March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 1

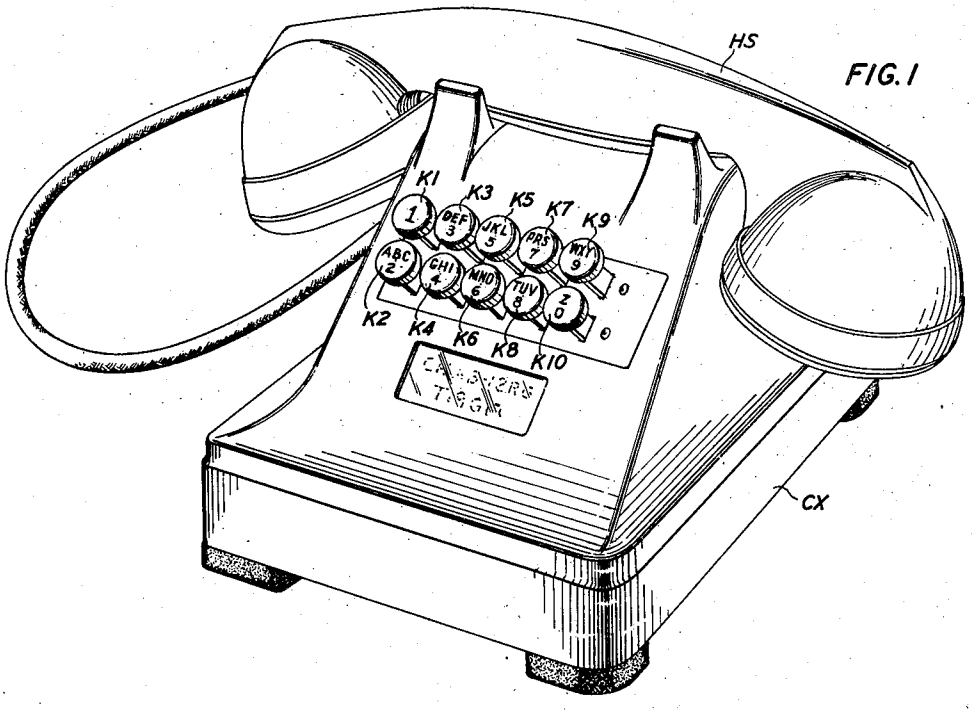
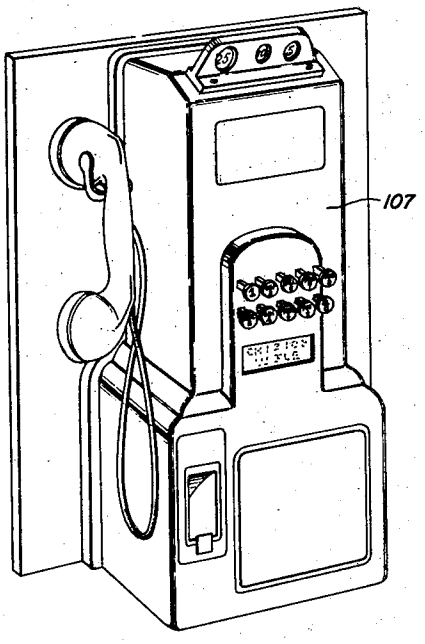


FIG. 1

FIG. 2



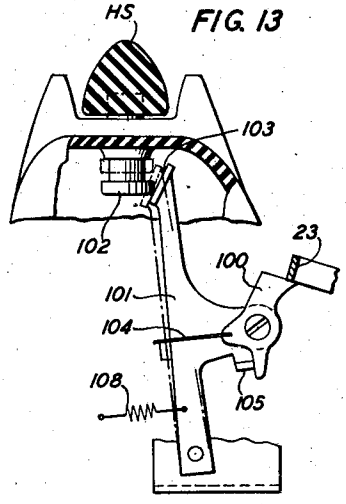


FIG. 13

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March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 2

FIG. 3

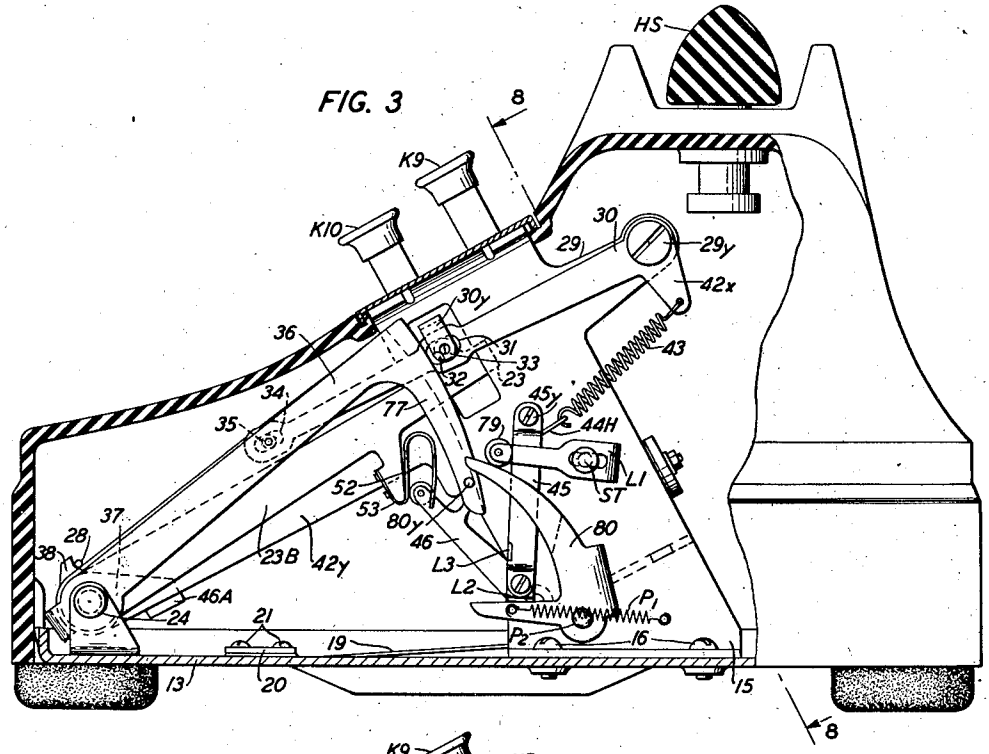
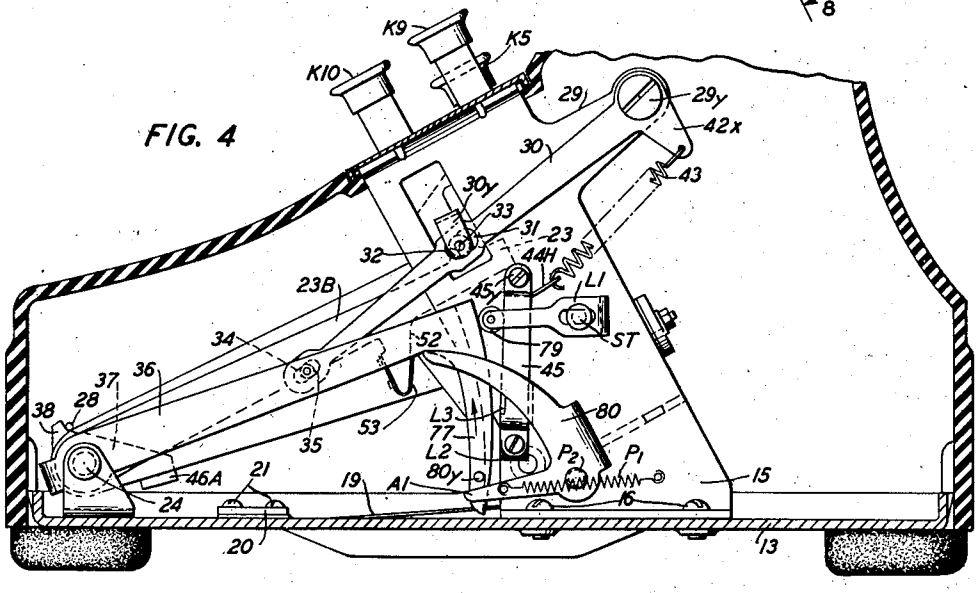


FIG. 4



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March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 3

FIG. 5

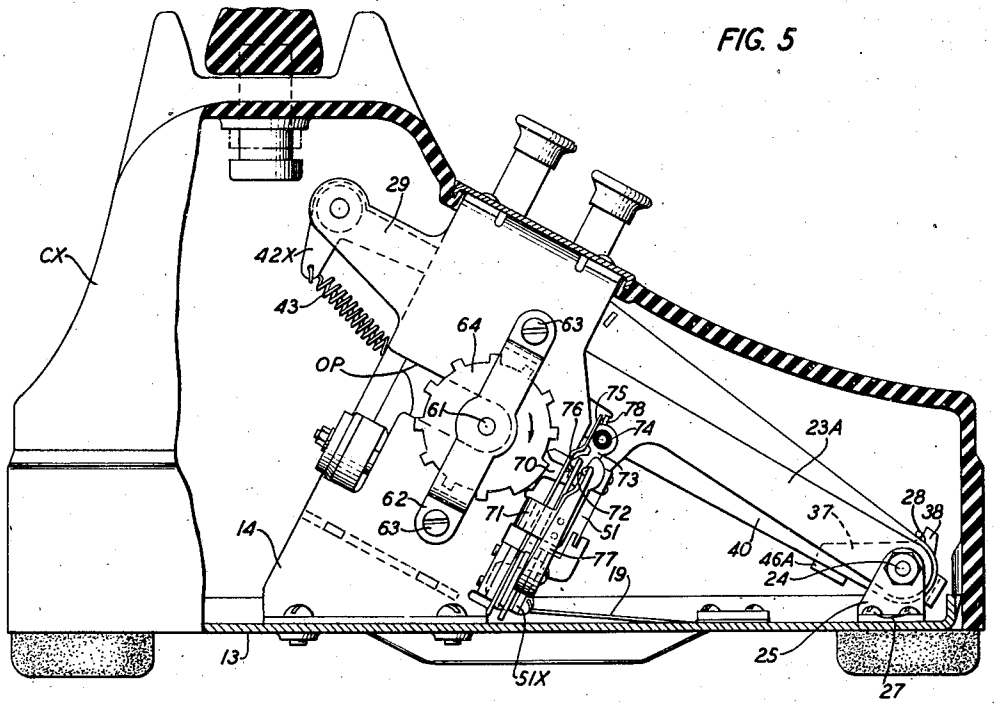
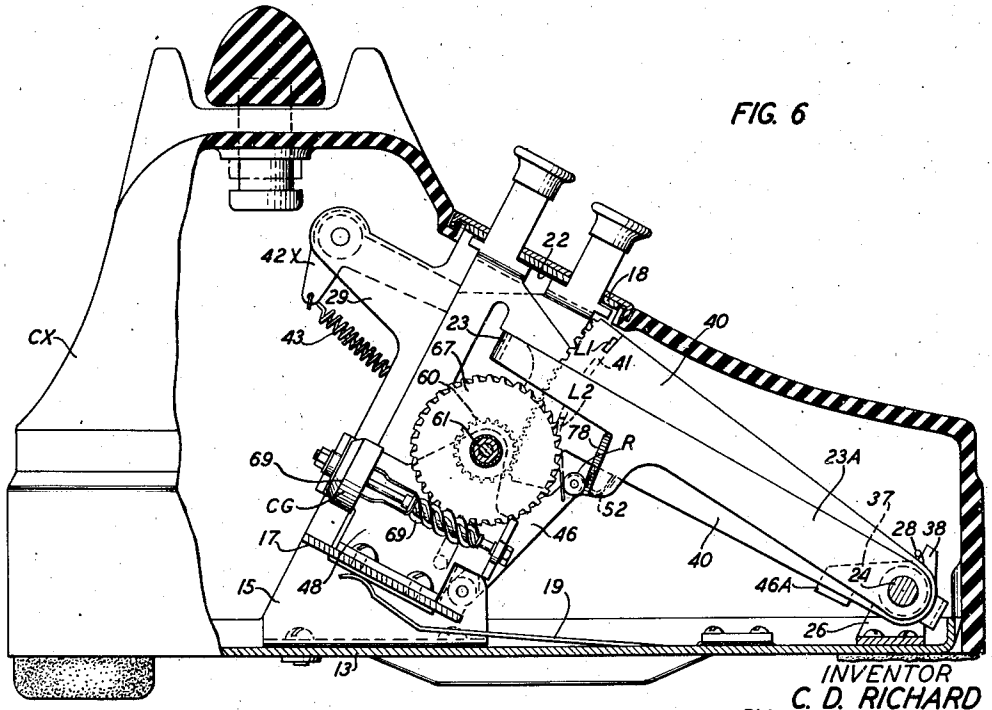


FIG. 6



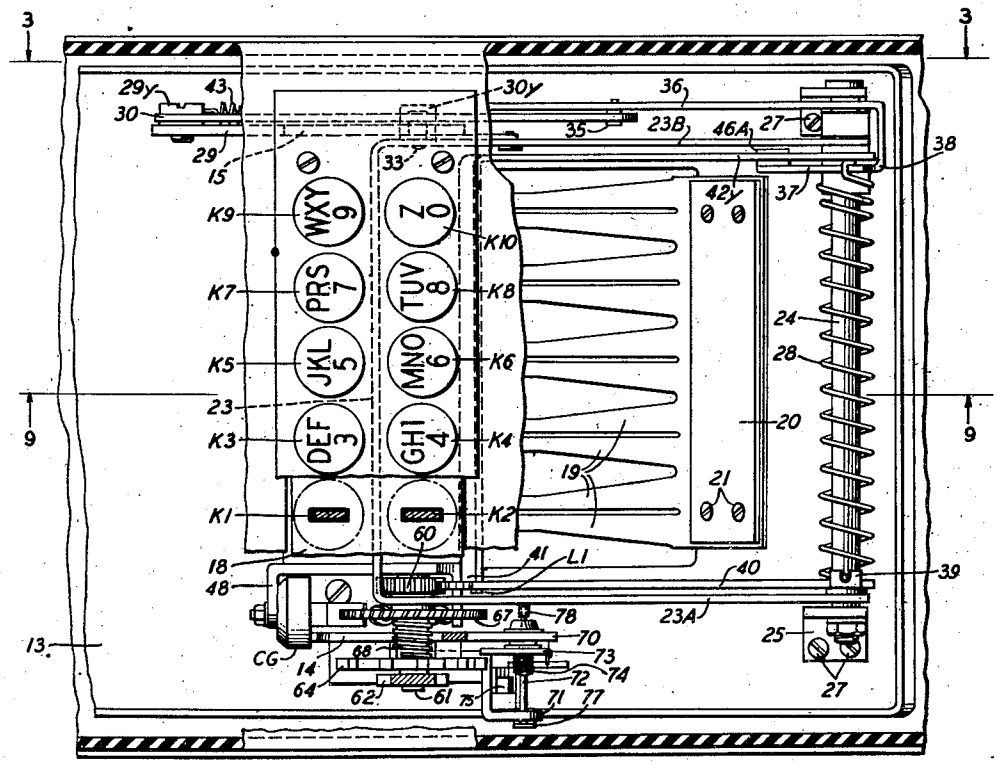
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March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 4

FIG. 7



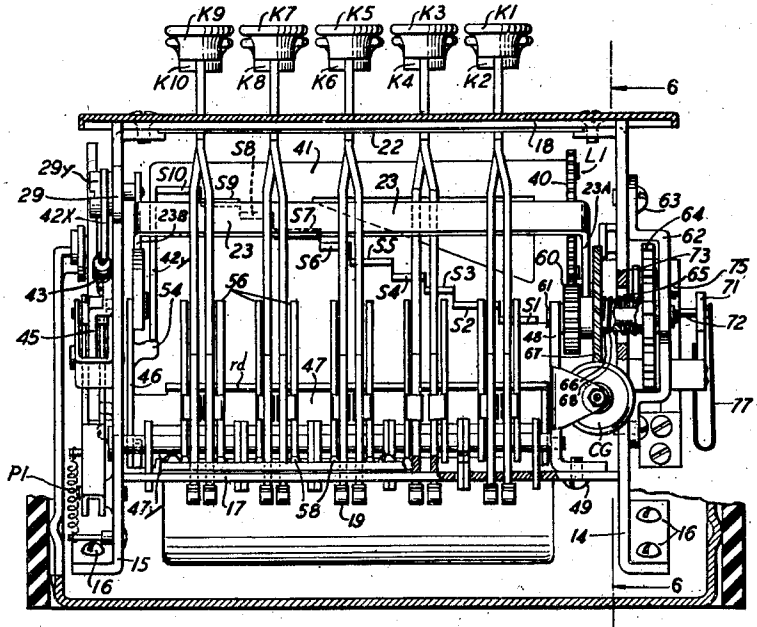


FIG. 8

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March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 5

FIG. 9

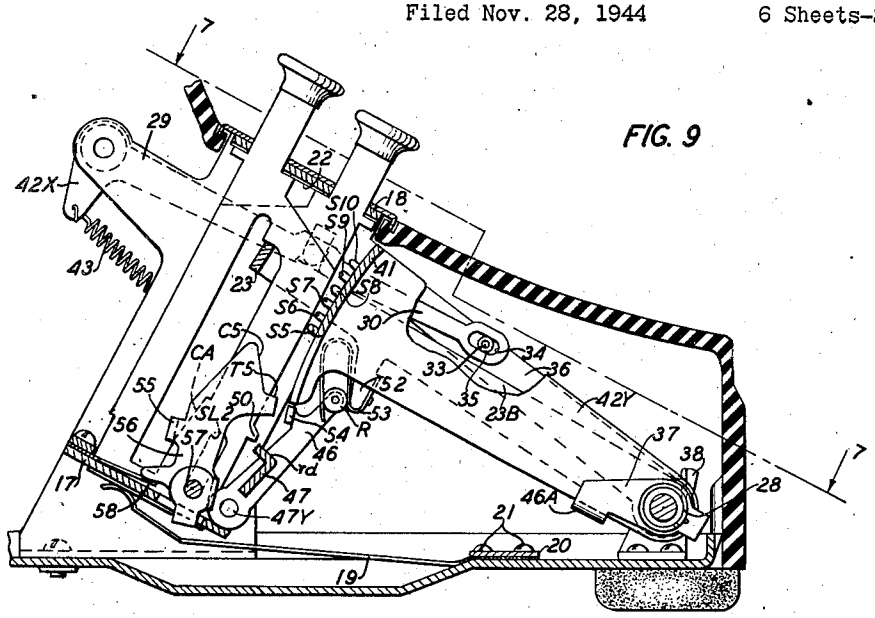


FIG. 10

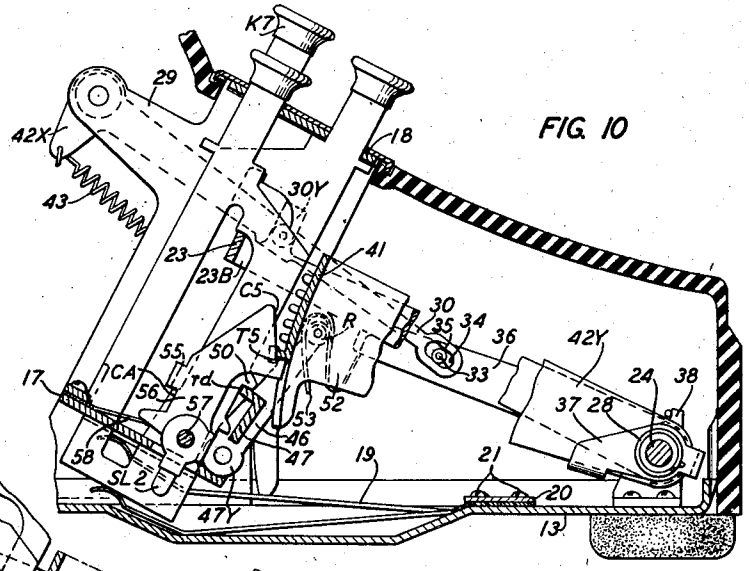


FIG. 12

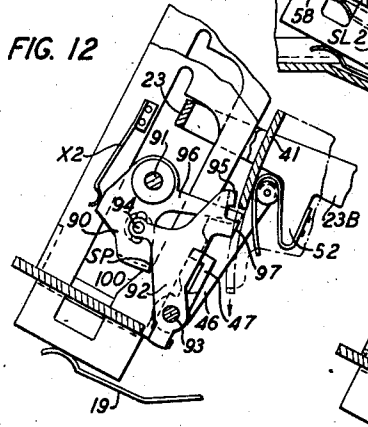
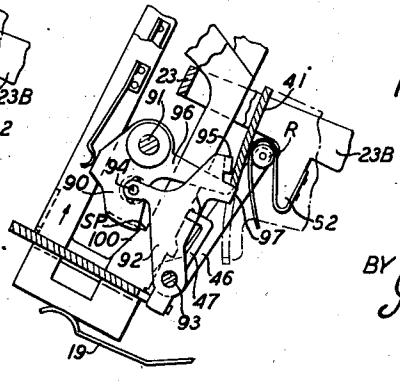


FIG. 11



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March 4, 1947. C. D. RICHARD 2,416,715

TELEPHONE CALL TRANSMITTER

Filed Nov. 28, 1944 6 Sheets-Sheet 6

FIG. 14

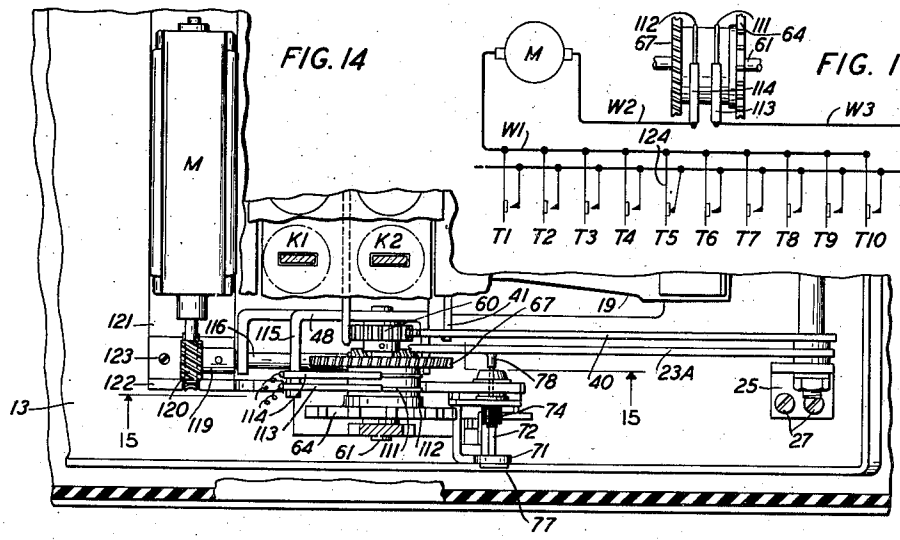


FIG. 18

FIG. 15

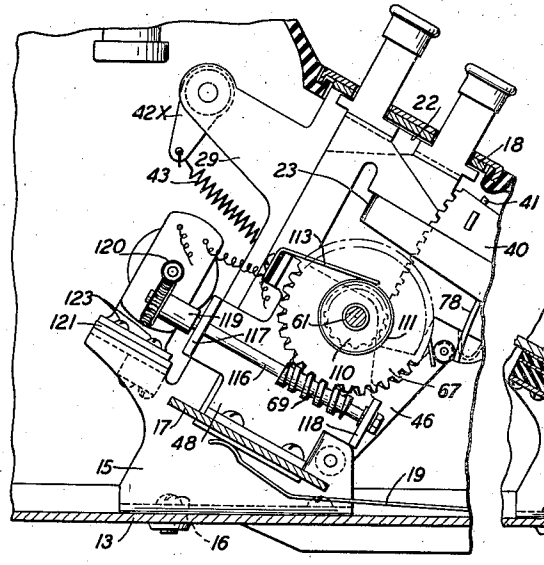


FIG. 17

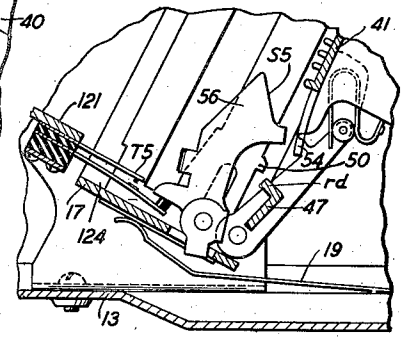
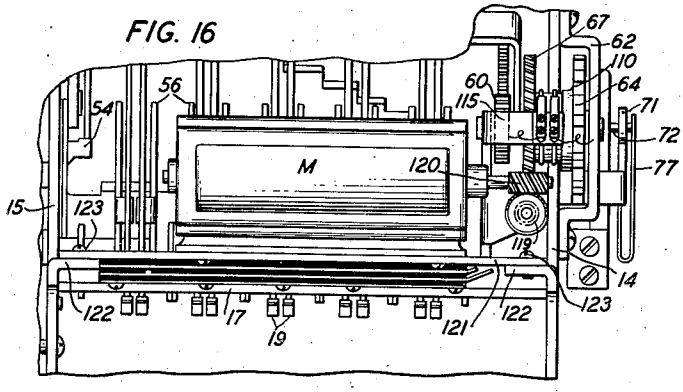


FIG. 16



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Patented Mar. 4, 1947 2,416,715

UNITED STATES PATENT OFFICE

2,416,715

TELEPHONE CALL TRANSMITTER

Charles D. Richard, West New Brighton, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 28, 1944, Serial No. 565,459

21 Claims. (Cl. 179—90)

1

This invention relates to telephone call transmitters and more particularly to call transmitters of the key-operated type.

The object of the invention is to provide a call transmitter of the type above referred to which will be simple in construction, convenient to use, and positive in operation.

A feature of the invention is the provision of a set of key members for operating a pivoted bar and causing the operation of means operatively associated with the keys for controlling the operation of motor means geared to a pulsing mechanism.

Another feature is the provision of means in the form of a step bar and gear sector unit movable concentric to the pivoted bar by the operation of the motor for actuating the pulsing mechanism, means in the form of an operable stop being provided for normally holding the step bar gear sector unit and the pulsing mechanism geared thereto from operation during the movement of the pivoted bar under control of the operated key member.

Another feature is the provision of means carried by the pivoted bar for operating the stop means and a pawl bar movable therewith for permitting the operation of the step bar gear sector unit and locking the non-operated keys collectively in that position upon the operation of one of the key members.

Another feature is the provision of means carried by the key members effective to cause the operation of spring-pressed pawls for locking their individually associated keys in the operated position during the operation of the step bar gear sector unit and that of the pulsing mechanism geared to the motor.

Another feature is the provision of camming means carried by the pivoted bar for imparting a longitudinal movement to a shaft for moving a contact spring actuating member in position effective relative to a cam in the pulsing mechanism for actuating such a contact spring upon the operation of the step bar gear sector unit as effected by the motor.

Another feature is the provision of means carried by the spring-pressed pawls for engaging their respective steps in the step bar gear sector unit for controlling the angular movement of such unit and thereby the operation of the pulsing cam in relation to the digit value of the depressed key.

Another feature is the provision of spring means tensioned against one end of the shaft supporting the contact spring actuating element for returning such element in position non-effective relative to the pulsing cam during the return movement of the latter and the step bar gear sector unit to normal position for avoiding noise.

2

Another feature is the provision of means carried by the spring-pressed pawls engaged by their respective steps in the step bar gear sector unit for releasing the operated key following the operation of the pulsing mechanism.

Another feature is the provision of a motion amplifier mechanism for actuating a wedging device serving to prevent the reoperation of any one of the keys prior to the return movement of that key to full normal unoperated position.

Another feature is the provision of means operable for engaging the pivoted bar and thereby locking all the keys in normal non-operated position following the placing of the telephone handset in a cradle formed with the casing housing the transmitter mechanism, thus preventing manipulation of the keys when the telephone is not in use.

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

Fig. 1 is a perspective view of the call transmitter of this invention embodied in a so-called telephone desk set, the keys being shown in normal position and the telephone handset in position in a cradle formed with the casing housing the transmitter mechanism;

Fig. 2 is a perspective view of the call transmitter of this invention embodied in a so-called telephone coin collector box;

Fig. 3 is a right side elevation view showing the casing partly in vertical longitudinal section showing the motion amplifier mechanism and the keys in normal position;

Fig. 4 is a view similar to that of Fig. 3 but showing the motion amplifier mechanism and one of the keys in the operated position;

Fig. 5 is a left side elevation view partly in vertical longitudinal section showing the pulsing mechanism and the keys in normal position;

Fig. 6 is an elevation view shown partly in vertical section taken on line 6—6 of Fig. 8, the keys being shown in normal position;

Fig. 7 is a plan view partly in horizontal section taken on line 7—7 of Fig. 9;

Fig. 8 is a rear elevation view shown in sections taken on line 8—8 of Fig. 3;

Fig. 9 is a vertical longitudinal sectional view taken on line 9—9 of Fig. 7 showing the step bar and the keys in normal position;

Fig. 10 is a view similar to that of Fig. 9 but showing one of the keys and the step bar in operated position;

Figs. 11 and 12 are views of a modification of the step bar and gear sector unit and the key locking mechanism in different operated positions:

Fig. 13 is a detail view showing the collective

key locking mechanism in the operated position;

Fig. 14 is a partial plan view showing a modified drive for the pulsing mechanism;

Fig. 15 is a partial elevation view shown in vertical section taken on line 15—15 of Fig. 14, the keys being in normal position;

Fig. 16 is a partial rear view of Fig. 14;

Fig. 17 is a partial view showing one of the keys and its locking pawl in normal non-operated position holding the motor contact associated with that key in the open position; and

Fig. 18 is a diagrammatic view of the motor energizing circuit.

Referring to the drawings, a base 13 is provided for securing as by a number of similar screws 16 the upright supports 14 and 15. These supports as best seen in Figs. 6, 8, 9 and 10 are held in spaced relation to each other at their lower and upper ends by parallelly disposed plates 17 and 18 having registering rectangularly-shaped openings as shown in Fig. 7 serving as guides for a set of longitudinally movable key members K1, K2, K3, K4, K5, K6, K7, K8, K9 and K10. These keys are yieldably held in non-operated position by retracting springs 19, constructed in the form of a comb secured between the base 13 and a metallic strip 20 under the tightening effect of a number of screws 21, while a strip 22 of non-metallic material secured to the underside of plate 18 serves for damping the movement of the keys when the latter are returned to normal position under the tension of their respective springs 19 following their release from operated position in a manner which will be hereinafter described in detail.

A U-shaped bar 23 best seen in Figs. 7 and 8 has its parallel arms 23A and 23B pivoted on a shaft 24 journaled in supports 25 and 26 secured to the base 13 as by a plurality of similar screws 27. The bar 23 extends transverse of the key members K1, K2, K3, etc., in openings formed in these keys for operation by the individual movement of the latter from normal to operated position as shown by key K5 in Fig. 10, the operation of bar 23 being effective to tension a motor spring 28 and to perform other functions which will be hereinafter described in detail.

The upright support 15, as best seen in Figs. 3 and 4, is provided with a projection 29 for pivotally mounting as on a shoulder screw 29Y a lever member 30. This lever is provided at its middle length portion with an oblong-shaped opening 31 engaged by a roller 32 mounted on a pin 33 supported at one end by the arm 23B of U-shaped bar 23 and a projection 30Y formed with that arm.

The free end of arm 30 is provided with an oblong-shaped opening 34 for receiving a roller 35 carried by a lever member 36. The lever 36, as best seen in Fig. 7, terminates in a U-shaped bend providing bearings for pivoting this arm on the shaft 24, the arm 37 thus formed having an upward extending lug portion 38 provided for hooking one end of the motor spring 28 while the opposite end of this spring is hooked to a lug 39 formed with a gear sector 40 pivoted on shaft 24 and forming an arm of a step bar 41 of arcuate cross-section best seen in Figs. 7, 8, 9 and 10.

The plate 41 in turn is formed integrally with an arm 42Y bent at right angles thereto and pivoted at its end on shaft 24. This plate is secured to the gear sector 40 through lugs L1 and L2 engaging similarly-shaped openings in the gear sector 40 for riveting or welding and steps as S1, S2, S3, S4, S5, S6, S7, S8, S9 and S10 are provided

at the edge of the plate to perform functions which will be hereinafter described in detail.

The U-shaped bar 23 and the step bar 41 thus constructed are normally collectively held in the non-operated position as shown in Figs. 3, 5, 6, 8 and 9 by the tension of a rectractile spring 43 hooked at one end to the downwardly extending projection 42X of lever 36 and its opposite end to a lug 44H formed with an element of a wedging device in the form of a bar 45 secured to the upright support 15 as by a number of screws 45Y, the arm 37 formed with lever 36 being provided with a lug 46A best seen in Figs. 3, 4, and 7, engaging the underside of arm 42Y formed with the step bar 41 as above described for returning and holding this bar in normal unoperated position.

A bar 47, disposed transverse of the key members K1, K2, K3, etc., best seen in Figs. 8, 9 and 10, is pivoted on studs 47Y one of them extending from the upright 15 and the other extending from a bracket or upright support 48 secured on the spacer plate 17. The bar 47 is normally held in position wherein a lug 54, best seen in Figs. 8 and 9, carried by a lever member 46 secured to this bar as by welding, engages the undersurface or edge of plate 41 at the point adjacent its arm 42Y for preventing the operation of this bar during the movement of the U-shaped bar 23 for tensioning the motor spring 28. The bar 47 is moved in position for engaging a ridge *rd* formed at right angles therewith with the teeth 50 shown in Figs. 9 and 10 formed with the keys for locking the non-operated keys in that position simultaneously with the disengaging of lug 54 from the step bar gear sector unit thus formed for permitting the operation of such a unit and thereby the operation of a pulsing mechanism which will be hereinafter described in detail.

The movement of bar 47 for locking the non-operated key in timed relation with the release of the step bar 41 upon the operation of any one of the keys is effected by the engagement of a cam portion 52 formed with the arm 23B of U-shaped bar 23 with a roller R mounted at the free end of arm 46, while a two-way spring 53 secured to the cam portion 52 normally holds the lever 46 following the movement of bar 23 in a position wherein the lug 54 carried thereby is clear of the step bar 41.

A plurality of pawl-like members 56, one for each key member K1, K2, K3, etc., are pivoted on a common shaft 57 extending in slots SL2 formed in the keys as shown in Figs. 9 and 10. These pawls are actuated by similar spring 58 following the movement of their respective keys from normal to operated position for individually locking these keys to the position indicated by key K5 for example in Fig. 10 wherein the pawl 56 associated with that key under control of the cam surface CA engages the tooth or shoulder portion 57 for locking its associated key in the operating position. In the movement of pawl 56 as for locking its associated key is effective to position its cam surface C5 and its stop T5 in engageable relation with the corresponding step S5 in the step bar 41, preparatory to the operation of this bar, the function of projection S5, as in this example, being to engage the camming portion C5 of the operated pawl 56 for disengaging the operated key following the operation of the step bar gear sector unit and that of the pulsing mechanism at an angular distance corresponding to the digit value of the depressed key, while the function of stop T5 of this pawl-like member is to stop the movement of the step

bar gear sector unit simultaneously with the release of the key.

The gear sector 40, as shown in Figs. 6, 7 and 8, engages a pinion 60 keyed on a shaft 61 supported at one end by upright support 48 and its opposite end by a bracket 62 secured to the upright 14 by screws 63. On shaft 61 is keyed a pulsing cam 64 having a hub portion 65 of a diameter corresponding to the diameter of a hub 66 formed with a worm gear 67 mounted for free rotation on shaft 61, this worm gear being operatively connected to impulse cam 64 by a clutch spring 68 coiled on the hub of worm gear 67 and the hub 65 of impulse cam 64 to operate as a one-way clutch between the worm gear and the impulse cam for driving a centrifugal governor mechanism CG through the engagement of the worm gear 67 with a worm 69 on the governor shaft.

The upright support 14 is provided with an opening OP, best seen in Fig. 5, permitting the assembly of pulsing cam 64, worm gear 67, pinion 60 and clutch spring 68 and shaft 61 as a unit prior to the mounting of this shaft in position in its bearings in support 48 and bracket 62.

The upright support 14 is formed with two bracket elements 70 and 71, best seen in Figs. 5, 7 and 8, having bearing portions for a shaft 72 mounted for angular and longitudinal movement, and on this shaft is keyed an angle lever 73 having one of its arms positioned in engageable relation with the pulsing cam 64 through the engagement of a ribbon spring 51 having its free end fitted for sliding movement in a slot formed in the projection of a plate 51X serving to secure the cooperating springs of a contact 76 in a pile-up assembly on the upright support 14 and the other arm 73 of this angle lever being provided with a stud 74 of insulating material disposed in engageable relation with the operable spring 75 of the pulsing contact 76.

A spring 77 bent upon itself, as best seen in Fig. 8, has one of its ends secured to the bracket 71 and its opposite end tensioned against one end of shaft 72 for resiliently and normally holding this shaft and the angle lever 73 keyed thereon in position out of engagement from the impulse cam 64, while a cam 78 carried by the arm 23A of the U-shaped bar 23 is provided for engaging the opposite end of shaft 72 for imparting a longitudinal movement to this shaft, when the bar 23 reaches a small angular distance from its full operated position as effected by any one of the key members K1, K2, K3, etc., for placing the angle lever 73 in operative relation with the impulse cam 64 for operating the pulsing contact 76 during the movement of this cam in the direction indicated by the arrow shown in Fig. 5, as effected by the operation of the gear sector 40 under the tension of motor spring 28 and thereby actuating the operable spring 75 of pulsing contact 76, the extent of the angular movement of gear sector 40 as above described being controlled by the step bar 41 engaging any one of pawl-like members 56 which may be operated by the movement of its respectively associated key.

A U-shaped lever L1 of the wedging mechanism is mounted, as best seen in Figs. 3 and 4, for longitudinal and pivotal movement on a stud ST laterally extending from the upright support 15. This lever is provided with a roller 79 normally held against the stop bar 45 by a pivoted camming element 80 under the tension

of a spring P1 having normally its line of tension above the center of stud P2 on which this camming element is supported. The angular movement of camming element 80 in its upward direction is limited by a stop in the form of a lug L2 formed with the bar 45 while the downward movement of this camming arm is limited by a lug L3 also formed with the bar 45.

The pivotal movement of camming element 80 from the position shown in Fig. 3 to the position shown in Fig. 4 is effected by the engagement of a pin 80Y carried by the wedge portion 77 of lever 36 with the arm A1 of this camming element upon the operation of any one of the keys and consequently the operation of bar 23, the levers 30 and 36. The movement of camming element 80 as above described causes the line of tension of spring P1 to pass the dead center of pivot P2 and thereby cause this spring to yieldably hold the cam element 80 in the position shown in Fig. 4 so as to permit the pivotal movement of lever L1 for positioning the roller 79 carried thereby between the bar 45 and the wedge portion 77 of lever 36 at the time the operated key and therefore lever 36 reach their full operated position.

Upon the release of the key K5 in the example above mentioned, and the consequent return movement of arm 36 to normal position, i. e., from the position shown in Fig. 4 to the position shown in Fig. 3, the arm 36 is free to return to its normal non-operated position without interference from the roller 79 now engaged with the wedge portion 77 of this lever and with the bar 45. Under this condition, however, an attempt by an operator to return the key to operated position, prior to its full return to normal non-operated position, causes the downward movement of arm 36, which, in turn, causes the wedge portion 77 to force the roller 79 against the bar 45 so as to prevent any downward movement of the key.

In the modification shown in Figs. 11 and 12, each key is associated with a pawl-like member 90 pivoted on a common shaft 91 and movable in position for locking their respective keys by similar springs X2. Each pawl 90 is provided with an arm 96 extending in engageable relation with their respective steps in the step bar 41, while lever members as 92 are pivoted on a shaft 93 for movement in engageable relation with the steps S1, S2, S3, etc., of their respectively associated pawls 90 through the engagement of pins 94 in slots formed in the pawls 90, the lever members 92 having lug portions 95 bent at right angles thereto to form stops for the arms 96, formed with pawls 90 for holding the latter in operative relation with their respective steps formed with bar 41 when their respective keys are moved to the locked positions, while lugs, such as 97, formed with the lever members 92, serve for stopping the movement of the step bar 41 so as to limit the movement of the gear sector 40 movable therewith to angular distances which correspond to the digit of the key depressed, the movement of pawl 90 from the position shown in Fig. 12 to the position shown in Fig. 11 as effected by the engagement of step bar 41 with arm 96 of pawl 90 being effective to release the operated key which is then returned to normal position by the tension of its own retracting spring 19.

As shown in Fig. 13, a mechanism is provided whereby the manual operation of key members K1, K2, K3, etc., is prevented when the telephone is not in use through the engagement of the U-

shaped bar 23 by a pawl 100 pivoted on a lever member 101. This lever is actuated by one of the plunger members 102 engaging with a cam surface 103 at the free end of this lever upon the placing of the telephone handset in position in a cradle formed with the casing CX housing the transmitter mechanism. The pawl 100 is resiliently held in engageable relation with the U-bar 23 by a retractile spring 104 normally urging this pawl against a stop 105 carried by lever 101, the spring 104 permitting the movement of the pawl as effected upon the return movement of the U-bar to normal position whenever the telephone receiver is placed in its cradle, prior to the return of the U-bar 23, to normal non-operated position.

The key-controlled call transmitter of this invention as shown in Fig. 2 may be conveniently housed in the casing 107 of a telephone coin collector without changes in its operating mechanism.

In a typical example of operation of the call transmitter of this invention, the downward movement of any one of the key members, as key K5 in the example above-mentioned, from the position shown in Fig. 9 to the position shown in Figs. 4 and 10, is effective to impart a pivotal movement to the U-shaped bar 23 and thereby a pivotal movement to levers 30 and 36 for tensioning the motor spring 28, while the roller 79 of the wedging mechanism is held in the position shown in Fig. 3 by the camming arm 80 under the tension of spring P1, the line of tension of which is now above the dead center of pivot P2 supporting the camming arm.

The gear sector 40 and the stop bar 41 movable therewith are held in the non-operated position, as shown in Figs. 8 and 9, by the stop lug 54 of arm 46 so as to prevent the operation of this step bar gear sector unit and that of the pulsing mechanism during the tensioning of the motor spring as effected by the manual operation of key member K5 above-mentioned. Movement of U-shaped bar 23 but a small angular distance from its full operated position causes the cam 52, carried by arm 23B of U-shaped bar 23, to engage the roller R at the free end of lever 46, simultaneously with the engagement of the pin 80Y carried by the wedge portion 77 of lever 36 with the arm A1 of camming arm 80 for pivoting the latter from the position shown in Fig. 3 to the position shown in Fig. 4, thus releasing the roller 79 which falls as by gravity between the wedge 77 and the bar 45.

The movement of arm 46 so as to release the step bar gear sector unit causes the bar 47 secured thereto to move in the position shown in Fig. 10 in the path of teeth 50 of keys K1, K2, K3, K4, K6, K7, K8, K9 and K10, thus locking these keys in the non-operated position, the two-way retractile spring 53 now holding the bar 47 in the operated position with the lug 54 of arm 46 out of frictional contact with the arcuate edge of arm 42Y formed with the step bar 41, while the locking of the operated key K5 is effected as above-described by the operation of spring-pressed pawl-like member 56 having its lug portion 55 engaging the shoulder portion 57 of key K5 in timed relation with the release of step bar gear sector unit and the operation of camming arm 80 for movement from the position shown in Fig. 3 to the position shown in Fig. 4.

The movement of spring-pressed pawl member 56 for locking its operated key K5 also positions its camming surface C5 in the path of the projection formed with the step S5 of the step bar to

be actuated by the movement of the latter for releasing the operated key K5 following the operation of the pulsing mechanism as effected by the gear sector 40. The operation of U-shaped bar 23 by key K5 through its cam 78, best seen in Figs. 5, 6, 7 and 8, is effective to impart a longitudinal movement to the shaft 72 against the tension of its retractile spring 77 and thereby positioning the angle lever 73 in operative relation with the pulsing cam 64 which occurs simultaneously with the release of the step bar 41 by the operation of arm 46. The operation of the step bar and the gear sector 40 is effective to actuate the pinion 60, the shaft 61 and thereby the impulse cam 64 in the direction indicated by the arrow in Fig. 5. The pulsing cam now clutched to the worm gear 67 rotates under control of the governor mechanism CG for operating the angle lever 73 and thereby the spring 75 for opening the contact 76 a number of times corresponding to the angular movement of gear sector 40 from normal to the point wherein the projection formed with step S5 moves its associated pawl member 56 against the tension of its retractile spring 58 for disengaging the lug 55 of this pawl from the shoulder portion of key K5 which is then returned to normal position by the tension of its retractile spring 19.

Upon the return movement of key K5 to normal and consequently the return movement of the U-shaped bar 23, the cam 78 carried by arm 23A of this bar is effective to free the shaft 72 which is returned to normal position by the tension of its retractile spring 77 so as to prevent the operation of the latter during the rotation of impulse cam 64 in the direction opposite to that indicated by the arrow in Fig. 5, and thereby preventing noises from this source.

The return movement of the U-shaped bar 23 through the engagement of lug 46A with the arm 42Y of the step bar 41, and the connection of arm 36 with the arm 30 to which the retractile spring 43 is attached, the wedge portion 77 of lever 36 is free to move in the direction indicated by the arrow in Fig. 4 without interference from roller 79. However, an attempt by the operator to depress the key K5, prior to its return to full normal position, causes the wedge 77 to move the roller downward forcing the latter against the bar 45 resulting in locking the key against any downward movement. Upon the return of key K5 but a smaller angular distance from normal non-operated position, the pin 80Y carried by the wedge portion 77 engages the underside of camming arm 80 for pivoting the latter from the position shown in Fig. 4 to the position shown in Fig. 3, where the line of tension of spring P1 is moved above the center of pivot P2 for yieldably holding this camming arm and roller 79 in the non-operated position, thus again permitting the operation of any one of the keys.

The return movement of U-shaped bar 23 and the step bar gear sector unit to normal position, the free end of retractile spring 53, is effective to return the lever 46 to normal position, and thereby positioning the lug 54 carried by that lever in reengagement with the step bar 41 while positioning the bar 47 out of the path of teeth 50 of the keys and the transmitter is now ready for the operation of a succeeding key for the operation of the pulsing mechanism as described in connection with the operation of key K5.

The placing of the telephone handset HS in its cradle, which is formed with casing CX in Fig. 1, the operation of plunger 102, as shown in Fig. 13,

is effective to impart a small angular movement to the lever 101 against the tension of its retractile spring 108 for placing the pawl 100 in engagement with the underside of U bar 23 and thereby preventing the manipulation of any one of the keys when the telephone handset is not in use. In cases when the handset is placed in its cradle prior to the return of the depressed key in normal non-operated position, the return movement of the U-shaped bar 23 by the tension of the retractile spring 104 causes the pivotal movement of pawl 100 to a point wherein the pawl is free to move under the lower edge of bar 23 for locking the keys in the manner above-described.

In the operation of the transmitter of this invention by the use of the modified mechanism shown in Figs. 11 and 12, the operation of key K5 in the example above-described, the spring X2 respective to that key causes the engagement of pawl 90 with the shoulder portion SP for holding that key in the operated position as shown in Fig. 12. The angular movement of pawl 90 for locking its associated key is effective to position its arm portion 96 in engageable relation with the step S5 of step bar 41. Such movement, however, is limited by a stop in the form of lug 95 formed with the arm 92 pivoted on shaft 93, while the pivotal movement of pawl 90 is effective to move the arm 92 for positioning the lug 97 formed with that arm in the path of step S5 of step bar 41 for stopping the movement of the latter as effected by the tension of motor spring 28 following the engagement of step bar 41 with arm 96 and the consequent pivotal movement of pawl 90 so as to disengage its operated key as shown in Fig. 11 to permit the return movement of the latter to normal position under the tension of its own retractile spring 19, which is followed by the return movement of U-shaped bar 23 to normal position as above-described, while the continued pivotal movement of pawl 90 under control of the cam portion 100 formed with that key is effective to move this pawl to an angular distance sufficient to position the free end of arm 96 away from frictional contact with the step bar 41 and the mechanism is now ready for the operation of a succeeding key.

In the modification shown in Figs. 14, 15, 16, 17 and 18 the worm gear 67 and the magnetic clutch 110 secured thereto are mounted for free rotation on shaft 61. This magnetic clutch is provided with slip rings 111, 112 engaged by brushes 113 and 114 securely mounted on a lug 115 formed with the support 48. The magnetic clutch 110 is disposed in attractable relation with a pulsing cam 64 keyed on one end of shaft 61, to the other end of which is secured a pinion 60 meshing with the gear sector 40 of the step bar gear sector unit.

The worm gear 64 meshes with a worm 69 keyed on or formed with a shaft 116 journaled in bearing portions 117 and 118 formed with support 48 while on the opposite end of shaft 115 is keyed a worm gear 119 meshing with a worm 120 keyed on the armature shaft of a motor M, in circuit with the magnetic clutch 110 through the brushes 113 and 114 and normally open contacts T1, T2, T3, T4, T5, T6, T7, T8, T9 and T10 closed by the operation of pawl-like members 56 best seen in Fig. 17 under control of their respectively associated key members K1, K2, K3, etc., as will be hereinafter described in detail.

Contacts T1, T2, T3, etc., as best seen in Fig. 17 are formed in the manner of combs and mounted in an inverted pile-up arrangement to the under side of a spacer bar 121 secured at both ends to lugs 122 formed with the upright supports 14 and 15 by a number of similar screws 123, the spacer bar serving as support for the motor M.

In a typical example of operation by the use of the electric motor drive mechanism of this invention the operation of key K5 as in the example above-mentioned is effective to impart an angular movement to the U-shaped bar 23 for actuating the arm 46 to engage the ridge *rd* of bar 47 with the tooth 50 of each non-operated key while disengaging the lug 54 carried by lever 46 from the bar 41 and simultaneously causes the movement of pawl-like member 56 under the tension of the operable spring 124 of contact T5 to close its contact and lock the key in the operated position. In that condition the motor and the magnetic clutch are energized through a circuit comprising the conductor W, see Fig. 18, connecting to one side of the telephone line, the now closed contact T5, the conductor W1, connecting with the motor M, the wires W2, the brush 114, the slip ring 112, the coil of the magnetic clutch, not shown, the slip ring 111, the brush 113 and the conducting wire W3 connecting with the other side of the telephone line. The rotation of the motor and thereby that of the now energized magnetic clutch is effective to attract its armature which is formed with the pulsing cam 64 for rotating the latter and thereby the pinion 60 in mesh with the gear sector 40 of the step bar gear sector unit for actuating the latter to a point wherein step S5 of the step bar engages the camming surface S5 of pawl-like member 66 for operating the latter for releasing the operated key and reopening the contacts T5 to cause the de-energization of the magnetic clutch, and stopping the operation of the motor. The operated key is returned to normal non-operated position by the tension of its retractile spring 19 followed by the return of the U-shaped bar 23 to normal non-operated position by the tension of retractile spring 43 in the manner described in the example of the operation in connection with the mechanism shown in Figs. 2, 3, 4, 5, 6, 7 and 8 and the transmitter is again ready for the operation of a succeeding key and while the motor M is described as being operatively connected to the telephone line, it is obvious, that, it may be connected to any electric source instead.

What is claimed is:

1. A call transmitter comprising a set of key members, a step bar and gear sector unit, a pulsing mechanism geared to the sector of said unit, a motor, means actuated by the operation of one of said key members to start the operation of said motor for actuating said pulsing mechanism, and means set by the individual operation of said key members for holding the depressed key in the operated position and for engaging one step in the step bar of said unit for stopping the operation of said pulsing mechanism and releasing the operated key.

2. In a call transmitter, a set of key members, a pivoted bar disposed for operation by the movement of any one of said key members, a gear sector, a step bar arranged for movement with said gear sector as a unit, a motor for actuating said unit, a movable stop element normally holding said unit from operation during the operation of said pivoted bar, means carried by said pivoted bar for actuating said stop means to cause the operation of said unit, and a pulsing mechanism actuated by said gear sector.

3. In a call transmitter, a set of longitudinally

movable key members, a pivoted bar actuated by the movement of each of said key members, a pivoted gear sector, a motor spring tensioned by the movement of said bar for actuating said gear sector, a step bar secured to said gear sector for movement therewith as a unit, means engaging said step bar for holding said unit against movement during the tensioning of said motor spring by the operation of said bar, a cam carried by said bar for actuating said operable means following the tensioning of said motor spring for releasing said unit, a pulsing mechanism actuated by said gear sector, means positioned by the movement of the operated key cooperating with one of the steps in said step bar for controlling the operation of said pulsing mechanism, means for returning the operated key to normal following the operation of said pulsing mechanism, and means for returning said bar and said unit to normal simultaneously with the return of the operated key to normal.

4. In a call transmitter, a set of longitudinally movable key members, a mounting having means for guiding said key members, a shaft supported by said mounting, a bar pivoted on said shaft disposed for operation by the movement of any one of said key members, a step bar gear sector unit pivoted on said shaft for movement concentric to said bar, a helical motor spring disposed concentric to said shaft, a system of levers operatively connected to said bar, said motor spring having one of its ends connected to one of said levers and its opposite end connected to said unit, means for holding said unit from operation upon the tensioning of said motor spring by the movement of said pivoted bar, means actuated by said pivoted bar for actuating said holding means to cause the operation of said unit, a pulsing mechanism actuated by the gear sector of said unit, and means set by the operated key member actuated by the step bar of said unit for controlling the extent of operation of said pulsing mechanism for transmitting a number of pulses corresponding to the operated key member.

5. In a call transmitter, a set of key members, a shaft, a bar mounted for free movement on said shaft and actuated by the operation of any one of said key members, a step bar and gear sector unit mounted for free rotation on said shaft, movable means normally positioned in the path of said unit, a pulsing mechanism operatively connected to the gear sector of said unit, a motor spring tensioned by the movement of said bar relative to said unit for actuating said mechanism, means carried by said bar for actuating said movable means to cause the operation of said pulsing mechanism by the gear sector of said unit, a pawl cooperating with means carried by the depressed key for locking the latter to operated position, said pawl having means engaged by the step bar of said unit under the tension of said motor spring for unlocking the operated key following the operation of said pulsing mechanism, spring means for returning the operated key to normal position, and spring means for returning said bar and said unit to normal position collectively.

6. In a call transmitter, a set of longitudinally equidistant movable key members, a base, a mounting carried by said base having means for guiding said key members, a shaft, means carried by said base for supporting said shaft, a bar pivoted on said shaft for movement by the operation of any one of said key members, a step bar and gear sector unit pivoted on said shaft for movement concentric to said bar, a motor for actuating said unit, a cam operatively connected to the gear sector of said unit, a pulsing contact, a pawl-like member for actuating said pulsing contact normally in position out of engageable relation from said cam, said bar having means for moving said pawl-like member in the path of said cam for operating said contact upon the operation of said unit by said motor, operable means for holding said unit from movement during the operation of said pivoted bar and other means carried by said bar for actuating said operable means to cause the operation of said unit, independently actuating means for returning the operated key, said bar and said unit to normal following the operation of said pulsing mechanism, and spring means for returning said pawl-like member out of engaged relation from said cam upon the return of said pivoted bar to normal.

7. A call transmitter comprising a set of key members, a movable step bar and gear sector unit, a motor for actuating said unit, combined stop and latch elements individually associated with said key members and set by the operation thereof in position for locking the depressed key in that position and engaging the steps of said bar upon the movement of said unit for determining the extent of movement of the latter, a shaft having a pinion engaging the gear sector of said unit, a pulsing cam keyed on said shaft, a pulsing contact, operable means associated with said cam for actuating said contact but normally positioned in a path ineffective to actuate said contact upon the movement of said cam, means actuated by the movement of the operated key member for moving said operable means in position effective relative to said cam prior to the operation thereof for actuating said contact by the operation of said bar sector unit, and spring means for returning said operable means to normal position following the release of the operated key by the operation of said combined stop and latch means by said unit.

8. In a call transmitter, a pulsing contact, a set of key members, a step bar and gear sector unit, a motor spring, a bar actuated by the operation of any one of said key members for tensioning said motor spring for operating said unit, a pawl for holding the depressed key in operated position, an operable stop normally holding said unit from movement against the tension of said motor spring, a cam element carried by said bar for actuating said stop to cause the operation of said unit, a pulsing cam operably connected to the gear sector of said unit, a pawl-like member actuated by said cam for actuating said contact, said holding pawl having a cam portion engaged by the step bar of said unit to cause the release of the operated key, means carried by said holding pawl for stopping the movement of said unit following the release of the operated key, means for returning the operated key to normal, means for returning said unit to normal simultaneously with the return movement of the operated key, and a one-way operable governor mechanism actuated by the movement of said unit for controlling the speed of said pulsing cam during the operation of said contact.

9. In a call transmitter, a motor spring, a set of digit key members, means actuated by the operation of said key members for tensioning said motor spring, a step bar and gear sector unit actuated by the tension of said motor spring, a pulsing cam operatively connected to the gear sector of said unit as effected by said motor spring, a contact, means actuated by said puls-

ing cam for actuating said contact, a cam element carried by each of said key members, means operable under control of the cam element carried by the depressed key for locking the latter to operated position during the operation of said cam, and means carried by the step bar of said unit for operating said locking means for releasing the operated key and stopping the operation of said unit for controlling the operation of said pulsing cam.

10. In a call transmitter, a set of key members, a shaft, a helical motor spring coiled on said shaft, a movable step bar and gear sector unit pivoted on said shaft, a motion amplifier lever mechanism, pivoted means on said shaft actuated by the movement of any one of said key members for actuating said lever mechanism for imparting a greater angular tensioning movement to said motor spring than the angular movement imparted to said pivoted means on said shaft for operating said unit, a pulsing mechanism actuated by the gear sector of said unit, and means movable upon the operation of the depressed key for locking the latter in that position, said means cooperating with one step of said step bar for stopping the movement of said unit for controlling the operation of said pulsing mechanism and releasing the operated key.

11. In a call transmitter, a pulsing mechanism, a set of longitudinally movable digit key members, a pivoted bar, a step bar and gear sector unit, a motor spring tensioned by the operation of said pivoted bar under control of any one of said key members for actuating said unit, operable means for holding said unit in normal position during the tensioning of said motor spring, spring actuated pawls operable under control of means carried by said key members for individually holding the latter in operated position, means carried by said pivoted bar for moving said operable means in position for releasing said unit following the tensioning of said motor spring, means actuated by said operable means for collectively locking the non-operated key in that position simultaneously with the starting operation of said unit for actuating said pulsing mechanism, means carried by the spring-operated pawl of the depressed key member for stopping the operation of said unit to a point corresponding to the value of the digit of the depressed key, means carried by the step bar of said unit for moving the operated spring-operated pawl for releasing the operated key, and a plurality of spring means for returning the depressed key, said bar and said unit to normal following the operation of said pulsing mechanism.

12. In a call transmitter, a set of key members, a shaft, a bar pivoted on said shaft operable by the movement of any one of said key members, a lever member actuated by the movement of said bar, an arm pivoted on said shaft actuated by said lever member, a wedge element carried by said arm, a mounting for said key members, a bar secured to said mounting, a pivot carried by said mounting, a lever member mounted for angular and longitudinal movement on said pivot, a roller mounted at the free end of said lever member for engaging said wedge element and said bar, a camming member pivoted on said mounting for controlling the engagement of said roller with said wedge element and said bar, means carried by said wedge element for moving said camming member in position for holding said roller in position ineffective relative to said wedge element during the movement of one of said key members for normal to operated position and to actuate said camming member to cause the engagement of said roller with said wedge element and said bar for preventing the redownward movement of the operated key members during the return movement of the latter from operated to full normal position, the means carried by said wedge element operating said camming member for moving said roller in position ineffective relative to said wedge element upon the return of the depressed key to full operated position.

13. In a call transmitter, a set of key members, a pivoted bar actuated by the movement of any one of said key members, another bar disposed transverse of said key members formed with staggered steps along its length and mounted for angular movement concentric to said pivoted bar, a pawl-like member associated with each of said key members and with each of said staggered steps in said other bar for stopping the movement of the latter but normally in position ineffective relative to said other bar, a lever member actuated by said pivoted bar, a motor spring tensioned by the movement of said lever member for actuating said step bar, means carried by said key members to cause the operation of said pawl-like members in the path of their respective steps in said other bar and engaging means formed with said key members for locking them in the operated position, camming portions formed with said pawl-like members engaged by their respective steps in said other bar upon the movement of the latter under the tension of said motor spring. a pulsing mechanism, means carried by said other bar for actuating said pulsing mechanism, the movement of said bar actuating the pawl-like member of the operated key for releasing the latter following the operation of said pulsing mechanism.

14. In a call transmitter, a set of digit numbered key members, a pivoted bar actuated by the movement of any one of said key members, another bar movable concentric to the first-mentioned bar, said other bar having a gear sector portion, motor means for actuating said other bar, a cam operatively connected to said gear sector, a pulsing contact, means operable upon the movement of said cam for actuating said contact but normally positioned in a path where the operation of said cam is ineffective to actuate said contact, means carried by said pivoted bar for moving the first-mentioned means in the path of said cam for actuating said contact upon the operation of said gear sector, spring means for returning the operated key and said pivoted bar to normal position following the operation of said contact, means set by the movement of the operated key member for stopping the movement of the latter and said sector for transmitting a series of pulses corresponding to the digit of the operated key member, and spring means for returning the first-mentioned means to said ineffective path prior to the return movement of the operated key of said bar and of said gear sector to normal position.

15. In a call transmitter, a set of key members, a pivoted bar disposed for operation by the movement of any one of said key members, a retractile spring for said bar, means normally positioned for engaging said pivoted bar for locking the latter in the non-operated position for collectively locking said key members in normal non-operated position, means manually operable to cause the operation of the first-mentioned means for unlocking said pivoted bar for per-

mitting the movement of the latter by the individual movement of said key members, said first-mentioned means being movable for permitting the return movement of said bar to normal, under the tension of said retractile spring, while said manually operable means is in the operated position.

16. In a call transmitter, a set of rectangularly-shaped digit key members, a U-shaped bar, a shaft for pivotally supporting said U-shaped bar, a step bar pivotally supported by said shaft for angular movement concentric to said U-shaped bar, another shaft disposed transverse of said key members, spring-pressed pawl-like members pivoted on the last-mentioned shaft, one for each of said key members, cams carried by said key members forming ratchets for engagement with their respectively associated pawl-like members for individually locking said key members in the operated position, said pawl-like members having projecting arms movable in engageable relation with the steps of said bar upon the locking of their respectively associated keys in the operated position, a third shaft disposed transverse of said key members, a plurality of arms pivoted on said third shaft, one for each of said pawl-like members operatively connected thereto, means carried by said arms for controlling the engagement of said pawl-like members with the teeth of said key members, other means carried by said arms for stopping the movement of said step bar following the engagement of one of said steps with the projecting arm of one of said pawl-like members for releasing its operated key, spring means for returning such a key to normal position, the return movement of the operated key causing its cam to return its associated pawl-like member and its operatively connecting arm to normal, a gearing mechanism actuated by the movement of said step bar, and a contact actuated by said mechanism a number of times corresponding to the digit value of the depressed key.

17. In a call transmitter, a pulsing mechanism, a set of digit key members, a U-shaped bar actuated by the movement of any one of said key members, a spring-operated means for locking the depressed key to its operated position, a step bar gear sector unit, a motor spring tensioned by the movement of said U bar relative to said unit, means for holding said step bar against movement during the tensioning of said motor spring, a cam element carried by said U-shaped bar for actuating said holding means to cause the operation of said unit, means carried by said holding means for collectively engaging with means carried by the non-operated keys for locking the latter in said non-operated position during the operation of said unit for actuating said mechanism.

18. A call transmitter comprising a set of key members, a pivoted bar actuated by the movement of any one of said key members, a step bar gear sector unit, a lever mechanism actuated by said pivoted bar, a motor spring tensioned by said lever mechanism for actuating said unit, a pulsing mechanism driven by the gear sector of said unit, means set by the movement of the operated key member for engaging a step in the step bar for controlling the extent of movement of said unit for transmitting a number of pulses corresponding to the depressed key member, and a wedge mechanism operable upon the return movement of said pivoted bar for preventing reverse movement of the operated key prior to the return of this key to full normal non-operated position.

19. In a call transmitter, a set of key members, a pivoted bar disposed for operation by the movement of each of said key members, a gear sector, a pulsing mechanism keyed to said gear sector, an electric motor for actuating said gear sector, a normally open contact in the energizing circuit of said motor, a step bar movable as a unit with said gear sector, operable means for normally holding said unit against movement during the operation of said pivoted bar, a cam carried by said bar for actuating said operable means for permitting the movement of said unit, spring-actuated means positioned by the movement of the operated key for closing said contact to cause the operation of said motor, said spring-actuated means cooperating with one of the steps in said step bar for reopening said contacts for stopping the operation of said motor for determining the number of pulses transmitted by said mechanism.

20. In a call transmitter, a set of manually operable key members, a retractile spring for each of said key members, spring-actuated means operable upon the movement of any one of said key members for locking the latter in the operated position against the tension of its retractile spring, a pivoted bar actuated by the movement of the depressed key, another bar, means actuated by the movement of said pivoted bar for actuating said other bar for engaging means carried by this bar with means carried by said key member for collectively locking the non-operated key members in that position, a pulsing mechanism, an electric motor for actuating said mechanism, an energizing circuit for said motor having contacts closed by the individual operation of said spring-actuated means for actuating said pulsing mechanism, means actuated by said motor for moving the operated spring-actuated means in position for releasing the operated key for permitting the return movement of the latter to normal position under the tension of its retractile spring, and a wedge mechanism operable upon the movement of said pivoted bar in position for stopping the operated key upon an attempt to manually move this key towards operated position prior to the return of the latter to full non-operated position following the operation of said pulsing mechanism.

21. In a call transmitter, a set of digit key members, a pulsing cam, a magnetic clutch, an electric motor, an energizing circuit connecting said magnetic clutch and said motor, said circuit having normally open contacts, means operable upon the movement of any one of said key members for closing one of said contacts to cause the operation of said motor for actuating said pulsing cam, and a step bar actuated by said motor for actuating said operable means for controlling the operation of said pulsing mechanism according to the digit of the operated key member.

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