

Sept. 17, 1946.

T. W. MacKENZIE

2,407,889

AUTOMATIC TELEPHONE DIALER

Filed June 9, 1944

2 Sheets—Sheet 1

Fig. 1.

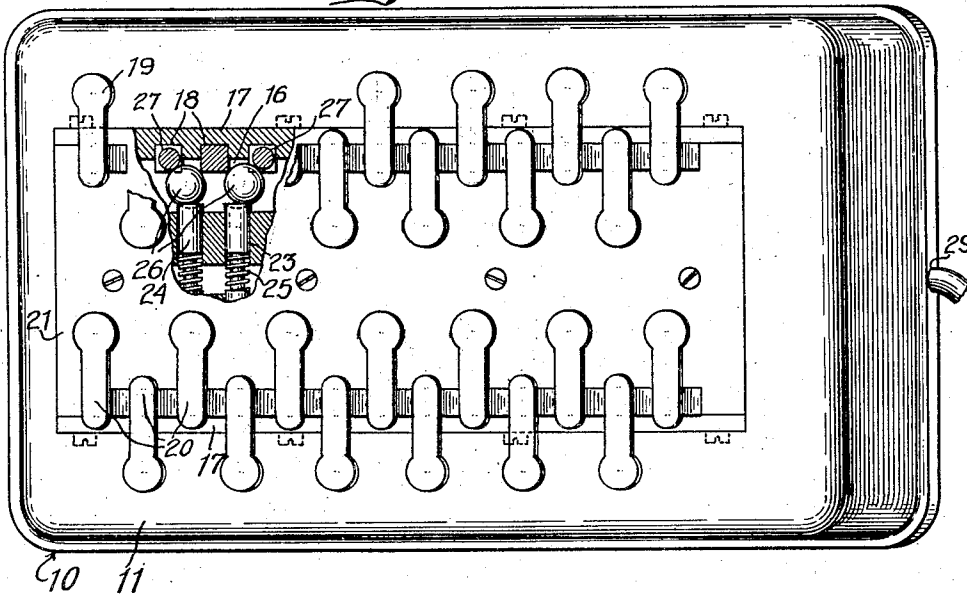


Fig. 2.

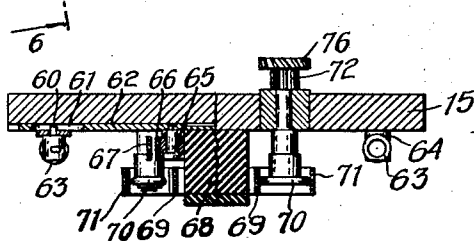
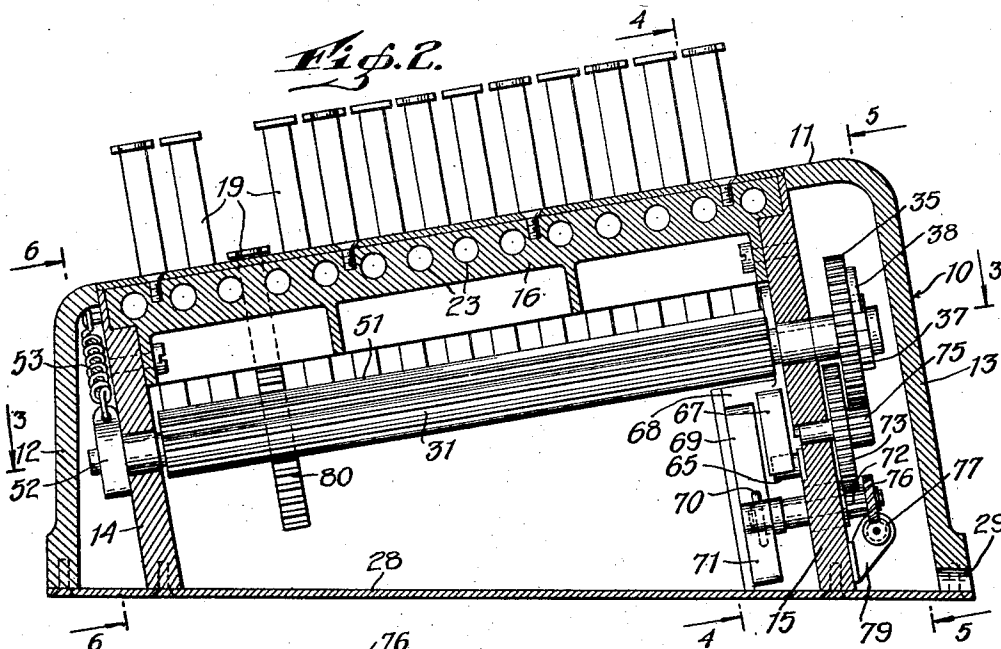


Fig. 3.

INVENTOR
THOMAS W. MacKENZIE
BY
Howard C. Thompson
ATTORNEY

Sept. 17, 1946.

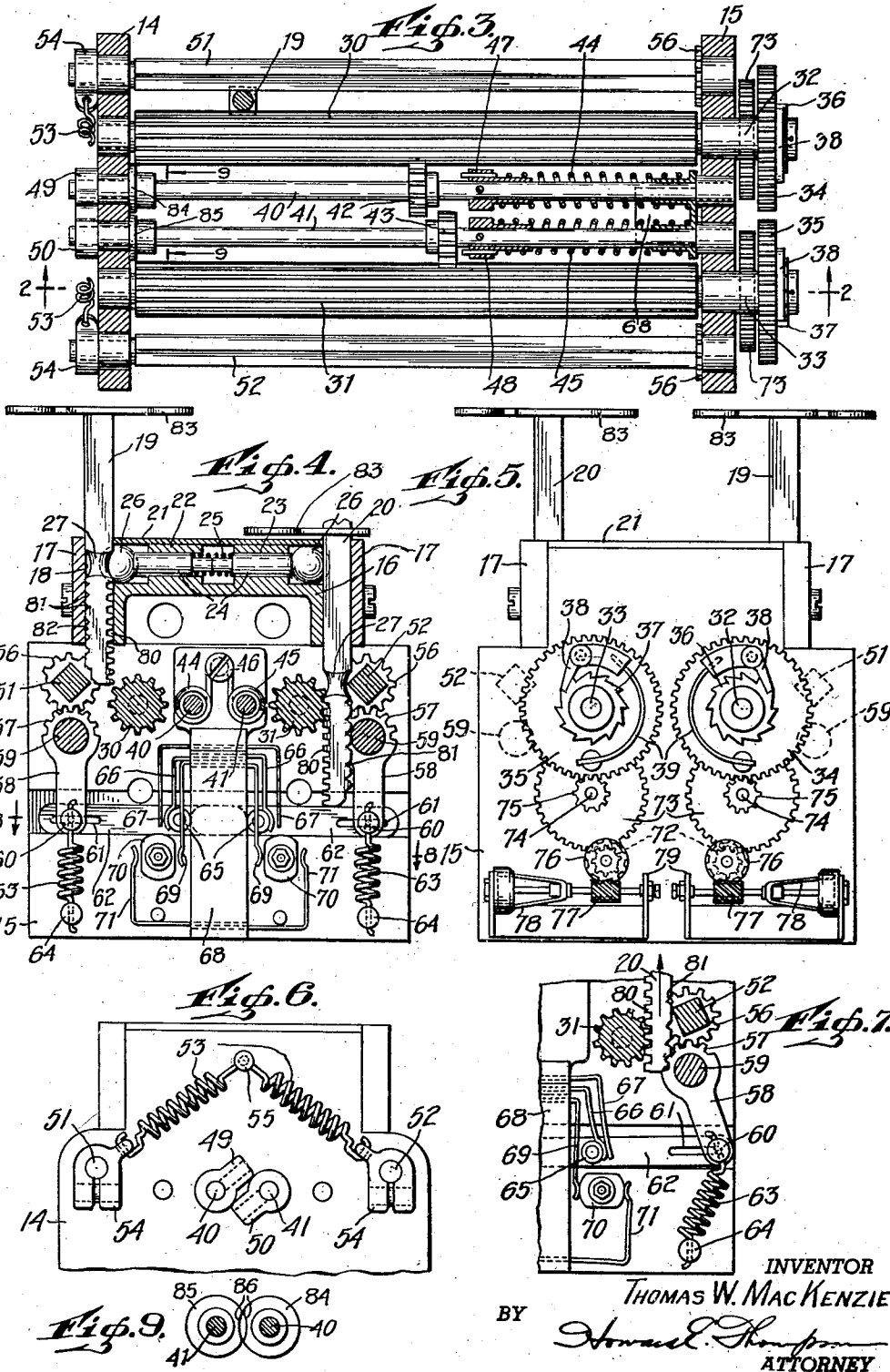
T. W. MacKENZIE

2,407,889

AUTOMATIC TELEPHONE DIALER

Filed June 9, 1944

2 Sheets-Sheet 2



INVENTOR
 THOMAS W. MacKENZIE
 BY *Howard E. Thompson*
 ATTORNEY

UNITED STATES PATENT OFFICE

2,407,889

AUTOMATIC TELEPHONE DIALER

Thomas W. MacKenzie, Cranford, N. J.

Application June 9, 1944, Serial No. 539,512

21 Claims. (Cl. 179-90)

1

This invention relates to apparatus for use in automatically making telephone calls for normal interexchange uses within the range of a self-calling area, as well as devices or apparatus of this kind adapted for inter-department or house calling systems. More particularly, the invention relates to an apparatus employing a large number of closely and compactly arranged keys divided into two banks or sides, each bank or side operating independent control or call mechanisms, whereas means is employed whereby the operation of a key in one bank will automatically lock adjacent keys in said bank and in the opposed bank. The novel features of the invention will be best understood from the following descriptions when taken together with the accompanying drawings, in which certain embodiments of the invention are disclosed, and in which the separate parts are designated by suitable reference characters in each of the views; and in which:

Fig. 1 is a plan view of an apparatus made according to my invention, with part of the construction broken away and in section.

Fig. 2 is a longitudinal sectional view substantially on the line 2-2 of Fig. 3, with parts of the construction shown in elevation.

Fig. 3 is a partial section on the line 3-3 of Fig. 2.

Fig. 4 is a partial section on the line 4-4 of Fig. 2, showing a different key depressed.

Fig. 5 is a partial section on the line 5-5 of Fig. 2.

Fig. 6 is a partial section on the line 6-6 of Fig. 2, showing only a part of the construction.

Fig. 7 is a view similar to Fig. 4, but showing only a part of the construction with parts in a different position.

Fig. 8 is a broken detailed section on the line 3-3 of Fig. 4; and

Fig. 9 is a partial section on the line 9-9 of Fig. 3.

This application constitutes a continuation in part of the structure disclosed in my prior application serial number 432,677, filed February 27, 1942 now Patent No. 2,391,911 granted January 1, 1946, in which application an apparatus of the general type and kind herein disclosed is illustrated, which apparatus is modified and altered to the extent more fully hereinafter set forth, and particularly in that each row or bank of keys operate independent pawl mechanisms, thus minimizing complications which would prevail in apparatus employing a single mechanism operated by all the keys employed.

In the present construction, the apparatus

2

has been illustrated as a unit independent and apart of telephone receiver and transmitting apparatus, except of course, for the electrical connections which would be made with the conventional apparatus. In other words, in my earlier application, the casing of the apparatus included the means for supporting the receiver and transmitter as well as the dialing apparatus, whereas in the present structure, the casing is devoted primarily to the mechanism of the dialer, thus materially simplifying the construction of this apparatus and minimizing the size thereof.

In the drawings, 10 represents a casing, preferably having an inclined top wall 11 formed by a short front wall 12, and a longer back wall 13, as will clearly appear from a consideration of Fig. 2 of the drawings. Within the casing is arranged supplemental end walls 14 and 15 which form the bearings and supports for the various shafts employed, as will clearly appear from a consideration of Figs. 3, 4 and 5 of the drawings. The end walls 14 and 15 are joined by a top plate casting 16, shown in section in Fig. 2 of the drawings, to which is attached side key guide plates 17, which in conjunction with the plate 16 form vertical apertures or key channels 18 for supporting and guiding a plurality of keys 19 and 20. Arranged upon the top of the casing 10 is a cover plate 21 which also has apertures therein registering alinement with the apertures 18.

The casting 16 has two longitudinal raised ribs 22, note Fig. 4, which have therein longitudinally spaced and directly opposed bores or passages 23, in which are mounted independent rods 24, inner adjacent ends of which are reduced to receive coil springs at 25. At the outer ends of the rods are arranged balls 26 which normally seat in recesses 27 in the keys 19 and 20 to retain all of the keys in raised position, as indicated at the left of Fig. 4 of the drawings. However, in the depression of one of the keys, the balls at the opposite sides of the depressed key are moved laterally in opposite directions to lock adjacent keys in one row and the balls also move inwardly to jam the rods 24 against the balls of the keys in the opposed row or bank to lock these keys against depression, thus preventing accidental operation of more than a single key at any one time. In the broken away portion of Fig. 1 of the drawings, one of the keys 19 is shown depressed, which key is shown in complete rectangular cross section, whereas adjacent keys show the balls 26 engaging the recesses 27 thereof.

It will be understood that the entire mechanism may be insertable into and out of the cas-

3

ing 10, and retained therein by any suitable means as a bottom plate 28 secured to the casing, and the casing will have at one end, as at 29 openings for admission of the circuit wires for attachment to the switches employed, and later described.

Arranged longitudinally of the unit and rotatably mounted in the opposed end walls 14 and 15, are two elongated gears 30 and 31. These gears have shaft portions 32 and 33 respectively, which extend through the end wall 15, and mounted thereon are gears 34 and 35, and ratchets 36 and 37, note Figs. 3 and 5 of the drawings.

The ratchets 36 and 37 are secured to the shafts, whereas the gears 34 are free to rotate on the shaft. Pivoted to the face of each gear 34 and 35 is a pawl 38 actuated by a spring 39 to support the same in constant engagement with the ratchets 36 and 37, so that upon depression of one of the keys 19—20, its associated elongated gear 30—31 is rotated to rotate the ratchet 36—37 freely beneath the respective pawls 38, so that, in the spring motor rotation of the elongated gears, the ratchets will operate to rotate the gears 34—35 for operating the circuit maker and breaker mechanism, later described.

Arranged inwardly of the gears 30 and 31 are two shafts 40 and 41 on which are arranged pinions 42 and 43, note Fig. 3. These pinions are in constant mesh with the gears 30—31, and in the initial rotation or the gears 30—31 the pinions are rotated to wind-up elongated coil springs 44 and 45, which springs then serve to rotate the gears 34—35 through the medium of the ratchets 36—37, as previously described.

In the construction shown, the motors 44 and 45 are formed from a single wire, the central portion of which is looped around a stud or screw, as seen at 46 in Fig. 4 of the drawings to anchor one end of each motor. The other ends of these springs or motors 44—45 are keyed to collars 47 and 48, as seen in Fig. 3 of the drawings, the collars being secured to the shafts 40 and 41. The shafts 40 and 41 protrude through the end wall 42, and adjustably secured thereon are stops 49 and 50 which check the final rotary movement of the gears 30 and 31.

Arranged outwardly of the gears 30 and 31, and slightly above these gears, are two longitudinal control or escapement rods 51 and 52, which are rectangular in cross sectional form throughout the major portion of the length thereof, at least throughout such lengths of the rods as will be exposed to the row or bank of keys 19 and 20 employed. These rods are normally supported with the high-points of the rectangular cross section thereof arranged horizontally, as clearly seen in Fig. 4 of the drawings, by springs 53 secured to blocks 54 mounted on the ends of the rods 51 and 52, which protrude through the wall 14, as clearly seen in Fig. 6 of the drawings. Adjacent ends of the springs 53 are secured to a common post 55. Secured to the rods adjacent the wall 15 are pinions 56. These pinions 56 are adapted to register with rack faces 57 on levers 58, pivoted to the wall 15, as seen at 59.

The free ends of the levers have pinions 60 which operate in elongated slots 61 in switch operating rods 62. Also coupled with the pinion 60 are springs 63 supported on the wall 15, as seen at 64, to normally maintain the levers 58 in perpendicular position. These latter springs also cooperate with the springs 53 to maintain the rods 51 and 52 in their normal position, as seen in Fig. 4.

4

Secured to the switch operating rods 62 are insulators, sleeves or rollers 65 adapted to engage and operate one spring contact 66 to move the same into engagement with an adjacent contact 67 in the manner illustrated in Fig. 7 of the drawings to complete the electric circuit to the telephone apparatus in automatically dialing or transmitting a telephone number by one of the depressed keys of the apparatus, as later described.

The spring contacts 66 and 67 are supported in a block of insulating material 68, as is also other spring contacts 69, forming parts of the make and break circuits, and engaged by the make and break element 70, rotated between the contact 69 and associated contacts 71 in providing the desired impulses controlling the signal or call transmitted to the telephone system in calling a predetermined number in the upward movement of a depressed key, as more specifically described later.

Each make and break element 70 is mounted on a shaft arranged in the wall 15, and has at its outer end a pinion 72 which meshes with a gear 73 arranged on a stub shaft 74 supported in the wall 15. On the shaft 74 is a pinion 75 which meshes with the gear 34—35. As each of the several unit mechanisms are common to both sides of the apparatus, one reference has been used in identifying each unit in order to reduce the number of characters applied to the drawings. Also arranged on the shaft supporting the pinions 72, and outwardly of said pinions are spiral gears 76 registering with corresponding gears 77 on the shafts of governor devices 78 arranged in suitable supports 79 on the outer surface of the wall 15.

Inner surfaces of the keys 19 and 20 have rack teeth 80 which are adapted to mesh with the gears 30 and 31 to rotate these gears by the pressure applied to the keys in the downward movement thereof. On the outer surfaces of the keys 19 and 20 are arranged longitudinally spaced V-shaped recesses 81 between which are surfaces 82 forming spaced elements characterizing predetermined telephone numbers, these surfaces or elements are of different lengths, and the lengths of these surfaces control the period of time that one of the rods 51 and 52 is held in the position shown in Fig. 7, completing the circuit through the contacts 66 and 67. However, when the call rod 51—52 drops into one of the recesses 81, the circuit between the contact 66 and 67 will be broken. The construction of the keys 19 and 20 are generally of the type and kind more specifically disclosed in my prior application 432,676, being modified in the present case in the contour of the recesses 81 and in inclusion of the rack teeth 80 thereon.

The upper ends of the keys 19 and 20 have flat finger pieces 83 of the general contour, seen in Fig. 1 of the drawings, by means of which each of the keys may be depressed, and these finger piece ends or heads of the keys are directed inwardly in the manner seen in Fig. 1 of the drawings.

Adjustably secured on the shafts 40 and 41 are interfitting key locking elements 84 and 85, each having a recess 86 in the periphery thereof adapted to receive the other element. In other words, in the rotation of the shaft 40, the element 84 will enter the recess 86 of the element 85, and thus key the element 85 against rotation. This will automatically lock all of the keys in the row controlled by the spring motor 45

and gear 31 against operation. The same operation takes place when the element 85 is rotated and enters the recess 36 of the element 84.

Bearing in mind that each row or bank of keys actuates independent mechanisms, one bank and row of keys can be used for an intercommunicating system, whereas the other row or bank of keys can be used for other or outside calls by simply constructing the switch devices and the wire accordingly.

In the operation of automatically calling a telephone number, the particular key 19—20 which would have thereon the surface markings 82 governing the number to be called, will be depressed by the operator. In the accompanying drawings, one of the keys 19 has been shown depressed in Figs. 1, 2, 3, 4 and 7 of the drawings. In the downward movement of the keys, the shaft 30 is rotated, which in turn rotates the pinion 42, and winds the spring motor 44. In this downward movement, the rod 52 will be partially rotated and this partial rotation will throw the associated lever 58 inwardly in the slot 61. However, when the depressed key reaches its lowermost position, the reduced collar or neck portion 37 on the key is brought into registering alignment with the rod 52, and this rod is then automatically returned to its neutral position, the result of which is shown in Fig. 4 of the drawings.

When pressure is released from the key, the motor 44 through the mechanism previously described now feeds the key upwardly. This operation rotates the rod 52, and throws the lever 58 outwardly in the manner shown in Fig. 7, thus completing the circuit between the contact 66 and 67 at the one side of the apparatus. Here it is to be understood that the switch operating rods 62 are independent. Contact will be kept closed through the switches 66 and 67 as long as the first surface 82 of the lever maintains the rod 52 in the position last mentioned. Immediately upon reaching the first notch 31 in the outer surface of the key, the rod 52 returns to its neutral position shown in Fig. 4, thus breaking the circuit through the contacts 66 and 67. Upon engaging the next successive surface 82, the above operation is repeated, and this is continuous until the last surface has been passed and the key is returned to its normal raised position.

In returning to the normal raised position the gears 30—31 move the keys upwardly, about until the two spring pressed balls 25 at opposite sides of each key start to enter the recess 27 of the raised key, and these balls in engaging the recesses 27 actually impart the final upward movement to the key by snapping into the recesses 27, which movement also moves the key into the position clearing its operating gear, as is illustrated at the left of Fig. 4 of the drawings. This final upward movement will also give a slight clicking sound which will advise the operator that the call has been completed, even though it takes place slightly after the actual completion of the call.

During the above operation, it will be understood that the make and break element 70 is constantly rotated to provide the usual make and break impulses which govern the call signal transmitted as and when the circuit is completed through the contacts 66 and 67. It will also be understood that while one unit side of the apparatus is in operation, the other unit side is stationary or idle. By reason of this construction, the wear on the operative parts of the

complete apparatus is minimized, particularly as compared with the structure disclosed in my earlier application, wherein the complete mechanism was always in operation regardless of what key was depressed. In other words, with the present construction, the question of wear is distributed between the two unit transmitting mechanisms, thus giving longer life to the entire apparatus. From the above described operation, it will be understood that the locking of adjacent keys heretofore specifically described takes place, as well as the locking of rows of keys through the lock elements 84—85, and this renders the apparatus foolproof.

It will be noted that each key is of the same construction, and thus one standard type of key will be made, this enables the keys to be shifted into different positions at either side of the apparatus, or in either row of keys, excepting that the finger piece ends 83 may be directed differently on certain of the keys by reason of the arrangement illustrated in Fig. 1 of the drawings. The keys are all of the same structure and the finger piece ends may be attached in any desired manner, the details of this not being shown in the accompanying drawings. This is desirable from the standpoint of keeping keys which are operated more frequently at convenient positions on the dialer.

By utilizing keys of the square cross sectional contour, these keys may be easily guided and supported in the apparatus and can be economically produced. Still further, the square cross sectional contour of the operating rods 51—52 materially simplifies the structure of these elements and apparatus, and if any appreciable wear should appear on the surface engaged by the keys, these rods may simply be turned to bring a new surface or corner into position, thus four wearing surfaces are provided.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An automatic telephone dialer comprising a frame, means forming two rows of longitudinally spaced key receiving channels at the upper portion of the frame, keys having rack surfaces mounted to move vertically in said channels, elongated gears in the frame one adjacent each row of keys and adapted to be operated by any one of the keys in a row, spring motors operatively engaging said gears, two control rods, one arranged longitudinally of each row of keys, said rods being of rectangular cross sectional form, means maintaining said rods in operative engagement with spaced elements on each of the keys characterizing predetermined telephone numbers, two independent impulse transmitting devices, independent switches controlling circuits to said devices, and means in direct operative engagement with each bar for closing and opening the circuit through an associated switch device in controlling automatic transmission of a telephone number by movement of a key relatively to its associated rod.

2. An automatic telephone dialer comprising a frame, means forming two rows of longitudinally spaced key receiving channels at the upper portion of the frame, keys having rack surfaces mounted to move vertically in said channels, elongated gears in the frame one adjacent each row of keys and adapted to be operated by any one of the keys in a row, spring motors operatively engaging said gears, two control rods, one arranged longitudinally of each row of keys, said

7

rods being of rectangular cross sectional form, means maintaining said rods in operative engagement with spaced elements on each of the keys characterizing predetermined telephone numbers, two independent impulse transmitting devices, independent switches controlling circuits to said devices, means in direct operative engagement with each bar for closing and opening the circuit through an associated switch device in controlling automatic transmission of a telephone number by movement of a key relatively to its associated rod, said last named means comprising a switch operating bar, and a lever directly actuated by said rod for moving the bar to close said switch.

3. An automatic telephone dialer comprising a frame, means forming two rows of longitudinally spaced key receiving channels at the upper portion of the frame, keys having rack surfaces mounted to move vertically in said channels, elongated gears in the frame one adjacent each row of keys and adapted to be operated by any one of the keys in a row, spring motors operatively engaging said gears, two control rods, one arranged longitudinally of each row of keys, said rods being of rectangular cross sectional form, means maintaining said rods in operative engagement with spaced elements on each of the keys characterizing predetermined telephone numbers, two independent impulse transmitting devices, independent switches controlling circuits to said devices, means in direct operative engagement with each bar for closing and opening the circuit through an associated switch device in controlling automatic transmission of a telephone number by movement of a key relatively to its associated rod, said last named means comprising a switch operating bar, a lever directly actuated by said rod for moving the bar to close said switch, and means providing free movement of the lever relatively to the bar in the depression of a key.

4. In an automatic telephone dialer of the class described employing a frame, with means for supporting two independent rows of keys in said frame and exposed through one surface thereof, each row of keys having an independent operable unit controlling transmission of a telephone number in actuation of one of the keys in said rows, each unit comprising an elongated gear, means on each key of a row for independently rotating said gear, an elongated control bar arranged longitudinally of the row of keys and operatively engaging characterized elements on said keys, each unit having means transmitting impulses to a telephone circuit and a switch controlling the circuit to said last named means, and each unit having means directly operable by said bar controlling, through the medium of the elements on said keys, the opening and closing of said switch.

5. In an automatic telephone dialer of the class described employing a frame, with means for supporting two independent rows of keys in said frame and exposed through one surface thereof, each row of keys having an independent operable unit controlling transmission of a telephone number in actuation of one of the keys in said rows, each unit comprising an elongated gear, means on each key of a row for independently rotating said gear, an elongated control bar arranged longitudinally of the row of keys and operatively engaging characterized elements on said keys, each unit having means transmitting impulses to a telephone circuit and a switch controlling the circuit to said last named means, each unit having means directly operable by said bar controlling, through the medium of the elements on said

8

keys, the opening and closing of said switch, said last named means comprising a lever having a rack surface, a gear on said rod engaging the rack of said lever, and a switch operating bar in operative engagement with said lever.

6. In an automatic telephone dialer of the class described, a frame, means for supporting a row of call keys longitudinally of the frame, keys arranged in said last named means, each key having on one surface a gear rack and on the other surface spaced elements characterizing a telephone number to be called, an elongated member having means adapted to operatively engage the rack of all of said keys in the depression of said keys, a spring motor operatively engaging said elongated member and wound upon the depression of any one of the keys in said row, means transmitting impulses to a telephone circuit, means placing said elongated member when actuated by the spring motor in operative engagement with said last named means, a switch controlling the circuit to said impulse transmitting means, and a single member operatively engaging the spaced elements of all of said keys in controlling said switch.

7. In an automatic telephone dialer of the class described, a frame, means for supporting a row of call keys longitudinally of the frame, keys arranged in said last named means, each key having on one surface a gear rack and on the other surface spaced elements characterizing a telephone number to be called, an elongated member having means adapted to operatively engage the rack of all of said keys in the depression of said keys, a spring motor operatively engaging said elongated member and wound upon the depression of any one of the keys in said row, means transmitting impulses to a telephone circuit, means placing said elongated member when actuated by the spring motor in operative engagement with said last named means, a switch controlling the circuit to said impulse transmitting means, a single member operatively engaging the spaced elements of all of said keys in controlling said switch, said keys having inwardly of the racks and elements thereon recesses, and means in the frame operatively engaging the recesses of said keys to support the same in raised position.

8. In an automatic telephone dialer employing a row of keys, with means for supporting said keys for inward and outward movement with respect to the support, means directly operable by one movement of any one of the keys in a row for actuating a motor to move the keys in the opposite direction, an elongated rod of rectangular cross sectional form arranged longitudinally of and in operative engagement with all of said keys, means spaced longitudinally of the surface of all of said keys arranged adjacent said rod for imparting intermittent rotary movement to said rod in the last mentioned movement of the keys, and means in operative engagement with said rod for opening and closing an electric circuit in the intermittent rotary operations of said rod.

9. In an automatic telephone dialer employing a row of keys, with means for supporting said keys for inward and outward movement with respect to the support, means directly operable by one movement of any one of the keys in a row for actuating a motor to move the keys in the opposite direction, an elongated rod of rectangular cross sectional form arranged longitudinally of and in operative engagement with all of said

keys, means spaced longitudinally of the surface of all of said keys arranged adjacent said rod for imparting intermittent rotary movement to said rod in the last mentioned movement of the keys, means in operative engagement with said rod for opening and closing an electric circuit in the intermittent rotary operations of said rod, and means rendering the last named means inoperative in the first named movement of the keys with respect to said rod.

10. In an apparatus of the class described employing an impulse transmitting means and a switch controlling the circuit to said means, a spring motor for actuating said first named means, means involving a key for winding said motor, means utilizing said motor to feed the key in one direction in the apparatus, means operatively engaging said key in the last named movement thereof for opening and closing the circuit through said switch, said last named means comprising a key engaging rod, a switch operating sliding rod, and a lever operatively engaging both rods and movable independently of said sliding rod.

11. In an automatic telephone dialer employing a row of keys, with means for supporting said keys for inward and outward movement with respect to the support, means directly operable by one movement of any one of the keys in a row for actuating a motor to move the key in the opposite direction, an elongated rod of rectangular cross sectional form arranged longitudinally of and in operative engagement with all of said keys, means spaced longitudinally of the surface of all of said keys arranged adjacent said rod for imparting intermittent rotary movement to said rod in the last mentioned movement of the keys, means in operative engagement with said rod for opening and closing an electric circuit in the intermittent rotary operations of said rod, and tensional means for supporting the last named means and said rod in neutral position.

12. In an automatic telephone dialer apparatus, the combination with call keys having spaced elements characterizing predetermined telephone numbers arranged at one end portion of said keys, a recess in the keys inwardly of said elements, of a unit comprising a frame having spaced rows of key supporting channels at opposite sides of said frame, yieldable means at the upper portion of the frame operatively engaging the recess portions of keys arranged in said channels to support said keys in raised position in said frame with all of the elements arranged within boundaries of the frame, and a single member arranged longitudinally of each row of keys in operative relation with the elements of said keys for controlling transmission of predetermined telephone numbers in one movement of said keys relatively to said frame.

13. In an automatic telephone dialer apparatus, the combination with call keys having spaced elements characterizing predetermined telephone numbers arranged at one end portion of said keys, a recess in the keys inwardly of said elements, of a unit comprising a frame having spaced rows of key supporting channels at opposite sides of said frame, yieldable means at the upper portion of the frame operatively engaging the recess portions of keys arranged in said channels to support said keys in raised position in said frame with all of the elements arranged within boundaries of the frame, a single member arranged longitudinally of each row of keys in operative relation with the elements of said keys for con-

trolling transmission of predetermined telephone numbers in one movement of said keys relatively to said frame, said keys each including gear racks on the surface thereof opposed to said elements, and a single gear member arranged longitudinally of each row of keys adapted to be operated by any one of the keys in a row for putting the apparatus in operation.

14. An apparatus of the class described comprising a unit frame, said frame having a longitudinal gear at each side of the frame, a rectangular rod adjacent and longitudinally of each gear, coil spring motors inwardly of said gears with means engaging the gears for winding said motors, a row of key supporting and guiding channels arranged above and intermediate said gears and rods, keys arranged in said channels and movable vertically between and operatively engaging the gears and rods, means supporting each of the keys in raised inoperative position above said gears and rods, each side of the frame having independent means for transmitting impulses to an electric circuit, gear trains placing said spring motors in operative engagement with the last named means, an independent switch controlling each of the last named means, and means in operative engagement with each rod controlling one of said last named switches.

15. An apparatus of the class described comprising a unit frame, said frame having a longitudinal gear at each side of the frame, a rectangular rod adjacent and longitudinally of each gear, coil spring motors inwardly of said gears with means engaging the gears for winding said motors, a row of key supporting and guiding channels arranged above and intermediate said gears and rods, keys arranged in said channels and movable vertically between and operatively engaging the gears and rods, means supporting each of the keys in raised inoperative position above said gears and rods, each side of the frame having independent means for transmitting impulses to an electric circuit, gear trains placing said spring motors in operative engagement with the last named means, an independent switch controlling each of the last named means, means in operative engagement with each rod controlling one of said last named switches, said last named means comprising a racked lever engaging a pinion on said rod, and a switch operating bar actuated by said lever.

16. An apparatus of the class described comprising a unit frame, said frame having a longitudinal gear at each side of the frame, a rectangular rod adjacent and longitudinally of each gear, coil spring motors inwardly of said gears with means engaging the gears for winding said motors, a row of key supporting and guiding channels arranged above and intermediate said gears and rods, keys arranged in said channels and movable vertically between and operatively engaging the gears and rods, means supporting each of the keys in raised inoperative position above said gears and rods, each side of the frame having independent means for transmitting impulses to an electric circuit, gear trains placing said spring motors in operative engagement with the last named means, an independent switch controlling each of the last named means, means in operative engagement with each rod controlling one of said last named switches, said last named means comprising a racked lever engaging a pinion on said rod, a switch operating bar actuated by said lever, and tensional means for supporting the lever and rod in neutral position.

11

17. An apparatus of the class described comprising a unit frame, said frame having a longitudinal gear at each side of the frame, a rectangular rod adjacent and longitudinally of each gear, coil spring motors inwardly of said gears with means engaging the gears for winding said motors, a row of key supporting and guiding channels arranged above and intermediate said gears and rods, keys arranged in said channels and movable vertically between and operatively engaging the gears and rods, means supporting each of the keys in raised inoperative position above said gears and rods, each side of the frame having independent means for transmitting impulses to an electric circuit, gear trains placing said spring motors in operative engagement with the last named means, an independent switch controlling each of the last named means, means in operative engagement with each rod controlling one of said last named switches, said last named means comprising a racked lever engaging a pinion on said rod, a switch operating bar actuated by said lever, and tensional means for supporting the lever and rod in neutral position and in operative engagement with the elements of said keys.

18. In a key actuated telephone number calling device employing two rows of call keys, a frame in which said keys are vertically movable, means in the frame supporting all of the keys in raised position, independent number transmitting units, one unit controlling one row of keys and another unit controlling another row of keys, each unit comprising means transmitting impulses to a telephone circuit in transmitting a predetermined telephone number, a switch controlling the circuit to said last named means, and a single switch operating element operatively engaging all of the keys alined in a row and actuated by each depressed key in upward movement of said key in controlling movement of said switch into operative and inoperative positions in calling a number.

19. In a key actuated telephone number calling device employing two rows of call keys, a frame in which said keys are vertically movable, means in the frame supporting all of the keys in raised position, independent number transmitting units, one unit controlling one row of keys and another unit controlling another row of keys, each unit

12

comprising means transmitting impulses to a telephone circuit in transmitting a predetermined telephone number, a switch controlling the circuit to said last named means, a single switch operating element operatively engaging all of the keys alined in a row and actuated by each depressed key in upward movement of said key in controlling movement of said switch into operative and inoperative positions in calling a number, all of said keys having gear rack surfaces, and means operated by the gear rack surface of any one of the keys in said row for putting the second named means in operation.

20. In a key actuated telephone number calling device employing two rows of call keys, a frame in which said keys are vertically movable, means in the frame supporting all of the keys in raised position, independent number transmitting units, one unit controlling one row of keys and another unit controlling another row of keys, each unit comprising means transmitting impulses to a telephone circuit in transmitting a predetermined telephone number, a switch controlling the circuit to said last named means, a single switch operating element operatively engaging all of the keys alined in a row and actuated by each depressed key in upward movement of said key in controlling movement of said switch into operative and inoperative positions in calling a number, and tensional means for supporting the switch operating element in constant engagement with a key in the upward movement of said key.

21. In a key actuated telephone dialer, means for supporting a plurality of keys in predetermined alinement in a casing with adjacent keys in close proximity to each other, said keys having recessed portions centrally thereof, means engaging all of the keys to maintain the same in predetermined inoperative position, said last named means comprising spring pressed balls engaging the recessed portions of said keys, means whereby in the operation of one of the keys adjacent keys will be automatically retained against operation, means for returning the keys to normal inoperative position, and said spring pressed balls in cooperation with the recessed portions of the keys serving to move said keys and hold the same in their final inoperative position.

THOMAS W. MacKENZIE.