March 31, 1936. H. W. GOFF 2,036,037

TELEPHONE CALL TRANSMITTER

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FIG. 1

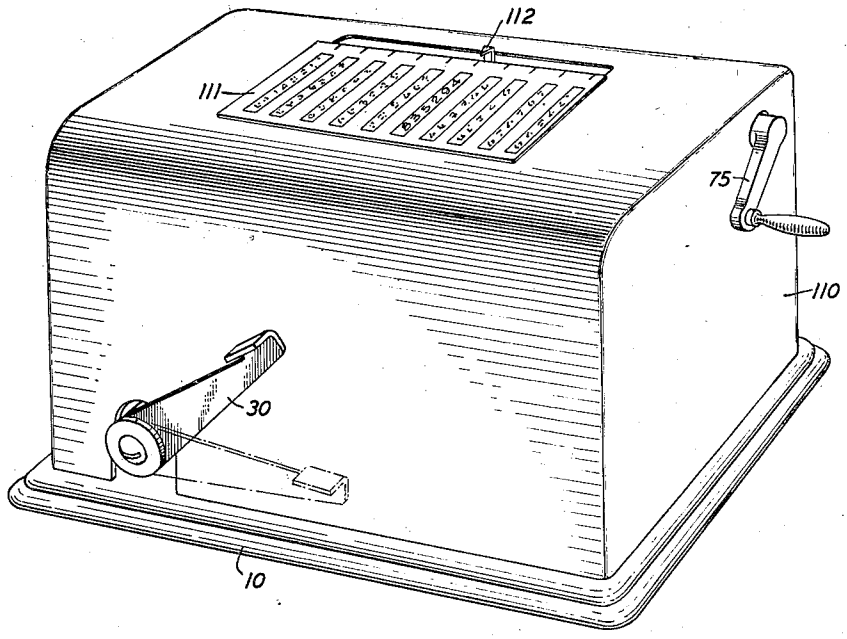

FIG. 9

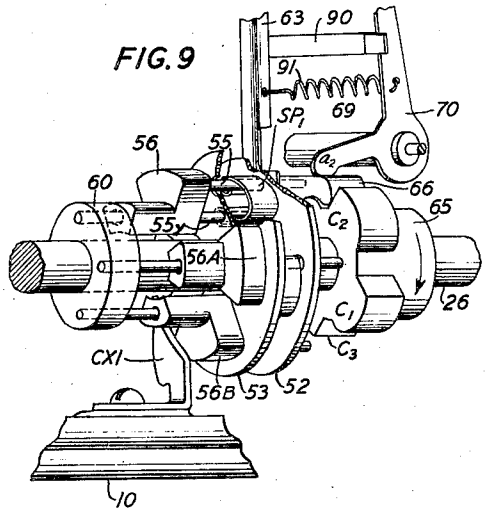

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FIG. 2

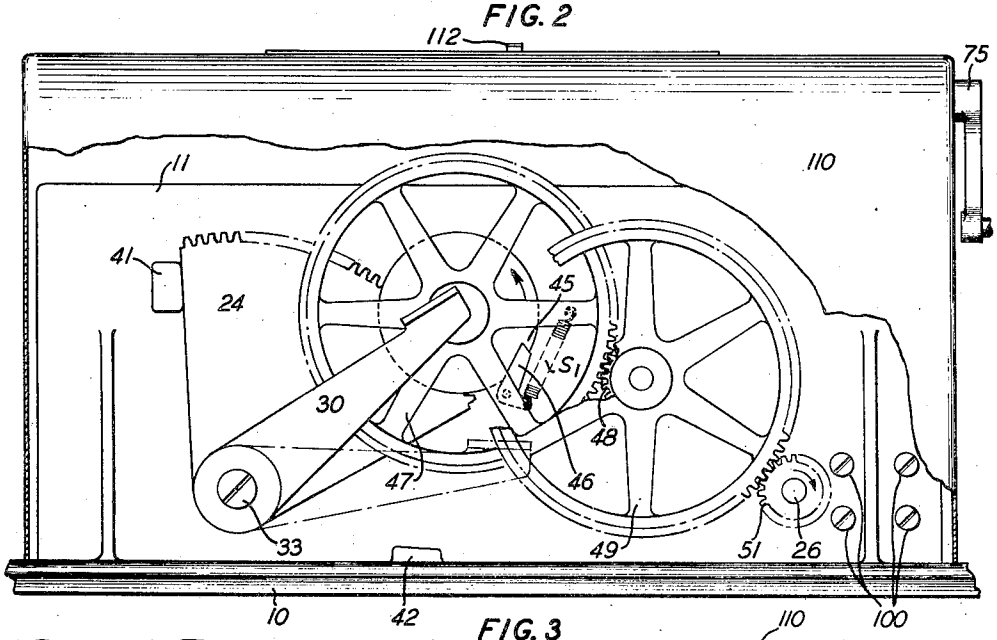
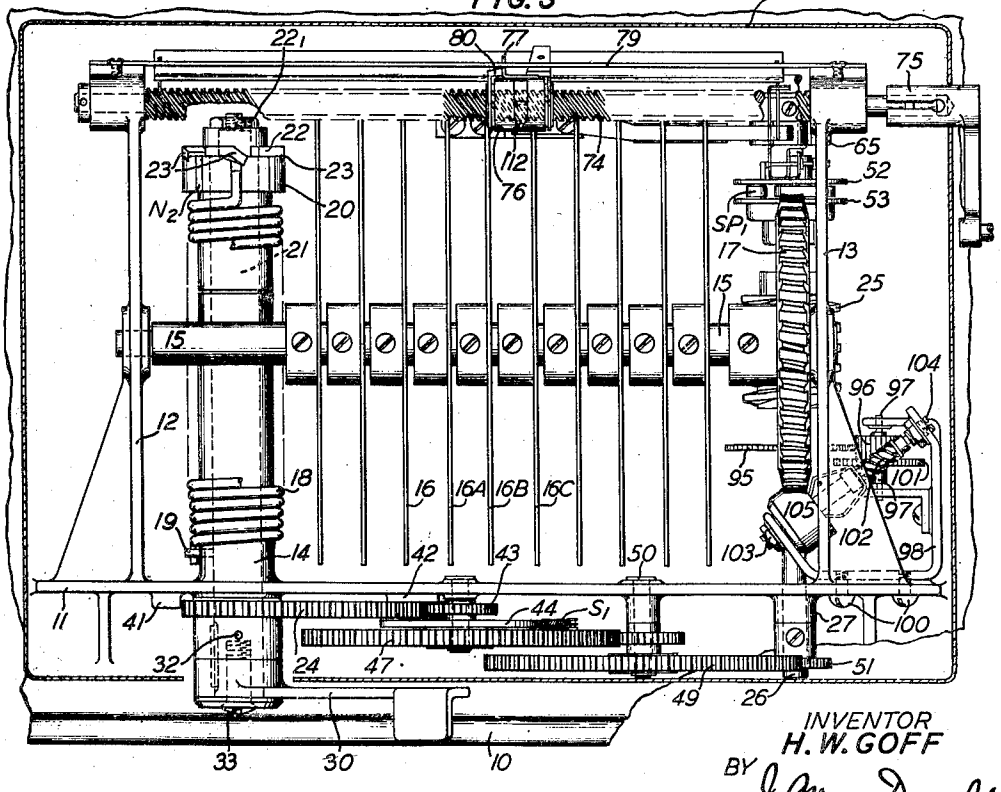


FIG. 3



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TELEPHONE CALL TRANSMITTER

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FIG. 4

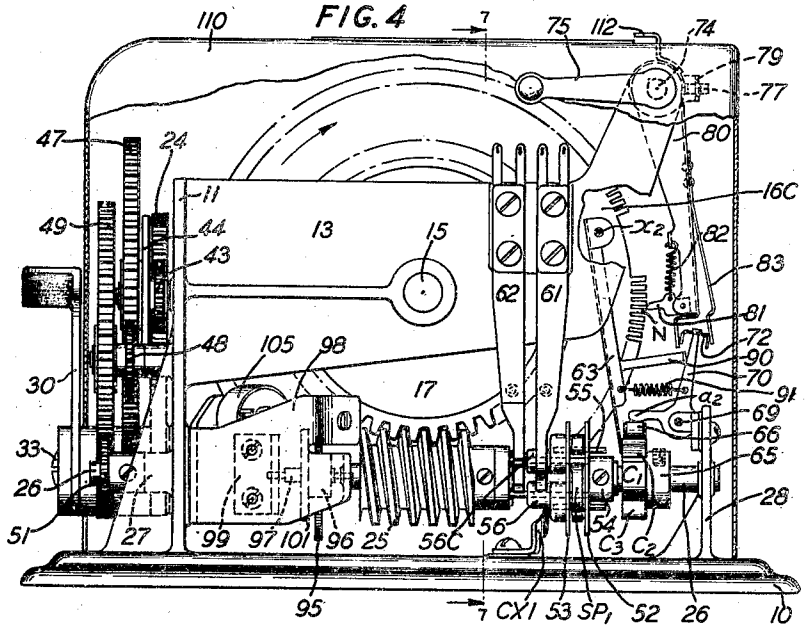
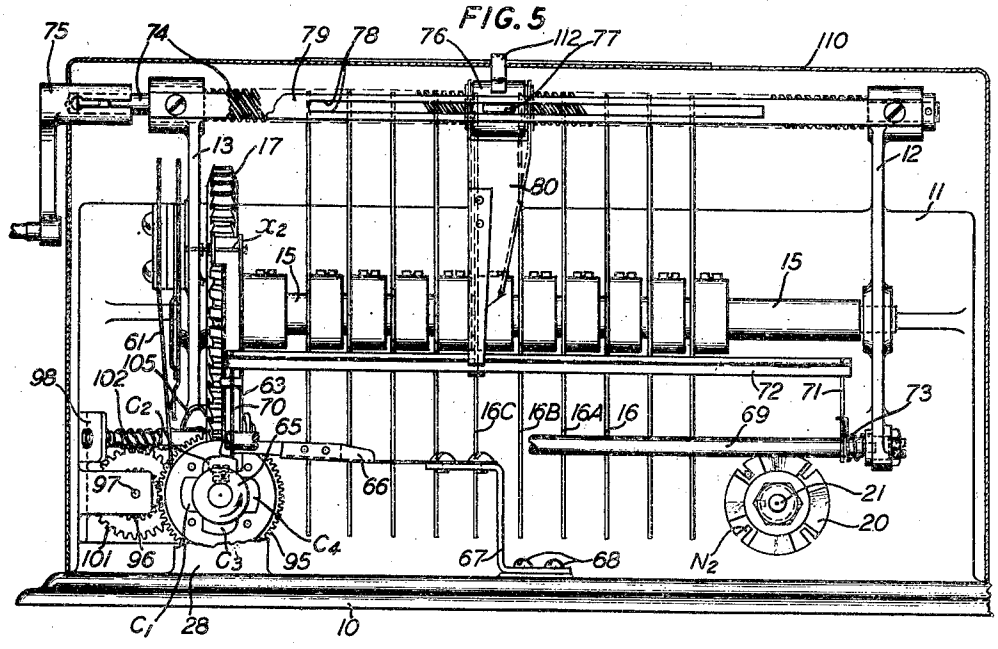


FIG. 5



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TELEPHONE CALL TRANSMITTER

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FIG. 7

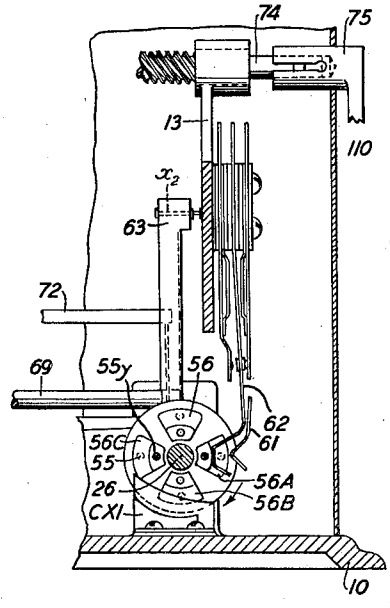


FIG. 6

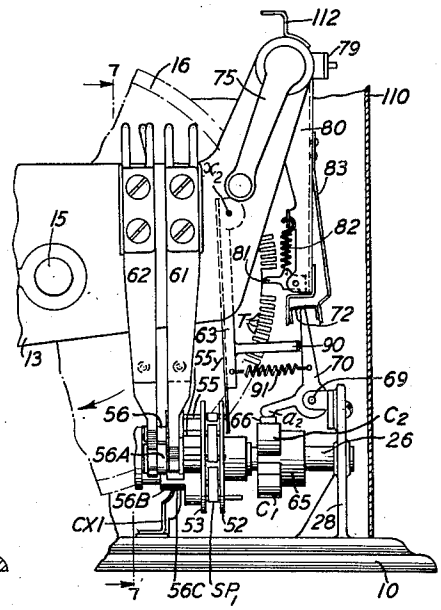


FIG. 8

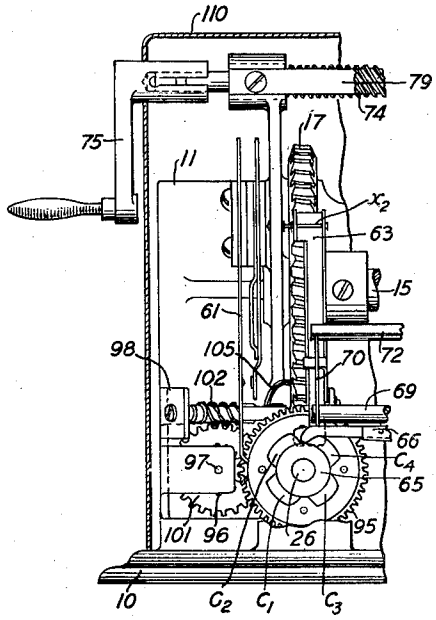
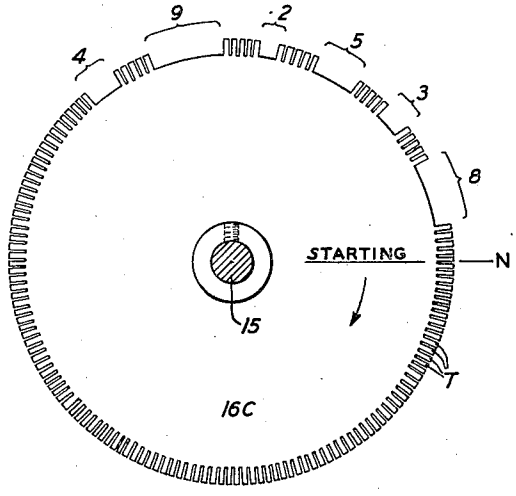


FIG. 10



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Patented Mar. 31, 1936

2,036,037

UNITED STATES PATENT OFFICE

2,036,037

TELEPHONE CALL TRANSMITTER

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Application October 6, 1934, Serial No. 747,113

13 Claims. (Cl. 179—90)

This invention relates to call transmitters of the so-called "repertory" type which are used in automatic telephone exchange systems to simplify the calling operations involved in selecting certain most frequently called telephone lines. This is accomplished in such transmitters by a preliminary "setting-up" operation, whereby the calling party sets a pointer opposite the name of the party to be called, which conditions the transmitter mechanism to transmit the code of impulses for calling such party by the mere depression of a single lever.

The object of this invention is to improve the construction and operation of such transmitters.

In the repertory dialing device of this invention each of the subscribers' lines to be called by the device has allotted thereto on a common shaft a notched disc. All these discs are rotated in unison when a lever is actuated and released, the lever winding up a spring to revolve the shaft upon the release of the lever, through suitable gearing. A single revolution of the preselected disc causes the transmission of the entire code of impulses individual to the line allotted to such disc. The disc is originally divided into a certain number of teeth and to condition the disc to transmit the entire code for selecting a given subscriber's line, groups of teeth are cut out or removed from the disc periphery. Attached to the pointer of the mechanism which is moved in the preliminary setting-up operation is an arm adapted to engage the selected disc. A mechanism is provided which imparts a back and forth or reciprocating movement to said arm for each tooth passed over. As the disc is rotating, if the arm in its forward movement engages a tooth, the impulse transmitting mechanism is inoperative, but if it does not engage a tooth in such movement, means is brought into action thereby to cause the impulse mechanism to transmit an impulse. Thus it is the length of the cut-out portion of the disc which determines the number of pulses for the digit of the called number which corresponds to this particular notch or cut-out portion of the disc. The notches between the sets of teeth provide the so-called "interdigit" space to enable the automatic switches to have time to test for an idle trunk, or other changeover operation.

More specifically, a call transmitter is provided whereby the operation of a handle member is effective to rotate a shaft for tensioning a motor spring, the release of which actuates camming members through a gearing mechanism and a clutching device connecting the camming members' supporting shaft to the motor shaft. Another shaft geared to the camming members' supporting shaft actuates a plurality of discs having peripherally disposed indentations representing the digits of the telephone call to be transmitted, means in the form of a lever mechanism being provided whereby the conjoint movement of the impulse predetermining elements thus formed and that of the camming members in the path of normally closed contacts being effective to operate such contacts for causing impulses in the telephone line for operating switches according to the character of the impulse predetermining disc used for establishing the desired telephone connection, and means is provided for controlling the operation of the motor shaft together with means whereby the manual operation of a lead screw is effective to selectively move an arm of the lever mechanism in operative relation with any one of the impulse predetermining discs, such selection being indicated by a pointer or marks inscribed on a casing serving as a housing for the call transmitter mechanism.

Other features of the invention and advantages 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 perspective view of the machine shown with the housing in position thereon;

Fig. 2 is a front view showing the operating gear mechanism, the housing being shown with portions cut away;

Fig. 3 is a top view;

Fig. 4 is a right end assembly view with portion of the casing cut away;

Fig. 5 is a rear assembly view showing a number of operating parts and the housing with portions cut away;

Fig. 6 is a partial view showing elements of the impulse cam controlling mechanism in their operated position;

Fig. 7 is a sectional view taken on lines 7—7 of Fig. 4;

Fig. 8 is a partial view showing elements of the impulse cam controlling mechanism in their non-operated position;

Fig. 9 is a partial enlarged view of the impulse cam and its controlling mechanism in perspective; and

Fig. 10 is a plan view of a preformed impulse predetermining element.

As shown in the drawings the base 10 is formed integrally with an upright extending flange por-

tion 11 having a pair of laterally extending supporting arms 12 and 13 and a bushing 14 shown in Fig. 3.

On arms 12 and 13 is journaled a shaft 15 provided for mounting any desired number of impulse predetermining elements or discs, such as 16, 16—A, 16—B, and 16—C and a worm gear 17. This worm gear operatively engages a worm 25 shown in Figs. 3 and 4 securely mounted on a shaft 26 disposed at right angles to shaft 15 and journaled at one end in a bearing portion 27 formed with the flange 11 and its other end in a bracket 28 formed with the base 10.

The shaft 26 is operatively connected to a motor shaft 21 shown in Figs. 3 and 5 through a gearing mechanism which will be hereinafter described in detail. The shaft 21 is rotatably mounted in bushing 14 and on one end of this shaft is mounted for free movement thereon a collar 20 having a plurality of parallelly disposed slots or notches, such as N_2 extending clear across its length to form teeth for engaging registering resilient pawl shaped portions, such as 23, formed with a disc 22, this disc being secured on the end of shaft 21 by an ordinary key and a nut screw 22'.

A helical spring 18 is mounted in position concentric with bushing 14 and has one of its ends engaging one of the notches N_2 in the collar 20, its other end engaging a lug 19 carried by bushing 14, the tension adjustment of spring 18 being effected through the movement of collar 20 relative to disc 22.

On the other end of shaft 21 there is keyed a gear sector 24 and a handle lever 30, both being held against axial movement thereon by a screw 33.

The movement of gear sector 24 and the shaft 21 upon the operation of handle lever 30 within the limit defined by stops 41 and 42 shown in Figs. 2 and 3 is imparted to shaft 26 through a gearing mechanism including the gear sector 24 keyed on shaft 21, a pinion 43 keyed on the hub of a disc 44 having a tooth 45 for engagement with a pawl 46 carried by a gear 47, in turn loosely mounted on the hub of pinion 43 and the gear 47 engaging with a pinion 48 secured on the hub of gear 49 in turn engaging the pinion 51 secured on one end of shaft 26, the speed ratio of this gearing mechanism being of the order of 288 to 1 but limited to an angular movement of thirty-six turns to shaft 26 to a forty-five degree angular movement to shaft 21 through the engagement of gear sector 24 against the stops 41 and 42. This speed ratio, however, may be changed according to the desired amplitude or angular movement of hand lever 30, the speed ratio of shafts 26 and 15 as defined by the worm 25 and gear 17 being of the order of 36 to 1.

It is to be noted that the movement of pinion 43 and the disc 44 carried thereby in a counterclockwise direction as indicated by the arrow in Fig. 2 is ineffective to impart movement to the shaft 26 and that the friction of pawl 46 on the periphery of disc 45 under the tension of spring S_1 is prevented from rotating gear 47 and therefore shaft 26 through the cooperation of a star wheel and a spring pressed finger member, which will be hereinafter described in detail.

On shaft 26 is mounted a multiple impulse cam shown in Figs. 3, 4, 5, 6, 7, 8 and in an enlarged view in Fig. 9. This cam consists of discs 52 and 53 and a collar 60 mounted on the ends of a hub 54 in turn securely mounted on the shaft 26. These discs carry a plurality of pairs of parallelly disposed pins, such as 55 and 55—Y, each pair being disposed ninety degrees apart. The pins 55 of each pair are mounted for axial movement on the discs 52 and 53 and have their other ends embedded in duplex segment shaped cams 56, 56—A, 56—B, and 56—C, the latter segment being shown in Figs. 7 and 8. One end of each pin 55—Y in each pair securely engages the collar 60 carried by the hub 54, and these pins are supported at their other ends by the disc 53. The cams 56, 56—A, 56—B, and 56—C are mounted for sliding movement on pins 55—Y from the position shown by segment 56—A to the position shown by segment 56 upon the engagement of pins 55—Y by a lever member 63 for placing these camming segments in registry with associated contact springs 61 and 62 shown in Figs. 4, 5, 6, 7, and 8 for actuating them upon the rotation of shaft 26, a stationary cam CX1 which is secured on the base 10 and placed in the operated path of the camming segments 56—A, 56—B, etc. being provided for returning these camming segments to their unoperated normal position upon each operation of their associated contact springs 61 and 62.

Each camming segment 36, 36—A, etc. is frictionally held in its sliding movement by a ribbon-shaped spring, such as SP1 having its ends telescopically engaging the pins 55 and 55—Y as shown in Figs. 3, 4, 6, and 9.

On the downward extending portion of arm 12 and on the top portion of bracket 28 shown in Figs. 4, 5, and 6 there is journaled a shaft 69 and on the ends of this shaft is mounted an angle shaped lever 70 and a lever 71 provided for mounting a bar 72 in parallel relation to the shaft 69, the arm $a2$ of angle lever 70 being held in operable relation with a spring pressed finger 66 by a helical spring 73 mounted on the shaft 69 as shown in Fig. 5.

A star wheel 65 is securely mounted on the shaft 26 and is provided with four equally spaced ratchet-like teeth C—1, C—21, C—3, and C—4 for operating the spring pressed finger member 66. This member is mounted on a bracket 67, in turn, secured to the base 10 by a number of screws 68. The movement of finger member 66 due to the rotation of star wheel 65 in the direction indicated by the arrow is imparted to the shaft 69 and the bar 72 through the engagement of arm $a2$ of angle lever 70 with finger member 66, the engagement of finger member 66 with the star wheel 65 effectively prevents any movement of shaft 26 in a direction opposite to that indicated by the arrow during the movement of shaft 21 and gear sector 24 upon the movement of handle 30 as for tensioning the motor spring 18.

On a lead screw 74 which is journaled on the upward extending portions of arms 12 and 13 is mounted a nut screw 76 shown in Figs. 3, 4, 5, and 6 having a lug portion 77 extending radially therefrom for engaging a slot 78 in a bar 79 provided for preventing the rotation of this nut upon the movement of lead screw 74 through the operation of a crank 75 and on the nut 76 is pivotally mounted a downwardly extending arm 80 on the free end of which is pivotally mounted a pawl 81 shown in Figs. 4 and 6 which is held in engageable relation with the periphery of the discs 16, 16—A, etc. as the case may be by a spring 82, the movement of pawl 81 being limited in its upward movement by a stop afforded by the bent portion of lever 80 and an abutting portion formed with the pawl 81 as shown in Figs. 4 and 6.

Lever arm 80 is provided with a ribbon spring

83 for resiliently holding the free end of arm 80 in engaged relation with the bar 72 and to permit the movement of this lever along this bar upon the operation of lead screw 74, thus permitting the selective movement of lever 80 and the pawl 81 carried thereby with respect to disc 16, 16—A, etc.

Lever 63 is pivotally mounted on a pin $x2$ carried by arm 13 of plate 11 and is provided with laterally extending arm 90 having its free end abutting against the vertically extending arm of angle lever 70 under the tension of a spring 91, shown in Figs. 4, 6, and 9.

On shaft 26 there is securely mounted a gear 95 shown in Figs. 3, 4, 5, and 6 which meshes with a pinion 96 formed with a shaft 97. This shaft is journaled in brackets 98 and 99, the latter being secured to plate 11 by a number of screws 100 and on shaft 97 there is mounted a worm gear 101 disposed in engaged relation with a worm 102 journaled in bearing portions 103 and 104 of brackets 98, the bearing portion 103 being fitted with a drum 105 in which the weights of a centrifugal governor are rotated through the movement of worm 102 for controlling the operation of the motor shaft 21 in the well-known manner.

The discs 16, 16—A, etc. have each at their peripheries a plurality of teeth T, shown in Figs. 4, 6, and 9, dividing these discs into one hundred and forty-four equal parts. Therefore, since the speed ratio of shafts 26 and 15 is as above mentioned of the order of 36 to 1 and with the spring pressed finger 66 operating four times for each revolution of shaft 26, the total number of reciprocating cycles or movements of this finger member is 144 for each turn of disc 16, 16—A, etc. or one vibrating cycle for each two degrees thirty minutes angular movement of these discs for each ninety degree angular movement of shaft 26 and that of the star wheel 65.

The vibrating or reciprocating movement of spring pressed finger 66 upon the operation of wheel 65 as above described is imparted to the bar 72 through the angle lever 70 and the retracting spring 73. The rocking movements of this bar are effective to move the arm 80 and the pawl 81 carried thereby an angular movement corresponding to the depth of the indentation at the periphery of the discs 16, 16—A, etc., that is, from the position shown in Fig. 6 to the position shown in Fig. 4 where the lever 80, the bar 72 and therefore the arm 63 are held from following the movements of finger member 66 upon the engagement of pawl 81 on the apex of the teeth T of the discs 16, 16—A, etc.

The movements of lever arm 63 as controlled by the conjoint action of star wheel 65 and discs 16, 16—A, etc. is effective to move the pins 55 and their associated duplex camming segments 56, 56—A, 56—B, and 56—C in the path of contact springs 61 and 62 for actuating them due to the rotation of shaft 26, the lever arm 63 being operated once for each ninety degree movement of wheel 65 and two degrees thirty minutes angular movement of the discs 16, 16—A, etc. so that the number of teeth T removed from these discs determine the number of impulses in the digits to be signaled.

While, as above mentioned, a group of teeth T of discs 16, 16—A, etc. may be in the path of the pawl 81, the movements of finger member 66 is not followed by a movement of angle lever 70 due to the bar 72 and lever arm 63 being held in the position shown in Fig. 4 through the pawl 81 abutting against the tops of such teeth.

In the disc shown in Fig. 10, for example, starting from the point N which represents the normal starting position of disc 16—C with respect to the pawl 81 counting off five teeth in a counter-clockwise direction, eight teeth are cut in a row from the disc and this space represents the digit 8 since as above described each tooth T of disc 16 is equal to ninety degrees angular movement of shaft 26 and therefore one oscillating movement of lever 63. Counting off five teeth, three teeth are cut from the disc and this space represents the digit 3, this operation being repeated for each of the digits representing a telephone number, in this example, 835294, the groups of teeth between each digit thus formed being provided to permit the hunting operation of the telephone exchange switches, in a manner well-known in the telephone art.

The base 10 is fitted with a casing 110 provided for protecting the operating parts of the mechanism. This casing carries a plate 111 having registration surfaces on which the names of subscribers to be called are inscribed. The selection of such subscribers is effected by the turning movement of crank 75 for moving the arm 80 in registry with the discs 16, 16—A, etc., predefining as above mentioned the telephone numbers of telephone subscribers, such selection being indicated by a pointer 112 carried by the nut screw 76.

In a typical signaling operation of the call sender of this invention the crank 75 is operated for moving pointer 112 in registry, for example, with the name of the subscriber desired appearing on the plate 111 on casing 110, and this movement positions the arm 80 in registry with the disc 16 representing the telephone number 835294, which has been preformed to correspond with the call number of that subscriber by cutting rows of teeth in the order above mentioned. The handle lever 30 is moved from its position shown in Figs. 1 and 2 to the position indicated in dotted lines in Fig. 1, for tensioning the motor spring 18, the operation of gear sector 24 and the pinion 43 together with the disc 45 in its counter-clockwise movement being effective to reengage this disc with the pawl 46 at a point corresponding to the maximum tension of spring 18 when sector 24 engages the stop 42.

The tension of spring 18 upon the release of lever 30 by the operator is effective to rotate the gear sector 24, the pinion 63, the gear 47 through disc 45 and pawl 46, pinion 48, gear 49 and pinion 51 on shaft 26, the angular movement of shaft 26 being thirty-six turns for a forty-five degree angular movement of gear sector 24 between stops 41 and 42. The movement of shaft 26 through the operation of worm 25 and worm gear 17 is effective to rotate the shaft 15 and the discs 16, 16—A, etc. one turn for each thirty-six turns of shaft 26. The operation of star wheel 65 on shaft 26 is effective to impart one hundred and forty-four reciprocating movements to finger member 66 and lever 63 through its abutting connection with angle lever 70. However, the movement of bar 72 carried by angle lever 70 and lever 71 and that of arm 63 is normally prevented by the pawl 81 engaging the top portions of teeth T at the periphery of disc 16—A. Upon a further movement of disc 16—A to a point wherein the pawl 81 is permitted to engage the spaces formed by the cutting off of a tooth or a group of teeth T as the case may be, in order to form a certain digit permits the movement of bar 72 under the tension of spring 73 to operate according to the

movement of finger member 66 under control of wheel 65, and thereby actuating lever arm 63 for successively imparting axial movements to the pins 55 for moving their duplex camming segments 56, 56—A, 56—B, and 56—C in registry with their associated pairs of contact springs 61 and 62 for actuating them a number of times corresponding to the number of teeth cut off from any one of the discs 16, 16—A, etc. these camming segments being returned to their ineffective paths by the cam CX1 after each successive operation of the contact springs 61 and 62. The rate of speed at which the contact springs 61 and 62 are operated is controlled by a centrifugal governor geared to the shaft 26 as shown in Figs. 3, 4, 5, and 8.

Upon a complete turn of the disc 16—A the tooth N reaching a point in juxtaposition with respect to the pawl 81 and the gear sector 24 in abutment with the stop 41, as shown in Fig. 2, prepares the call sender for a subsequent operation.

It is to be noted that the groups of teeth T, forming the portions of the disc holding the pawl 81 and the bar 72 from operating according to the movement of finger member 66, are provided only to facilitate the formation of the digits on the discs without the use of special tools, but perform no mechanical function in the operation of the device.

What is claimed is:

1. A call transmitter comprising normally closed stationary impulse contacts, a plurality of normally ineffective rotating camming members associated therewith and a common mechanism for moving said members independently in position at right angles to their direction of rotation for operating said contacts.

2. A call transmitter comprising normally closed contact elements, one of said elements being operable, a plurality of camming members normally movable in a circular path ineffective with respect to said element, actuating means for moving said members independently in a path at right angles to said circular path in position effective with respect to said element, and a common mechanism for returning each of the first mentioned members in said path after each operation of said element.

3. A call transmitter comprising a plurality of normally closed contact elements, one of said elements being operable, a plurality of actuating means normally movable in a path ineffective with respect to said movable element, a disc having groups of teeth determining the digits of a call to be transmitted, a lever mechanism, and means for actuating said mechanism in phase with respect to the number of teeth in said disc for moving each of said means from their ineffective path in a path effective for actuating said elements for transmitting such a call.

4. A call transmitter comprising a plurality of normally closed contact elements, a plurality of independently actuating means normally movable in a circular path ineffective with respect to said elements, a notched disc, a star wheel, and a lever mechanism operable under the conjoint operation of said disc and star wheel to move each of said means in a circular path parallel to the first-mentioned path in position effective with respect to said elements.

5. A call transmitter comprising a plurality of camming members, a plurality of normally closed contact elements operatively associated with said members, means for collectively actuating said members in a path ineffective with respect to said elements, means operable for independently moving each of said members in a path to cause the operation of said elements and a camming device for returning each of said members in said ineffective path upon each operation of said elements.

6. A call transmitter comprising a rotatable shaft, a plurality of camming members and a star wheel actuated by said shaft, another shaft disposed at right angles to the first-mentioned shaft, a gear reduction mechanism operatively connecting said shafts, a notched disc actuated by the last mentioned shaft, a plurality of normally closed contact elements operatively associated with said member, a lever mechanism including a reciprocating bar controlled by the operation of said disc and said wheel for moving said members in position for operating said contact elements according to the character of the notches in said disc, and motor means for actuating said shafts.

7. A call transmitter comprising a driving shaft, camming members mounted on said shaft, another shaft geared to said driving shaft, a disc having peripherally disposed notches mounted on said driven shaft, normally closed contact elements operatively associated with said members, said members being rotatable in a plane ineffective with respect to said elements, means for changing the position of said members according to the character of the notches in said disc to cause the operation of said elements upon the rotation of said driving shaft, said means comprising a lever arm, a pawl carried by said arm for engaging the notches in said disc, a bar operatively connected to said arm, another arm operatively connected to said bar and a star wheel carried by said driving shaft for imparting rocking movement to said bar for engaging the last mentioned arm with said camming members for moving them in a plane effective with respect to said elements, and motor means for actuating said driving shaft.

8. A call transmitter comprising a driving shaft, a driven shaft, a gearing mechanism operatively connecting said shafts, a plurality of normally closed contact elements, a plurality of independent camming members slidably mounted on said driving shaft and normally rotatable in a plane ineffective with respect to said elements, a star wheel carried by said driving shaft, a spring pressed finger member disposed in operable relation with said wheel, an angle lever having one of its arms engaging said finger member, another lever, a pivoted shaft for supporting said levers, a bar carried by said levers and reciprocable upon the rotary movement of said star wheel, a lever member operatively connected to said bar, a pawl carried by said lever member, a disc carried by said driven shaft, a plurality of means of different characters carried by said disc, one of said means engaging said pawl for normally preventing the operation of said bar during the operation of said star wheel, and the other means permitting the movement of the bar according to the movement of said wheel, means controlled by the movement of said bar for changing the plane of movement of said camming members for operating said contact elements, motor means for actuating said driving shaft, and means for controlling the operation of said motor means.

9. A call transmitter comprising a driving shaft, a motor shaft, a gearing mechanism operatively connecting said driving shaft to said mo-

tor shaft, a manually operable handle lever mounted on said motor shaft, a spring tensioned by the movement of said handle lever, a gear sector mounted on said motor shaft and movable in conjunction with said handle, a plurality of stops for limiting the movement of said gear sector, a gearing mechanism actuated through the movement of said gear sector, a clutching device automatically operable to render the movement of said gear sector ineffective with respect to said shaft, in one direction, a driven shaft, a gearing mechanism operatively connecting said driving shaft to said driven shaft, a plurality of camming members and a star wheel mounted on said driven shaft, a plurality of normally closed contacts operably associated with said camming members, and a lever mechanism controlled by the conjoint operation of said impulse determining element and said star wheel for causing said camming members to operate said contacts.

10. A call transmitter comprising a driving shaft, a driven shaft, a gearing mechanism operatively connecting said shafts, a plurality of impulse predetermining elements carried by said driven shaft, normally closed contacts, a plurality of camming members and a star wheel mounted on said driving shaft, a lever mechanism controlled upon the conjoint movement of said elements and said wheel, a pivoted arm in said mechanism, means for moving said arm in selected position with respect to said elements for actuating said contacts according to the character of the selected elements, and means for indicating the position of said arm.

11. A call transmitter comprising a rotatable shaft, a camming member and a star wheel actuated by the movement of said shaft, normally closed impulse contacts operatively associated with said member, said cam being normally movable in a path ineffective with respect to said contacts, a disc having groups of equally spaced peripherally disposed teeth representing a code number, a lever mechanism actuated by said star wheel and according to the number of said teeth for moving said cam in position effective for actuating said contacts for transmitting such number and means for restoring said member in said ineffective path upon each operation of said contacts.

12. A call transmitter comprising a driving shaft, a rotatable camming member and a star wheel mounted on said driving shaft, normally closed contacts operatively associated with said member, said member being normally movable in a path ineffective with respect to said contacts, a vibrating lever mechanism, actuated by said star wheel, a disc provided with raised portions and depressions defining digits of a number, said disc controlling the operation of said lever mechanism whereby said camming member is moved into position with respect to said contacts according to the digits of the called number, a motor spring connected to said driving shaft, and means for tensioning said spring for actuating said driving shaft.

13. A call transmitter comprising a plurality of normally closed contact elements, a plurality of camming members operatively associated but normally movable in a path ineffective with respect to said elements, a shaft for moving said members collectively in said path, a rotatable disc having groups of digit determining projections, a star wheel, a reciprocating lever mechanism actuated by said star wheel once for each of said projections, and means for deviating said members according to the frequencies of movement of said lever mechanism in a path for effecting the operation of said elements, and a device for successively returning said camming members independently to said ineffective path upon each operation of said elements.

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