably given a distinctive color and the corresponding series of scale divisions is given the same color in order that reference between the two may be readily had.

A further object of my invention consists in making the annular charts of the mechanical apparatus removable so that one series of charts may be readily removed and replaced by another to further increase the different cryptograms which may be employed.

With these and other objects in view, my invention will be more fully described, illustrated in the accompanying drawings and then specifically pointed out in the claims which form a part of this application.

In the drawings:

Figure 1 is a plan view of the annular chart supporting member, showing one set of charts in place and in normal position;

Fig. 2 is a similar view showing the charts set to code or de-code a message under certain specific circumstances;

Fig. 3 is a plan view of a chart adapted to be employed in connection with the above apparatus;

Fig. 4 is a diametric vertical sectional

view taken through the chart ring carrying apparatus, the cover of the apparatus, not shown in Figs. 1 and 2, being here shown in dotted lines;

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a diagram representing the order of vowels and consonants to be employed in setting the apparatus for coding and de-coding successive messages between the same parties;

Figs. 8 and 9 show tables which may be employed by the correspondents in keeping check upon the number of messages received and the successive orders of vowels and consonants which have been employed upon the apparatus in coding and de-coding them;

Fig. 10 is a view showing two additional dial rings of a different set from those shown in Figs. 1 and 2.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

In order to insure a clear understanding of my invention I will first explain the apparatus and various charts employed and will then give an example of the method in which they are employed.

Referring more particularly to Figs. 4 to 6 of the drawings the apparatus includes a substantially shallow cylindrical casing 10 formed interiorly with upstanding supporting studs 11 upon which rests a table 12 which is secured to the studs by screws 13, being disposed centrally of the casing and formed with an upwardly directed central shaft 14 the top of which terminates at substantially the level of the upper edge of the peripheral wall of the casing. Fitting closely around this shaft and resting upon the table 12 is a fixed hub 15 which may be secured against turning about the shaft in any suitable manner and which is held against upward displacement by a thumb screw 16 threaded into the upper end of the shaft. Mounted about this fixed hub are a plurality of disks 17, 18, 19, 20, 21, 22 and 23 gradually increasing in diameter from the uppermost which is the smallest, to the last or lowest disk 23 which at its edge is supported by an annular shoulder 24 formed in the peripheral wall of the casing. The smallest disk 17 is practically a relatively narrow ring and is fixed to the hub in any suitable manner to remain stationary, while the remaining disks are free for turning movement about the hub. Each of the remaining disks, save the bottom disk 23, is formed in its lower face with recesses 25 to receive roller bearings 26 which extend radially with respect to the disks and which engage the upper faces of the next lower disk so that one disk may turn freely upon another.

Each of the rotatable disks 18 to 23 is formed with an internal gear 27, one of which is clearly shown in Fig. 5, and meshing with each of these internal gears is a pinion 28. These pinions are disposed in recesses 29 formed in the peripheral face of the hub at the proper levels for the various disks and these recesses are spaced about the hub so that no pinion will over-lie another. Shafts 30 are journaled in the hub and have squared portions 31 engaging one in the hub of each pinion. At their outer ends these shafts project above the hub and are squared to receive turn-buttons 32 by means of which the shafts may be independently rotated in either direction to act through their pinions to independently and selectively revolve the various disks, with the exception of the upper or smallest disk 17. As shown in Figs. 1 and 2 the upper face of each turnbutton 32 is inscribed with a number corresponding to the location of the disk which it controls, the fixed disk not being considered and the others being numbered from the innermost to the outermost, the disks 18 to 23 inclusive being numbered one to six respectively. At suitable levels the hub is also formed with radial bores 33 receiving light helical springs 34 which engage against circular detents 39 to hold such detents one in engagement with each of the internal gears of the rotatable disks. By this means a frictional lock is provided which will hold a disk against turning through friction between it and another disk being positively turned so that all likelihood of any undesired shifting of the disks is avoided.

A plurality of studs or pins 36 are threaded or otherwise secured in the exposed peripheral portions of the several disks 18 to 23 inclusive, being spaced at suitable circumferential intervals and fixed to the upper ends of these studs or pins are rings 37, 38, 39, 40, 41 and 42 which are thus supported in concentric relation with respect to each other, these rings being so proportioned that their edges will substantially engage against each other and the pins being so proportioned that the upper surfaces of all of the rings and the upper surfaces of the disk 17 lie in a common plane. The disk or ring 17 and all of the rings 38 to 42 inclusive are provided at spaced peripheral intervals with short upwardly directed pins or prongs 43 which serve as a means for retaining chart rings 44, 45, 46, 47, 48, 49 and 50, the chart rings 44 to 50 inclusive corresponding to the disks 17 to 23 respectively. Obviously by this arrangement any chart ring will be turned when its corresponding disk is turned while at the same time any chart ring, which as will be later explained has certain in-

scriptions or lettering, may be readily removed or replaced by a differently inscribed or lettered chart ring. At this point it should be noted that the chart rings are preferably colored and that each ring has a distinctive color as regards the remaining rings.

All of the chart rings upon their upper faces are inscribed with radial division lines 51 so that each chart ring is divided into twenty equal divisions or sections, the division lines being so arranged that the lines of the various rings may be brought into alinement with each other to bring the sections or divisions into alinement, as clearly shown in Figs. 1 and 2. The inner or fixed chart ring has its divisions consecutively numbered from 01 to 20, while the remaining or revolving chart rings which will be considered as numbered from one to six inclusive have each division inscribed with some two-letter syllable, each syllable in every instance beginning with a consonant and ending with a vowel, Y being employed both as a consonant and as a vowel. The first or inner lettered chart disk 45 has its divisions consecutively inscribed with the consonants from B to Z inclusive, with the exception of the consonant Q, Y being provided in the nineteenth division as a consonant. In each of these divisions the consonant is followed by the same vowel which in the chart ring shown in Fig. 1 is the vowel A and in the chart ring shown in Fig. 2 is the vowel U. In like manner each chart ring has its distinguishing vowel in all its various divisions preceded by the same consonants employed in the same order as on the first chart ring. As shown in Fig. 1 the order of vowels for the successive chart rings beginning with the first or inner and ending with the sixth or outer is A E I O U Y, while in Fig. 2 showing a different set of the chart rings the order of vowels from the first to the sixth chart rings is U Y A E I O, although in all instances the same alphabetical order of consonants has been followed. The only exception to this rule of inscribing the letters upon the charts, is that wherever due to the use of Y both as a vowel and as a consonant the two would come together in a chart division an arbitrarily selected consonant such as S will be substituted for the second Y in order to make a pronounceable syllable. Obviously, the reason for employing six chart rings in connection with the first numbered ring is due to the fact that there are six vowels and as many rings as there are vowels should be employed.

Upon an examination of the two series of chart rings shown in Figs. 1 and 2 it will be obvious that six complete sets of lettered chart rings may be employed without changing the order of vowels from their regular alphabetical order by merely having the inner chart ring inscribed with the six different vowels. Obviously, if all possible changes in the order and arrangement of the vowels upon the six chart rings was carried out 720 different sets of chart rings could be provided, but as a rule only the six main sets will be employed as the facility with which the apparatus may be used is greatly increased if the vowels are arranged in familiar alphabetical order. In like manner an infinite number of additional series of chart rings could be provided by arranging the successive order of the consonants in different ways, but this will not ordinarily be done due to the added facility with which the apparatus may be employed with the consonants arranged in alphabetical series for, as will be later apparent, an almost infinite number of cryptographic codes with only the six sets of charts will be provided by means of varying the order of their use through prearrangement between the correspondents. It should be noted that every group or syllable of two letters in the various divisions, always being made up of a consonant followed by a vowel is readily pronounceable so that words formed by combining a number of such syllables will be pronounceable and, therefore, acceptable by telegraph and cable companies.

Coöperating with the above described apparatus and employed in connection therewith is a chart 52 shown in Fig. 3. This chart may be printed upon paper, celluloid or other suitable material, such as may also be employed for the chart rings previously described and is in the form of a table having vertical and transverse columns with divisions 53 above the vertical columns and divisions 54 at the left of the horizontal columns inscribed with ordinates which used in conjunction with each other will give the location of any table division both by its vertical and its horizontal column. The divisions 53 are successively inscribed with the ordinate numbers from 01 to 20 corresponding to the numbers in the fixed chart ring 44 of the apparatus previously described. The divisions at the left of the table are successively inscribed from the upper to the lower division as the first, second, third, fourth, fifth and sixth rings. The divisions of the chart table itself are inscribed in numbers ranging from 01 to 117, the order of numbering being from left to right in the first horizontal column and from left to right in succeeding horizontal columns. This numbering leaves three spaces at the lower right hand corner of the table which are inscribed with the numerals 0, 00, 000. Each horizontal column of this table is distinctively colored in correspondence with its chart ring of the apparatus previously described. For instance, if the first and second chart rings

of the apparatus are colored blue and red the first and second horizontal columns of the table will be colored blue and red respectively. It will, therefore, be apparent that at a glance correspondent may determine from any column in the table just which chart ring is to be consulted or from any chart ring just which horizontal column of the table is to be consulted. This feature will be more clearly brought out in describing the use of the apparatus.

In order to describe the operation of the method of employing the foregoing apparatus both for preparing messages to be sent and for de-coding messages received I will give a sample message and trace through the successive steps gone through by both the correspondents sending the message and the one receiving it. In doing this I will assume that through a prearranged plan the apparatus is to be employed with the chart rings inscribed and relatively arranged as shown in Fig. 2, in which the order of the vowels from the inner to the outer ring is U Y A E I O and in which the order of the consonants from the inner to the outer ring opposite the numeral 01 of the fixed ring is X T N K G D.

Under these circumstances the correspondent sending the message will consult any predetermined code book, such as the A. B. C. code book and will first write his message in this code as a series of numbers or numerical words in the usual manner and as follows:

60,341—19,652—41,806—10,633—90,185—9,300—17,872—101.

These eight numbers taken from the code, of course, represent eight complete phrases or sentences constituting the message which the correspondent wishes to transmit and the correspondent will, therefore, proceed to transpose these numbers into letters which may be grouped into words of ten letters, each taking care during the operation that the successive syllables formed be readily pronounceable, in other words, making sure that any consonants employed without connection with a vowel shall occur either as the third or last letter in the group of letters obtained by coding each number. Correspondent by referring to the table shown in Fig. 3, will find that there is no single number in the table greater than 117 and will, therefore, take 60, being the first two figures of the first number as the group to be first coded and will find 60 in the table. As there shown the number 60 occurs in the vertical column numbered 20, and in the horizontal column corresponding to the third ring of the apparatus shown in Fig. 2 correspondent will therefore find the division of the fixed disk numbered 20 and the corresponding radial division of the third chart ring and will there find the letters M A. Knowing that the number 341 constituting the remainder of the numeral is not contained as a whole in the table, correspondent will next locate the number 34 in the table and will find that it corresponds to the fourteenth division of the second ring which consulting the apparatus of Fig. 2 will give the letters K Y. The remaining digit of the number being coded, which is 1, will be found from the table to be in the first division of the first disk in which the letters XU occur. Inasmuch, however, as the division of the disk is less than ten, and the particular disk is, the first correspondent will disregard the vowel and merely accept the letter X which will give the letters MAKYX as representing the number 60,341. The dropping of this vowel indicates that the remaining letter represents the one digit member and the vowel may be safely dropped as the remaining consonant comes at the end of a five-letter word so that the word is readily pronounceable.

In like manner the correspondent will separate the number 19,652 as 19—65—2 and by locating these numbers in the table and referring to the lettered charts will find the corresponding syllables VU—PE—Y. As each of the words thus far found is readily pronounceable and has but five letters the two may be combined to form a single non-dictionary word which will be accepted as a single word by telegraph and cable companies.

As the correspondent proceeds with this coding he will preferably tabulate the results throughout the entire message as follows:

60—MA 34—KY 1—X		
95		
19—VU 65—PE 2—Y		
	MAKYXVUPEY	
86		
41—NA 80—JE 6—D		
127		
106—KO 33—JY		
139		
90—SI		
18—TU 5—C	NAJEDKOJYS	
113		
93—WI 00—BO		
93		
	ITUCWIBOSU	
17—SU 87—NI 2—Y		
106		
00—BO 101—DO		
	NIYBODOGMA	
101		
860		

Referring to this table it will be noted that the subdivided numbers 60—34 and 1 of the first number 60,341 when added give the number 95 which constitutes, as will be later explained the test number for the particu-

lar phrase or sentence represented by the number taken from the code book and which is as a consequence written conveniently near the coded word representing such number.

Correspondent having thus coded the first two numbers will divide the third number into the portions 41—80 and 6 and code them as MA—JE and D respectively in the manner previously described. He will then divide the number of 10,633 into two numbers 106 and 33 and find the letters KO and JY respectively, following the rule to always accept the largest number which can be found in the table and consequently dividing the number as 106 and 33 rather than as 10—63 and 3. This also possesses the added advantage that only four letters in this particular case are required to represent the number, where if divided in any other manner possible within the limits of the table, six letters would be required. Correspondent then proceeds to code the number 90,185 by dividing it as 90—18 and 5 and determining the proper letters from the combined use of the table and code rings as SI—TU—C respectively. When correspondent has reached this point he will find that the third number coded, namely, 41,806 required five letters, that the next number coded required four and that these four letters may be combined with the five preceding and with the next following letter obtained by coding the number 90,185 to give the second code word of ten letters in the message.

The number 9,300 is then coded as 93—00 and in letters as WI—BO; 17,872 is coded as 17—87—2 or in letters as SU—NI—Y and the last number 101 is coded as 00—101 or in letters as BO—DO. The insertion of the two O's before this number, of course, does not change its value as a code number and at the same time indicates that the resultant number 101 is not to be combined with any further numerals which may follow as a check upon the message, as will be soon explained.

As each number is transformed to lettered code the sum of the numbers into which such number was divided is placed at a suitable point as described with the first number coded, these sums for the different numbers coded being preferably disposed one below the other so that they may be readily added In the present instance the sum thus obtained is 860 and this number is coded as 8–60 or in letters as GMA. In forming the second transmittable code word of ten letters, as previously described, the S of the SI obtained from coding the number 90,185 was employed, the third transmittable code word of ten syllables will consequently start with the I and be as follows: ITUCWIBOSU. The remainder of the message proper therefore contains only the letters NIYBODO, seven in all to which may be added in forming the third word the letters GMA which constitute the test for the entire message. It will, therefore, be seen that correspondent has transformed eight code numbers, each of which if sent in numerical form would constitute a separate word, into four code words in alphabetical form, the last of which also includes a test for the entire message. These words are, therefore, transmitted over the wire or cable to the second correspondent who proceeds to de-code the message as follows. Upon receipt of the message correspondent will write it as follows:

MAKYXVUPEYNAJEDKOJYSITUC
WIBOSUNIYBODOGMA.

He will then divide this message as follows, taking care that no syllable contains over two letters and that all two-lettered syllables consist of a consonant followed by a vowel, always considering that when the letter Y immediately follows a vowel it be considered as a consonant, while when it follows directly after a consonant it be considered as a vowel:

MA—KY—X—VU—PE—Y—N A—J E—
D—KO—JY—SI—TU—C—W I—B O—
SU—NI—Y—BO—DO—G—MA.

The receiving correspondent knowing by prearranged plan the particular series of chart rings employed by the sender and their relative arrangement will set a corresponding series of chart rings in the same manner and will then proceed to de-code the syllables into numbers. For instance, the first syllable MA will be found in the twentieth division of the third chart ring and correspondent will therefore consult the table division beneath the ordinate 20 and in line with the third ring ordinate and find the number 60. In like manner KY will be found in the fourteenth division of the second ring and its corresponding number will be found in the fourteenth and second column of the table as 34. X, combined with the vowel U will be found in the first division of the first ring and reference to the table will locate it as 1. At this point it should be noted that in some instances any one of the numerals 1 to 9 will be of necessity transmitted, while in some instances any one of the two digit numbers 01 to 09 will of necessity be transmitted. This is the primary reason for omitting the vowel normally occurring with the consonant for numbers from 1 to 9, it being understood that two digit numbers from 01 to 09, when coded will not drop the vowel. Having found the numbers 60—31 and 1 and knowing that the code book employed does not use numbers of over five places correspondent

will group them to provide the code number 60,341. Correspondent will then proceed in the same manner to de-code the remaining syllables, tabulating the results as follows, placing the test numbers conveniently below each other as shown:

MA— 60 KY— 34 X— 1 VU— 19	95	60,341.	The sentence found in code book.
PE— 65 Y— 2 NA— 41 JE— 80	86	19,652.	" "
D— 6 KO—106	127	41,806.	" "
JY— 33 SI— 90 TU— 18	139	10,633.	" "
C— 5 WI— 93	113	90,185.	" "
BO— 00 SU— 17 NI— 87	93	9,300.	" "
Y— 2 BO— 00	106 00	17,872.	" "
DO—101	101	101.	" "
	860		
G— 8 MA— 60		860.	

The letters G—MA de-coded give the final number 860 which is obviously the test number for the entire message. The remaining test numbers for the various numerals de-coded are then added and if the result is 860 the message is known to be correct. Of course, after tabulating the de-coded message the resultant numbers are found in the proper code book, determined by prearranged plan between the correspondents, and the phrases or sentences are preferably written in place upon the table as indicated.

After the entire message has been de-coded and the test numbers thus added if the sum of the test numbers does not correspond with the number obtained by de-coding the letters representing the test number the receiver of the message will understand that some error has been made in its transmittal. This will usually also be apparent by the fact that one or more of the phrases or sentences will be obviously incorrect when considered in conjunction with the remainder of the message as it will in all likelihood be incongruous to the subject-matter of the message as a whole.

As an example we may assume that in the message above received the first five letters of the message appeared as MAZEX which de-coded would give the numbers 60—40 and 1 or the code book number 60,401. This number would be obviously incorrect as the sentence which it represents in the code book would not be appropriate with the rest of the de-coded message. The test number for this message would, however, be 101 and the sum of all the test numbers of the message would as a result be 866 which is six more than given in the message. The correspondent would, therefore subtract 6 from the 60, assuming that the error might be in the first two letters and obtain the number 54,341 and find this number in the code book. Finding that the sentence corresponding to this number was not such a sentence as would be expected he would then subtract the 6 from the 40 finding the number 60,341 which when looked up in the code book would give the correct sentence. Of course, if the error happened to be in the third number 1 the operation would be continued as above described. If two sentences were found to be incorrect and the test number was correct the person receiving the message would, of course, know that two errors had been made, one of which for test purposes offset the other and would attempt to correct the error by successively adding and subtracting numbers ranging from 1 up from each number of one of the incorrect code numbers until the correct number was obtained when he would add or subtract the same number, as the case might be, to the number divisions of the other incorrect number until the proper second number was found.

If the test number is incorrect and several code numbers are found to be incorrect it may, in some instances, be almost impossible to properly correct the code numbers by the above described methods but oftentimes the correspondent may happen upon the right numbers by following the above method, always keeping in mind the fact that the differences between the correct test number and that found by adding the test numbers of the different code numbers may be the sum of the errors or the differences between them. However, this method provides a certain means of determining a single error in a code message and it is seldom that more than one error will occur and in any event it is sure indication to the person receiving the message of whether the message is correct or incorrect.

As will be readily appreciated any interpreting of an intercepted message coded according to my system is practically impossible even though the person attempting it is familiar with the code book in which the numbers obtained by translating the code are to be found. Of course, however, a private or secret code may be employed and the numbers taken from such a code and transmitted as letters under my system.

Of course, there should be certain prearranged plans between the corresponding parties in all cases as to the use of the apparatus for coding and de-coding messages and these plans may be of such a character that even though a number of the messages or even a number of de-coded messages are surreptitiously obtained it would be impossible, reasoning from them to de-code further messages which might be intercepted.

For instance, referring to the diagram in

Fig. 7 showing one relative arrangement of the numerals and of the consonants employed as regards the numbers of the divisions two correspondents may have it understood between them the first message sent will be coded with the apparatus arranged as shown in Fig. 2 in which the first ring will have its divisions occupied by a consonant followed by the vowel U and in which the order of the vowels in the successive outer rings will be YAEIO and in which the order of consonants in the same rings will be XTNKGD. The understanding may then be that the second message will have a different set of chart rings in which the vowel of the first or inner ring will be Y, the vowels of the succeeding outer rings being arranged in the order of AEIOU and that the arrangement of the consonants from the inner to the outer ring will be TNKGDX. In other words, the correspondents may understand that in successive messages the next vowel in order to the last will be employed and that the order of the consonants will advance one division upon the diagram or table with each message. Inasmuch as there are six vowels and twenty consonants it will be apparent that when it becomes necessary to repeat any vowel such as the first, the order of the consonants will be entirely different from what it was when the vowel was first employed. Because of this any attempt to deduce the manner of setting the apparatus for de-coding any particular message by reasoning from other messages obtained or de-coded will be impossible. If the correspondents desire they may keep charts, as indicated in Figs. 8 and 9, checking off the order of vowels and consonants as they have been employed so that there may be no likelihood of their forgetting the manner in which the apparatus should be set for coding or de-coding the next message.

Although the above method of varying the order of vowels and consonants by the employment of successive sets of chart rings arranged in different relative positions is simple and one which will be commonly employed, the correspondents may, of course, make any desired plans as regards the order of use of the sets of chart rings and the manner of arranging them, merely being sure that both correspondents fully understand the system to be employed.

In Fig. 10 I have illustrated two chart rings of yet a third set showing them removed from the remainder of the apparatus. In these rings, which are the two inner lettered rings, the inner vowel is E and the vowel of the second ring is I and it will be appreciated from the previous description that the consequent arrangement of vowels would be EIOUYA when employing this entire set of chart rings.

Having thus described the invention, what is claimed as new is:

1. In an apparatus of the character specified a plurality of supporting rings concentrically disposed with the inner ring fixed and the remainder mounted for turning movement, means for selectively and independently turning the latter rings, and a plurality of chart rings detachably engaged upon the supporting rings, all of the chart rings being provided with corresponding radial divisions, successively increasing numbers inscribed in the divisions of the fixed ring, and two-letter syllables inscribed in the divisions of the remaining rings.

2. In an apparatus of the character specified a plurality of supporting rings concentrically disposed with the inner ring fixed and the remainder mounted for turning movement, means for selectively and independently turning the latter rings, and a plurality of chart rings detachably engaged upon the supporting rings, all of the chart rings being provided with corresponding radial divisions, successively increasing numbers inscribed in the divisions of the fixed ring, and two-letter syllables inscribed in the divisions of the remaining rings, each syllable of each ring comprising a consonant followed by a vowel, the consonants of each ring being dissimilar and the vowel in each division of the same ring the same.

3. In an apparatus of the character specified a plurality of supporting rings concentrically disposed with the inner ring fixed and the remainder mounted for turning movement, means for selectively and independently turning the latter rings, and a plurality of chart rings detachably engaged upon the supporting rings, all of the chart rings being provided with corresponding radial divisions, successively increasing numbers inscribed in the divisions of the fixed ring, and two-letter syllables inscribed in the divisions of the remaining rings, each syllable of each ring comprising a consonant followed by a vowel, the consonants of each ring being dissimilar and the vowel in each division of the same ring the same, each ring having a distinguishing vowel.

4. In an apparatus for the purpose specified, a casing, a table supported within the casing, a hub fixed upon the table, a plurality of superimposed disks rotatably supported about the hub and decreasing in diameter from the lowermost to the uppermost, a fixed supporting ring mounted about the hub above the uppermost disk, a plurality of concentrically disposed supporting rings surrounding the first ring, all of the rings lying in the same plane, pins carried by the disks and supporting said latter rings whereby the rings may turn with the disks, and means for selectively turning the disks.

5. In an apparatus for the purpose speci-

fied, a casing, a table supported within the casing, a hub fixed upon the table, a plurality of superimposed disks rotatably supported about the hub and decreasing in diameter from the lowermost to the uppermost, a fixed supporting ring mounted about the hub above the uppermost disk, a plurality of concentrically disposed supporting rings surrounding the first ring, all of the rings lying in the same plane, pins carried by the disks and supporting said latter rings whereby the rings may turn with the disks, means for selectively turning the disks, and anti-friction elements interposed between the disks to permit their free turning.

6. In an apparatus for the purpose specified, a combination with a plurality of concentrically disposed rings independently adjustable with respect to each other and divided into corresponding radial divisions the divisions of one of the rings being numbered in sequence to form ordinate numbers for the remaining rings and the divisions of the remaining rings being inscribed with two-letter syllables each syllable consisting of a consonant followed by a vowel particular to its ring, of a table divided into vertical columns corresponding to the divisions of the rings, and horizontal columns corresponding to the number of the rings, the divisions thus formed being inscribed with numbers in sequence whereby each division of the table corresponds through its location in a certain horizontal column to a particular division of some ring and through its location in the vertical column to a particular ring.

7. A method of transmitting messages which consists in finding code numbers representing the sentences of the desired message, in dividing these numbers into sections, in locating the sectional numbers thus found in a table having vertical and horizontal coördinate indicia, in finding by reference to a series of concentric charts certain chart divisions corresponding to the various coördinate indicia, in taking therefrom inscribed alphabetical syllables and in combining the syllables thus found to form pronounceable non-dictionary words which may be transmitted as the message.

8. A method of transmitting messages which consists in finding code numbers representing the sentences of the desired message, in dividing these numbers into sections, in locating the sectional numbers thus found in a table having vertical and horizontal coördinate indicia, in finding by reference to a series of concentric charts certain chart divisions corresponding to the various coördinate indicia, in taking therefrom inscribed alphabetical syllables and in combining the syllables thus found to form pronounceable non-dictionary words which may be transmitted as the message, and in then reversing the process to de-code the message.

In testimony whereof I affix my signature.

RAMÓN GUZMÁN M. [L. S.]