

June 24, 1941.

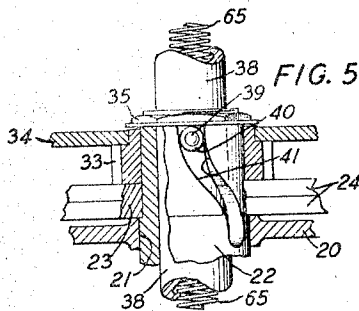
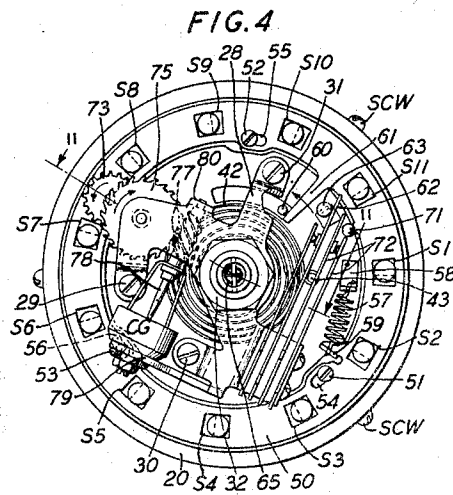
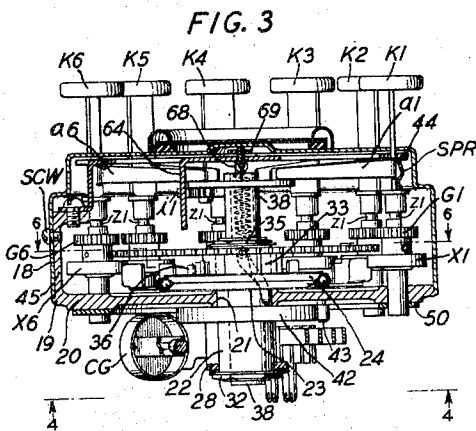
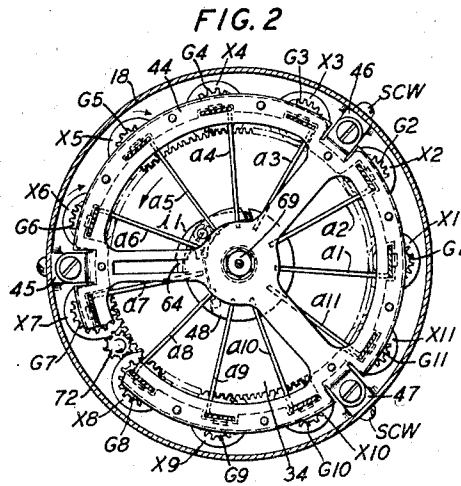
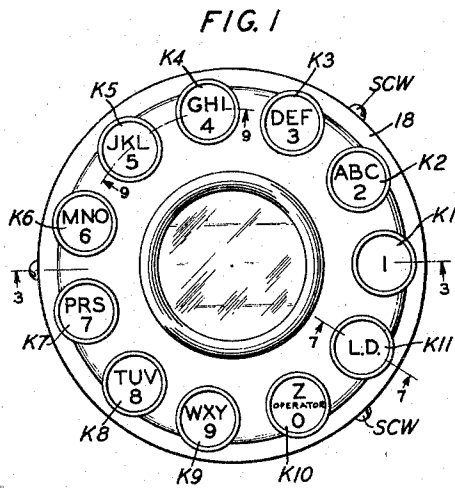
J. G. ROBERTS ET AL

2,246,698

CALL TRANSMITTER DEVICE

Filed Dec. 15, 1938

3 Sheets-Sheet 1



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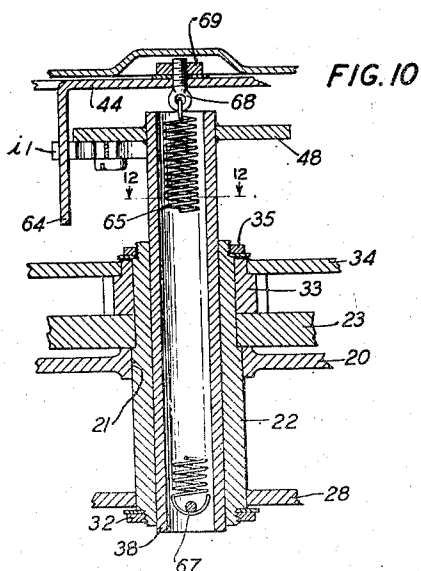
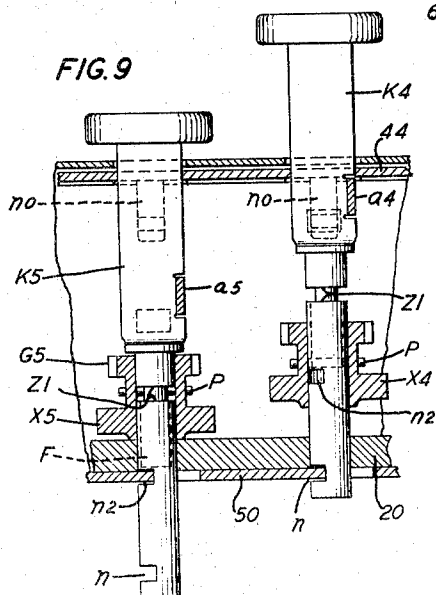
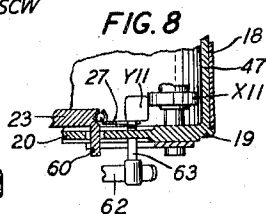
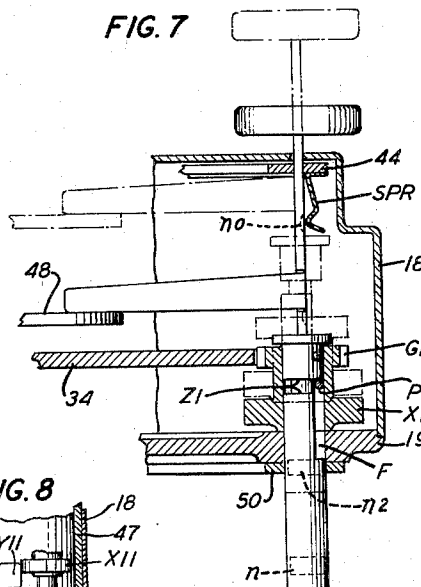
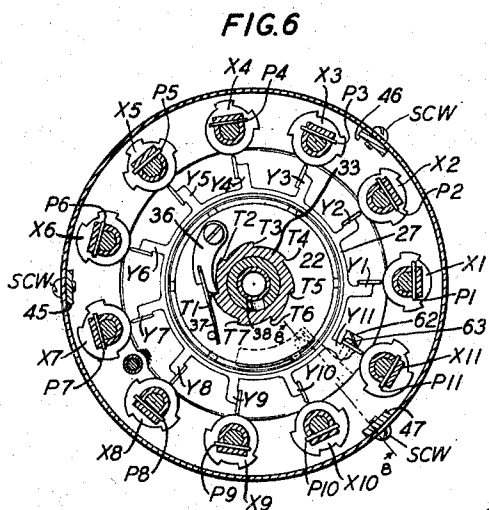
J. G. ROBERTS ET AL

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CALL TRANSMITTER DEVICE

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3 Sheets-Sheet 2



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CALL TRANSMITTER DEVICE

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3 Sheets-Sheet 3

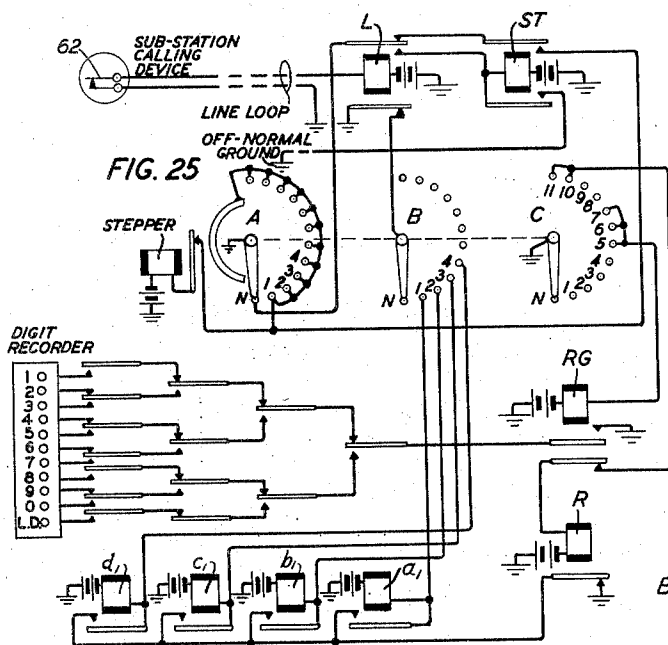
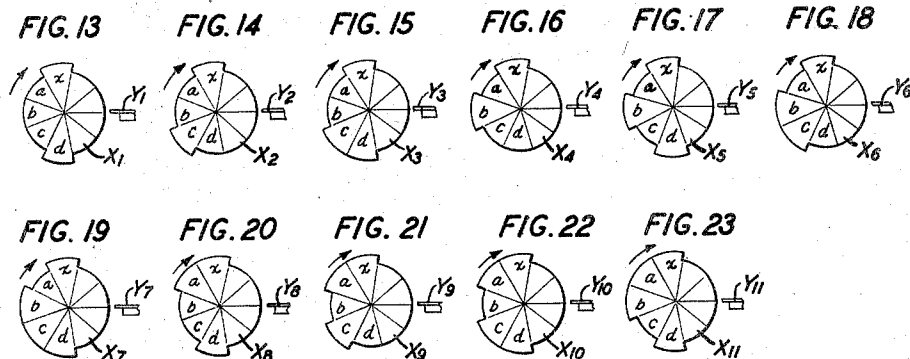
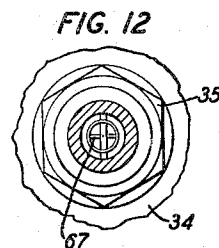
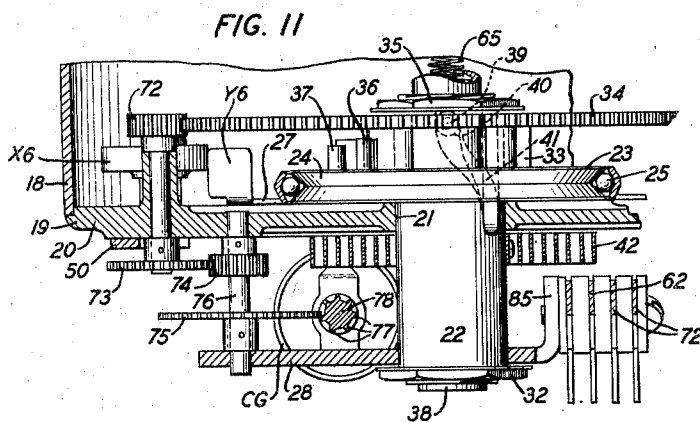


FIG. 24

CODE	START	a	b	c	d	STOP	a	b	c	d
1										
2										
3										
4										
5										
6										
7										
8										
9										
0										
L.D.										

PULSES SENT RELAYS OPERATED DURING CYCLE

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2,246,698

CALL TRANSMITTER DEVICE

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Application December 15, 1938, Serial No. 245,836

10 Claims. (Cl. 179-90)

This invention relates to apparatus for transmitting signaling impulses suitable for the control of automatic switches of telephone exchanges, and more particularly to a call transmitter of the code type.

The invention contemplates a code calling device which transmits a code of variations of line circuit interruptions and closures, which selectively operate a set of decoder relays at the central office which in turn cause the called number to be stored up on suitable registers thereat, whereupon these registers control the setting of the automatic switches to select the called line. The code calling device first produces a break in the calling line circuit in order to start a progressive switch in motion at the central office. This switch makes its complete movement in say five units of time in synchronism with the code calling device, and as it steps ahead over a series of contacts to which the decoder relays are connected, these relays are energized or not in accordance with the digit being called.

More specifically, in the call transmitter of this invention, manually operable key members numbered to represent digits are provided for positioning normally ineffective associated gear and cam units in operative relation with a driving mechanism in the form of a gear actuated by a motor spring. Means operatively associated with all the key members is provided whereby the operation of any one of these keys is effective to rotate a shaft and thereby to tension the motor spring for actuating the driving gear during the return movement of the shaft. Means is provided whereby the operation of any gear and code wheel unit is effective to operate a pulsing contact for transmitting a series of electrical impulses in code corresponding to the character of the operated key. Means is provided for locking each key in its operated position and the other key members in their non-operated position during the operation of the transmitter. Means actuated by the motor mechanism is provided for operating the locking mechanism at the conclusion of each digit or code transmitting operation for releasing the operated key and thereby permitting the return movement of the key and the plunger to normal unoperated position as effected under the tension of a common retractile spring, means carried by each gear and code wheel unit being provided for holding such units in normal position on their respective keys and with reference to the driving gear and with a contact actuating member when their controlling keys are returned to retracted position.

Other novel features and advantages of the invention will appear from the following description and by the claims appended thereto, reference being had to the accompanying drawings in which:

Fig. 1 is a top view of the transmitter;

Fig. 2 is a top assembly view showing the casing and a number of operating parts in section;

Fig. 3 is a cross-sectional view taken on line 3-3 of Fig. 1;

Fig. 4 is a rear view of the transmitter;

Fig. 5 is a partial view of the motor spring tensioning mechanism;

Fig. 6 is a sectional view taken on line 6-6 of Fig. 3;

Fig. 7 is a sectional view taken on line 7-7 of Fig. 1 showing a key member and associated operating parts in the operated position;

Fig. 8 is a partial view of the pulsing contact actuating mechanism shown in section taken on line 8-8 of Fig. 6;

Fig. 9 is a sectional view taken on line 9-9 of Fig. 1 showing two key members, one of them being locked in the operated position and the other in the non-operated position;

Fig. 10 is a longitudinal sectional view of the driving shaft and its operating plunger member;

Fig. 11 is a sectional view taken on line 11-11 of Fig. 4 showing the governor and its operating gear mechanism;

Fig. 12 is a cross-sectional view taken on line 12-12 of Fig. 10;

Figs. 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 are detail views of the pulsing cams;

Fig. 24 is a diagrammatic view of the codes transmitted according to the pulsing cams; and

Fig. 25 is an example of a circuit suitable for use in connection with the code impulse transmitter of the invention.

In the call transmitter of this invention, a base plate 20 is provided with a plurality of arms 45, 46 and 47 and a rim portion 19 for receiving a casing 18 for housing the transmitter mechanism which will be hereinafter described in detail. The casing is secured to arms 45, 46 and 47 by a plurality of screws SCW shown in Figs. 2 and 6. The base plate 20 is provided with a centrally disposed bearing portion 21 for rotatably receiving a hollow shaft 22. On this shaft is secured as by a press fit engagement a disc member 23 provided at its periphery with a V-shaped groove 24 shown in Figs. 3, 5 and 11, which forms in cooperation with a similar groove in the rim portion of a contact operating member 27 a ball bearing for this member.

The hollow shaft 22 is journaled at its lower end portion in a bracket 28 shown in Figs. 3, 4, 10 and 11 secured to the underside of base plate 20 by screws 29, 30 and 31, and a nut 32 which is screwed on the lower end of this shaft cooperates with the disc member 23 for preventing the axial movement of this shaft in its bearings.

On the upper end portion of hollow shaft 22 is loosely mounted a ratchet wheel 33 having a hub portion for securely mounting a spur gear 34, and a nut 35 screwed on this end of shaft 22 cooperates with the disc portion 23 for preventing the axial movement of ratchet wheel 33 and the gear 34 carried thereby on this shaft.

On the disc member 23 is mounted a pawl 36 shown in Figs. 3, 6 and 11 yieldably held in engaged relation with the ratchet wheel 33 by a spring 37, thereby serving as a one-way effective clutch for operatively connecting the gear 34 to shaft 22.

A plunger 38 which is mounted for axial or longitudinal movement in shaft 22 is provided with a laterally extending pin 39 provided for mounting a roller 40, best seen in Figs. 3, 5 and 11. This roller engages a helical track 41 in the hollow shaft 22 so that the downward movement of plunger 38 is effective to rotate the shaft 22 in the direction indicated by the arrow in Fig. 6 an angular distance corresponding to the pitch of this track which in turn corresponds to the spacing of the teeth T1, T2, T3, T4, T5, T6 and T7 in ratchet wheel 33. The movement of shaft 22 tensions a motor spring 42 which has the end of its inner convolution secured to the shaft 22 and the end of its outer convolution to a pin 43 laterally extending from the underside of base plate 20 as shown in Figs. 3 and 4.

The downward movement of plunger 38 is effected by the axial movement of either one of a plurality of key members K1, K2, K3, K4, K5, K6, K7, K8, K9, K10 and K11 each of which is formed with a laterally extending arm a1, a2, a3, a4, a5, a6, a7, a8, a9, a10 and a11, operatively engaging a disc 48 formed with or secured to the upper disposed end of plunger 38.

These keys are formed at their lower end with cylindrical portions engaging bearing portions in the base plate 20, while their upper ends, which are rectangular in cross-section engage similarly shaped holes in a ring-shaped bracket 44, secured to the arms 45, 46 and 47 extending from the base plate 20, and springs as SPR shown in Fig. 7 cooperate with notches NO in the rectangular portion of the keys for resiliently holding them in the non-operated position.

The cylindrical portions of keys K1, K2, K3, etc. extend through slots S1, S2, S3, S4, S5, S6, S7, S8, S9, S10 and S11 in a ring 50 mounted for free angular movement on the underside of base plate 20, such movement being limited by a plurality of screws 51, 52 and 53 shown in Fig. 4 engaging respectively the slots 54, 55 and 56. The cylindrical portions of keys K1, K2, K3, etc. as shown in Figs. 7 and 9 are provided with notches as n and $n2$ which may be engaged by the ring 50 upon its turning movement as imparted by the tension of a spring 57 having one end hooked to a bracket 58 secured to the base plate 20 and its other end to a lug 59 formed with the ring 50 as shown in Fig. 4. The release of spring 57 so as to cause the angular movement of ring 50 within the limit defined by the slots 54, 55 and 56 is effected by a pin 60 projecting from the disc 23 of shaft 22 through a slot in base plate 20 (Figs. 4 and 8) in engaged

relation with a radial arm 61 formed with the ring 50, the ring 50 being normally held in disengaged relation from the notches n of keys K1, K2, K3, etc. through the normal tension of motor spring 42 acting on the shaft 22.

On the cylindrical portions of keys K1, K2, etc. is mounted a plurality of pinions G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 and G11 formed with or secured on the hub portions of code wheels X1, X2, X3, X4, X5, X6, X7, X8, X9, X10 and X11. The hub portion of each pinion and code wheel units G1—X1, G2—X2, etc. thus formed is provided with a tangentially disposed pin P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 and P11, Figs. 6 and 7, cooperating with flat keyways in the cylindrical portion of the key members K1, K2, etc. for locking these pinions against turning movement when in disengaged position from the driving gear 34 as shown by keys K1, K2, K3, K4, K5 and K6 in Fig. 3 and key K4 in Fig. 9, circular grooves as Z1 being provided which when the key members K1, K2, K3, etc. and the pinion and code wheel units G1—X1, G2—X2 and G3—X3 etc. are moved in their operated position register with the pins P1, P2, P3, etc. as shown by key K5 in Fig. 9 for permitting the rotating movement of pinions G1, G2 and G3 etc. as effected by the driving gear 34.

Upon the downward movement of any one of the key members K1, K2, K3, etc. and thereby that of the plunger member 38, against the tension of a retractile spring 65, this plunger is prevented from turning in a counter-clockwise direction by an arm 64, shown in Figs. 2, 3 and 10, extending downwardly from the ring-shaped bracket 44 in parallel relation with the axial or longitudinal movement of plunger 38 for engagement with a spring pressed pawl 61 carried by disc 48 of plunger 38, for causing the clockwise movement of hollow shaft 22 due to the engagement of roller 40 against the helical track 41 of this shaft, thus tensioning the motor spring 42 and simultaneously moving the pawl 61 for engaging the tooth T2, for example, of ratchet wheel 33, the clockwise and counter-clockwise movement of shaft 22 as imparted by the operation of the key and the motor spring being thus translated for operating the gear 34 and the pinion and code wheel units G1—X1, G2—X2, etc. in a unidirectional movement.

The downward movement of plunger 38 and the pawl 61 carried thereby to a point clear of the extreme end of arm 64 and the consequent locking of its operating key members K1, K2, etc. as the case may be by the ring 50, as above described, prevents the longitudinal return movement of this plunger to normal unoperated position as effected by the tension of retractile spring 65 best seen in Figs. 3, 5, 10 and 11, while the operation of hollow shaft 22 in its counter-clockwise movement as imparted by the tension of motor spring 42 is effective to rotate this plunger due to the engagement of roller 40 against the track 41 thus positioning the pawl 61 past its cooperating arm 64. Upon the release of the depressed key and the simultaneous return of this key and the plunger 38 to normal unoperated position under the tension of retractile spring 65, this plunger is caused to rotate in a clockwise direction as determined by the track 41, thus re-engaging the pawl 61 with the arm 64 preparatory to the operation of another key. The retractile spring 65 is hooked at one end to a pin 67 extending across the lower end of plunger 38 and its other end to a stud 68, formed with a

screw threaded portion at its upper end for receiving a nut 69 resting on the ring-shaped bracket 44.

As shown in Fig. 4 a stud 71 carried by locking ring 70 is provided for actuating shunting contact members 72 upon each movement of this ring under the tension of spring 57 for effecting switching functions well known in the telephone art. The operation of shaft 22 and the driving gear 34 actuated thereby under the tension of motor spring 42 and the operation of cams X1, X2, X3, etc. as the case may be, is transmitted to a movable contact spring 62 through the operation of a contact operating member 27, shown in Figs. 3, 6 and 11, this member having a stud 63 extending through a slot in base plate 20 in engageable relation with the movable contact spring 62 for operating it according to the character of the depressed keys as translated in codes by their associated cams X1, X2, X3, etc., the shunting and pulsing springs being mounted in a pile-up arrangement on a lug 85 formed with the bracket 28, as shown in Figs. 4 and 11.

The operation of driving gear 34 and the cams X1, X2, X3, etc. actuated thereby is controlled by a centrifugal governor CG through the operation of a gearing mechanism comprising a pinion 72 meshing with the gear 34, a gear 73 secured to the spindle 72, pinion 74 engaging the gear 73, the worm gear 75 secured on shaft portion 76 of pinion 74 and the worm 77 formed on the governor shaft 78, the governor shaft 78 being journaled at both ends in lugs 79 and 80 formed with the bracket 28.

In the operation of the call transmitter of the invention, the operation of key member K5, for example, from the position shown in Fig. 3 to the position shown in Fig. 9 is effective to move the gear G5 in engaged relation with the driving gear 34 and simultaneously imparts a downward movement to plunger 38 through the engagement of arm a5 with the disc 49, thereby imparting a turning movement to hollow shaft 22 through the engagement of roller 40 with track 41 of this shaft. The turning movement of shaft 22 is effective to tension the motor spring 42 and simultaneously release the spring 57 through the disengagement of pin 60 from arm 61 of ring 50 for permitting the engagement of this ring with the notch n2 of the operated key K5 and thereby the simultaneous engagement of notches n of the non-operated keys K1, K2, K3, K4, K5, K6, K7, K8, K9, K10 and K11, plunger 38 being held in the operated position through the locking of the key K5 by ring 50.

The turning movement of shaft 22 and the disc 23 carried thereby imparted by the movement of key K5, as above described, is effective to move the pawl 36 in engaged relation with the tooth T2 of ratchet wheel 33 so that the return movement of shaft 22 to normal under the tension of motor spring 42 is effective to rotate the gear wheel 34 and thereby the pinion and code wheel unit G5—X5, the gear ratio between gear wheel 34 and pinions G1, G2, G3, etc. being of the order of seven to one, the pinion and code wheel unit G5—X5 as in this example controlled by key K5 is turned a complete revolution in a clockwise direction as indicated by the arrow in Fig. 17.

The turning operation of code wheel X5, as above described, is effective to rotate the contact operating member 27 through the engagement of this code wheel with the projecting arm 75

Y5 of this member. The operation of contact operating member 27 and the stud 63 carried thereby in a counter-clockwise direction as indicated by the arrow in Fig. 6, is effective to actuate the pulsing spring 62 for transmitting pulses according to the character of code wheel X5 as will be hereinafter described in detail.

The movement of shaft 22 in the clockwise direction under the tension of motor spring 42 as controlled by the operation of governor CG, at a point a small angular distance from its normal position the pin 60 carried by disc 23 engages the arm 61 of locking ring 50 and moves this ring against the resistance of spring 57 for disengaging it from the notch n2 of the operated key K5, and the notches n of the non-operated key members, thus releasing the operated key K5 which is returned to normal position by the movement of plunger 38 under the tension of its retractile spring 65. It is to be noted that the return movement of this plunger to normal due to the engagement of roller 40 in the track 41 causes the turning movement of this plunger for reengaging the pawl 36 with the arm 64.

The return of key K5 to normal non-operated position is effective to move the gear G5 out of engagement from the driving gear 34 through the abutment afforded by the shoulder portion at the lower end of key-way F of key K5 engaging the pin p of pinion and code wheel unit G5—X5, such engagement also serving to hold the pinion and code wheel units G1—X1, G2—X2, etc. in adjusted position with respect to gear 34 and the arms Y1, Y2, Y3, etc. of the contact actuating member 27.

As shown in Figs. 6, 13, 15, 16, 17, 18, 19, 20, 21, 22 and 23, the code wheels X1, X2, X3, etc. are each divided into nine equal parts and each code wheel is provided with two camming surfaces of different length for sending sets of impulses as shown diagrammatically in Fig. 24 wherein the dash lines represent the "make" periods of the pulsing contact during the cyclic movement of the code wheels X1, X2, X3, etc. Code wheel X1 which is operatively associated with key K1 will cause the operation of the pulsing contact at points x and d:

Code wheel X2 at points x and c
Code wheel X3 at points x and cd
Code wheel X4 at points x and b
Code wheel X5 at points x, b and d
Code wheel X6 at points x and bc
Code wheel X7 at points x and bcd
Code wheel X8 at points xa and d
Code wheel X9 at points xa and c
Code wheel X10 at points xa, cd, and
Code wheel X11 at points xab and d

The operation of code wheels X1, X2, X3, etc. and thereby that of the pulsing contact in the order above described is effective to control the operation of devices at the central for establishing telephone connections or indicating the telephone designation transmitted in terms of the numbered key members K1, K2, etc. which may have been operated.

The type of devices which may be used for establishing telephone connections and the devices for indicating such call designations together with their operating circuits which are shown, as for example, in Fig. 25 are well known in the telephone art and form no part of the present invention.

Circuit description

According to Fig. 25 when the connection from the code calling device to the L relay is established, relay L operates over the line loop. When relay L has operated, it in turn operates relay ST which locks to the off-normal ground lead thus preparing the circuit for the initial or start impulse from the code calling device. Relay ST remains operated during registration of the called number.

When the initial interruption occurs, relay L releases, thus causing the stepper magnet to operate and since its operating circuit is under control of its own contacts, it will release when these contacts break. Each time that the stepper magnet operates and releases, it causes the brush assembly of arcs A, B and C to advance one step. The circuit for the initial operation is traced from ground on arc A through the N contact of arc A, normal contacts of relay L, operated contacts of relay ST, normal contacts of stepper magnet to the winding of this magnet. When the brush assembly leaves the normal position, the circuit for advancing the stepper magnet is traced from the feeder of arc A through the successive terminals of arc A, normal contacts of the stepper magnet and the winding of this magnet. Hence, the brush assembly of arcs A, B and C progress successively over all terminals of their respective arcs until the normal position is again reached where the further progress of the switch will depend upon the action of the L relay.

As the switch passes by terminals 1, 2, 3 and 4 of arc B, a circuit is closed to the bottom contact of relay L through arc B in successive order to recording relays *a1*, *b1*, *c1* and *d1*. If the L relay is not operated while the switch is passing over any of the terminals 1, 2, 3 or 4 of arc B, ground will be furnished to the associated recording relays. If any recording relays *a1*, *b1*, *c1* or *d1* operate they will lock to ground at the normal contacts of relay R. Thus the recording relays will register the digits in code as supplied by the code calling device. It is assumed, of course, that the speed of the stepper magnet is synchronized with the code calling device so that the interruptions of the L relay will be indicated to the recording relays *a1*, *b1*, *c1* and *d1* at the proper time.

As the brush for arc C passes over terminals 5, 6 and 7, ground is supplied to relay RG causing this relay to operate. When relay RG operates, it supplies ground through its operated contacts to the armature of recording relay *a1*. This causes a signal to be furnished to one of the eleven leads of the digit recorder in accordance with the combination setting of recorder relays *a1*, *b1*, *c1* and *d1*. When the brush of arc C passes over terminals 8 and 9, relay RG releases and will remain normal until it is again reoperated on succeeding digits. When the brush of arc C passes over terminals 10 and 11 ground is supplied by the brush to these terminals, through the normal contacts of relay RG to relay R causing this relay to operate. The operation of relay R releases any of the recording relays *a1*, *b1*, *c1* and *d1* which were previously operated by the release of the L relay as the brush of arc B passed over terminals 1, 2, 3 and 4 of this arc in accordance with the code for the recorded digit. Thus recording relays *a1*, *b1*, *c1* and *d1* are reset and ready to be used again in recording the next digit. It should be

observed that a separate digit recorder must be connected to the eleven recording leads for recording each digit of the called number. This could be done by the insertion of a series of steering relays having contacts in the eleven leads from the relays *a*, *b*, *c*, *d*, to the digit recorder 80, that a different digit recorder is connected for each revolution of the stepping switch. When the brush of arc C leaves terminal 11, relay RG releases and remains normal until it is again reoperated in recording the next digit.

It should be observed that while only four recording relays are used others could be furnished if changes in the impulse code require it. The switch is sufficiently fast in returning to the normal position so that it will be ready to be actuated on the succeeding registration. At the completion of the first registration, the L relay will remain operated over the line loop until the next digit is to be recorded. In the meantime, the switch will have returned to the normal position N and will there be awaiting the start signal for the next registration.

When the next digit is to be recorded, the line loop will be momentarily interrupted at the start of the impulse code, thus releasing relay L. This causes the stepper magnet to operate as for the first digit and advance the switch to the No. 1 terminals. Again the switch will advance on a self-interrupted basis until it reaches the normal position. In the meantime, as the switch passes over terminals 1, 2, 3 and 4 of arc B impulses will be received by the recorder relays *a1*, *b1*, *c1* and *d1* in accordance with the operated or non-operated position of relay L as the switch passes over these terminals. Of course, the second set of signals are received by a second digit recorder substituted for the first by a steering relay, not shown, this second recorder being connected to the eleven leads associated with relays *a1*, *b1*, *c1* and *d1* immediately after the first digit has been recorded. As the brush of arc C passes over terminals 5, 6 and 7, relay RG operates to cause the signal to be supplied over one of the eleven leads to the digit recorder under direction of the recording relays *a1*, *b1*, *c1* and *d1*. As the brush of arc C passes over terminals 10 and 11, relay R is operated which removes ground from the locking contacts of recording relays *a1*, *b1*, *c1* and *d1*, thus causing the previously operated relays to release. This operation is repeated for each digit until all digits have been recorded.

As an example, assuming that the digit 6 is to be recorded. As previously mentioned, relay L operates when the connection from the code calling device to this relay is established and off-normal ground is furnished in preparation for holding relay ST operated. When relay L operates over the line loop, it in turn operates relay ST by connecting ground from the brush of arc A through the normal terminal N to the winding of relay ST. When relay ST operates, it locks to the off-normal ground supply and prepares the circuit for receiving the initial or start impulse from the code calling device. Relay ST remains operated during registration of the called number.

According to the code chart of Fig. 24, the code for digit 6 is such that ground closures will be furnished to recording relays *b1* and *c1* as the brush of arc B passes over terminals 2 and 3 while no ground closures will be furnished to the other recording relays *a1* and *d1* as the brush of arc B passes over terminals 1 and 4.

These code signals are furnished by the cam X6 shown in Fig. 18 which is used to control the line interruptions when the key for digit 6 is depressed. Thus, as the cam X6 starts to rotate, segment X actuates the contact operating member 27 through its arm Y6 and the movement of this member and the consequent operation of contact 62 in turn causes the line loop to be interrupted releasing relay L. Relay L released connects ground from the brush of arc A through the normal top contacts of relay L, the operated contacts of relay ST, the normal contacts of the stepper magnet to the winding of this magnet. This causes the stepper magnet to operate and remove ground from its winding. This self-interruption causes the stepper magnet to release. Each operation and release of the stepper magnet causes the brush assemblies of arcs A, B and C to advance one step or one position. At the completion of the first self-interruption, the brush of arc A advances to terminal 1 and thus connects a supplementary ground to the normal contacts of the stepper magnet. This ground will be furnished by the brush of arc A to the contacts of the stepper magnet in all positions of the brush assembly excepting the normal position, thus providing a ground source for the automatic operation and release of the stepper magnet in all positions. This insures that the switch will advance on a self-interrupted basis from position 1 through all positions until it reaches its normal position. When the brush of arc B advances to position 1, the cam X6 advances in synchronism so that segment a releases the arm Y6 of contact operating member 27 and closes the pulsing contact 62 thus causing relay L to operate. Relay L removes ground to the brush of arc B which is now resting momentarily on terminal 1. This prevents recording relay a1 from operating.

When the brush of arc B reaches terminal 2, the cam X6 will have advanced under control of the governor mechanism in position wherein segment b engages the arm Y6 of contact actuating member 27 for opening the contact 62 thus causing the line loop to be interrupted and releasing relay L at the time when the brush of arc B is resting on terminal 2, thus operating recording relay C1. Relay C1 operated locks to ground supplied by the normal contacts of relay R and prepares its contacts which will be used later when the digit is recorded.

When the brush of arc B reaches terminal 3, the cam X6 will have advanced so that segment c maintains the contact 62 operated causing the line loop to continue to be interrupted and the line relay L will therefore remain released. Hence, with relay L released when the brush of arc B is resting on terminal 3 recording relay c1 will be energized. Relay c1 will lock to ground supplied by the normal contacts of relay R and will also prepare its contacts for use later when the digit is recorded.

When the brush of arc B reaches terminal 4, the cam X6 will have advanced so that segment d releases arm Y6 and thereby causes the closure of contact 62 causing relay L to operate. Relay L will not connect ground to the brush of arc B which is now resting momentarily on terminal 4. Thus recording relay d1 will not operate. At this point digit 6 has been registered by the settings of recording relays b1 and c1 which are operated and relays a1 and d1 which are normal.

When the switch reaches position 5, ground is

connected by the brush of arc C to relay RG causing this relay to operate. Relay RG operated, connects ground to the functioning contacts of recorder relay a1 which is directed through normal contacts of relays a1 and d1 to the operated contacts of relays b1 and c1 to the lead of the digit recorder which records the digit 6. Relay RG will remain operated as the brush of arc C is passing over terminals 5, 6 and 7 thus insuring a satisfactory length of closure to the digit recorder.

When the switch leaves position 7, relay RG releases, thus removing ground from the armature of recording relay a1 and partially preparing the circuit for operating relay R. When the switch passes through positions 10 and 11 ground is supplied through the brush of arc C and the normal contacts of relay RG to the winding of relay R causing this relay to operate. Relay R operated, releases relays b1 and c1 thus preparing these recording relays for recording the next digit. When the switch leaves position 11, relay R releases and the switch continues its progress in returning to normal on a self-interrupted basis under control of the brush and terminals of arc A until the switch arrives at the normal position. When the switch reaches the normal position, the brushes of arcs A, B and C will be resting on their respective N terminals.

What is claimed is:

1. In a call transmitter, a motor having a driving gear, a plurality of key members, a pinion and a cam unit carried by each of said keys, said pinions being movable in operative relation with said driving gear upon the operation of said keys for actuating said cams, means operable automatically for locking said keys in operated position during the movement of each of said cams, means actuated by said motor for releasing such operated key members at the conclusion of each operation of said cams for disengaging said pinions from said driving gear, and means carried by said units cooperating with means carried by said keys for locking said units against turning movement on said keys when said pinions are disengaged from said driving gear.

2. In a call transmitter device, a base, a ring-shaped bracket secured to said base in spaced relation therewith, a set of key members mounted for longitudinal movement in said base and said bracket, a hollow shaft journaled in said base having a helical track formed in its wall, a plunger mounted for longitudinal movement in said shaft, means carried by each of said keys for operatively engaging said plunger, a roller carried by said plunger for engaging said track for rotating said shaft upon the operation of said keys for tensioning said spring, a ratchet wheel loosely mounted on said shaft, a gear carried by said ratchet wheel, a pawl carried by said shaft for engaging said ratchet wheel, a motor spring tensioned by the operation of said shaft for actuating said gear and a pulsing mechanism actuated by the operation of said gear according to each individual operation of said key members.

3. In a call transmitter device, a base, a ring-shaped bracket secured to said base in spaced relation therewith, a set of key members mounted for longitudinal movement in said base and in said bracket, a hollow shaft mounted for movement in said base in two opposite directions, said shaft having a helical track in its wall, a plunger mounted for longitudinal movement in said shaft having means for engaging said track for rotating said shaft in one direction, a motor spring

tensioned by the operation of said shaft, a gear, a one-way effective clutch mechanism operatively connecting said gear to said shaft for movement of the latter in the opposite direction under the tension of said spring, camming members, pinions moved in operative relation with said gear by the operation of said keys, camming members actuated by said pinions during the movement of said shaft in the last-mentioned direction, a pulsing contact, means actuated by the operation of each of said camming members for actuating said contact and automatically operable means controlled by the operation of said shaft in the first-mentioned direction for locking said keys collectively during the operation of each of said camming members.

4. In a call transmitter, a base, a hollow shaft journaled in said base having a helical track formed in its wall, a plunger mounted for longitudinal movement in said shaft having means for engaging said track, a motor spring having one end secured to said plate and the other end to said shaft, a bracket secured to said base, a plurality of key members mounted for longitudinal movement in said base and said bracket, means carried by each of said keys operatively engaging means carried by said plunger whereby the operation of one of said keys is effective to cause the turning movement of said shaft for tensioning said spring, means automatically operable upon the movement of said shaft for locking said key in the operated position and the other keys in the non-operated position, a contact, a gearing mechanism and a cam actuated by the operation of said shaft under the tension of said spring for actuating said contact, a governor mechanism for controlling the operation of said motor spring, a plurality of cooperating means for releasing said operated key and said non-operated keys, and means controlled by the movement of said shaft for returning said plunger and said operated key to normal at the conclusion of the operation of said cam upon the release of said key.

5. In a call transmitter, a base, a hollow shaft rotatably mounted in said base, a bracket secured to said base, a plunger mounted for movement in said shaft, a set of key members slidably mounted in said base and said bracket having means for actuating said plunger, a retractile spring for said plunger, a plurality of cooperating means for rotating said shaft upon the axial movement of said plunger, a motor spring tensioned by the turning movement of said shaft, a cam actuated by the operation of said shaft under the tension of said motor spring, a governor mechanism for controlling such operation, a contact actuated by said cam, a mechanism operable automatically for locking said key in the operated position during the pulsing operation of said cam, and means actuated by said shaft upon its return to normal position for releasing said key for permitting its return movement and that of said plunger to normal under the tension of said retractile spring.

6. In a call transmitter device, a base, a bracket secured to said base, a hollow shaft journaled in said base and said bracket having a helical track formed in its wall, a hollow plunger mounted

for longitudinal movement in said shaft having means for engaging said track, a disc member carried by said plunger, a set of key members having means for operatively engaging said disc, a motor spring, said bracket having an arm extending in line parallel to the movement of said plunger, means carried by said disc member for engaging said arm for causing the turning movement of said shaft upon the movement of said plunger under control of said key members, a retractile spring in said plunger hooked at one end thereof, a member carried by said bracket for attaching the other end of said spring, a motor spring tensioned by the turning movement of said shaft in one direction upon the movement of said plunger by the operation of one of said key members, a cam actuated by the operation of said shaft in another direction under the tension of said motor spring, a contact actuated by said cam, a mechanism operable automatically for locking said key member in the operated position, and means actuated by said shaft upon its return movement to normal position for releasing said key member for permitting its return movement to normal under the tension of said retractile spring.

7. In a call transmitter, a motor spring, a plunger member, a set of key members movable for actuating said plunger for tensioning said spring, a pulsing contact, a plurality of individually operable contact actuating means mounted for rotation on said key members and actuated by said motor following the operation of said plunger for actuating said contact.

8. In a call transmitter, a set of key members, code cams rotatably mounted on said key members, a pulsing contact, and means for rotating one of said cams following the operation of its associated key member for actuating said contact.

9. In a call transmitter, a set of manually operable key members, a cam and a pinion mounted for rotation as a unit on each of said key members, motor means having a gear disposed for engagement with any one of said pinions upon the operation of its supporting key member for actuating its associated cam, an operating member actuated by the movement of the last-mentioned cam, a contact actuated by said member, and means operable automatically for disengaging said pinion from said gear following the operation of said contact.

10. In a call transmitter, a motor spring, a set of key members operable independently for tensioning said spring, a driving gear actuated under the tension of said spring, a pinion and a cam mounted for rotation as a unit on each of said keys, means normally locking said units against rotation on their associated key members, the pinions of said units being normally disengaged from said driving gear but engageable therewith upon the operation of their respective key members, a pulsing contact, means actuated by the rotation of any one of said cams following the operation of its supporting key member for actuating said contact, and a governor mechanism actuated by said driving gear for controlling the operation of said contact.

JOHN G. ROBERTS.

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