

March 23, 1943.

J. G. ROBERTS ET AL
TELEPHONE CALL TRANSMITTER

2,314,801

Filed Sept. 7, 1939

6 Sheets-Sheet 1

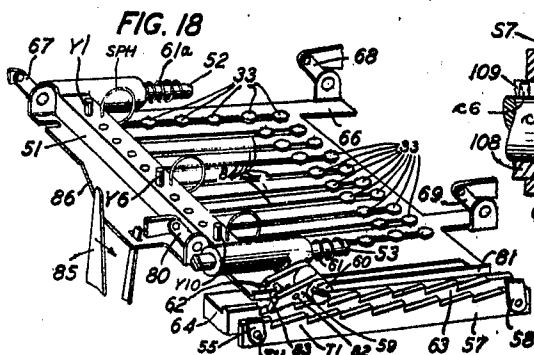
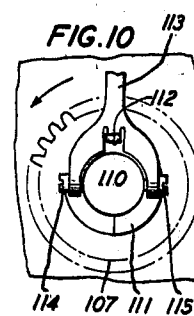
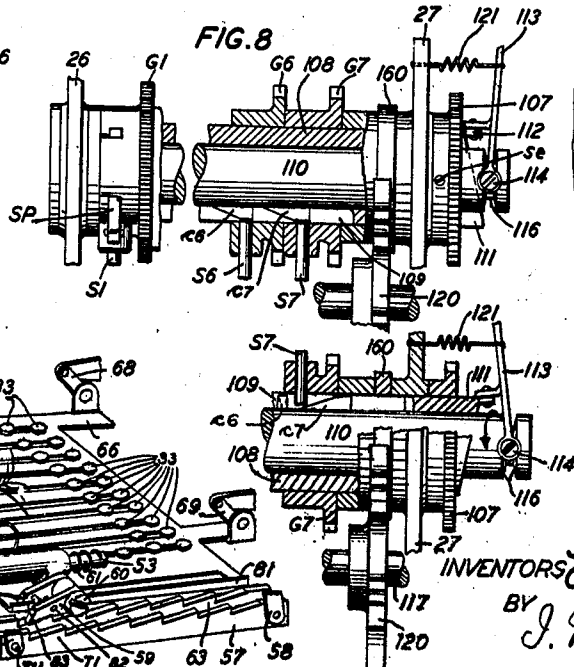
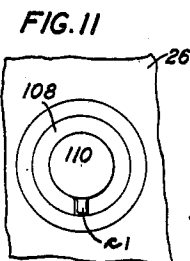
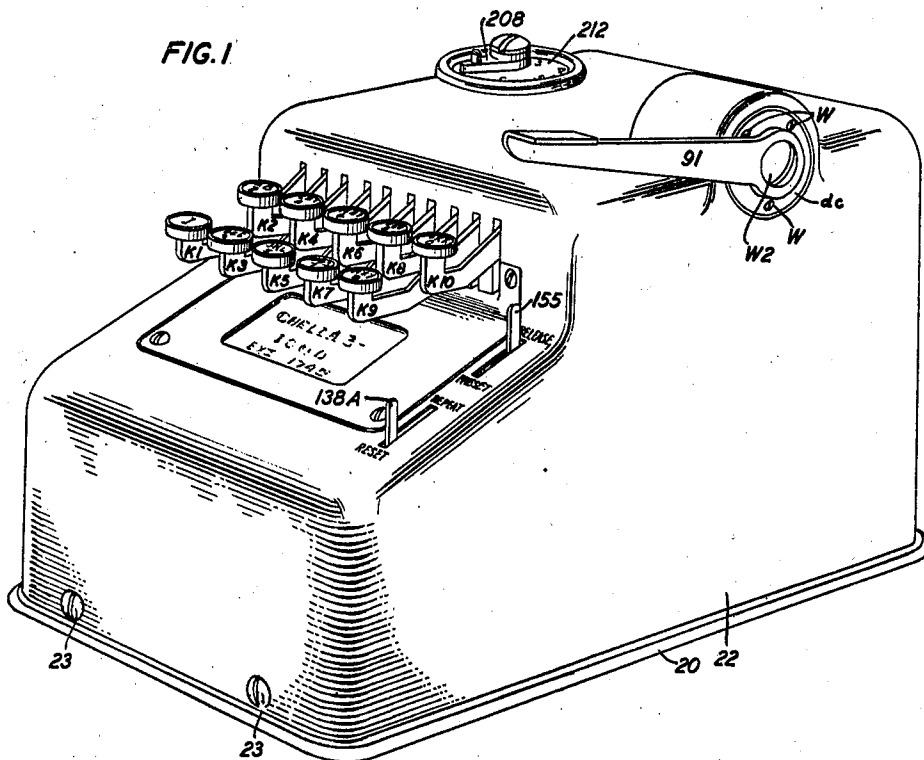


FIG. 9

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FIG. 2

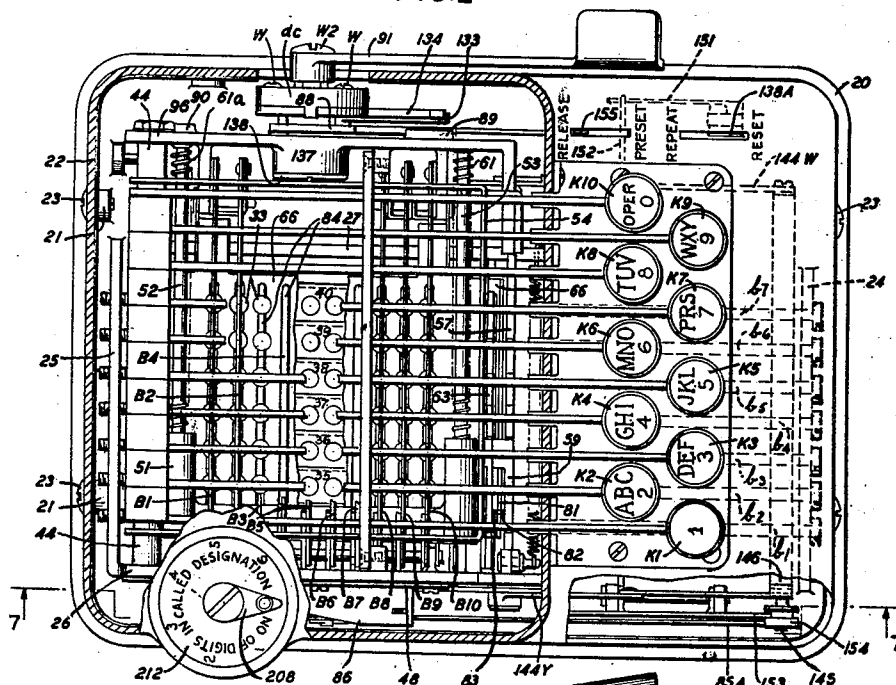
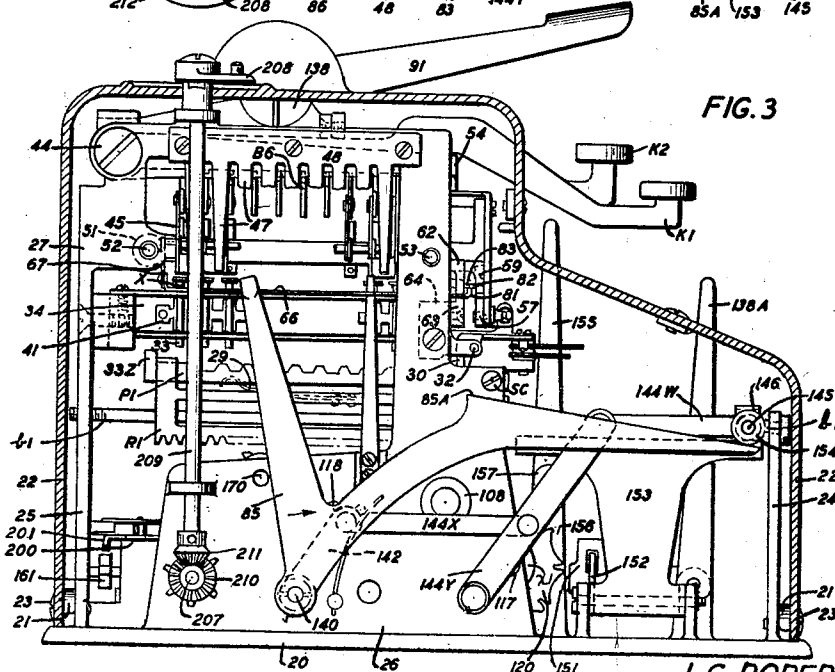


FIG. 3



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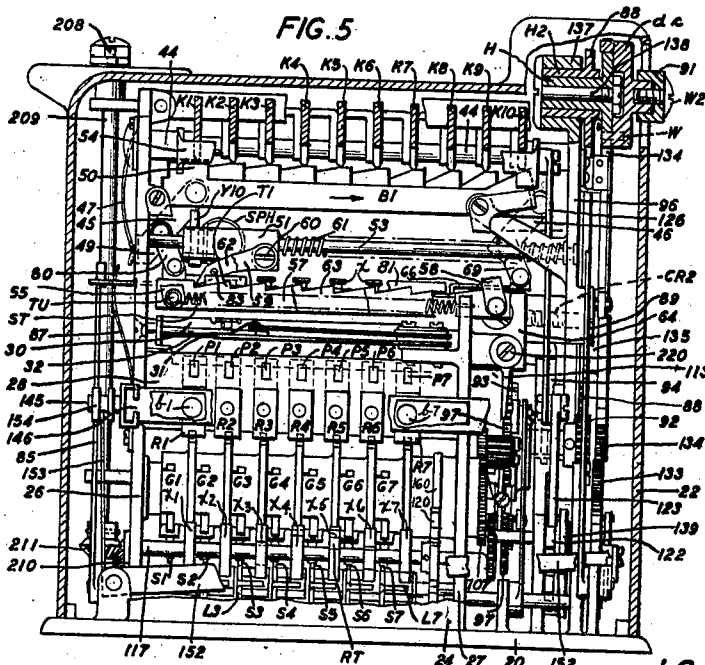
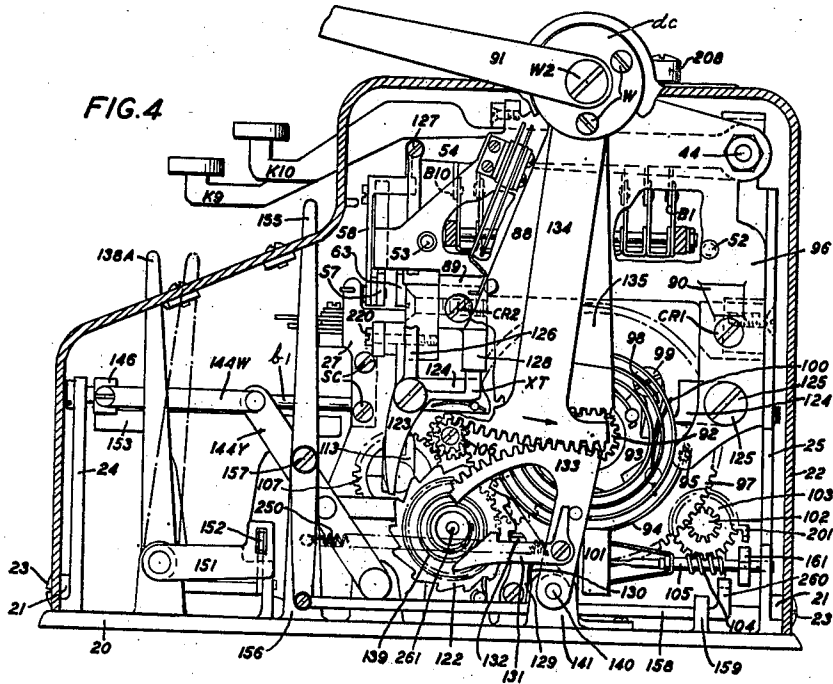
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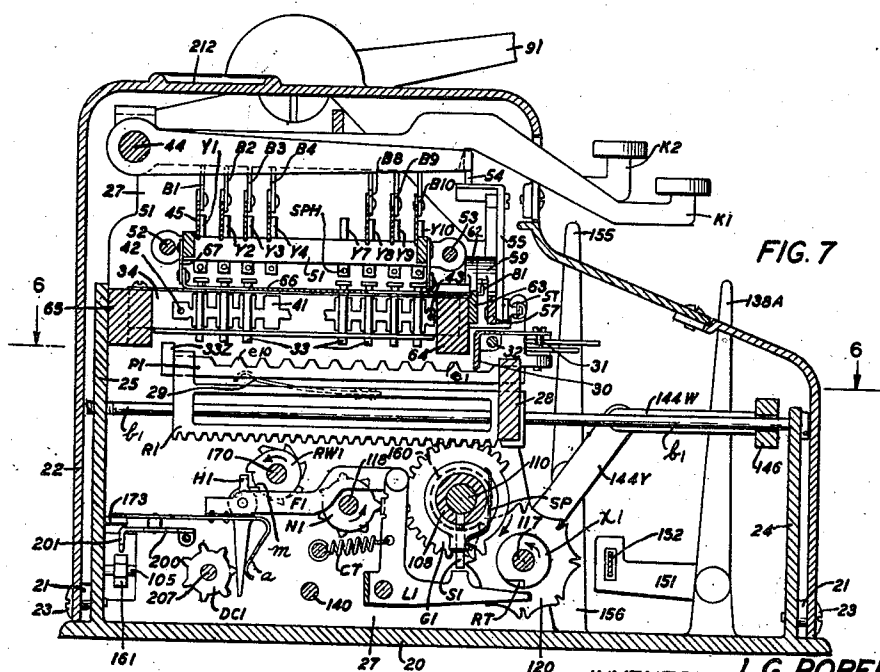
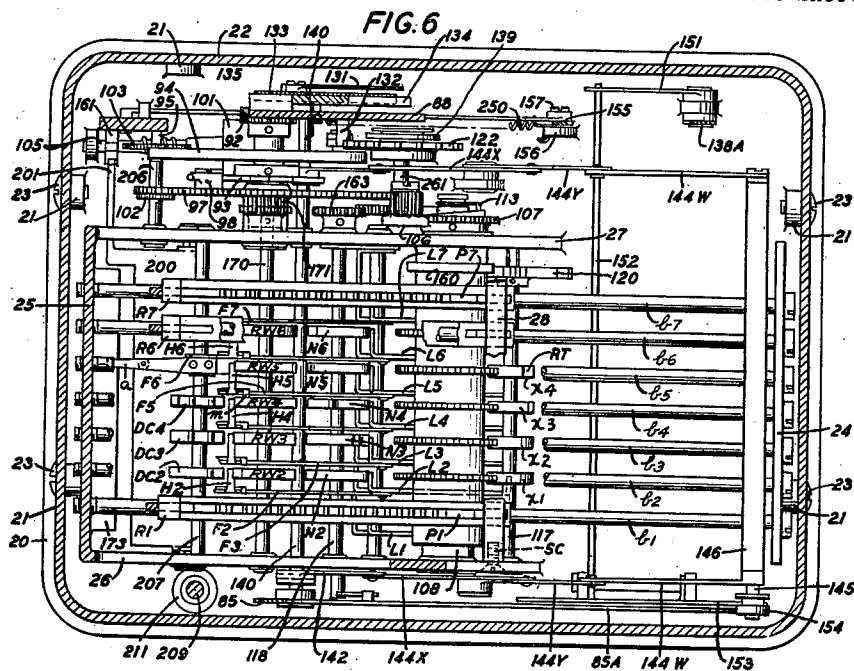
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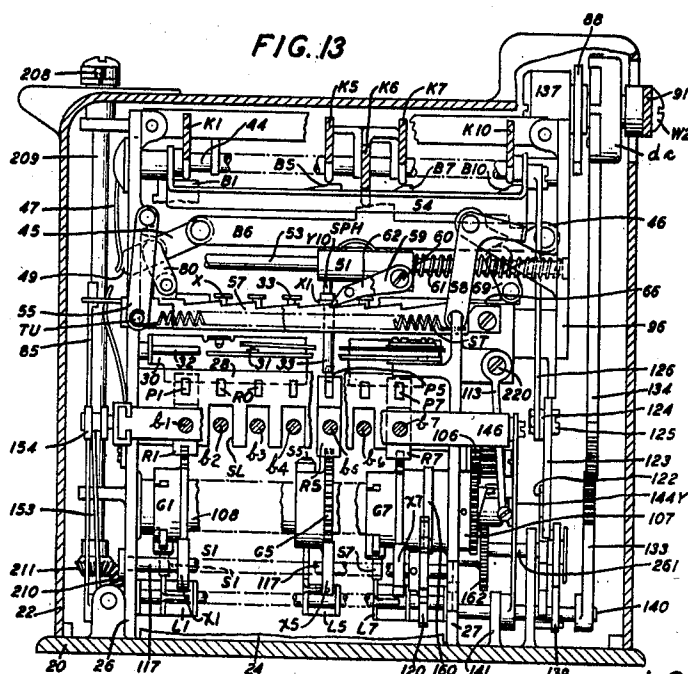
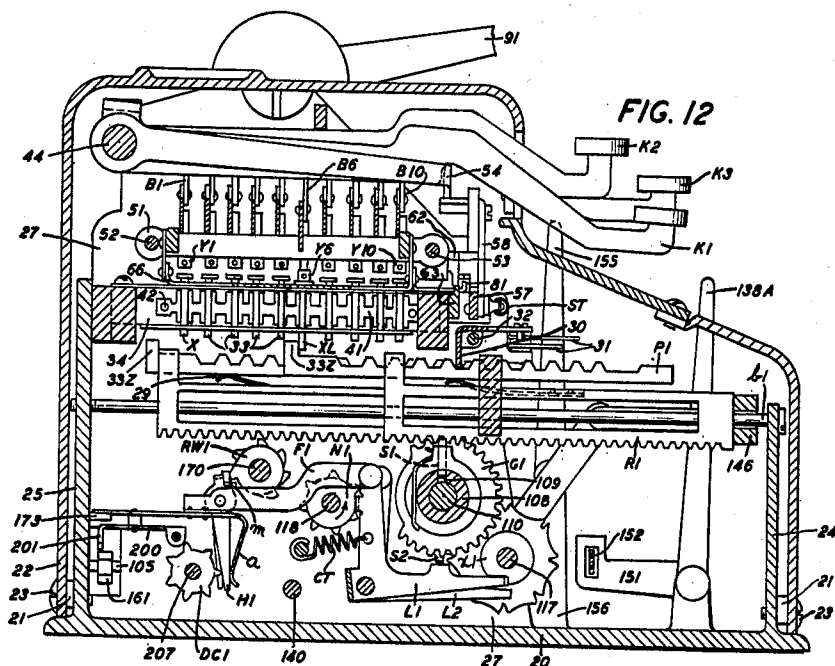
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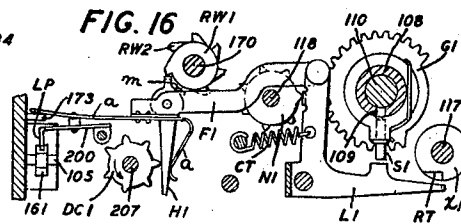
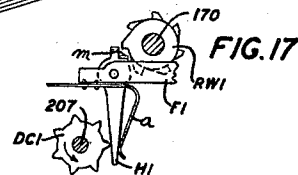
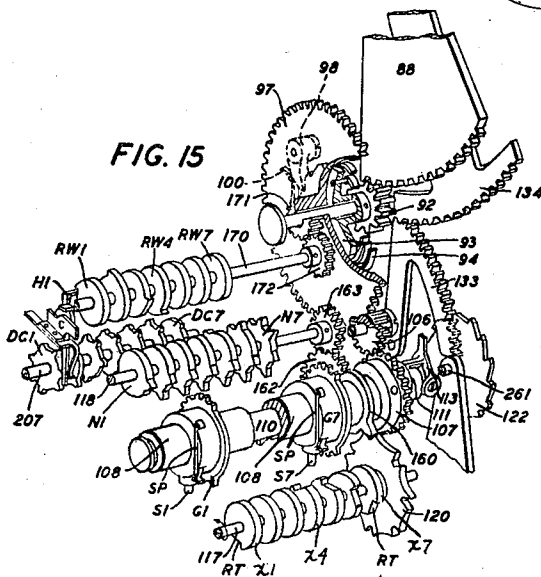
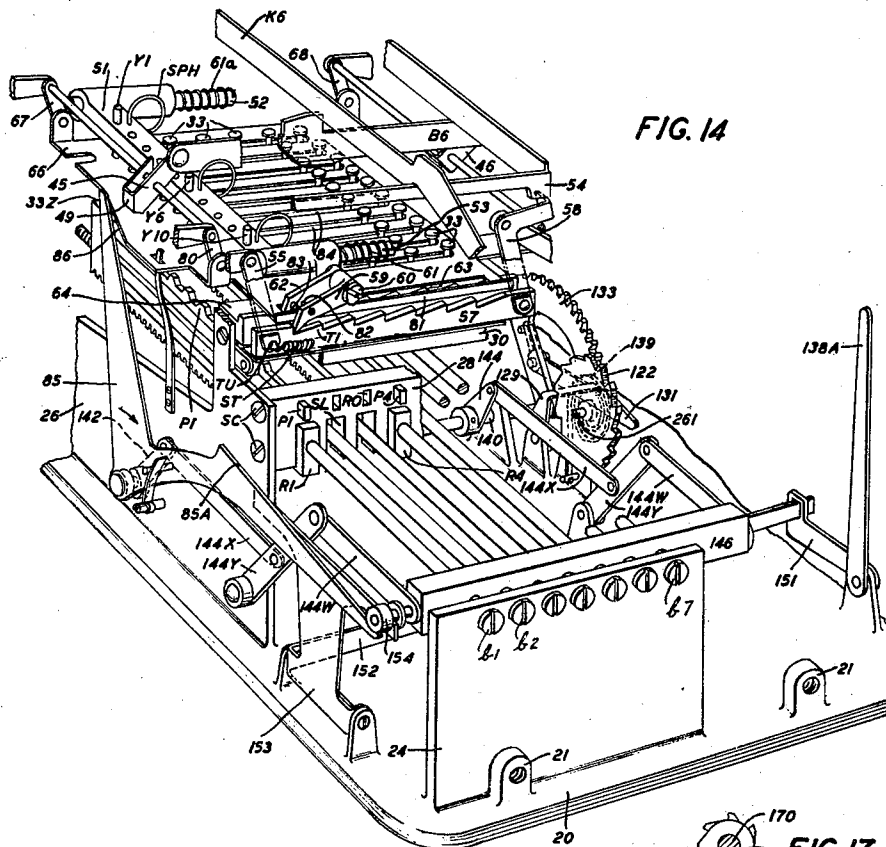
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UNITED STATES PATENT OFFICE

2,314,801

TELEPHONE CALL TRANSMITTER

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Application September 7, 1939, Serial No. 293,710

13 Claims. (Cl. 179-99)

This invention relates to call transmitters of the type used in telephone systems, for example, for establishing talking connections.

According to this invention, a call transmitter is provided in which the operation of a set of key members representing digits is effective to actuate camming bars which in turn actuate spring retracted plunger members for selectively positioning stopping members in the path of pulsing elements actuated by a motor, means being provided for operatively connecting the pulsing elements to the motor in a sequence of operations corresponding to the order of the manual operation of the key members which may represent a given telephone call designation.

Manually operable means is provided which when moved in either one of a number of predetermined positions, conditions the motor mechanism for transmitting telephone call designations by the so-called key-by-key or preset pulsing operation of the transmitter mechanism or to condition the transmitter mechanism for repeating a given call designation any number of times desired without subsequently resetting the digit key members following the first transmitting operation of such call designation.

Means operable under control of a camming mechanism is provided for stopping the operation of the motor at the conclusion of each digit transmitting operation by the key-by-key operation of the transmitter, while means actuated by the movement of the key members is effective to render the operation of such camming mechanism ineffective following the setting operation of the digit key members at a greater rate of speed than that required for the transmitting of a train of pulses corresponding to the individual operation of these keys.

Manually operable means is provided for moving a pointer on a dial which indicates the position of a cam shaft relative to a series of pawls, the operation of which conditions the pulsing mechanism for transmitting call designations which may consist of a number of digits less than the capacity of the transmitter while manually operable means is provided for tensioning the motor spring at the end of each call transmitting operation with means whereby the operation of such tensioning means is effective to return the operated camming elements and their associated stopping members to normal position preparatory to a subsequent call transmitting operation.

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;

Fig. 2 is a top assembly view shown with the casing partly in section;

Fig. 3 is a left side assembly view shown with the casing in section;

Fig. 4 is a right side assembly view also showing the casing in section;

Fig. 5 is a front assembly view showing the casing and a number of operating parts in section;

Fig. 6 is a sectional view taken on the line 6-6 of Fig. 7 and looking in the direction indicated by the arrows, a number of parts being shown with portions cut away;

Fig. 7 is a longitudinal sectional view taken on line 7-7 of Fig. 2 and looking in the direction indicated by the arrows;

Figs. 8, 9, 10 and 11 are partial views of the pulsing bar actuating mechanism shown with a number of operating parts in section;

Fig. 12 is a longitudinal sectional view taken on line 7-7 of Fig. 2 showing a number of parts in the operated position;

Fig. 13 is a front view shown with the casing and a number of operating parts with portions cut away, one of the keys and a number of parts actuated thereby being shown in the operated position;

Fig. 14 is an assembly view shown in perspective, a number of operating parts being shown with portions cut away;

Fig. 15 is a partial view of the camming bar operating mechanism shown in perspective;

Fig. 16 is a detailed view showing the governor shaft stopping mechanism;

Fig. 17 is a detailed view of the mechanism shown in Fig. 16 showing the manually operable digit defining camming shaft in the operated position; and

Fig. 18 is a view of the digit pin setting mechanism shown in perspective.

In the call transmitter of the invention, a base 20 is formed with lugs as 21 provided for securing a casing 22 by a number of screws 23. This base is formed with perpendicularly extending end flanges 24, 25 and side flanges 26 and 27 for mounting the transmitter operating mechanism which will be hereinafter described in detail.

The flange members 24 and 25 at the ends of the base as shown in Figs. 2, 3, 4, 5, 6 and 7 support a set of horizontally and parallelly disposed rods b_1 , b_2 , b_3 , b_4 , b_5 , b_6 and b_7 on which the gear racks R1, R2, R3, R4, R5, R6 and R7 are slidably

mounted. These gear racks engage slots as SL in a cross-bar 28 provided for holding these gear racks against turning movement on their supporting rods b₁, b₂, b₃, etc., the cross-bar being secured at both ends on side flange members 26 and 27 by a number of screws SC shown in Figs. 3, 4, 6 and 14.

On gear racks R₁, R₂, R₃, etc., are slidably mounted one end of pulsing bars P₁, P₂, P₃, P₄, P₅, P₆ and P₇, while their other ends are slidably mounted in rectangular openings RO in the supporting bar 28. The movements of gear racks R₁, R₂, etc. are imparted to their associated pulsing bars P₁, P₂, P₃, etc. by similar springs, such as 29 shown in Figs. 3, 7 and 12 having one of their ends secured to the gear racks R₁, R₂, R₃, etc. and their free ends frictionally engaging the under surface of pulsing bars P₁, P₂, P₃, etc. for operating them and thereby actuating a common rocking bar 39 for opening a normally closed impulse contact 31, Figs. 3, 5, 7, 13 and 14, the bar 30 being mounted for rocking movement on a shaft 32 supported by side flange members 26 and 27.

The pulsing bars P₁, P₂, P₃, etc., are limited in their rectilinear or sliding movements as imparted by the gear racks R₁, R₂, R₃, etc., by similar stop pins as 33 best shown in Figs. 2, 3, 7, 12 and 14 arranged in equal spaced relation in parallelly disposed rows in supporting bars 34, 35, 36, 37, 38, 39 and 40, there being ten pins in each bar.

The pins 33 in each supporting bar 34, 35, 36, etc. are frictionally held in normal non-operated position by springs in the form of combs 41 shown in Figs. 3 and 7 secured at both ends to their respective bars by screws as 42 and 43. The pins 33 may be moved selectively from the unoperated position shown at x in Figs. 3, 5, 7, 12 and 13 to operated position in the path of the pulsing bars P₁, P₂, P₃, etc. as shown at x₁ in Figs. 12 and 13 through the manual operation of key members K₁, K₂, K₃, K₄, K₅, K₆, K₇, K₈, K₉ and K₁₀ shown in Figs. 1, 2, 3, 4, and 5 in a manner that will be hereinafter described in detail. These key members are pivotally mounted on a common shaft 44 and are disposed in operative relation with the camming or bearing portions of bars B₁, B₂, B₃, B₄, B₅, B₆, B₇, B₈, B₉ and B₁₀ shown in Figs. 12, 13 and 14 which are connected at both ends on similar links 45 and 46 so as to permit the downward movement of these bars upon the operation of their associated key members. Springs such as 47, shown in Figs. 3, 5, and 13 bearing against the arm portions 49 of links 45 of each bar B₁, B₂, B₃, etc. are provided for yieldably holding these bars in engaged relation with the under surface of the key members K₁, K₂, K₃, etc. It is to be noted however that the surface of cross-bar B₁ that is nearest to the supporting shaft 44 at its point of contact with its respective key as shown in Fig. 13 is made parallel to the longitudinal axis of this bar while the bearing surfaces of the other cross-bars proportionally increase in height so as to compensate for the difference in the length of the circular arcs generated by the pivotal movement of the key members at their points of contact or intersections with their respectively associated cross-bars B₁, B₂, B₃, etc., this mechanism permitting to impart a uniform axial movement to a set of pins Y₁, Y₂, Y₃, Y₄, Y₅, Y₆, Y₇, Y₈, Y₉ and Y₁₀, see Figs. 5, 7 and 12 and to the stop pins 33 actuated thereby in response to the operation of any one of the key members K₁, K₂, K₃, etc.

The pins Y₁, Y₂, Y₃, etc. are slidably mounted

on a carriage 51 shown in Figs. 5, 6, 7, 12, 13 and 14 and are held in normal non-operated position by hook-shaped retractile spring SPH. Carriage 51 in turn is slidably mounted on guiding rods 52 and 53 for movement at right angles to the direction of the rows of pins 33 in supporting bars 34, 35, 36, 37, etc. and therefore longitudinally to camming bars B₁, B₂, B₃, etc. the pins Y₁, Y₂, Y₃, Y₄, Y₅, Y₆, Y₇, Y₈, Y₉ and Y₁₀ registering with the ten pins 33 in supporting bar 34 when the carriage 51 is in normal position as shown in Figs. 2, 5 and 14. The operation of any one of the key members K₁, K₂, K₃, etc. is transmitted to its associated camming bar B₁, B₂, B₃, etc. for operating its corresponding pin Y₁, Y₂, Y₃, etc. as the case may be against the tension of its retractile spring SP and thereby moving one of the pins 33 in the bar 34, for example, in the path of pulsing bar P₁, for arresting its movement as imparted by the operation of gear rack R₁ in turn actuated by a gearing mechanism which will be hereinafter described in detail.

The operation of any one of the key members K₁, K₂, K₃, etc. as above mentioned is imparted to a saw-toothed rack 57, see Figs. 4, 5, 12, 13, 14 and 18 through an angle lever 58 having one end loosely connected to the rack 57 and its other end engaging the under-disposed surface of a U-shaped yoke 54, while the other end of rack 57 is loosely connected to a link member 55 pivoted at its other end to a laterally extending lug formed with the side flange 26 as shown in Figs. 5, 13 and 14. The movement of rack 57 is effective to tension a retractile spring ST having one of its ends hooked to the side flange 27 and its other end to a stud TU which serves for pivotally connecting one end of saw-toothed rack 57 to the free end of link 55 the spring ST thus serving to yieldably hold the yoke 54 in engaged relation with the underside of key members K₁, K₂, K₃, etc. and the ratchet-toothed rack 57 actuated thereby in its normal non-operated position as shown in Figs. 5 and 14. The operation of any key K₁, K₂, K₃, etc. and thereby the movement of U-shaped yoke 54 and the angle lever 58 is effective to impart a longitudinal movement to the saw-toothed rack 57 for engaging the tooth T₁ for example of this rack with a pawl 59 mounted on a shoulder screw 60 engaging the carriage 51 so that the return movement of rack 57 to normal under the tension of its retractile spring ST when the depressed key is released is effective to move the carriage 51 one step by positioning the pins Y₁, Y₂, Y₃, etc. carried thereby in operative relation with the row of pins 33 in supporting bar 35 preparatory to the operation of the second digit key member K₁, K₂, K₃, etc. as the case may be.

The successive operation of rack 57 as effected by the operation of a number of key members K₁, K₂, K₃, etc. representing a given telephone number is therefore effective to impart a step-by-step movement to carriage 51 for successively positioning the row of pins Y₁, Y₂, Y₃, etc. with the pins 33 of bars 34, 35, 36, 37, 38, 39 and 40 for a seventh digit exchange office while tensioning the retractile springs 61 and 61a on the guiding rods 52 and 53, carriage 51 being held in each advanced position, however, by a pawl 62 mounted on the shoulder screw 60 and engaging a stationary saw-toothed rack 63 disposed in line parallel and adjacent to the movable saw-toothed rack 57.

The rack 63 is secured to a cross-bar 64 in

turn supported by side flanges 26 and 27 as shown in Figs. 3, 7, 12 and 14. The carriage actuating and retaining pawls 59 and 62 may be simultaneously disconnected from their associated saw-toothed racks 57 and 63 for permitting the return movement of carriage 51 to normal non-operated position at the end of each call transmitting operation through the operation of a plate 66 shown in Figs. 2, 3, 5, 7, 12, 13 and 18. This plate is mounted on four links 67—68 and 69—80 and is provided at its front end with a ridge portion 81 extending upwardly at right angles thereto for simultaneously engaging the pins 82 and 83 laterally extending from pawls 59 and 62 and thereby releasing the carriage 51 which is then returned to normal position from any of its advanced positions depending upon the number of digits comprised in the telephone number transmitted by the tension of its retractile springs 61 and 61a.

The plate 66 is provided with ten parallel slots 84 shown in Figs. 2, 14 and 18 through which the pins 33 in supporting bars 34, 35, 36, 37, 38, 39 and 40 extend so that an upward movement of this plate through the operation of a camming mechanism, which will be hereinafter described in detail, is effective to return the stop pins 33 while simultaneously releasing the carriage 51 by the operation of pawls 59 and 62 as above described.

The upward movement of plate 66 is effected by a lever member 85 which is moved in the direction indicated by the arrow in Figs. 3, 14 and 18 and having its free end engaging the camming surface 86 formed at the edge of the plate 66, the lever member 85 being operated upon the return movement of the gear racks R1, R2, R3, etc. to normal by a mechanism which will be hereinafter described in detail.

The gear racks R1, R2, R3, etc. and the impulse bars P1, P2, P3, etc. actuated thereby are operated by a gearing mechanism connected to a motor spring 94, see Fig. 4. This motor spring is tensioned by the manual operation of a handle lever 91 secured as by a screw W2 to a disc member dc which is in turn secured to a gear sector 134 shown in Figs. 4, 5, 13 and 15 by a plurality of screws W this gear sector having a hub portion H mounted for free movement in the hub portion H2 of another gear sector 88, and the hub portion of gear sector 88 is mounted for free movement in a bearing 137 formed integrally with a mounting plate 96, this plate being secured to side flange 27 by screws CR1 and CR2.

The movement of gear sector 134 in the direction indicated by the arrow in Fig. 4 is imparted to gear sector 88 through a projection 135 and the angular movement of gear sectors 88 and 134 is limited in the direction indicated by the arrow by a stop 90 engaged by the gear sector 88 and in its return movement by a stop 89 formed with plate 96 engaged by the gear sector 88. The movement of gear sector 88 and gear sector 134 in a counter-clockwise movement as imparted by the operation of handle 91 is effective to rotate a pinion 92 and the gear sector 133 respectively. The turning movement of pinion 92 rotates the ratchet wheel 93 and tensions the motor spring 94, which has the end of its outer convolution secured to a lug 95 formed with the mounting plate 96 and the end of its inner convolution to the hub of ratchet wheel 93. The return movement of pinion 92 and the ratchet wheel 93 carried thereby under

the tension of motor spring 94 is effective to rotate a gear 97 through the engagement of pawl 98 carried by the gear 97 with the ratchet wheel 93 under the tension of a spring 100, the turning movement of gear 97 being effective to actuate a centrifugal governor 101 through a pinion 102 and worm gear 103, in turn engaging the worm 104 formed with governor shaft 105 thus controlling the return movement of gear 97 under the tension of motor spring 94.

The turning movement of main gear 97 rotates a hollow shaft 108, see Figs. 8 and 15, through the intermediary gears 106 and 107 the latter being secured on the end of hollow shaft 108 by a set screw se.

The hollow shaft 108 which is rotated seven turns for each turn of gear 97 is journaled at both ends in side flanges 26 and 27 and on this shaft is loosely mounted a plurality of gears G1, G2, G3, G4, G5, G6 and G7 disposed in operative relation with gear racks R1, R2, R3, R4, R5, R6 and R7, respectively.

The gears G1, G2, G3, etc. are provided with slidable clutch pins S1, S2, S3, S4, S5, S6 and S7 for engaging a slot or key-way 109 in the hollow shaft 108 for imparting movement to the gear racks R1, R2, R3, etc. and thereby to the pulsing bars P1, P2, P3, etc., the engagement of clutch pins S1, S2, S3, etc. in the key-way 109 being effected successively through the operation of a camming mechanism, which will be hereinafter described in detail.

In the hollow shaft 108 is mounted for axial movement therein a shaft 110 having camming portions as c1, c2, c3, c4, c5, c6 and c7, shown in Figs. 8, 9 and 11 fitted in the key-way 109 of shaft 108 and disposed in engageable relation with the clutching pins S1, S2, S3, etc. of gears G1, G2, G3, etc. for disconnecting these gears from the shaft 108 under control of a cam 111 formed at the end of hollow shaft 108. The length of the effective portion of this cam is of the order of 180 degrees and is engaged by a roller 112 carried by a lever 113 pivoted on a screw 220 shown in Figs. 5 and 13. Lever 113 is provided at its free end with two diametrically disposed screws 114 and 115, the ends of which engage a collar 116 formed in one end of shaft 110 so that each turn of hollow shaft 108 as imparted by the gearing mechanism, above described, the cam 111 in cooperation with a retractile spring 121 is effective to impart a back and forth axial movement to the shaft 110 for disengaging any one of the pins S1, S2, S3, etc. which may have been engaged in the key-way 109 of hollow shaft 108.

The engagement of pins S1, S2, S3, etc. with the slot 109 of shaft 108 is controlled by individual lever members L1, L2, L3, L4, L5, L6 and L7 shown in Figs. 5, 6 and 7 through the cooperation of two cam shafts 117 and 118 rotatably mounted on the flanges 26 and 27. Cam shaft 117 is operatively connected to the hollow shaft 108 through the intermittent or Geneva gears 120 and 160. The driver gear 160 which is secured to the end of hollow shaft 108 in cooperation with gear 120 on shaft 117 imparts $\frac{1}{7}$ of a turn to this shaft for each turn of shaft 108.

The cams x1, x2, x3, x4, x5, x6 and x7 of shaft 117 are in the form of discs each provided with a ratchet-shaped tooth as RT shown in Figs. 5, 6, 7, 15 and 16 disposed in equal angular relation on the shaft 117 thus permitting the successive operation of clutch pins S1, S2, S3, etc. following each complete turn to cam shaft 117 for operatively connecting the gears G1, G2, G3, etc. to hollow

shaft 108 subsequent to the release of the levers L1, L2, L3, etc. by the operation of cam shaft 118 as will be hereinafter described in detail.

Cam shaft 118 is actuated in a step-by-step movement upon the successive operation of key members K1, K2, K3, K4, etc. through the operation of a ratchet wheel 122 secured at one end of a shaft 161, see Figs. 4, 6, 13, 14 and 15 as effected by a pawl 123 pivoted at the free end of an arm 124 which is in turn pivoted on a shoulder screw 125 and connected at its free end portion to the lower disposed end of a link member 126, this link being connected at its upper end portion to the U-shaped yoke 54 as by screw 127.

The movement of ratchet wheel 122 as effected by the pawl 123 is transmitted to the cam shaft 118 through a gear 162 securely mounted on shaft 261 and engaging the gear 163 keyed on shaft 118, the gear ratio between gears 163 and 162 being such as to impart $\frac{1}{2}$ of a turn to cam shaft 118 for each tooth of ratchet wheel 122 for each digit key operated.

Pawl 123 as shown in Fig. 4 is normally held in disengaged relation from the ratchet wheel 122 through an extension XT of this pawl engaging the under surface of a stop 128 so as to permit the return movement of this wheel and that of cam shaft 118 to normal position under the tension of a retractile spiral spring 139 shown in Figs. 4, 5 and 14 upon the release of the ratchet wheel 122 by a spring-pressed retaining pawl 129 provided for holding this ratchet wheel in each advanced position.

The disengagement of pawl 129 from ratchet wheel 122 is effected by the operation of an arm 131 having a tooth-shaped portion for engaging the bent over portion 132 of pawl 129 upon the rotary movement of sector 133 to which the arm 131 is pivoted. The movement of sector 133, as above described, is effected by the operation of gear sector 134 secured to the handle lever 91 and movable upon the tension of motor spring 94.

As above described, the successive operation of the key members K1, K2, K3, etc. imparts a step-by-step unidirectional movement to cam shaft 118 through the movement of U-shaped yoke bar 54, the connecting rod 126 attached at one end thereto, the lever 124 attached at the other end of rod 126 and the pawl 123 carried thereby engaging the ratchet wheel 122 on shaft 261, thus rotating the gears 162 and 163 and the cams N1, N2, N3, N4, N5, N6, and N7 in the form of discs having different numbers of projections at their peripheries disposed in angular spaced relation so that the first key member which may be depressed for the transmitting of a given telephone designation will release the lever L1, the second key the lever L2, the third key the lever L3, etc., for permitting the successive operation of these levers under the tension of their retractile springs CT and thereby the engagement of clutching pins S1, S2, S3, etc. carried by gears G1, G2, G3, etc. with the sleeve 108 in the sequence determined by the operation of cam shaft 117. These clutching pins are frictionally held in operated position by similar springs SP shown in Figs. 5, 7, 12 and 13 so that a rotary movement of the hollow shaft 108 is effective to rotate the gears G1, G2, G3, etc. as the case may be for imparting a longitudinal movement to their respective gear racks R1, R2, R3, etc., a distance corresponding to a corresponding number of pins 33 and the upward extending portions 33Z of the impulse bars P1, P2, P3, etc.

On the top end of angular levers L1, L2, L3, L4, 75

L5, L6 and L7 is pivotally mounted one of the ends of the arms F1, F2, F3, F4, F5, F6 and F7 shown in Figs. 6, 7, 12 and to the free end of each of these arms is mounted a pawl H1, H2, H3, H4, H5, H6 and H7, each resiliently held against a stop lug formed with each arm F1, F2, F3, etc. by the tension of similar springs a, the top disposed end of each pawl H1, H2, H3, H4, H5, etc. being normally disposed in engageable relation with the tooth of its respective ratchet wheel RW1, RW2, RW3, etc., which are mounted in equal angular spaced relation on a shaft 170 shown in Figs. 6, 7, 15, 16 and 17. The shaft 170 is operatively connected to the driving gear 97 through a pinion 171 securely mounted on gear 97 and engaging a similar pinion 172 mounted on the shaft 170. The other ends of springs a which are secured to arms F1, F2, F3, etc. rest on a projection 173 formed with the rear flange 25. Each of these springs is disposed in engageable relation with a common plate 200 having an extending arm 201 best seen in Fig. 6 provided for engaging a star wheel 161 carried by a shaft 105 of a centrifugal speed governor 101 for preventing the operation of the pulsing mechanism against the tension of motor spring 94 under conditions which will be hereinafter described in detail, the speed governor being actuated, as above described, by the main gear 97 through a pinion 102 and a worm wheel 103 keyed on the spindle portion 206 of pinion 102.

The pawls H1, H2, H3, etc. may be moved out of engageable relation from the one tooth ratchet wheels RW1, RW2, RW3, etc. on shaft 170 by cams as DC1, DC2, DC3, etc. on a shaft 207. This shaft is rotated by a knob 208, shown in Figs. 1, 2, 3, 5, 13, secured to the top disposed end of a vertical shaft 209 in turn operatively connected to shaft 207 by bevel pinions 210 and 211. The movement of shaft 207 as defined by the movement of knob 208 in registry with one of the digit numbers 1, 2, 3, 4, 5, 6 and 7 printed on a dial 212 on the casing 22 is effective to move as many pawls H1, H2, H3, etc., out of operable relation from the ratchet wheels RW1, RW2, RW3, etc., as the number selected on the dial 212, the conditioning of the pawls H1, H2, H3, etc. permitting the stopping of the motor mechanism following the pulsing operation of the transmitter in response to each key depressed in a call designation of less than seven digits and to permit the running down of the motor mechanism following the transmission of the last digit comprised in that call designation. A resetting mechanism operated by the handle lever 91 is provided for returning the pulsing bars P1, P2, P3, etc. to normal together with their actuating gear racks R1, R2, R3, etc. following the transmission of each telephone call designation. In this resetting mechanism the operation of handle lever 91 and therefore that of the gear sectors 134 and 133 is effective to disengage the pawl 132 from ratchet wheel 122 so as to permit the cam shaft 118 actuated thereby to return to normal unoperated position under the tension of spiral spring 139. The gear sector 133 is secured at one end of a shaft 140 journaled at that end in a bearing portion 141 formed with the base 20 and its other end in a bearing portion in the flange 26. A pair of lever arms 142 and 144 best seen in Fig. 14 are secured on the ends of shaft 140 and the free ends of these arms are operatively connected to similar levers 144Y through bell cranks 144X, while the free ends of levers 144Y are connected to the pivot portions of bar 146 by similar links 144W,

the bar 146 being mounted for sliding movement on the guiding bars b_1 , b_2 , b_3 , b_4 , etc. so that the movement of gear sector 133, as effected by handle 91, is effective to return to normal the gear racks R_1 , R_2 , R_3 , etc. and thereby the pulsing bars P_1 , P_2 , P_3 , etc., collectively, to normal starting position as shown in Figs. 3 and 7.

The movement of lever 138A in the "reset" position, as shown in Figs. 3, 4 and 6, the arm 151 actuates a plate 153 through the arm 152 of the plate for moving a roller 154 in engageable relation with the camming arm 85A of lever 85 for pivoting this arm in the direction indicated by the arrow during the return movement of rack R_1 , R_2 , R_3 , etc. and their associated pulsing bars b_1 , b_2 , b_3 , etc. to normal and thereby causing the operation of plate 66 for disengaging the pawls 62 and 59 from racks 63 and 57 so as to permit the return to normal resetting of carriage 51 and simultaneously moving the pins 33 to normal non-operated position.

Upon the manual movement of lever 138A into the position marked "repeat," that is, in the position shown in dotted lines in Fig. 4, the movement of arm 151 carried thereby is imparted to arm 152 for moving the plate 153 and the roller 154 out of engageable relation from the camming surface 85A of lever 85 so that the operation of handle lever 91 and gear sectors 134 and 133 actuated thereby is effective to return the gear racks R_1 , R_2 , R_3 , etc. and their associated pulsing bars b_1 , b_2 , b_3 to normal, but the lever 85 and therefore the plate 66 are not operated and the pins 33 previously set remain in their adjusted operated position so that the tensioning of motor spring 94 through the operation of handle 91 causes the operation of pulsing bars b_1 , b_2 , b_3 , etc. in the manner above described without requiring the resetting of the key members K_1 , K_2 , K_3 , etc. previously set for repeating the transmission of the call.

A manually operable lever 155 is pivoted as on a screw 157 on an upright supporting member 156 shown in Figs. 3, 4, 6 and 7 formed with the base 20 and the lower end portion of this lever is connected to a longitudinally movable rod 158 supported at its free end portion in a guiding lug 159 formed with the base 20. The rod 158 is provided with an upright extending lug portion 269 for engaging a star wheel 161 carried by the governor shaft 195 for preventing the operation of the transmitter mechanism under the tension of motor spring 94, thus permitting the setting of all the key members K_1 , K_2 , K_3 , etc. representing a given telephone number prior to the operation of the transmitter, the release of the governor being effected by the movement of the manually operable lever member 155 adjacent the word "release," as shown in Figs. 1 and 2.

In a typical example of operation as for transmitting the telephone call designation 6234652 by the so-called key-by-key pulsing operation of the transmitter, the knob 208 is moved in registry on the No. 7 printed on dial 212, as shown in Fig. 2, signifying a seven digit call, the movement of this knob being effective to rotate the shaft 209 and thereby the cam shaft 237 in position ineffective relative to pawls H_1 , H_2 , H_3 , etc. so as to permit the locking of the pulsing mechanism following its operation in response to each key depressed as will be hereinafter described in detail.

Lever 155 is moved in the released position so as to permit the immediate starting operation of the pulsing mechanism following the setting of the first key in such designation while lever 138A

is moved in the reset position shown in Fig. 1, so as to prepare the resetting mechanism for returning the gear racks R_1 , R_2 , R_3 , etc., the pulsing bars or elements P_1 , P_2 , P_3 , etc. and the digit pin 33 to normal operated position, such resetting mechanism being operated by the movement of handle 91 simultaneously with the tensioning of motor spring 94.

The operation of key K_6 representing the first digit of the call designation 6234652 above-mentioned, is effective to operate its respective camming bar B_6 and thereby the spring retracted pin Y_6 , now in operative relation with this bar, Figs. 3, 7, 12 and 18 for moving the corresponding stop pin member 33 in the path of lug 33Z of camming or pulsing bar P_1 . With the pulsing bar P_1 , P_2 , P_3 , etc. the gear racks R_1 , R_2 , R_3 , etc. and therefore the respective driving gears G_1 , G_2 , G_3 , etc. in normal position as shown in Figs. 7, 8, 9 and 15, the clutch pins S_1 , S_2 , S_3 carried by gears G_1 , G_2 , G_3 , etc. are disposed in operable relation with their respective angle levers L_1 , L_2 , L_3 , L_4 , etc. and in engageable relation with the groove 109 of hollow shaft 108, the operation of each angle lever L_1 , L_2 , L_3 , L_4 , etc. being in turn controlled by respective cam wheels x_1 , x_2 , x_3 , etc. and similar retractile springs CT.

The motor spring 94 is normally prevented from actuating the gears G_1 , G_2 , G_3 , G_4 , etc. due to the pawl H_1 at the free end of arm F_1 , being engaged with its respective wheel RW_1 and normally maintaining the spring a carried by arm F_1 flexed as shown in Fig. 16 for holding the plate 200 and its lug portion LP in engagement with the star wheel 161 carried by governor shaft 105. Upon the operation of the first key member K_6 , above mentioned, and the consequent stepping movement of shaft 113, as effected by ratchet wheel 122, the angle lever L_1 is moved by its retractile springs CT in position wherein the clutching pin S_1 of gear G_1 is moved in the groove of hollow shaft 108 while simultaneously disengaging the pawl H_1 at the end of arm F_1 from its one-toothed ratchet wheel RW_1 to cause the spring a to return to its normal position under the medium of its own resiliency and thereby pivoting the plate 200 for moving its lug LP out of engagement from the star wheel 161, thus permitting the operation of hollow shaft 108 and gear wheel G_1 clutched thereto.

The rotation of gear wheel G_1 through the rotation of hollow shaft 108 as effected by the engagement of gear 107, with pinion 106 and the engagement of this pinion with main gear 97 is effective to impart a longitudinal movement to the gear rack R_1 from the position shown in Fig. 7 to the position shown in Fig. 12 frictionally carrying with it the pulsing element P_1 through the tension of spring 29. The pulsing bar P_1 is arrested in its movement due to the engagement of its lug 33Z with the depressed pin 33 as effected by key K_6 while the gear rack R_1 continues its movement until the clutching pin of gear G_1 is disconnected from hollow shaft 108 by the sliding movement of shaft 110 which movement is imparted by the cam 111 on the side of gear 107 in cooperation with lever 113 and retractile spring 121 shown in Figs. 8, 9 and 10 and timed to occur following each half turn of gears G_1 , G_2 , G_3 , etc., but the engagement of the succeeding clutch pins carried by the gears is timed to occur following each complete turn of hollow shaft 108 when the groove 109 of this shaft is again in registry with clutching pins S_2 , S_3 , S_4 , etc. thus providing a so-called inter-digit space

between each set of pulses as effected by the movement of pulsing elements P1, P2, P3, etc.

Supposing now that key K2, the second digit of the call designation 6234652, above mentioned, has not been depressed. In that condition the angle lever L2 is held from movement by its cam N2 on shaft 118 while the pawl H2 at the end of arm F2 is engaged by its one-toothed ratchet wheel RW2 in the manner described in connection with pawl H1 for flexing its spring *a* and thereby imparting a downward pivotal movement to the common plate 200 for engaging its lug portion LP with the star wheel 161 and thereby preventing the operation of the motor mechanism which is released upon the operation of key K2, this cycle of operation being repeated for each digit to be transmitted in the call designation above mentioned.

Supposing now that key K2 was depressed prior to the completion of the operation of the transmitter mechanism for transmitting the six pulses in response to the operation of key K6, the cam N2 on shaft 118 which is actuated a second step by key K2 releases the angle lever L2 so as to permit the engagement of clutch pin S2 carried by gear G2 with the groove 109 of hollow shaft 108 under control of its cam wheel *x*2 and prevents the locking of the governor shaft as above mentioned in connection with angle lever L1. The operation of any one of the keys as in this example keys K2 and K6 in addition to the setting of stop pins 33 in the path of pulsing racks P1, P2, P3 as the case may be is effective to impart a pivotal movement to the yoke lever member 54, see Figs. 5, 7 and 14, and thereby a pivotal movement to the angle-shaped lever 53 having its downward extending arm loosely connected to one end of the saw-toothed rack 57, the other end of this rack, as above described, being loosely connected to the arm 55, pivoted to a lug extending perpendicularly from the side flange 26, the spring ST serving for returning the rack 57 to normal position, as defined by the yoke 54 normally bearing against the under surface of the keys K1, K2, K3, etc. when each of these keys are in normal non-operated position, so that the movement of rack 57 by the operation of any one of the keys is effective to engage the tooth T1, for example, of this rack with pawl 59 on carriage bar 51 so that upon the return movement of the operated key to normal, the retractile spring ST causes the movement of rack 57 for moving the carriage 51 in position for placing the spring retracted pins Y1, Y2, Y3, etc. in axial alignment with the succeeding row of stop pins 33 preparatory to the operation of the succeeding key as in this example key K3.

Upon the last digit transmitted when the gear sector 88, Figs. 4 and 14, and 134 are arrested in their operated position due to gear sector 88 engaging the stop 89, the transmitter mechanism is now ready for a succeeding operation which is effected by the operation of lever 91 for returning the gear sectors 134 and 135 to normal unoperated position, the movement of lever 125 tensioning the motor spring 94 while the movement of gear sector 134 actuates the gear sector 133 for imparting a small angular movement to shaft 140 and to the arms 142 and 144 carried thereby for returning the camming or pulsing bars P1, P2, P3, etc. to normal unoperated position through the movement of bar 146 connected to arms 142 and 144 on shaft 140 by the links 144X, the lever arms 144Y and links 144W.

The movement of gear sector 133 is effective

to impart a longitudinal movement to pawl 131 for disengaging the pawl 129 from ratchet wheel 122 for permitting the returning of the camming shaft 118 to normal position through gear 162 on shaft 261 and pinion 163 on cam shaft 118 as effected by the tension of the spiral retractile spring 139.

The placing of lever 138A in the "reset" position, as above described, imparts a small angular movement to the plate 153 through its arm 152 for moving the roller 154 in operative relation with the cam surface 85A of fork-shaped lever 85 whereby the movement of bar 146 is effective to impart a pivotal movement to this lever and an upward movement in the plate 66 due to the engagement of the free end of arm 85 with the camming portion 86 of the plate 66 and its arcuated movement as generated by its connecting links 67, 68, 69 and 80, thus returning the operated stop pins 33 to normal. The bar 146 is returned to normal as shown in Figs. 2, 3, 4, 6, 7, 12 and 14 automatically by the tension of spring 250 having one of its ends connected to upright 156 extending from base 20 and its other end to the gear sector 133 on shaft 140, the return movement of gear sector 133 by spring 250 being effective to return the gear sector 134 and the handle 91 to the unoperated position while the gear sector 135 remains in the operated position against the stop 90 with the motor spring 94 tensioned preliminary to succeeding call designation transmitting operation.

Supposing now that it is desired to transmit the call designation 6234652 by the so-called present operation of the transmitter and that it is desired to repeat such a call in the event that the called telephone substation is found to be busy. According to the transmitter of the invention, the lever 138A is moved to the "repeat" position and lever 155 to the "preset" position. The movement of lever 155 to the preset position is effective to impart a longitudinal movement to the bar 158 for engaging its upward extending end with the star wheel 161 on governor shaft 105, see Fig. 4, thus permitting the setting of all the keys in the manner above described without causing the starting operation of the motor mechanism which may, however, be started at any time by returning the lever 155 in the released position and thereby moving the bar 158 and its lug portion 260 out of engaged relation from star wheel 161. Supposing now that the call telephone designation 6234652 is busy and that it is desired to repeat such a call. The movement of lever 138A to the repeat position, as above described, imparts a pivotal movement to the plate 153 for moving the roller 154 out of engageable relation from the camming surface 85A of fork lever 85 so that the movement of bar 146 as for resetting the impulse bars P1, P2, P3, etc. is ineffective to operate the plate 66. Therefore the stop pins 33 previously set in position for transmitting the call designation above mentioned are not returned to normal during the tensioning of the motor spring 94. The cam shaft 118, however, is returned to normal starting position upon the disengagement of pawl 129 from ratchet wheel 122 and therefore is ineffective relative to angle levers L1, L2, L3, L4, etc. during the repeat operation of the transmitter and the reengagement of clutching pins S1, S2, S3, etc. by levers L1, L2, L3, L4, etc. is now under control of the wheel X1, X2, X3, etc. on shaft 117 which is driven by intermittent gears 160 and 120.

According to this mechanism, a certain telephone call designation may be repeated any number of times by the tensioning of the motor spring through the operation of handle 91.

Supposing now that it is desired to transmit a call designation of less than seven digits, the knob 208 is moved on the Nos. 1, 2, 3, 4, 5, 6 and 7 as the case may be for rotating the cam shaft 207. The operation of this shaft causes a pivotal movement of pawls X7, X8, X5, X4, X3, X2, X1 in number corresponding to the number of digits selected for moving them out of engageable relation with their corresponding one-toothed ratchet wheel RW7, RW6, RW5, RW4, RW3, RW2 and RW1. Under this condition the pawls H1, H2, H3, H4, etc. which have not been moved out of engagement from their one-toothed ratchet wheel R1, R2, R3, R4, etc. operate in the manner above described in connection with the key-by-key digit transmitting operation, but the pawls R7, R6 and R5 which have been moved in position out of engageable relation with their one-toothed ratchet wheel permits the continued movement of the driving mechanism following the number of digits transmitted as defined by the position of knob 208 until the gear sector 88 is arrested by its stop 135 engaging gear sector 134 in turn normally resting against stop 89 as previously described.

What is claimed is:

1. In a call transmitter, a set of pivoted key members, a plurality of pulsing cam bars, a gearing mechanism and a friction drive for each of said bars for moving them longitudinally, a motor for actuating said mechanisms, clutching devices operable for operatively connecting said gearing mechanisms to, and disconnecting said gearing mechanisms from, said motor for imparting to each of said mechanisms a predetermined movement, means operated by said key members for controlling the extent of movement of said bars relative to the operation of said mechanisms and a contact actuated by the operation of any of said bars.

2. In a call transmitter, a set of key members, bars actuated by said key members respectively, spring retracted plungers actuated by said bars respectively, a motor mechanism, longitudinally movable pulsing elements actuated by said motor, and normally ineffective stop means positioned by the operation of said plungers by said bars for controlling the longitudinal operation of said pulsing elements.

3. In a call transmitter, a motor, a set of key members, a plurality of longitudinally movable pulsing cam elements, a contact actuated by the successive movement of each of said elements, a clutching mechanism geared to said motor for successively actuating said elements, means actuated by the operation of said key members for stopping the operation of said longitudinally movable pulsing elements during the continued operation of said mechanism by said motor, and manually operable means for returning said elements to normal position collectively following the successive operation of said contact by said elements.

4. In a call transmitter, a plurality of longitudinally movable pulsing cam elements, a contact, means disposed in operative relation with each of said pulsing elements for actuating said contact, driving gears, racks movable longitudinally by the movement of said gears for actuating said elements, a common shaft for rotating each of said gears but normally ineffective thereto,

clutch mechanisms for successively operatively connecting said gears to said shaft for actuating said pulsing elements, a system of cam shafts and lever members for controlling the operation of said clutch mechanisms, a fixed mounting, a plurality of stop pins arranged in coordinate rows in said mounting, a carriage, a row of plunger members mounted on said carriage, a set of key members, means actuated by said key members for moving said plunger members and said stop pins in position for determining the operation of said contact by said elements, and a motor for actuating said shaft and said cam shafts.

5. In a call transmitter, a plurality of longitudinally movable pulsing elements, a contact, means disposed in operative relation with each of said elements for actuating said contact, driving mechanisms for said elements each comprising a clutching means, a set of key members, means actuated by said key members for defining the extent of operation of each of said elements, a motor, a cam shaft actuated by said motor, a cam shaft actuated by the operation of each of said key members, means actuated by the conjoint operation of said cam shafts for successively operating said clutching means to cause the successive operation of said elements, a speed governor for controlling the operation of said motor, another cam shaft actuated by said motor and a lever mechanism actuated by the last-mentioned cam shaft for stopping the operation of said speed governor following the operation of said elements.

6. In a call transmitter, a plurality of key members, pulsing elements, means actuated by the operation of said key members for controlling the operation of said elements, a motor, a shaft geared to said motor, a gear wheel for each of said elements loosely mounted on said shaft, a clutching pin carried by each of said gears, said shaft having a clutch element common to said clutching pins, a cam shaft actuated by the operation of each of said key members, a cam shaft geared to said motor, lever members operatively associated with said clutching pins and operable upon the conjoint operation of said cam shafts for successively engaging said clutching pins with said clutch element for operation of said pulsing elements, a pulsing contact, and a pivoted member actuated by the movement of each of said elements for operating said contact.

7. In a call transmitter, a plurality of key members, a plurality of longitudinally movable pulsing elements, a gear rack for each of said elements, friction drives operatively connecting said pulsing elements to said gear racks, a row of normally ineffective stopping members for each of said elements, means operable by the movement of each of said key members for setting one of said stopping members in each of said rows for predetermining the extent of movement of said pulsing elements, a motor spring, a rotatable shaft connected to said motor, gears for actuating said racks mounted free on said shaft, means for individually and operatively connecting each of said gears to said shaft to cause the operation of said elements to points determined by the position of said stopping members, means actuated by said motor for successively disconnecting said gears from said shaft following the operation of each of said gear racks and a contact actuated by the movement of each of said elements.

8. In a call transmitter, a set of key members, a plurality of pulsing elements, means set by the operation of said key members for defining the

operation of said elements, a motor, a rotatable shaft actuated by said motor, gears for said pulsing elements mounted on said shaft, normally ineffective clutching devices for operatively connecting said gears to said shaft for actuating said elements, a cam shaft actuated by the operation of each of said key members, a cam shaft actuated by said motor, a plurality of lever members operated by the conjoint operation of said cam shafts to render said clutching device effective relative to said gears, a speed governor for controlling the operation of said motor, and a two-position manually operable means movable in one position for locking said governor shaft against movement for permitting the operation of a plurality of said key members prior to the operation of said motor and in the other position releasing said motor.

9. In a call transmitter, a set of key members, pulsing elements, a contact actuated by the operation of each of said elements, a plurality of rows of stopping members normally ineffective relative to said elements, a carriage, a row of spring retracted plunger members mounted on said carriage, a ratchet mechanism actuated by each of said key members for moving said carriage step by step for successively positioning said plunger members in operative relation with each row of said stopping members, means actuated by the operation of each of said key members during the ineffective stroke of said ratchet mechanism for setting one of said stopping members in each of said rows in position effective relative to said pulsing elements for controlling the operation of said contacts, a motor spring for actuating said elements, means for tensioning said springs, and means operated upon the tensioning of said spring for collectively resetting said elements to normal.

10. In a call transmitter, a set of key members, a contact, a plurality of pulsing elements, means actuated by the operation of said key members for controlling the extent of movement of said pulsing elements for operating said contact according to the digit values represented by the operation of said key members, a rotatable shaft, a motor for operating said shaft, gears for said pulsing elements supported by said shaft, said shaft having a clutch element, a clutch element carried by each of said gears for engaging the clutch element of said shaft, a camming mechanism for successively engaging the clutch elements of said gears with the clutch element of said shaft for imparting movement to said pulsing elements for actuating said contact, and manually operable means for negating a predetermined operation of said camming mechanism for permitting the continued operation of said motor to normal position following the transmission of a number of series of pulses corresponding to the number of the operated key members.

11. In a call transmitter, a set of key members, a plurality of pulsing elements, a contact, means actuated by the successive operation of said key members for controlling the extent of movement of each of said pulsing elements, gears for actuating said elements, a common shaft for each of said gears having a clutch element, a clutch element carried by each of said gears for engaging the clutch element of said shaft, a cam shaft operated by the operation of said key members, a

cam shaft operated by said motor, lever members operated by the conjoint operation of said cam shafts for controlling the engagement of each of said clutch elements with the clutch element of said shaft for operating said contact, another cam shaft actuated by said motor, and means actuated by the conjoint operation of said manually operable cam shaft and the last-mentioned cam shaft for stopping the operation of said motor following the transmission of each successive train of pulses according to the operation of said key members.

12. In a call transmitter, a set of key members, a contact, a plurality of pulsing elements for actuating said contact, means actuated by said key members for controlling the extent of movement of each of said pulsing elements, gear mechanisms for actuating said elements, a driving shaft common to said gear mechanisms but normally ineffective thereto, means for successively operatively connecting said gear mechanisms to said driving shaft, said means comprising a plurality of lever members, retractile springs for said levers, a cam shaft for successively operating said levers under the tension of said springs, a cam shaft operated by the movement of each of said key members for determining the number of said pulsing elements to be operated for transmitting trains of pulses according to the values of the digit keys operated, and a plurality of means operable in one position for transmitting such pulses in response to the successive operation of said key members and in another position by the preset operation of said key members.

13. In a call transmitter, a contact, a plurality of pulsing elements for actuating said contact, a set of key members, a plurality of rows of stopping members selectively actuated by the operation of said key members for determining the extent of movement of said pulsing elements, a motor, a shaft operatively connected to said motor, said shaft having a clutch element, a plurality of gears mounted on said shaft, each having means for engaging said clutch element, mechanisms for effecting such engagement, said mechanism comprising a lever member for each of said means, a manually operable lever mechanism, a cam shaft operated by said mechanism for predetermining the engagement of said clutch elements relative to the clutch element carried by said shaft, a cam shaft actuated by said motor cooperating with the first-mentioned cam shaft for permitting the successive automatic engagement with said clutch elements for causing the successive operation of said gears for actuating said pulsing elements, a ratchet shaft actuated by said motor in timed relation to the first-mentioned cam shaft, arms carried by said levers, pawls carried by said arms successively engaged by said ratchet shaft for stopping the operation of said motor following the operation of said pulsing elements in response to the operation of each of said key members, and a manually operable cam shaft for operating said pawls to render a predetermined operation of said ratchet shaft ineffective relative to said pawls for determining the number of digits to be transmitted by the operation of said elements.

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