No. 756,209. PATENTED APR. 5. 1904.

C. G. BURKE.

CODE INDEX.

APPLICATION FILED MAR. 25, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig: 1

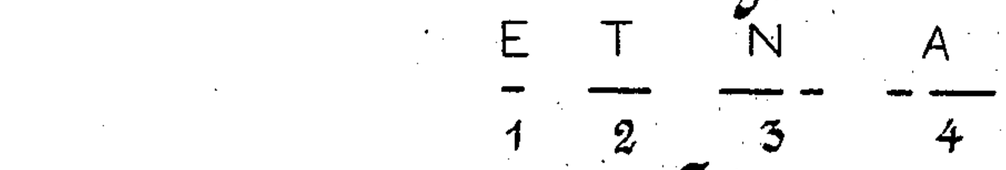


Fig: 2

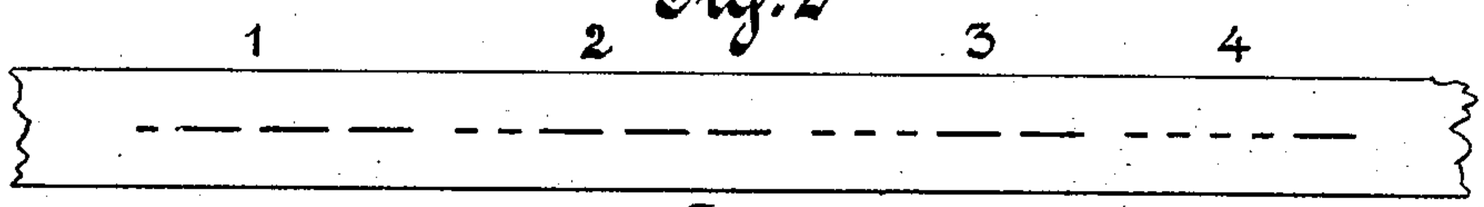


Fig: 3

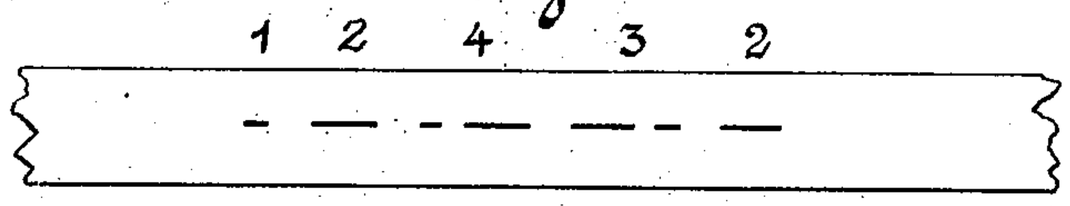


Fig: 4

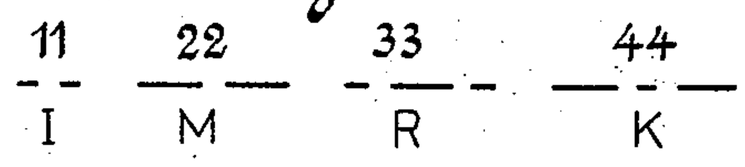


Fig: 5

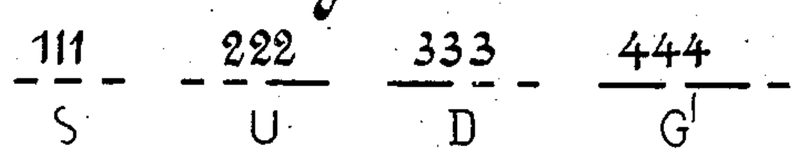
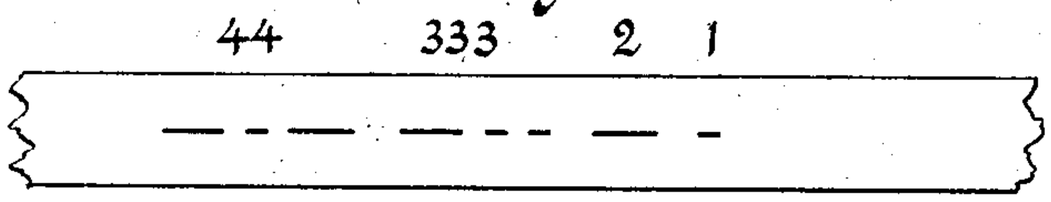


Fig: 6



Witnesses
F. N. Roehrich
L. O. Gampler

Inventor
Charles G. Burke,
By his Attorney F. F. Campbell

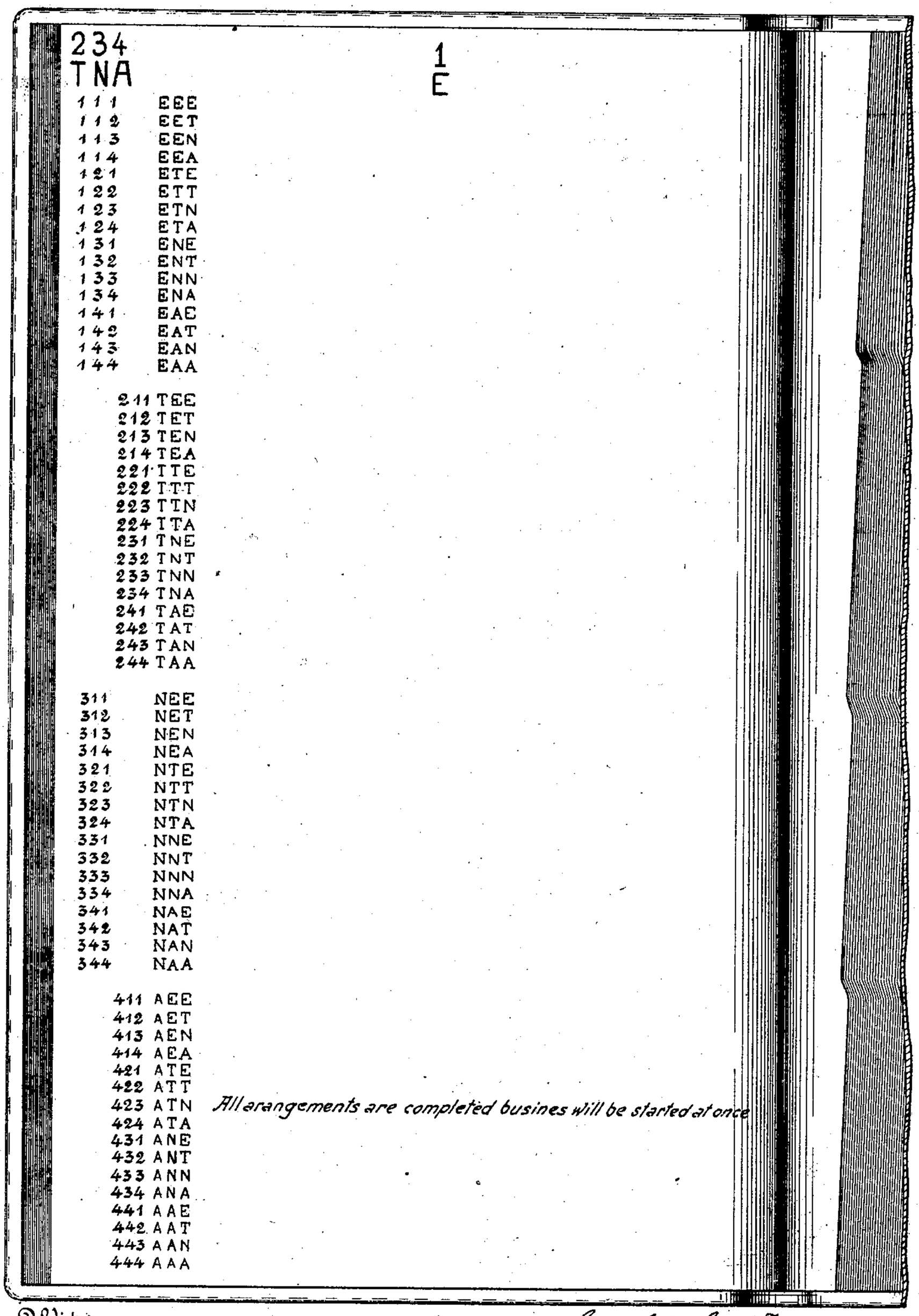
No. 756,209. PATENTED APR. 5, 1904.

C. G. BURKE.

CODE INDEX.

APPLICATION FILED MAR. 25, 1903.

NO MODEL. 2 SHEETS—SHEET 2.



Witnesses
F. N. Roehrich
J. O. Grumpler.

Fig. 7.

Charles G. Burke Inventor
By his Attorney
G. G. Compton

No. 756,209. Patented April 5, 1904.

UNITED STATES PATENT OFFICE.

CHARLES G. BURKE, OF BROOKLYN, NEW YORK, ASSIGNOR OF TWENTY-ONE THIRTIETHS TO JOHN Q. A. WHITTEMORE, OF BOSTON, MASSACHUSETTS.

CODE-INDEX.

SPECIFICATION forming part of Letters Patent No. 756,209, dated April 5, 1904.

Application filed March 25, 1903. Serial No. 149,438. (No model.)

To all whom it may concern:

Be it known that I, CHARLES G. BURKE, a citizen of the United States, and a resident of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Code-Indexes, of which the following is a specification.

This invention relates to telegraphic signals for indicating or representing letters, numbers, or other characters which constitute what is known as "cipher" or "code" messages.

It has for its object to provide an improved means which will permit of greatly-increased speed and more perfect accuracy in the transmission and deciphering of code or cipher messages over that which is obtained by the use of the code-messages and code-books now known in the art.

It consists in providing any number of complete signal combinations and so arranged in relation to each other that they will indicate the meanings associated with the complete signals.

It further consists of an improved article of manufacture in the form of an index of the signals which may be constructed as a card-index or as a book-index. The index is such that the signals specify in themselves the location of the meaning of the signal in the index.

In the present practice all code and cipher messages consist of words formed of the letters of the alphabet. This necessitates large combinations of dots and dashes to make up the signals of the letters. Each letter in the present form of code-signaling requires on an average three impulses and each figure requires five impulses. The large number of electrical impulses now required to transmit each complete code combination makes telegraphing over cables comparatively very slow. The length of the combination of impulses to make up a code-word in the present practice necessarily limits the business that the cables can do. Inasmuch as code and cipher messages to-day constitute about ninety-five per cent. of the business of submarine cable companies any improvement in the method of the code-signaling which materially reduces the time of transmission directly increases the business capacity of the cables.

By my invention I provide a substitute for all present forms of code and cipher combinations. Similar meanings now used in the present code-books may be easily attached to my code combinations. Moreover, the code combinations may be telegraphed by considerably fewer electrical impulses than any code combinations now in use. Because of the large reduction of the number of electrical impulses which my improved code combination secures, it is found in practice that any meaning which can be expressed by the present form of code or cipher combinations may be as readily conveyed by means of my improved method of signaling in less than one-half the time now required. It is also found that the record may be more readily and accurately deciphered and the meaning more quickly ascertained than in the present form of telegraphy. These advantages will be apparent from the following description of my invention.

I have illustrated my invention in the accompanying drawings, wherein—

Figure 1 illustrates the four signals used in connection with the code transmission. Fig. 2 illustrates the signals used in the present method of signaling in connection with the first four members of the decimal notation—namely, "1" to "4." Fig. 3 illustrates three combinations of signals used in connection with my method of signaling. Fig. 4 illustrates a modification wherein the number of impulses used in sending a large number of the combinations may be greatly reduced. Fig. 5 is an extension of the modification illustrated in Fig. 4. Fig. 6 illustrates a record of one of the combinations illustrated in Fig. 3 when made according to the modification illustrated in Figs. 4 and 5. Fig. 7 illustrates a part of the code-index.

In my present improvement I preferably use four elemental signals, which are illustrated in Fig. 1 of the accompanying drawings. The signals preferably used are the same signals used in the Morse and continental codes for indicating the letters "E," "T," "N," and "A."

These letters are transmitted by the simplest combination of the dots and dashes of the codes—namely, "E" by a dot, "T" by a dash, "N" by a dash and a dot, and "A" by a dot and a dash. It is obvious that other simple signals—such as signals used to transmit the letters "M," "A," "I," and "N," or "E," "I," "S," and "H," or "T," "I," "M," and "E" of the codes, or other letters or symbols—may be used in the place of those described herein. In order that these simple signals—that is, of "E," "T," "N," and "A"—may be used to indicate the position of the combinations, together with their associated meanings, in a code-index, the numerals "1," "2," "3," and "4" are associated with the same signals in place of the letters "E," "T," "N," and "A." The different combinations of the numerals will then indicate numerically the relative positions of the meanings of the combinations of the index. It is obvious that more than four letters may be used and represented by numerals; but in practice it is found that these four give the best results. As the letters "E" and "T" require but one electrical impulse and "N" and "A" but two impulses each, the average number of impulses for each of the four will be one and a half. If more than four of the letters are used, the average number of the impulses per symbol will be increased—for instance, if ten letters having the shortest signals were used the average number of the impulses per symbol would be two and one-fifth. The greater the number of symbols employed the greater the proportional increase will there be in the possibilities of making mistakes. The greater the number of impulses or units in any one symbol the greater the liability to errors. Thus the liability to error is greatly increased when all the letters of the alphabet are used, and the number of the elemental signals for each signal combination is doubled. As code words or combinations are principally employed in cable telegraphy, the fewer the number of the impulses per symbol and the fewer the number of symbols in a given combination the greater will be the speed of transmission. This is particularly true where the difference between the dot and the dash depends in part on the difference in polarity. In cable telegraphy, wherein this difference of polarity, exists the letter "E" is of a polarity opposite to that for the letter "T," and "N" and "A" are each formed of impulses of opposite polarity. If "E" be a positive impulse, "T" will be a negative impulse. "N" will be a positive impulse followed by a negative and "A" a negative impulse followed by a positive. By the use of these letters the charge and discharge of the cable is very uniform. As none of these letters involve immediate succession of impulses of the same polarity and as a space must come in between each complete signal, all the signals will be clearly defined and possibility of error reduced to a minimum. The impulses can therefore be sent more rapidly and yet retain clearness of definition. The signals represented by these letters are the elemental signals and the permutations of the elemental signals of the Morse code. They constitute the simplest signal combinations possible and by their use tend to keep the line at normal condition of operation. By using the permutations and combinations of the signals formed by the elemental signals or impulses and the permutations of the elemental signals the total number of elemental signals used is reduced more than fifty per cent.

It is obvious that by selecting the numerals "1," "2," "3," and "4" to represent the four fundamental letters "E," "T," "N," and "A" the ordinary signals which are used in telegraphy to indicate these letters will equally well indicate the numerals selected to indicate them when used for code purposes and that any meaning that might be attached to any code combination of these letters might be equally well attached to the corresponding combinations of the numerals.

The signals may be sent manually or automatically. If the signals are sent automatically, they are produced by first perforating a ribbon or strip in the manner well known in the art of telegraphy. The ribbon thus prepared is passed through a transmitter having a contact-maker. As the ribbon passes under the contact-maker impulses are sent to the line, the contact-maker closing contact through the holes of the ribbon. A suitable recording means is provided for receiving the signals at the other end of the line or cable.

The signals designated by the numbers "1," "2," "3," and "4," as illustrated in Fig. 1, permit of the formation of the combinations having about half the number of impulses as the combinations now used in telegraphy and cable-work. In combinations of five symbols or numbers there are one hundred and twenty-four combinations; of six symbols, four thousand and ninety-six combinations; of seven symbols, sixteen thousand three hundred and eighty-four combinations; of eight symbols, sixty-five thousand five hundred and thirty-six; of nine symbols, to make an even one hundred thousand combinations, twelve thousand nine hundred and sixty combinations. The number of impulses for sending each symbol averages one and one-half, so that the average number of impulses for each of the one hundred thousand combinations amounts to about eleven and three-fourths impulses, while on the other hand is requires twenty-two to thirty impulses for each of the same number of combinations used in the present code telegraphy.

Fig. 2 illustrates the space, the length of the ribbon, and the number of impulses required to use the signals indicating the same numbers—namely, "1" to "4," as in the present method of telegraphy. Each symbol requires

five impulses, and therefore if these signals were used they would require three and one-third times as many impulses to transmit them.

Fig. 3 illustrates three combinations used in connection with my method of code transmission. The signals are divided into three parts. The first signal indicates the part of the index in which the meaning of the signal is located, the next signals except the last three indicate the division of the part of the index in which the meaning is located, and the last three signals indicate the subdivision of the index in which the meaning of the signal is located. If the index is arranged in the form of a book, as illustrated in Fig. 7, the first signal will indicate the part or section of the book in which that particular combination is located. The next signals except the last three will indicate the page of the book, and the last three signals will indicate the line of the page where the combination and the meaning of that combination is to be found. If the index is a card-index, a corresponding arrangement is to be made of the signals in so far as they pertain to the divisions and subdivisions of the card-index. In the form illustrated in Fig. 7 the book is divided into four parts, each part being designated by the signal corresponding to its number, as illustrated in Fig. 1. Each page of the book is numbered in succession by the numbers formed of the combinations of the four figures—namely, "1," "2," "3," and "4." The lines of the book are numbered in the same way. Each page has sixty-four lines, which are numbered by the successive combinations of the four figures, using three of them to designate each line. It is obvious that this number of figures used to indicate each line may be varied and a corresponding number of the signals in the combination as transmitted may be used to indicate the line or subdivision of the index.

If it is desired to send a message as follows: "All arrangements are completed business will be started at once," the one sending the signal will find in the index the particular message, as done in the use of all code-books, and then will send merely the location of the message in the index as defined by part, page, and line. The party receiving the message in not required to hunt for a strange and unsual word, as done in the present method of telegraphy, but merely turns to the page and line and notes the message.

If it is desirable, the message-blanks used by the cable companies for signals that are to be sent and for signals received may be divided into columns. In the first column may be placed the number corresponding to the parts of the books, in the second column may be placed the pages of the book, and in the last column may be placed the lines of the book in which the messages and the combinations are found.

Further assistance for ready reference will be found by placing the number indicating the part of the book on each page, as illustrated in Fig. 7, wherein it is shown as located in the center and at the top of the page. This number, however, could be located at any other place in the book or in each of the pages. It will be noticed upon examination of the numbers as they occur on each of the pages of the book and as illustrated in Fig. 7 that there is a repetition of consecutive figures or symbols in many of the combinations. When all of the combinations are taken into consideration, it is found that there is such a repetition in nearly half of the combinations. It is found that the number of impulses for the combinations wherein such repetition exists may be reduced by providing special and yet simple signals for the repeated figures or symbols of those combinations. In Figs. 4 and 5 are illustrated a series of signals. Where the the figures "1 1" occur, the signal for "I" may be used, which is two dots instead of a dot, a space, and then another dot. For "2 2" the signal of the letter "M" may be used, which is two dashes. For "3 3" the signal of the letter "R" may be used, which is a dot-dash-dot. For "4 4" the signal of the letter "K" may be used, which is dash-dot-dash. For "1 1 1" the signal corresponding to the letter "S" may be sent, which is three dots. For "2 2 2" the signal of the letter "U" may be sent, which is two dots and a dash. For "3 3 3" the signal of the letter "D" may be sent, which is dash and two dots, and for "4 4 4" the signal of the letter "G" may be sent, which is two dashes and a dot.

In Fig. 6 is illustrated one of the combinations shown in Fig. 3, but composed of the signals illustrated in Figs. 4 and 5. For the first two symbols a dash-dot-dash are sent. For the next three symbols a dash and two dots are sent, and then the signal for the "2" and the signal for the "1" are sent, as illustrated in Fig. 1.

The invention just described may be varied in many ways without departing from the spirit of my invention. What I have described and illustrated in the drawings is merely a preferable form of my invention.

What I claim, and desire to secure by Letters Patent, is as follows:

1. In a code-index for signal combinations, the said index having divisions, the said signal combinations consisting of the permutations of the combinations and repetitions of signals formed by the elemental signals of the Morse code and the permutations of the said elemental signals adapted to indicate the said divisions, meanings associated with the said signal combinations located in the said divisions whereby the signals will themselves indicate the relative position of their associated meanings in the index.

2. In a code-index for signal combinations,

the said index being divided into divisions and subdivisions, the said signal combinations consisting of the permutations of the combinations and repetitions of signals formed by the elemental signals of the Morse code and the permutations of the said elemental signals, a part of the signals of each of the combinations indicating the location of the division and the remainder of the signals of the said combinations indicating the subdivision, meanings associated with each of the signal combinations and located in the said subdivisions, whereby the signals will in themselves indicate the exact location of their associated meanings in the said index.

3. In a code-index for signal combinations, the said index being divided into parts and the parts being divided into divisions and subdivisions, the said signal combinations consisting of the permutations of the combinations and repetitions of signals formed by the elemental signals of the Morse code and the permutations of the said elemental signals arranged in sequence, meanings associated with each of the said signal combinations and located in each of the said subdivisions, the first signal of each combination indicating the part of the index in which the associated meaning is located, the remainder of the said signals indicating the division and subdivision in which the said associated meaning is located, whereby the signals will in themselves indicate the location of their associated meanings in the said index.

4. In a code-index for signal combinations, the said index being divided into parts and the parts being divided into divisions and subdivisions, the said signal combinations consisting of the permutations of the combinations and repetitions of signals formed by the elemental signals of the Morse code and the permutations of the said elemental signals, all the signal combinations having the same beginning signal being located in the same part of the index, each division having the same numbered subdivisions, the numbers of the subdivisions constituting the last signals of the signal combinations, the remaining numbers of the signal combinations indicating the relative positions of the divisions of the parts of the index, phrases located in each of the subdivisions of the index, whereby phrases may be telegraphically transmitted by indicating their location in the index.

5. In a code-index for signal combinations consisting of a code-book divided into four parts, the parts being divided into divisions and subdivisions, the said signal combinations consisting of the permutations of the combinations and repetitions of signals formed of elemental signals of Morse code and the permutations of the said elemental signals and represented by numerals, the first numeral of the combinations indicating the parts of the index, the remaining numerals of the combinations except the last three indicating the divisions of the parts of the index, the last three numerals of the said combinations indicating the subdivisions, meanings associated with each of the said signal combinations and located in each of the said subdivisions, whereby the signals will in themselves indicate the location of their associated meanings in the said index.

6. In a code-index for signal combinations consisting of a code-book divided into four parts, the said signal combinations consisting of the permutations of the combinations and repetitions of the four signals formed by the elemental signals of the Morse code and the permutations of the said elemental signals and arranged in sequence, the said four signals being represented by numerals, the first numeral of each of the signal combinations indicating the parts of the said book, the remaining numerals of the combinations except the last three indicating the pages of the said book, the last three of the numerals of the said combinations indicating the lines of the said pages, meanings associated with each of the said signal combinations and located in the said lines, whereby the signals will in themselves indicate the location of the associated meanings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES G. BURKE.

Witnesses:
FAUST G. CRAMPTON,
JOHN O. GEMPLER.