

March 8, 1932.

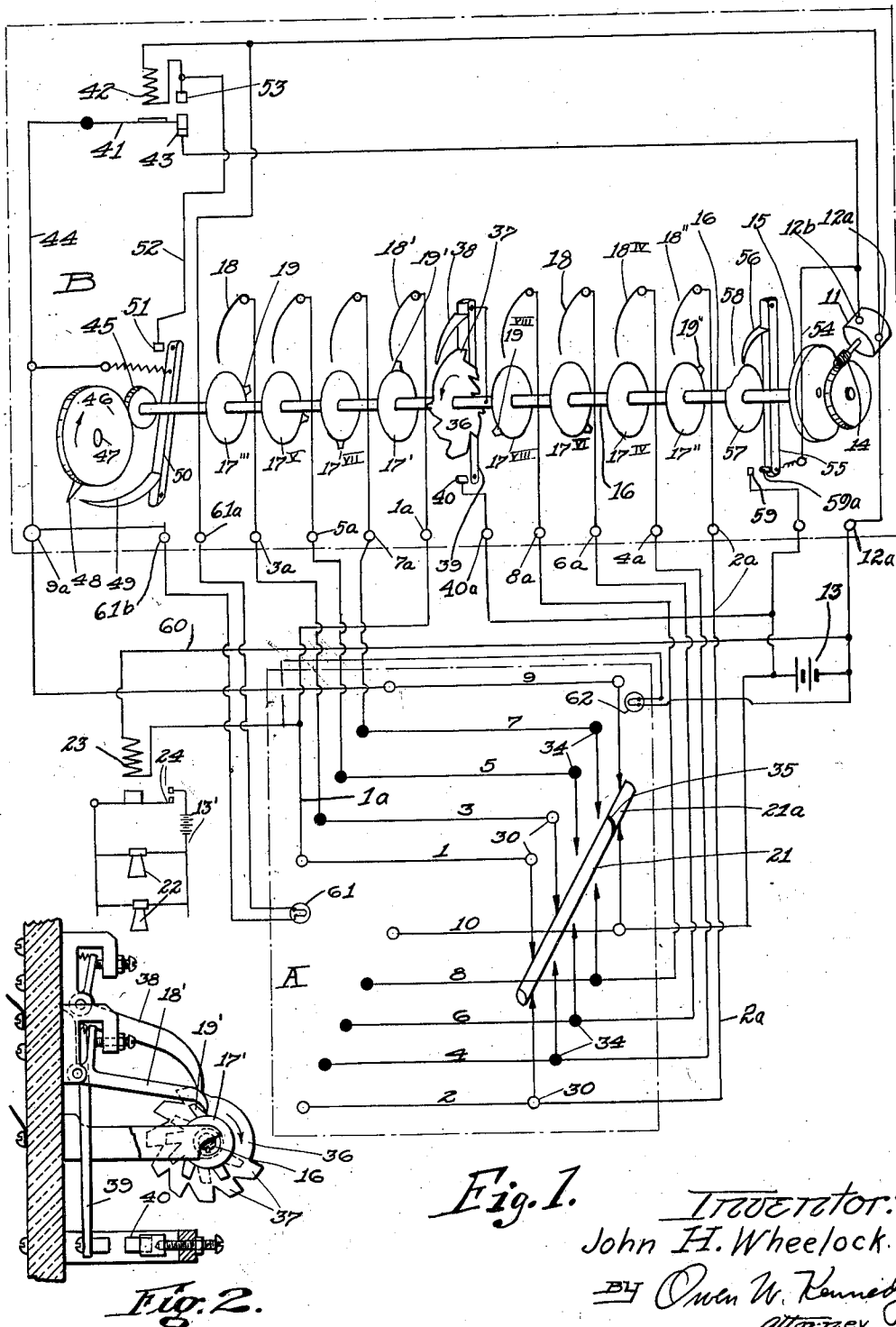
J. H. WHEELLOCK

1,848,148

ELECTRICAL SIGNAL SYSTEM

Filed Jan. 5, 1927

5 Sheets-Sheet 1



March 8, 1932.

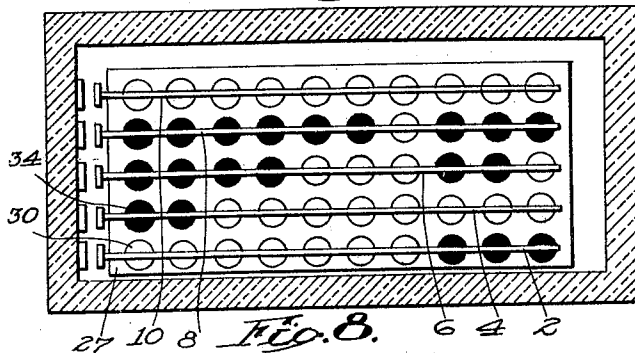
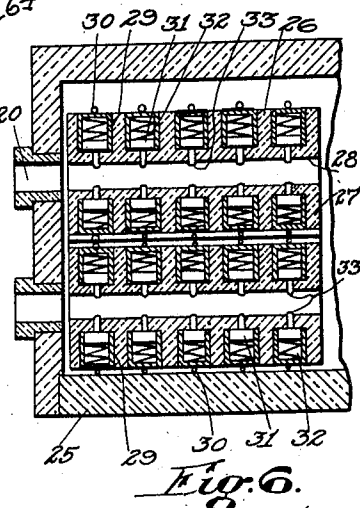
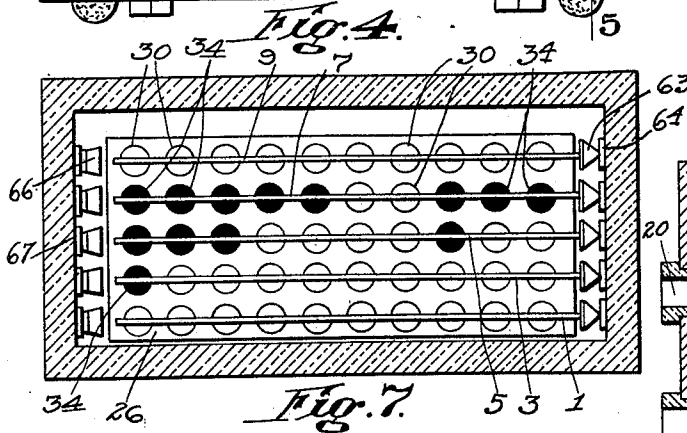
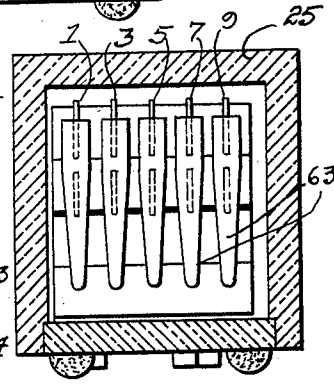
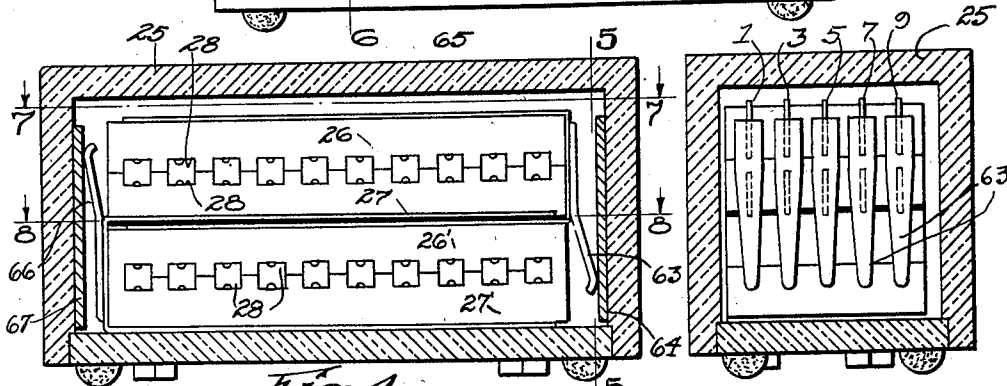
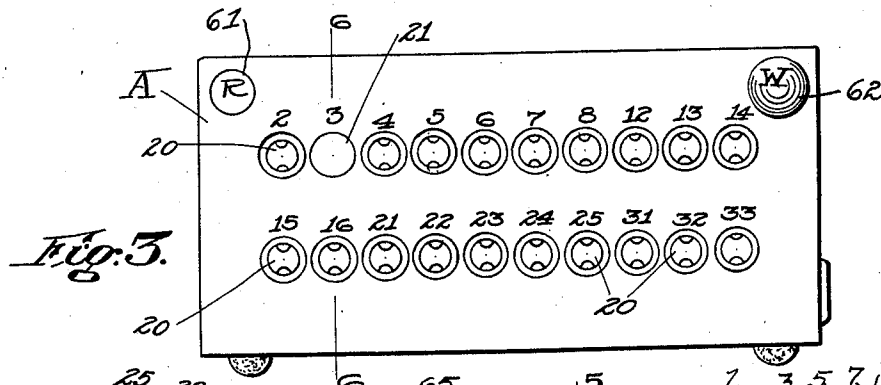
J. H. WHEELOCK

1,848,148

ELECTRICAL SIGNAL SYSTEM

Filed Jan. 5, 1927

5 Sheets-Sheet 2



Inventor:
John H. Wheelock
By *Oliver W. Kennedy*
attorney

March 8, 1932.

J. H. WHELOCK

1,848,148

ELECTRICAL SIGNAL SYSTEM

Filed Jan. 5, 1927

5 Sheets-Sheet 3

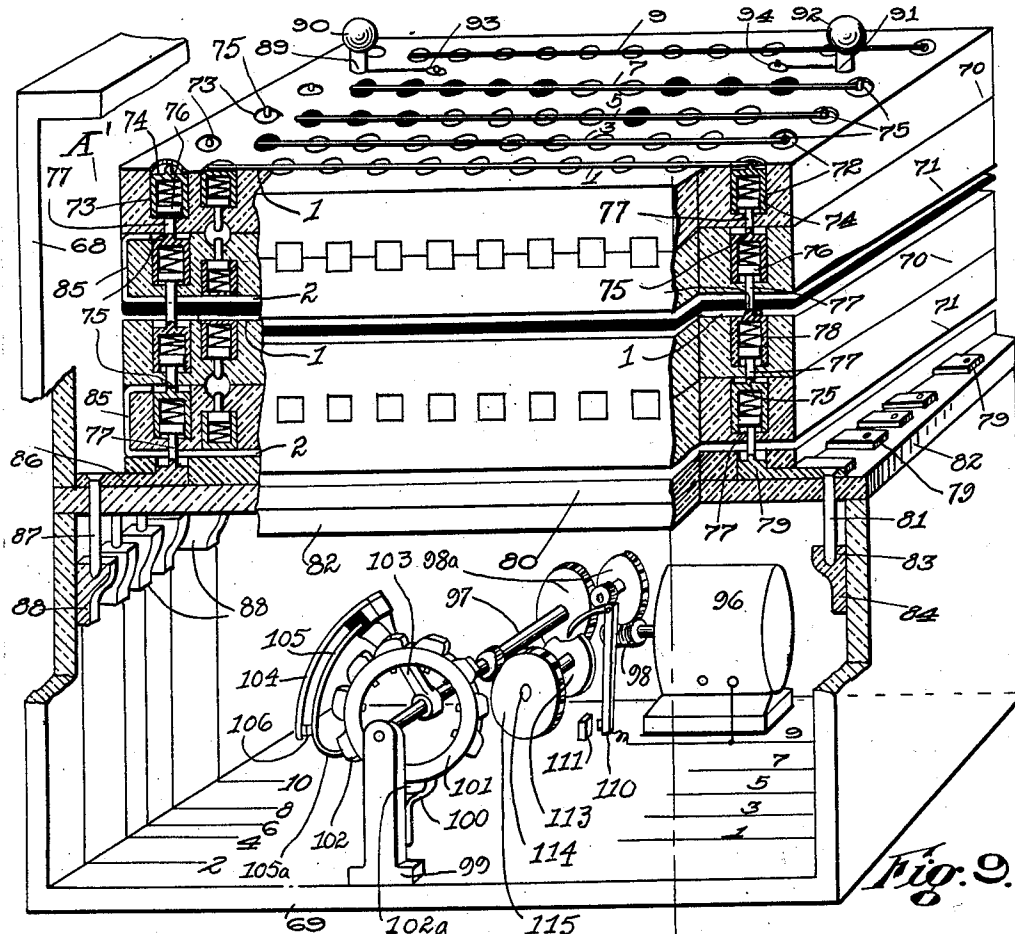


Fig. 9.

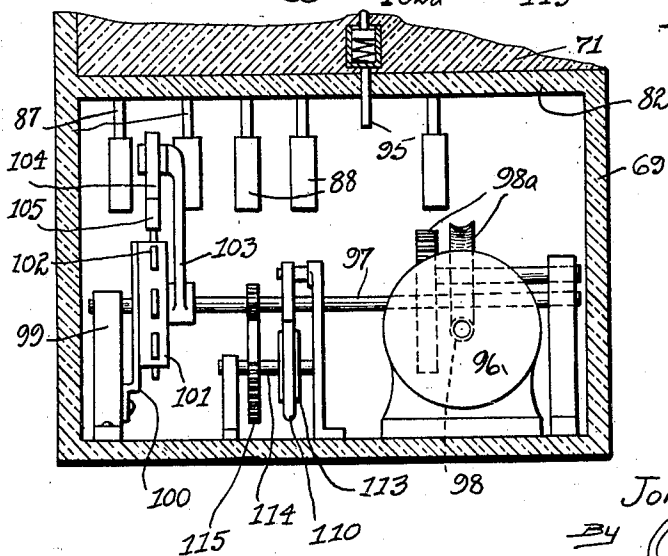


Fig. 11.

INVENTOR:
John H. Wheelock
BY Owen W. Kennedy
attorney

March 8, 1932.

J. H. WHELOCK

1,848,148

ELECTRICAL SIGNAL SYSTEM

Filed Jan. 5, 1927

5 Sheets-Sheet 4

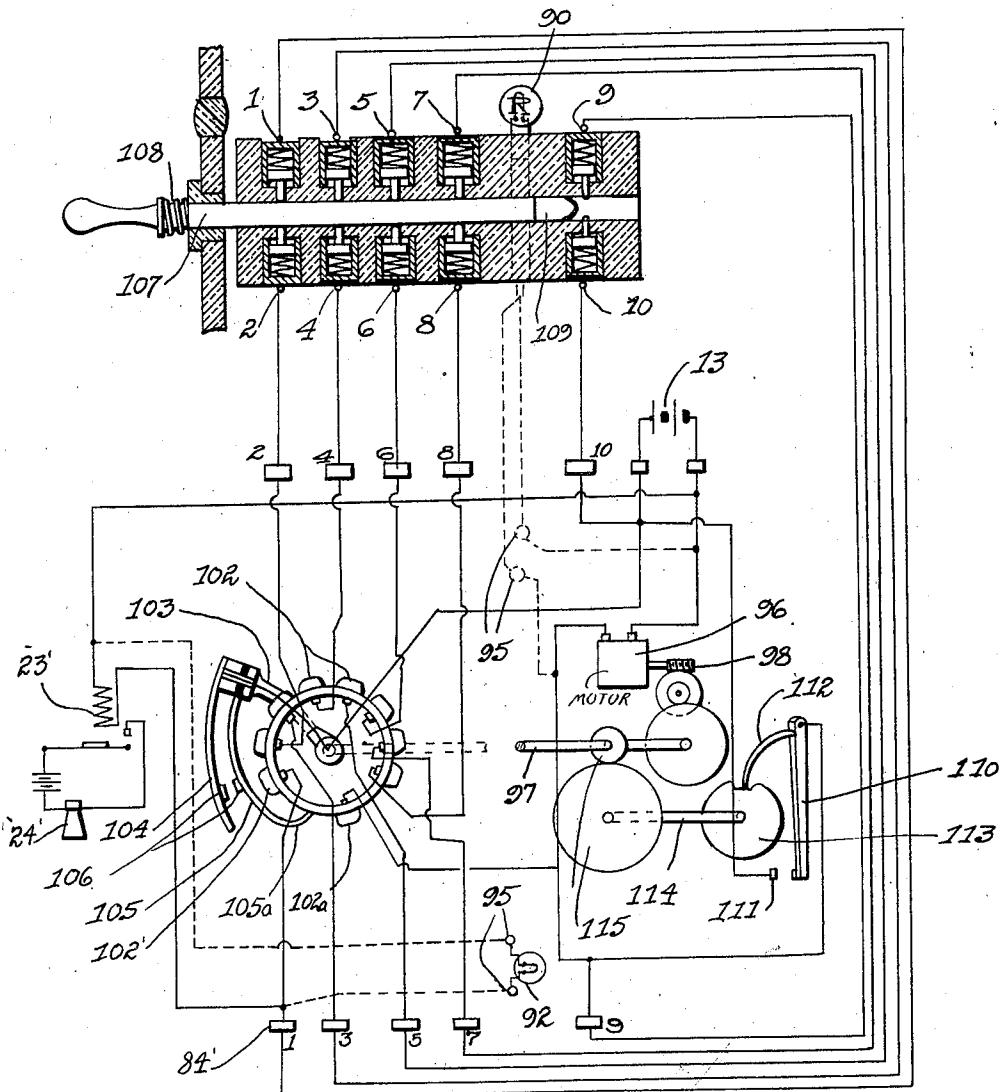


Fig. 10.

Inventor:
John H. Wheelock
By Owen W. Kennedy
Attorney

March 8, 1932.

J. H. WHEELLOCK

1,848,148

ELECTRICAL SIGNAL SYSTEM

Filed Jan. 5, 1927

5 Sheets-Sheet 5

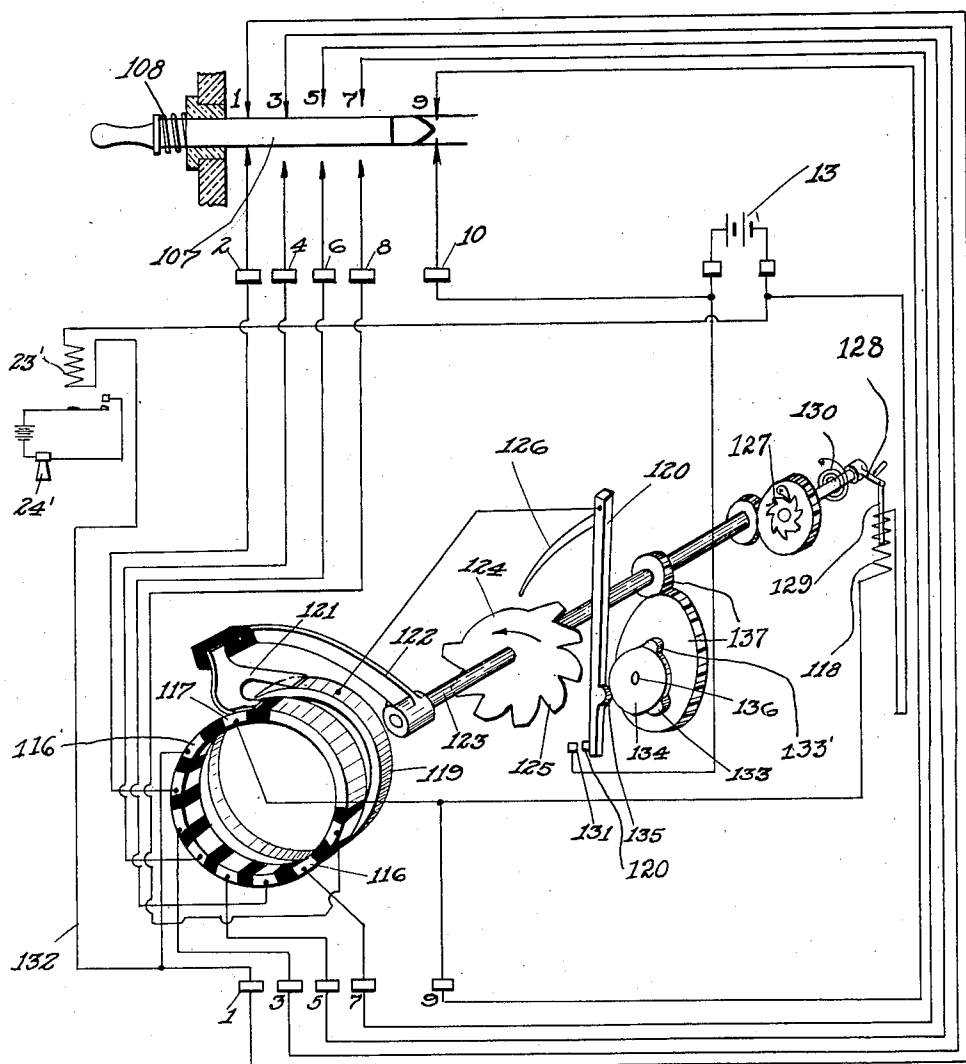


Fig. 12.

Inventor:
John H. Wheelock
By Owen W. Kennedy
Attorney

UNITED STATES PATENT OFFICE

JOHN H. WHEELOCK, OF FITZWILLIAM, NEW HAMPSHIRE, ASSIGNOR TO SIGNAL ENGINEERING & MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MASSACHUSETTS

ELECTRICAL SIGNAL SYSTEM

Application filed January 5, 1927. Serial No. 159,165.

My present invention relates to electric signalling apparatus and systems of the type commonly employed for controlling, from a given point, the operation of various kinds of apparatus, such as apparatus for sounding or displaying a multiplicity of different signals in accordance with a predetermined code. Usually the signalling apparatus is distributed at a large number of different stations throughout an industrial establishment, or other organization, and calling and locating individuals, as well as the sounding of fire alarm or time signals, are well known uses of such a system.

The present application contains certain subject matter found in my abandoned application Serial No. 143,146, filed January 18, 1917, forfeited September 18, 1924, in which application the essential elements of the present application are shown more or less diagrammatically. The present application embodies all of the apparatus shown and described in my above application, Serial No. 143,146, and in addition shows some of the apparatus in greater detail, as well as additional apparatus not shown in the aforesaid application. The basic principles underlying the system shown in the present application are however, essentially the same as the principles set forth in my aforesaid application No. 143,146, as will hereinafter more fully appear.

The object of my invention contemplates the provision of an electric code signalling system in which the apparatus is set into operation to transmit any desired series of code signals or impulses by a single, simple manual operation, the operation insuring that the desired code signal will be transmitted and reproduced at the controlled stations a predetermined number of times, after which the apparatus is automatically returned to starting condition, the apparatus always showing the last call transmitted.

Another object of my invention is to pro-

vide a system in which the transmission of a selected code call can be interrupted at will and another call substituted therefor, with the assurance that the newly selected call will always be properly transmitted.

Another object of my invention is to provide in connection with the electric commutating device which controls the sending of the code signals, improved means for preventing arcing in the commutating device itself and in the electromotor circuit as the device sends out the various code impulses.

Another object of my invention is to provide an improved code determining or setting device that is capable of controlling the code sending device from a remote point when desired and is of compact unit construction, whereby the device can be readily expanded to provide a greater number of code signals without affecting any of the units already installed for a lesser number of code signals.

A still further object of my invention is to provide for the convenient assembly of both the code setting and code sending devices embodied in my system, whereby these devices can be readily connected for joint operation, without making it necessary to provide any additional electrical connections other than those already provided in the code setting and code sending devices themselves. The above and other advantageous features of my invention will hereinafter more fully appear, reference being had to the accompanying drawings, in which—

Fig. 1 is a diagrammatic view illustrating my system, certain parts of the apparatus being shown in perspective and in developed form in order to more clearly illustrate the invention.

Fig. 2 is a fragmentary view showing the master arcer.

Fig. 3 is a view in front elevation of the code setting unit shown in Fig. 1.

Fig. 4 is a sectional view of the unit shown in Fig. 2, with the front cover cut away.

Fig. 5 is a sectional view along the line 5—5 of Fig. 4.

Fig. 6 is an enlarged sectional view along the line 6—6 of Fig. 3.

Fig. 7 is a horizontal sectional view along the line 7—7 of Fig. 4.

Fig. 8 is a horizontal sectional view along the line 8—8 of Fig. 4.

Fig. 9 is a view similar to Fig. 3, showing a modification in the manner of connecting the units of the code setting device to a modified code operating device.

Fig. 10 is a diagrammatic view illustrating the electrical connections between the apparatus shown in Fig. 9.

Fig. 11 is a sectional view along the line 11—11 of Fig. 9.

Fig. 12 is a diagrammatic view illustrating a further modification of my invention.

Like reference characters refer to like parts in the different figures.

Referring first to Fig. 1, there is shown diagrammatically my complete system which generally comprises a code setting device A enclosed in dot and dash lines and shown separately in Fig. 3, and a code sending or operating device B, also enclosed in dot and dash lines, which consists of an assembly of different pieces of apparatus conveniently mounted together on an insulating base. Obviously, the sending device B may be located remote from the setting device A. The code operating assembly B comprises a prime mover, such as an electric motor 11, one terminal 12a of which is permanently connected to one side of a source of electrical energy, such as a battery 13, although any other suitable source may be employed. The shaft of the motor 11 carries a worm gear 14 which is adapted to drive, through reduction gearing 15, the shaft 16 of a current commutating device of any desired type. For example, the commutating device shown herein is of the type shown in my Patent No. 1,178,431, issued April 4, 1916, and comprises a number of spaced disks 17 which are adapted to cooperate with current carrying fingers or brushes 18 in order to make or break a corresponding number of electrical branch circuits as the shaft 16 rotates. Each disk provides a tooth 19 which is adapted to engage a corresponding finger 18 once for each revolution of the shaft 16, and as shown in Fig. 2, the disks 17 are so mounted on the shaft 16 that the teeth are angularly spaced with relation to the axis of the shaft 16 to cause the brushes 18 to engage the cams 19 successively. In other words, rotation of the shaft 16 is adapted to cause the making and breaking of a number of separate branch circuits, and obviously other types of current commutating devices may be used for the same purpose as for example, the

type of commutating device shown in Fig. 9 herein.

The code setting device A as shown in Fig. 3, provides a number of rows of holes or receptacles 20, each carrying a code number, as indicated, and in the operation of the system to be hereinafter described, the act of inserting a plug 21 into any one of the receptacles 20 is adapted to cause the sounding of signals such as bells, or horns, a predetermined number of times in a sequence, corresponding to the number of the receptacle 20 in which the plug 21 is inserted. A number of signals 22, such as bells or horns, are indicated diagrammatically in Fig. 1, and these signals 22 are adapted to be connected to a suitable source 13' of electrical energy when the winding 23 of a suitable relay device is energized to close the normally open contacts 24. One terminal of the winding 23 is permanently connected to one side of the source 13, while the other terminal thereof is adapted to be connected to the other side of the source 13 through the commutating device as it operates under the control of the code sending device.

As best shown in Fig. 4, the code setting device A comprises a number of similarly constructed units disposed within a box 25, each unit comprising a pair of blocks 26 and 27 of insulating material. Opposed faces of the blocks 26 and 27 are provided with registering notches 28 and these notches line up with the receptacles 20 provided in the front of the casing 25, as shown clearly in Fig. 6.

Still referring to Fig. 6, it will be seen that opposed insulating blocks 26 and 27 provide pairs of alined openings 29 extending at right angles to the notches 28 in each of which is seated a cylinder 30 enclosing a plunger 31 pressed by a spring 32. Each plunger provides a contact tip 33 which normally extends into the groove 28, so that each groove 28 provides a number of pairs of opposed contact tips 33 yieldably maintained so as to extend slightly into the groove 28.

As shown in Fig. 7, the upper insulating block 26 of each code setting unit provides a number of parallel bus bars numbered 1, 3, 5, 7 and 9, extending across the tops of the plunger cylinders 30 and these bus bars are connected to the cylinders 30 as indicated, either by reason of their engagement with the cylinders 30, or by soldering, if desired. However, certain of the cylinders 30 are purposely maintained out of electrical contact with the bus bars by means of thin insulating disks 34, as indicated by the black circles, these insulating disks 34 being arranged in accordance with the code signal to be sounded by the insertion of the plug 21 in a given receptacle 20. The lower insulating block 27 of each code setting unit is provided on its bottom with a number of parallel bus bars numbered 2, 4, 6, 8 and 10, respectively, and as

shown in Fig. 8, these bus bars are respectively connected to, or insulated from the rows of cylinders 30 in accordance with the same code signals which determined the connections of the cylinders 30 to the upper bus bars 1, 3, 5, 7 and 9. It will be particularly noted that the bus bar 1 of each unit is connected to all of the cylinders 30 of its row as are also the bus bars 9 and 10.

A portion of the bus bars 1 to 10 inclusive, for the first code setting unit, are shown diagrammatically in Fig. 1, with the plug 21 shown as having been inserted in the receptacle designated "three" in Fig. 3. From this showing it is evident that the plug 21 is in electrical contact only with the bus bars 1, 2 and 3 respectively and with the bus bars 9 and 10, all the other bus bars being insulated from the plug 21 by the disks 34. It is also to be noted that the tip portion 21a of the plug 21 is insulated from the rest of the plug, as indicated at 35, so that there is no electrical connection between the bus bars 1, 2 and 3 and the bus bars 9 and 10, the purpose of which will shortly appear.

The bus bars 1 to 8 inclusive, are connected by correspondingly numbered conductors and terminals to commutator brushes 18, and it is evident from a consideration of Fig. 2, that rotation of the shaft 16 will cause the brushes 18 to engage the disk teeth 19 in the same order as the bus bars are numbered. In other words, the bus bar 1 will be connected to the shaft 16 through the brush 18' and disk 17', the bus bar 2 will be connected to the shaft 16 through the brush 18'' and disk 17'', and so on for the eight bus bars.

Still referring to Fig. 1, it will be seen that the shaft 16 also carries a master disk 36 which provides teeth 37 corresponding in number to the disks 17. A pivotally mounted finger 38 coacts with the disk 36 and as shown in Fig. 2, carries a movable contact 39 which is adapted to engage a stationary contact 40 connected to one side of the source 13 through terminal 40a. As fully set forth and claimed in my above mentioned Patent No. 1,178,431, these master contacts 39 and 40 are adapted to prevent arcing in the branch circuits controlled by the motor driven commutating device, and it is not believed necessary to burden the present specification with an exhaustive description of what is shown in the above patent. Suffice it to say that the teeth 37 are so formed and arranged with respect to the teeth 19 that each branch circuit is always completed and broken between the master contacts 39 and 40, so that no arcing ever occurs between the brush fingers 18 and the disks 17.

The bus bar 10 is permanently connected to one side of the source 13, while the bus bar 9 is connected through terminal 9a to the movable arm 41 of a relay device, the energizing coil of which is indicated at 42. The

contact arm 41 is normally in engagement with a stationary contact 43 which is in turn connected with the terminal 12b of the electric motor 11. Consequently, when the plug 21 is inserted in the receptacle marked "three" in Fig. 1, the insulated tip 21a of the plug will connect the bus bars 9 and 10 so that current will flow from one side of the source 13 to the bus bar 9, from thence through a conductor 44 through the then closed contacts 41 and 43 to the motor terminal 12b thereby starting the motor 11 in operation. The motor 11 will continue to operate as long as the circuit through the contacts 41 and 43 remains closed, as shown, and my invention contemplates means for stopping the motor 11 after it has made a predetermined number of revolutions, such as three.

To this end the shaft 16 carries a pinion 45 in mesh with a gear 46 on a countershaft 47, the ratio between the gears 45 and 46 being such that the shaft 47 makes only one revolution for every three revolutions of the commutator shaft 16. The gear 46 carries a cam 48 which is adapted to engage a finger 49 carried by a pivoted arm 50 and projecting into the path of movement of the cam 48 as the shaft 47 rotates. When the finger 49 is engaged by the cam 48 after the shaft 16 has made three complete revolutions, the arm 50 is turned about its pivot to move it into engagement with a stationary contact 51 connected by a conductor 52 to the open terminal of relay winding 42. The arm 50 is connected to the conductor 44 which leads from the bus bar terminal 9a so that when the arm 50 is moved to engage the contact 51, the winding 42 is energized. When this occurs the arm 41 is moved upwardly to break the circuit at 43, thereby interrupting the motor circuit at this point. When the arm 41 is attracted by energization of the winding 42, it engages a stationary contact 53, thereby establishing a holding circuit for the winding 42, so that the latter remains energized when the arm 50 is released by the cam 48. The holding circuit for the winding 42 when the arm 41 engages the contact 53 is from one side of the source 13 across the bus bars 9 and 10 through the plug 21 to the arm 41 and from thence through the winding 42 back to the other side of the source through terminal 12a.

While, as previously pointed out, the circuit of the motor 11 is interrupted at the end of every third revolution of the shaft 16 by the operation of the cam 48 on arm 50, the circuit of the motor 11 is maintained for a short interval after the cam 48 engages the finger 49 in order to clear the finger from the cam 48. This purpose is accomplished by means of a holding circuit comprising a conductor 54 leading from the motor terminal 12b to a pivotally mounted arm 55. The arm 55 carries a finger 56 which cooperates with a disk 57 carried by the shaft 16, but insulated

therefrom. The disk 57 provides a depression 58, and when the finger 56 is in this depression the end of the arm 55 is out of engagement with a contact 59 connected to the source 13 through terminal 59a.

When the finger 56 is in the depression 58, the angular relation between the disk 57 and the gear 46 is such that the cam 48 has just freed itself from the finger 49 and all parts are at rest.

Assuming then that the plug 21 has just been inserted to complete the circuit of the motor 11 through the conductor 44, as previously described, it is evident that as soon as the shaft 16 starts to rotate, the finger 56 will be lifted by the disk 57, thereby also closing the motor circuit at the contact 59. In other words, at this time current can flow to the motor 11 through either circuit. After the shaft 16 has made one revolution, the holding circuit is broken at 59 as the finger enters the depression 58, but at this time the cam 48 has only completed one-third of a revolution and the motor continues to operate through the circuit completed by the plug 21. The same thing occurs as the motor completes its second revolution.

However, as the shaft 16 is about to complete its third revolution, starting from the position shown in Fig. 1, the cam 48 engages the finger 49, and by causing energization of the winding 42, breaks the motor circuit through the conductor 44 and contacts 41 and 43. At this moment the finger 56 is still riding on the periphery of the disk 57, although just about to enter the depression 58. Consequently, the shaft 16 turns a few more degrees before the motor circuit is broken at 59, so that the shaft 16 comes to rest with the finger 49 freed from the cam 48. Thus the motor 11, when once started, is automatically caused to turn the shaft 16 through exactly three complete revolutions, and as will now be described, these three revolutions cause three cycles of signals to be sounded through the branch circuits established by the code setting device A and the commutating device operated from the shaft 16.

As previously pointed out, the diagrammatic showing of Fig. 1 indicates that the plug 21 has been inserted in the receptacle labeled "three" in Fig. 3, and as indicated by the arrow heads, only the bus bars 1, 2 and 3 are in electrical contact with the plug 21 through corresponding spring-pressed contact tips 33, Fig. 6. Therefore, when the motor 11 is started, as previously described, the first few degrees of revolution of the shaft 16 will cause the finger 18' to be engaged by the tooth 19' on the disk 17'. This causes the open end of the signal relay solenoid 23 to be connected to the shaft 16, but no current will flow until the circuit is closed at the contact 40 by the action of the finger 38 riding up on the first master disk tooth 37. When this

occurs the circuit of the winding 23 will be completed through the master contacts 39 and 40, the disk 17', finger 18', through a portion of the conductor 1a, through the winding 23, and from thence back to the source 13 through the conductor 60. This causes the signals 22 to be sounded for a short interval, determined by the time the finger 38 remains on the first tooth 37, and it is evident that this tooth is so formed that the finger 38 will drop off sharply, thereby opening the signal relay circuit at the master contacts 39 and 40. It will be noted that the signal relay circuit is broken at the master contacts while the first finger 18' is still riding on the tooth 19', so that when this finger 18' leaves its tooth there is no arcing. This action is clearly evident from a consideration of Fig. 2.

When continued rotation of the shaft 16 causes the tooth 19'' to engage the finger 18'', the closing of the master contacts at 40 which immediately follows establishes the circuit of the signal relay through the master contacts, the engaged tooth 19'' and finger 18'', then to the bus bar 2, by conductor 2a, where the current passes through the plug 21 to the bus bar 1. From here the current passes directly through the winding 23 back to the other side of the source, thereby again sounding the signals through an interval determined by the second master disk tooth 37''. From the foregoing, it is evident that continued rotation of the shaft 16 will cause the signals 22 to be sounded a third time as current passes from the finger 18''' to the bus bar 3 and from thence back through the common bus bar 1 to the signal relay. After the three signals have been sounded in spaced relation, nothing further happens until the shaft 16 starts on its second revolution, whereupon three signals are again sounded, and the same thing takes place at the beginning of the third revolution of the shaft 16.

When, as previously described, the shaft 16 comes to rest at the end of the third revolution, all parts remain as shown in Fig. 1 as long as the relay winding 42 remains energized through the engagement of the contacts 41 and 53. At this time the complete cycle of signals having been sounded, the attention of the telephone operator is called to this condition by the illumination of a red light 61 which is shunted around the winding 42 through terminals 61a and 61b and remains illuminated as long as the plug is all the way in. This red light 61 may be conveniently located in the front of the box casing enclosing the code setting device, as shown in Fig. 3, although it may be located elsewhere. When the illumination of the red light 61 indicates to the operator that a call has gone through, she can cause the call to be repeated by withdrawing the plug 21 far enough from its receptacle to break the circuit between the bus bars 9 and 10, this condi-

tion being immediately indicated by the extinguishment of the light 61, due to deenergization of the conductor 44.

When this occurs the arm 41 drops back into engagement with the contact 43 and the cycle of signals can be started again by the operator pushing in the plug all the way, thus restarting the motor. In order to indicate to the operator that the signals are being sounded, a second lamp 62 is connected in parallel with the signal relay winding 23, so that this lamp is illuminated each time that a signal is sounded. The lamp 62 is preferably white and is placed in the front of the casing of the code setting unit, as shown in Fig. 3. Thus the operator is always fully informed as to whether the signals are properly sounding and as to when a selected call has been completed. It is obvious that after a complete cycle of signals has been sounded and the red lamp 61 is illuminated, the plug 21 can be partly withdrawn to extinguish the lamp 61 and to deenergize the winding 42 of the motor relay.

Referring now to Figs. 4 and 5, it will be seen that the odd numbered set of bus bars 1, 3, 5, 7 and 9 on the upper insulating block 26 are connected to a number of separate fingers 63 extending downwardly into the space between the insulating block and the casing 25. These fingers 63 each bear against a terminal strip 64 carried by the wall of the casing 25, whereby connections may be readily made from the bus bars to the code sending apparatus.

As shown in Fig. 4, the pair of blocks 26 and 27 representing the upper row of code numbers rest upon a second pair of blocks 26' and 27', which in turn rest upon the bottom of the casing 25. The lower block 27 of the first unit is separated from the upper block 26' of the second unit by a sheet of insulating material 65 which serves to keep the even numbered bars on the block 27 out of engagement with the odd numbered bus bars on the block 26'. Fingers 63 which are connected to the bus bars on the block 26 are also connected to the odd numbered bus bars on the block 26', so that a single set of fingers 63 serves for both units. As shown at the left in Fig. 4, similar fingers 66 are connected to the even numbered bus bars 2, 4, 6, 8 and 10 on the blocks 27 and 27', these fingers 66 bearing on terminal strips 67.

From a consideration of Figs. 4 and 6, it is obvious that my code setting device comprises a number of similar units which may be manufactured in quantity and assembled to provide the desired number of signal calls. It is evident that the casing 25 could be readily extended to provide room for more than two units, as shown, the units resting firmly one upon the other, and the circuit connections being established from the bus bars

through the fingers 63 and 66 and terminal strips 64 and 67.

Referring now to Figs. 9, 10 and 11, there is shown a modification in the manner of connecting the units of the code setting device, as well as an improved arrangement for assembling the code setting unit directly upon the code operating unit without necessitating any electrical connections other than those provided by the units. The above figures also show a modified form of commutating device, the operation of which is essentially the same as that shown in Fig. 1.

Referring to Fig. 9, the code setting unit A' is enclosed within a box 68 of insulating material which rests directly on a similar box 69 containing the code sending apparatus. The code setting unit comprises a number of pairs of insulating blocks 70 and 71 respectively, which are similar to the pairs of blocks 26 and 27 previously described, with the exception that different means are provided for connecting the sets of bus bars of the several blocks together. Each block 70 and 71 provides along its right hand edge a series of openings 72 corresponding in number and in alinement with the odd numbered bus bars 1, 3, 5, 7 and 9, while the left hand edge of each block 70 and 71 provides a number of openings 73 corresponding in number to and in alinement with the even numbered bus bars 2, 4, 6, 8 and 10 on the lower blocks 71.

Each opening 72 and 73 receives a cylinder 74 which is countersunk in the opening, the top of each cylinder 74 providing a lug 75, which is substantially flush with the surface of the insulating block. A plunger 76 is provided in each cylinder 74, each plunger providing an elongated tip 77 that extends through the bottom of the corresponding block 70 and engages the lug 75 of the alined cylinder 74 of the block 71 below. The end of each tip 77 is concave and is adapted to be held in engagement with the convex lug 75 of a cylinder 74 by the pressure of a spring 78.

The bus bar 1 of each block 70 is connected to the lug 75 of the corresponding cylinder 74, so that when a number of blocks 70 and 71 are assembled, a circuit is provided from each of the bus bars 1 to the tip 77 at the bottom of the stack. This tip is in engagement with a suitable lug on a terminal 79 that is set in a base 80 and extends slightly beyond the edge of the blocks 70 and 71. The terminal 79 provides a finger 81 which extends through the top 82 of the box 69 and is closely received in a recess 83 provided on a terminal lug 84 carried by the side of the box 69.

Each of the odd numbered bus bars is connected to one right hand cylinder lug 75 on the blocks 70 and circuits established thereby to all of the terminals 79 and 84. The lugs 75 provided on the left hand edge of the

blocks 71 are respectively connected to the even numbered bus bars which are extended and bent around the ends of the blocks 71 in grooves 85, so that the even numbered bus bars can be readily connected. The lowermost tips 77 for the even numbered bus bars are connected by terminals 86 and fingers 87 to a corresponding number of terminal lugs 88, so that all of the bus bars are represented by terminals within the box 69 containing the commutating device.

Referring to the upper portion of Fig. 9, it will be seen that the uppermost block 70 provides a receptacle 89 for a red light 90 and a receptacle 91 for a white light 92. The upper block 70 also provides contact cylinders 93 and 94 which are disposed in the space between the bus bars 7 and 9 and are connected to the lights 90 and 92 respectively. As indicated in Fig. 11, the receptacles 89 and 91, as well as the cylinders 93 and 94, are connected by coating cylinders and tips extending straight through the stack and ending in four terminals 95 in the top 82 of the box 69.

The commutating device in the box 69 comprises a motor 96 adapted to drive a shaft 97 through a worm 98 and reduction gearing 98a. The end bearing 99 of the shaft 97 provides a bracket 100 carrying a commutator ring 101 of insulating material around the periphery of which are provided contacts 102. The contacts 102 provide terminal portions inside the ring 101 to which are connected the bus bars 1 to 8 inclusive, by conductors running from corresponding terminals 84 and 88 on the sides of the box. One contact 102a is connected to one terminal of motor 96. The shaft 97 carries an arm 103 provided at its end with a resilient contact finger 104 electrically connected to the shaft 97. The arm 103 also carries a finger 105 insulated from the finger 104, the finger 105 providing a bent-over tip 105a which is adapted to engage the contacts 102 consecutively as the shaft 97 rotates.

When the finger portion 105a is on a contact 102 the fingers 104 and 105 are in engagement through contact points 106, but when the finger 105 passes off a contact 102 the points 106 separate, thereby breaking the circuit between the shaft 97 and the contact 102 through the master contact points 106. This prevents arcing between the finger 105 and the individual contacts 102.

Referring now to Fig. 10, the circuit connections of the apparatus shown in Fig. 9 are shown diagrammatically, a plug 107 being shown in the receptacle marked "three" just as in Fig. 1. The plug 107 carries a coil spring 108 which is compressed when the plug is pressed all the way in to connect the bus bars 9 and 10, but which moves the plug 107 outwardly enough to disconnect the bus bars 9 and 10 when pressure on the plug is released. The insulated tip portion 109 of the

plug 107 is slightly tapered at its other end, but it is obvious that when the plug 107 is pushed all the way in, thus compressing the spring, the circuit of the motor 96 will be established through the bus bars 9 and 10.

As the motor 96 starts in response to pushing in the plug 107 all the way, a holding circuit is established for the motor 96 through a contact arm 110 and a stationary contact 111 connected to one side of the source 13. The contact arm 110 is pivotally mounted and provides a finger 112 which cooperates with a cam 113 on a countershaft 114. The shaft 114 is connected by gearing 115 so that it makes only one revolution for every three complete revolutions of the commutator shaft 97. The cam 113 provides a depression which receives the finger 112 when the parts are not operating, but it is obvious that as soon as the motor 96 starts the finger 112 will ride up on the periphery of the cam 113, thereby closing the contacts 110 and 111 and establishing a holding circuit for the motor 96 for three complete revolutions of the commutator shaft 97. Thus when once the motor 96 has been started by pushing in the plug 107 all the way, the motor is bound to make three complete revolutions, irrespective of the fact that the slight withdrawal of the plug 107 by the spring 108 breaks the circuit between the bus bars 9 and 10.

The relay winding 23' which controls the signals 24' is connected to one side of the source 13, while the other terminal thereof is connected to the terminal lug 84' of the bus bar 1. Consequently, when the brush finger 105 engages the commutator contact 102', the signals are sounded once, the commutator shaft 97 completing the circuit to the other side of the source 13. With the plug 107 as shown, the signals are sounded again when the commutator finger 105 engages the contacts 102 connected to the bus bars 2 and 3, respectively, and thus three signals are sounded in succession for each revolution of the commutator shaft 97. When the motor circuit is broken at the contacts 110 and 111 upon completion of the third revolution of the shaft 97, the parts come to rest in the position shown, and no more signals are sounded until the plug 107 is again pushed in all the way in the same receptacle or any other receptacle of the code setting unit.

The terminals 95 from the white light 92 are connected in shunt relation across the relay winding 23, so that the light 92 flashes in accordance with the signals being sounded. The other two terminals 95 for the red light 90 are connected between one terminal for the motor 96 and one side of the source 13, so that the red light 90 will be illuminated while the motor 96 is running. Thus the operator is advised when the motor 96 is started by the illumination of the red light 90 after which she is able to see that the signal is be-

ing sounded by the flashing of the white light.

Referring now to Fig. 12, there is shown a still further modification in the form of the commutating device and also in the electro-motor means for operating the same. Fig. 12 is a diagrammatic view similar to Fig. 10, and a plug 107 is employed in connection with the bus bars, which is normally maintained out of engagement with the bus bar contacts 9 and 10 by a spring 108. The code operating device is also shown as comprising a number of terminals numbered 1 to 10 inclusive, arranged as shown in Fig. 10.

In the modification of Fig. 12 the commutator consists of a number of annularly arranged contacts 116 connected to the bus bars 1 to 8 inclusive, respectively, and an extra contact 117, which is connected to one terminal of an electro-magnet 118, the other terminal of which is connected to the source of power 13. The commutator also provides a continuous annular segment 119 which is connected to the movable arm 120 of a master contact similar to the one shown in Fig. 2. A brush 121 is adapted to bridge the space between the spaced contacts 116 and 117 and the continuous segment 119, the brush 121 being carried by and insulated from an arm 122 mounted on a shaft 123. The shaft 123 also carries a master cam disk 124 providing projections 125 which are adapted to operate the movable contact 120 by means of a finger 126.

The shaft 123 is adapted to be driven by a spring motor 127, the motor 127 being of the type that is adapted to turn the shaft 123 through exactly one revolution for each winding of the motor. Such a motor is shown in Patent No. 1,098,772, issued June 2, 1914 to W. M. Waite and the present inventor, and the motor 127 of the present embodiment is provided with a crank 128 whereby it may be wound for one revolution. The crank 128 is connected to a plunger 129 which is adapted to be drawn downwardly when the electro-magnet 118 is energized, a spring 130 serving to hold the plunger 129 in its retracted position.

When the plug 107 is pressed in to establish a circuit between the bus bars 9 and 10 the circuit of the electro-magnet 118 is completed, thereby causing the plunger 129 to be drawn down to wind the motor 127 for one revolution of the shaft 123. As the shaft 123 starts to turn, the brush 121 is moved off the contact 117 into engagement with the contact 116' which is connected to the bus bar 1. Just as the brush 121 engages contact 116', the first projection 125 on the master cam 124 causes the pivoted contact arm 120 to engage the stationary contact 131 of the master arcer which is connected to one side of the source 13.

Current thereupon flows through the master arcer to the commutator segment 119 and

from thence through the brush 121 to the commutator contact 116'. From here the current flows through a conductor 132 to one terminal of the signal relay 23', the other terminal of which is connected to the source 13. This causes the signals 24' to be sounded once and with the plug 107 connected as shown it is obvious that the signals will be sounded a second and third time as the brush 121 engages the second and third contacts 116.

As the shaft 123 is about to complete its first revolution a projection 133 on a cam 134 engages a lug 135 on the master contact arm 120, thereby closing the master contacts just as the brush 121 again engages the contact 117 from which it started. When this occurs the electro-magnet 118 is energized through the master contacts and the commutator contact 117 thereby cranking the motor 127 for a second revolution. Obviously the magnet 118 is deenergized as soon as the master contacts 120 and 131 separate and the signals are sounded in the same sequence as before as the shaft 123 completes its second revolution.

The cam 134 is mounted on a countershaft 136 connected to the shaft 123 by reduction gearing 137, so that the cam 134 makes only one complete revolution for three revolutions of the shaft 123. The cam projection 133 is spaced from a second projection 133' by 120° measured in the direction of the shaft 136, so that when the shaft 123 completes its second revolution, the second cam projection 133' again closes the circuit of the electro-magnet as previously described, thereby cranking the motor 127 for a third revolution.

It will be noted that the cam projections 133 and 133' are separated by 240°, as measured against the rotation of the shaft 136, so that when the shaft 123 comes to rest at the end of its third revolution the lug 135 on the master contact arm is midway between the cam projections 133 and 133'. Consequently, the shaft 123 comes to rest in the position shown in Fig. 12 with the electro-magnet 118 deenergized and with the brush 121 resting on the contact 117. Thereafter all parts are in position to start another cycle of signal impulses whenever the operation of the commutator is initiated by pressing in the plug all the way to momentarily bridge the bus bars 9 and 10 and crank the motor 127 for one revolution through the energization of the electro-magnet 118.

In the modification shown in Fig. 12 it is to be noted that all circuit connections are made and broken between the master contacts 120 and 131, with the exception of a single momentary contact that is made between the bus bars 9 and 10 in order to initiate the operation of the commutating device, through an initial energization of the

electromotor. In other words, every time the circuit of the solenoid 118 is completed to operate the spring motor, the circuit of the solenoid is made and broken between the master contacts 120 and 131.

From the foregoing, it is apparent that by my invention I have provided a signal system in which the code operating device is automatically set in operation as soon as the code setting device is operated for a given call. Furthermore, the system insures that the given signal is repeated three times and then stopped automatically without further attention on the part of the operator. The code setting device is particularly characterized by the convenience of its unit construction, whereby the bus bars are all connected by the act of assembling the various units, the construction and stacking feature of the code setting device being claimed separately in my copending divisional application Serial No. 343,474, filed February 28, 1929. By my particular arrangement of bus bars in the setting device, it is possible to energize and start the electromotor of the commutating device by the mere act of inserting the plug in any given receptacle, after which the motor is automatically disconnected from the common continuously energized bus bar, even though the plug remains in a receptacle.

I claim,

1. A code signalling installation including a commutator having a plurality of contacts, a commutator arm to move thereover from contact to contact by a sustained movement, a code setting unit having a manually actuated key, said key in its operative position determining a circuit to those of the commutator contacts corresponding to the code, electro-magnetic motive means for rotating said commutator arm, an arcuate conducting segment on the commutator and a brush on the commutator arm through which the circuit to said motive means is established and maintained until the brush reaches the end of the conducting segment, said key having means under control thereof to close the circuit to said motive means independently of said commutator brush in order to initiate the operation of said commutator.

2. A code signalling installation including a commutator having a plurality of contacts, a commutator arm to move thereover by a sustained movement, a code setting unit having a manually actuated key cooperating with contacts arranged in various code combinations, said key in its operative position determining a circuit to those of the commutator contacts corresponding to a selected combination of code contacts, an electro-magnet for causing rotation of said commutator arm, an arcuate conducting segment on the commutator and a coacting brush on the

commutator arm through which the circuit to said motive means is established and maintained until the brush reaches the end of the segment, said key having means under control thereof, to close the circuit of said electro-magnet independently of said commutator brush in order to initiate the operation of said commutator, and means operating simultaneously with said commutator arm for automatically reestablishing the circuit of said electro-magnet through said conducting segment in order to continue the operation of said commutator through a predetermined cycle.

3. In an electrical system, the combination with a main circuit having branches therein and an electrically controlled operating mechanism, of means controlled by a single movement for bridging predetermined branches of the main circuit and temporarily establishing a circuit for initiating operation of said operating mechanism, and automatic means controlled by the operation of said mechanism for sustaining its operation a predetermined length of time by the reestablishment of the previous broken circuit of the operating mechanism.

4. In an electrical system, the combination with a main circuit having branches therein and an electrically controlled operating mechanism, of means controlled by a single movement for bridging predetermined branches of the main circuit and establishing electrical contacts for initiating operation of said operating mechanism, and means controlled by subsequent movement of the operating mechanism for establishing and breaking said branch circuits and the circuit to said operating mechanism through a single movable contact member.

5. A code signal controlling apparatus comprising a normally inactive electric commutating device, a selective code setting device providing a plurality of contact combinations adapted to be individually set for determining various connections to selected contacts of said commutating device, electromotor means controlled automatically from said code setting device for initiating movement of said commutating device, means controlling the energization of said electromotor means for restoring the commutating device to inactive position after a predetermined range of operation, said commutating device in the course of its operation automatically carrying out a plurality of cycles of operation, whereby the code signal determined by the setting device is repeated a predetermined number of times.

6. In an electric code signalling apparatus, the combination with a source of electrical energy, a commutator having a plurality of stationary contacts and a rotatable shaft carrying a movable brush, of an electromotor device normally idle for causing a sustained

contact to contact advance of the commutator brush, a code setting device cooperating with said cummutator contacts providing a plurality of contact combinations, and universal
5 means actuated by each code setting operation to energize said motor for effecting the first movement of the commutator brush, rotation of said commutator shaft thereafter closing a circuit through said brush to said
10 motor for effecting a continued advance of the brush until the commutator brush has returned to an initial position in which the motor circuit is interrupted.

JOHN H. WHEELLOCK.

15

20

25

30

35

40

45

50

55

60