Sept. 15, 1931. H. BURDICK 1,823,586

SIGNAL CODE SENDING DEVICE

Original Filed Jan. 3. 1927 2 Sheets-Sheet 1

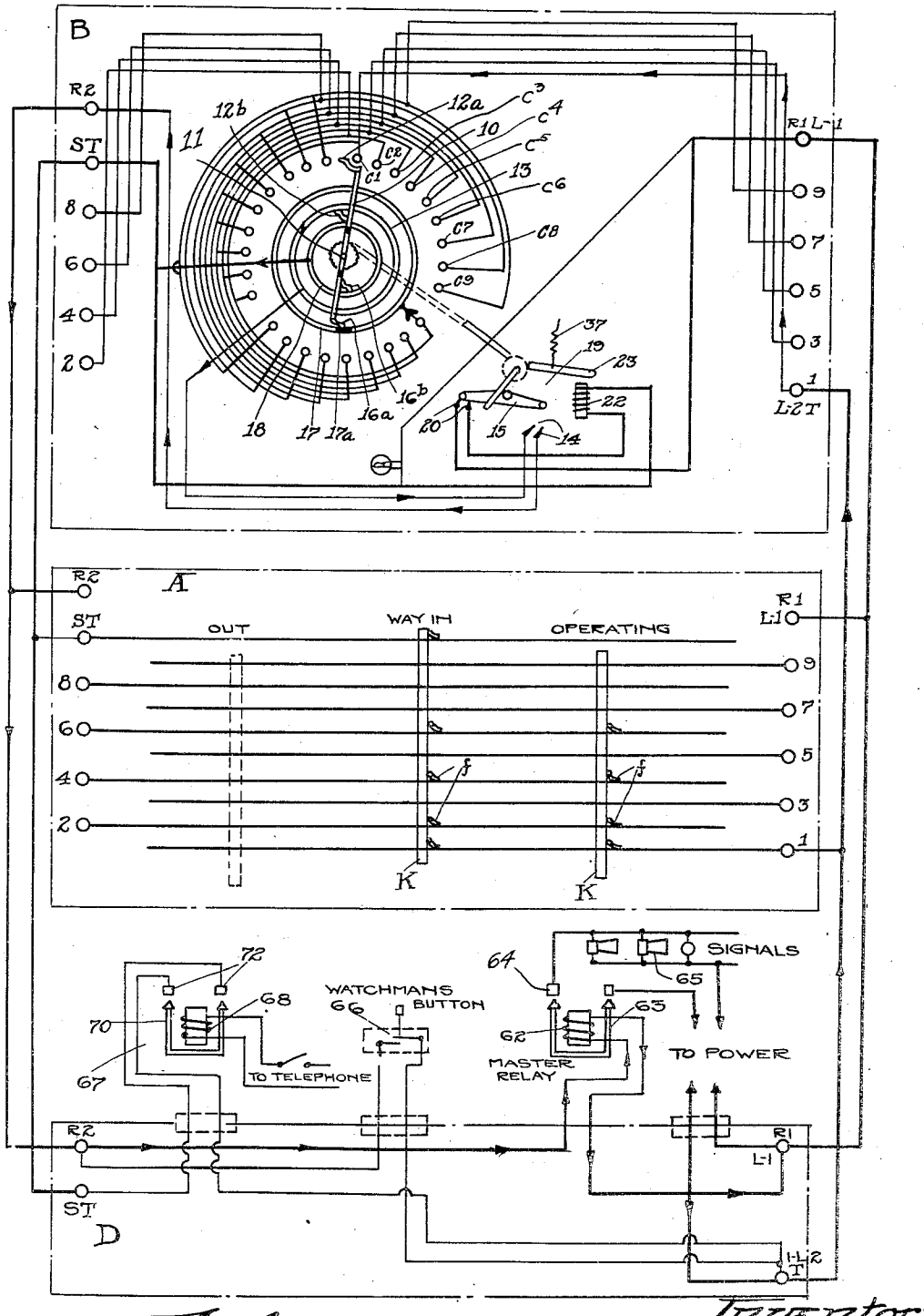


Fig. 1.

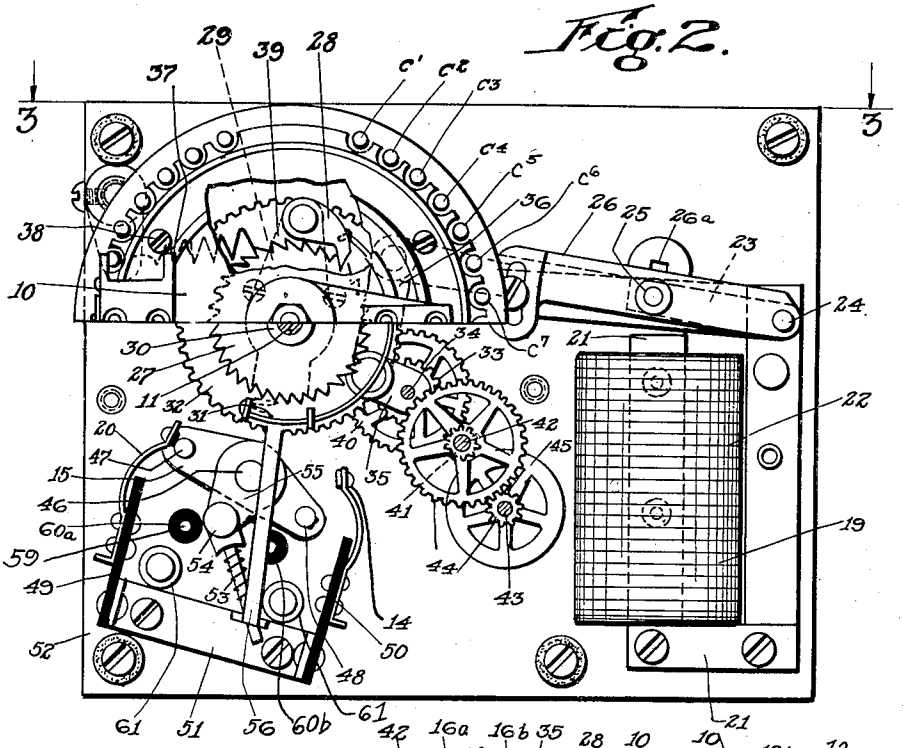
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Fig. 2.



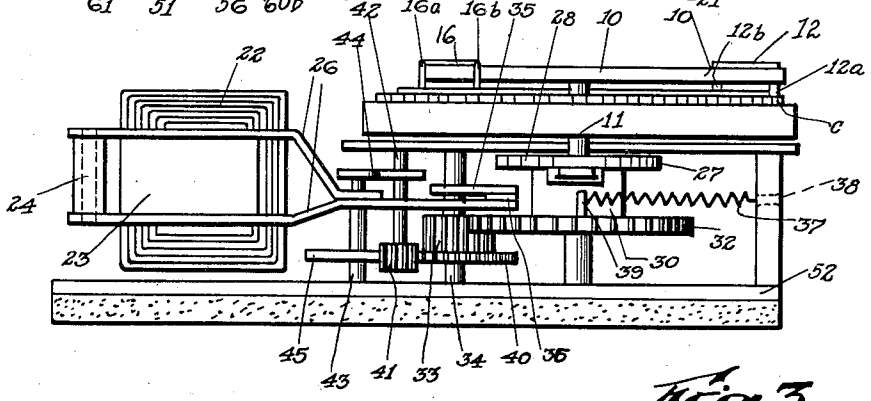


Fig. 3.

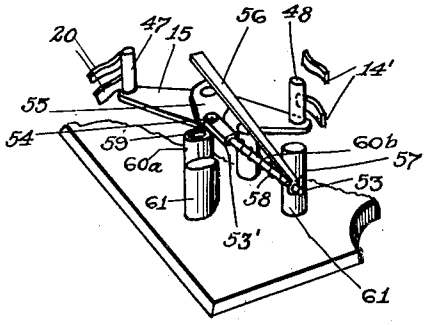


Fig. 4.

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UNITED STATES PATENT OFFICE

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SIGNAL CODE SENDING DEVICE

Original application filed January 3, 1927, Serial No. 158,665, Patent No. 1,809,020, dated June 9, 1931. Divided and this application filed December 31, 1928. Serial No. 329,601.

The present application is a division of my copending application Serial No. 158,665 filed Jannary 3, 1927, Patent No. 1,809,020, June 9, 1931, and relates particularly to an improved signal code sending device of the type employed for controlling, usually from a distance, the operation of various kinds of apparatus for sounding or displaying, a multiplicity of different signals at separate stations. Calling and locating individuals by code number as well as the sounding of time and fire alarms are well known uses of such a device.

The code sending device of the present application primarily consists of an electric current commutating mechanism and the object of the present invention is to provide an improved electro-motive means for actuating the commutating device, so as to operate the signals with proper spacing and in the sequence determined by a code setting device. For purposes of illustration, I have shown in the present application portions of a code setting device shown in my copending application Serial No. 148,464 filed November 15, 1026, although it is to be understood that the code sending device of the present application might also be as well employed in connection with other types of code setting devices. The above and other advantageous features of my invention will hereinafter more fully appear with reference to the accompanying drawings, in which:—

Fig. 1 is a diagrammatic view showing the electrical connections of my code sending device when used in connection with the code setting device of a signal system.

Fig. 2 is a plan view of the code sending device forming the subject matter of the present application, a portion of the commutator disk being broken away to show the mechanism.

Fig. 3 is a front elevation along the line 3—3 of Figure 2, turned around 180° with respect to Figure 2.

Fig. 4 is a perspective view of the toggle switch shown in Fig. 1.

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

Referring first to Fig. 1, there is shown diagrammatically the essential parts of the code setting and code sending devices as they are employed in my system, one code setting unit being indicated at A, while the base outline of the commutator of the core sending device is indicated at B. As clearly set forth in my aforesaid copending application No. 148,464, the code setting unit provides a series of parallel bus bars numbered 1 to 9, inclusive, and S*t*, which are connected by terminals to correspondingly numbered terminals on the base B. There is also provided an instrument base indicated at D and certain terminals designated L^1—R^1, I—L^2, R^2 and S*t* are connected to correspondingly designated terminals on the commutator base B by conductors extending vertically through the code setting unit A.

The commutator provides three groups of contacts c^1 to c^9 inclusive, which are connected to the bus bar terminals 1 to 9 inclusive, the corresponding contacts of each group being interconnected so that when any contact of the first group is energized the correspondingly numbered contact of each of the other groups is also energized. The commutator also provides a brush arm 10 rotatable clockwise with a shaft 11 centrally located with respect to the groups of contacts c^1 to c^9 inclusive. As best shown in Fig. 3, the brush arm 10 carries at one end a double brush 12 which provides a pair of spring fingers 12*a* and 12*b*, the outer finger 12*a* riding over the signal contacts *c* while the inner finger 12*b* rides over an annular contact ring 13. The ring 13 is adapted to be connected to the terminal R^2 only when a pair of normally open contacts 14 are bridged by a pivoted switch bar 15, the operation of which will be hereinafter described.

The brush arm 10 carries at its other end a double brush 16 which provides a pair of spring fingers 16*a* and 16*b*, the outer one 16*a* of which is adapted to ride over an annular contact ring 17 that is permanently connected to the contacts c^1 that are in turn connected to the bus bar 1 and the line terminal L^2. The ring 17 provides an insulated gap at 17*a* which the finger 16*a* engages when

the device is at rest. The inner brush finger 16*b* is connected to an annular contact ring 18 that is permanently connected to the terminal S*t*. The terminal S*t* is also permanently connected to one terminal of the coil 22 of an electro-magnet 19 which forms part of the impelling mechanism for the commutator shaft 11. The other terminal of the coil 22 is connected to line terminal L^1 through a pair of contacts 20 which are normally bridged by the switch bar 15 as will hereinafter appear.

Referring now to Fig. 2, the electro-magnet 19 is shown as of the alternating or direct current type and provides a laminated core 21, a coil 22 and a laminated armature 23 pivotally supported on the core 21 by a pin 24. The free end of the armature 23 has a bolt 25 extending therethrough, the ends of which are received in the parallel sides of a brass yoke 26, the ends of which are also supported by the pivot pin 24. Thus the yoke 26 is adapted to move with the armature 23 when the latter is attracted by energization of the coil 22, and this movement of the yoke is utilized to effect a step-by-step movement of the commutator brush arm 10, as will now be described.

For this purpose the shaft 11 of the brush arm 10 is provided with a ratchet wheel 27 secured thereto, the angular spacing of the teeth on the wheel 27 corresponding to the angular spacing between consecutive commutator contacts c^1 to c^9 inclusive. The ratchet wheel 27 is adapted to be operated by a pawl 28 pivoted on an arm 29 that extends from a collar 30 loose on the shaft 11. A spring 31 anchored at one end on the arm 29 serves to maintain the pawl 28 in engagement with the teeth on the wheel 27. The collar 30 of the pawl arm 29 also carries a gear 32 which is in mesh with a pinion 33 on a shaft 34. The shaft 34 carries a crank arm 35 which is connected by a link 36 to the free end of the armature yoke 26.

By the construction just described, each time the electro-magnet 19 attracts its armature 23 the movement of the latter will, through the yoke 26, impart a turning movement to the shaft 34. This movement of the shaft 34 will cause the pinion 33 to turn the gear 32 enough to step the ratchet wheel 27 forward through the angular displacement of one tooth. When the circuit of the coil 22 is interrupted by means about to be described, the armature 23 will be moved outwardly from the core 21 by the pull of a coil spring 37 anchored at one end to a lug 38 and connected at its other end to a stud 39 on the large gear 32, see Fig. 3. The spring 37 is tensioned when the armature 23 is attracted, so that the spring 37, acting through the gear 32, the shaft 34 and the linkage, will always return the armature 23 to its retracted position when the coil 22 is deenergized. The movement of the armature 23 by the spring 37 will also return the pawl carrying arm 29 to its initial position, thereby causing the pawl 28 to ratchet over the next succeeding tooth preparatory to the next stepping operation.

The above described mechanism for imparting a stepping movement to the commutator brush arm 10 is particularly designed so as to obtain the stepping movement with the development of a minimum amount of power by the electro-magnet 19. It is known that an alternating current magnet developing its maximum power will tend to make a considerable buzz and chatter which would be undesirable in a signal sending device of this type and that the chatter is greater with a small air gap because of the greater power developed. Consequently, the electro-magnet 19 is operated with a relatively large air gap between the armature 23 and core 21 so that when the coil 22 is energized the armature 23 is attracted without objectionable buzzing. In my improved device it is possible to effectively operate the commutator shaft 11 with the relatively small amount of power developed by the electro-magnet 19 with a large air gap, by the multiplication of this power through the linkage and the leverage obtained by the pinion 33 driving the large gear 32. With this arrangement, it is possible to turn the commutator shaft 11 with the development of a considerably smaller amount of power by the electro-magnet, than would be possible should the armature yoke 26 be connected directly to the gear 32. In order to provide for adjustment of the yoke 26 on the armature 23, the yoke has a slot 26*a* through which the bolt 25 extends.

The pinion shaft 34 also carries a gear 40 in mesh with a pinion 41 on a countershaft 42, and this shaft 42 is in turn connected to a flywheel shaft 43 by means of step-up gearing 44, so that the flywheel 45 on the shaft 43 is driven at a greatly increased speed, as compared to the pinion shaft 34. The flywheel 45 acts as an inertia governor so as to store up energy of rotation when the armature 23 is moved, the energy so stored being utilized to complete the motion of a make and break device for controlling the energization of the winding 22 and the sounding of the signals, as will now be described.

The means for interrupting the electromagnetic motor circuit between contacts 20 after each step of advance and which permits the spring return of the armature preparatory to the next step of advance, is preferably mechanically interlocked by the bar 15 with anti-arcing switch contacts 14 connected in circuit, preferably in series, with the signaling contacts *c* of the commutator, so as to prevent sparking at the latter. For this purpose, I mount the insulated double-ended bar 15 on a support 46 and provide current car-

rying contact posts 47 and 48 at the opposite ends thereof. Contact post 47 in circuit closing position establishes a bridging connection between the spring contacts 20 which are mounted on an upstanding insulating support 49 and are electrically connected one to one terminal of the electro-magnet coil 22 and the other to base terminal R^1—L^1. Spring contacts 14 on support 50 coact with post 48, one contact 14 being connected to the ring 13 of the cummutator block and the other to the relay terminal R^2 which leads through the signal unit stack to the master relay. The upstanding insulating contact finger supports 49 and 50 are riveted to the upstanding arms of a support bracket 51, attached to the metal base 52.

The double-ended switch bar 15 is oscillated by a toggle snap action to close the anti-arc contacts 14 through post 48 and to open the motor circuit contacts 20 when the armature 23 is attracted, and conversely to reclose the motor circuit contacts 20 and open the signal contacts 14 when the armature is retracted by its spring 37. The toggle action comprises a link 53 pivoted at 54 to a crank 55 rigidly secured to the middle of the switch bar 15. The pawl stepping arm 29 has a long extension 56 with a downturned eye 57 through which the extremity of the toggle link 53 extends, a coil spring 58 about the toggle link intervening between said eye and a shoulder 53′ on said toggle link. Stop pins 59 with insulating rollers 60*a* and 60*b* limit the stroke of the crank 55 and, therefore, of the contact posts 47 and 48 to prevent movement thereof beyond circuit making position. Cushioned stop posts 61 may also be provided to limit the stroke of the toggle-actuating arm extension 56. The mechanical operation of the toggle is such that when the coil 22 is energized to turn the pawl arm 29, the link 53 turns on the roller 60*a* very easily, thereby breaking the toggle as the extension 56 lines up with pivot pin 54. This snaps the post 47 away from contacts 20 to deenergize coil 22, but the energy stored in flywheel 45 is sufficient to throw the toggle all the way so that the crank 55 engages the right hand roller 60*b*. This causes the post 48 to bridge the signal contacts 14 momentarily, until the spring 37, acting on gear 32, overcomes the action of the inertia governor and returns the arm 29 and breaks the toggle again.

Having described the various parts entering into my invention the operation thereof will now be described, with reference to Fig. 1, in which parts of the electro-motor of the commutating device is shown schematically. In Fig. 1 there is also shown a key *k* of the code setting device in three different positions, as indicated, the operation of this key being fully shown and described in my aforesaid copending application, Serial No. 148,464. It is therefore not believed necessary to more fully describe the key *k* herein, other than to say that when the key *k* is in its inoperative position or "out" none of the fingers *f* on the bus bars engage the same, whereas when the key *k* is depressed to its operating position, the fingers on the bus bars 1, 2, 4 and 6 are in electrical contact therewith to sound the signal "211". The key *k* is also adapted to assume a "way in" position momentarily, in which the finger on the bus bar *St* also engages the key.

As previously pointed out, the brush finger 16*a* is in engagement with the insulated portion 17*a* of the commutator ring 17 when the device is not operating, so that even though the contacts 20 are bridged by the post 47, no current can flow through the finger 16*a* from the energized commutator ring 17 to the coil 22. However, when the operator pushes the key *k* all the way in before releasing it, the coil 22 will be immediately energized by current flowing from one side of the power source at the terminal 1—L^2 and from thence through the bus bar 1 and the key *k* to the terminal *St* of the commutator. From the terminal *St* the current flows to the coil 22 through the then closed contacts 20 and from thence to the other side of the source at the terminal R′—L′ as shown in heavy lines.

When the winding 22 is so energized the armature 23 will be attracted to move the brush arm 10 through the space of one ratchet tooth, thereby moving the brush 16*a* off the insulation at 17*a* into engagement with the energized commutator ring 17. This movement momentarily breaks the circuit of the coil 22 at the contacts 20, but as previously described, the spring 37 returns the armature 23, thereby reestablishing the circuit of the coil 22 at the contacts 20. Current then flows from the continuously energized commutator ring 17 through the finger 16*a* to the other commutator ring 18, as indicated by heavy arrows, and it is obvious that the coil 22 will be thus energized each time the contacts 20 are bridged by the post 47 on the bar 15. Thus the armature brush arm 10 will have a step-by-step clockwise movement imparted thereto until it has made one complete revolution, whereupon the finger 16*a* will again engage the insulating gap 17*a* in the ring 17 and the parts will come to rest.

As the brush arm 10 is stepped around, the brush 12*a* carried thereby will engage the contacts *c* consecutively, and it is apparent that when the brush 12*a* engages the first contact c^1 of the first group, current will flow from the terminal 1—L^2 through the brush 12 and commutator ring 13 to one relay terminal R^2 through the then closed contacts 14, as indicated by small arrows. The terminal R^2 is connected through the base D to one terminal of the winding 62 of a master signal relay, the other terminal of

which is connected to the source of power through the terminal R^1—L^1. When the relay winding 62 is so energized its armature 63 will engage the stationary contacts 64 and thereby connect a plurality of signals 65 to a source of power not shown, thus sounding the signals 65 throughout the establishment.

From a consideration of the operation of the toggle switch it is evident that the signal contacts 14 will be bridged by the post 48 only momentarily before the spring 37 returns the armature 23 so that the signals 65 are only sounded for one short impulse. When the brush 12*a* on the arm 10 engages the next contact c^2, the master relay winding 62 is again energized, the current this time flowing from the bus bar 1 to the bus bar 2 through the key *k* and from thence to the terminal 2, the brush 12 and the relay terminal R^2. This sounds the signals 65 again, but on the next step of the arm 10 the signals are not sounded, owing to the fact that the bus bar 3 is not connected to the key *k*. When, however, the brush 12*a* engages the commutator contacts c^4 and c^6, the master relay winding 62 is energized each time, thus causing the signals 65 to be sounded a third and fourth time with an interval therebetween, these impulses representing the code call "211". After this the brush 12*a* passes over the remaining contacts c^7, c^8 and c^9 of the first group without sounding any more signals.

As the brush finger 12*a* is stepped over the second group of contacts *c*, the signals 65 are sounded in the same sequence as before, corresponding to the code number "211", and the same thing occurs when the brush 12*a* passes over the third group of contacts, whereupon the brush arm 10 comes to rest as the brush 16*a* engages the insulated gap in the ring 17 at 17*a*.

From the foregoing then it is apparent that each time a key of the code setting unit is pushed all the way in it will initiate the operation of the code sending device by momentarily energizing the coil 22 of the electromotor, whereupon the commutator arm 10 will be stepped through a complete cycle without any further action on the part of the operator. As the arm 10 is turned it will cause the signals 65 to be sounded in accordance with the sequence determined by the arrangement of the fingers on the bus bars 1 to 9 inclusive, these fingers serving to connect the corresponding commutator contacts *c* to the continuously energized bus bar 1.

It will be noted that in the foregoing operation the snap switch contacts 14 are connected in series with all of the signal contacts *c*, when established, and that these snap switch contacts 14 are snapped to open circuit position by the action of the return spring 37 of the electro-magnetic motor when the latter resets the pawl 28 of the clockwork preparatory to the succeeding advance of the commutator brush arm 10. Thus the switch contacts 14 are brought to open position and the signalling circuit is interrupted prior to any stepping advance of the commutator arm 10, so that no sparking can occur at the commutator contacts *c*. After the electro-magnet has effected a step of movement of the commutator arm 10, the contacts 14 are immediately closed to permit a succeeding signal operation therethrough.

The governing flywheel 45 has considerable weight and its effective inertia is greatly increased by driving it through multiplying gears, thus the speed of the motor armature 23 is greatly reduced while, at the same time, power is stored up for carrying the peak loads, as when the armature 23 is forcing the switch toggle toward its dead center. The operation of the flywheel 45 so times the mechanism as to afford substantial intervals between successive steps of the commutator. This gives the master relay and the bells, horns, etc., time enough for each to complete its stroke or unitary impulse constituting a code element, before the next stepping stroke moves the commutator arm off the contact. Also, the stepping movement itself is deliberate, giving ample intervals between successive code elements, as is necessary for clearness and intelligibility of the code signal, as a whole. The adjustment between the armature 23 and yoke 26 permits changes in the timing of the mechanism.

I claim:

1. A code signalling device including a plurality of commutator contacts, a rotary contactor arm therefor, mechanism for advancing said arm in a stepping movement from contact to contact, a snap switch having arcing contacts connected in series with said contactor arm and thereby inhibiting arcing at all of said commutator contacts, toggle means to control said snap switch, actuating means interlocked with the commutator arm advancing mechanism to cause the toggle means to operate the snap switch to open circuit position prior to each step of advance of the arm, and electromagnetic means under control of said arm advancing mechanism furnishing the energy for re-closing said snap switch preparatory to advancing said contactor arm to a succeeding commutator contact.

2. A code signalling device including a commutator having contacts, a commutator arm for coaction with said contacts, a code announcing instrument means actuated from a common source of electric power for advancing said switch arm by a step by step movement and for initiating the operation of the code announcing instrument, said means including an electromagnet and an armature therefor, linkage operated from the armature of said electromagnet for advanc-

ing the commutator arm, a first switch for connecting said electric power to said electromagnet, a second switch for connecting said announcing instrument to said commutator arm, means interlocked with said linkage for opening said first switch after each stepping operation and closing the second switch, retractile means, and means responsive to said retractile means in withdrawing said armature from the electromagnet for opening said second switch in disconnecting said announcing instrument while reclosing the first switch in reenergizing said electromagnet.

3. A code signalling apparatus including a commutator having a plurality of contacts adapted to be selectively connected in circuit, in accordance with the code to be announced, a commutator arm adapted to move over said contacts, a current source, means deriving energy from said current to both move the commutator arm and to transmit signalling current therethrough, said means including a commutator arm stepping circuit including an electromagnet, a signalling circuit including further contacts in circuit with the commutator arm, and means mechanically inter-related with said commutator arm and electrically inter-related with said electromagnet for automatically closing the circuit of said electromagnet preparatory to each step of the commutator arm and for automatically closing said further contacts in the intervals between successive advances of the commutator arm, either of said stepping and signalling circuits being open when the other is closed.

4. A code signalling apparatus including a commutator having a plurality of fixed contacts, a rotary commutator arm, motive means for advancing said arm, said means including an electromagnet having an armature, linkage connecting the armature to said commutator arm to effect a step by step advance thereof from contact to contact, a toggle operated bar mechanically associated with said linkage, a first switch contact for said toggle bar snapped by the movement of the linkage after each stepping advance, to interrupt the circuit to said electromagnet, said toggle bar having a second switch contact, a signalling circuit to said commutator arm including said second switch which is closed when the first switch contact of said toggle bar is open and a spring serving to withdraw the armature from the electromagnet in effecting said toggle bar to snap open the signalling circuit to the commutator arm preparatory to interruption of contact at the commutator upon the subsequent step of the commutator arm.

5. In a code signalling apparatus, in combination, two pairs of contacts, a double arm toggle, a switch member in engagement at all times with one or the other of said pairs of contacts and controlled by said toggle, a commutator having a plurality of contact segments and a rotary arm therefor, one pair of said contacts in circuit with said rotary arm, an electromagnet in circuit with the other pair of said contacts, and a transmission operated from said electromagnet for controlling said double arm toggle in advancing the rotary arm through one step for each attraction of the electromagnet.

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