

Sept. 20, 1960

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2,953,647

MAGNETIC DRUM REPERTORY DIALER

Filed Nov. 9, 1956

5 Sheets-Sheet 1

FIG. 1

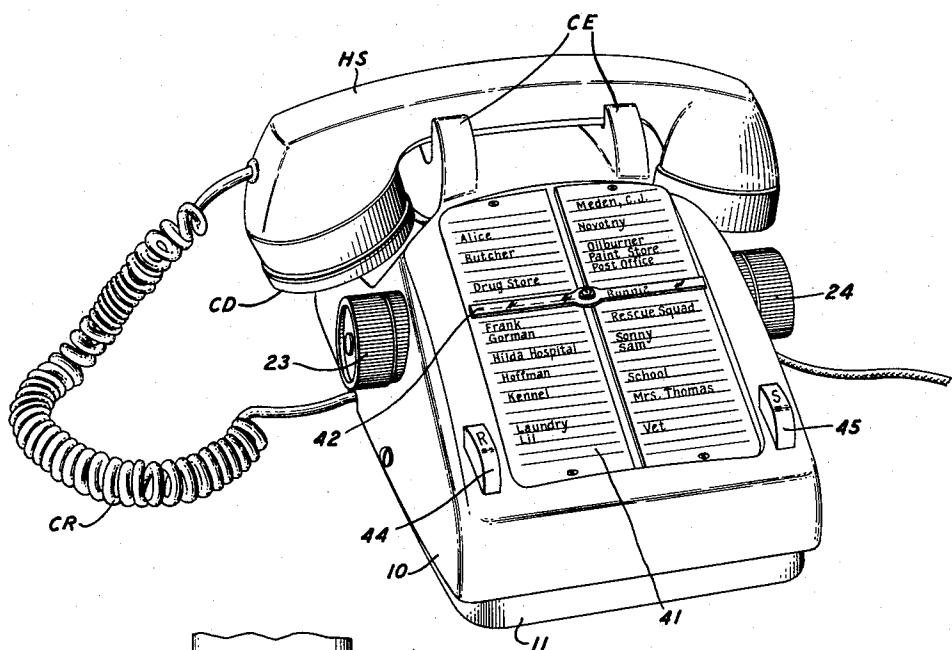


FIG. 12

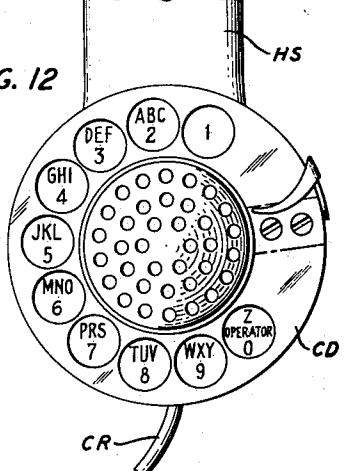
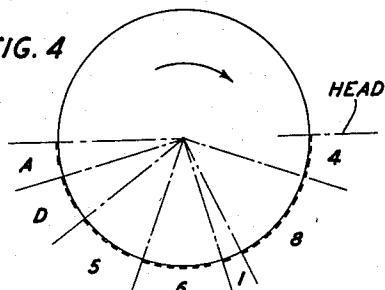


FIG. 4



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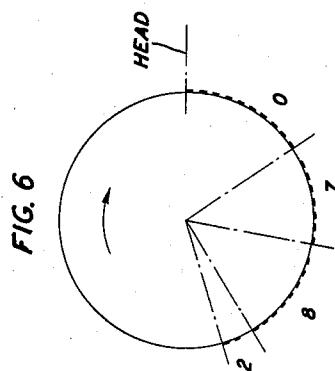
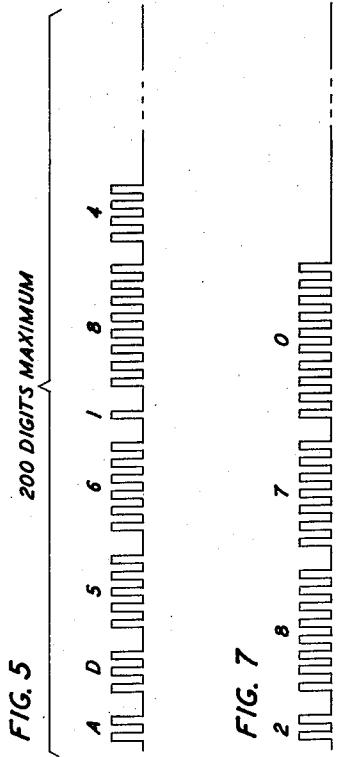
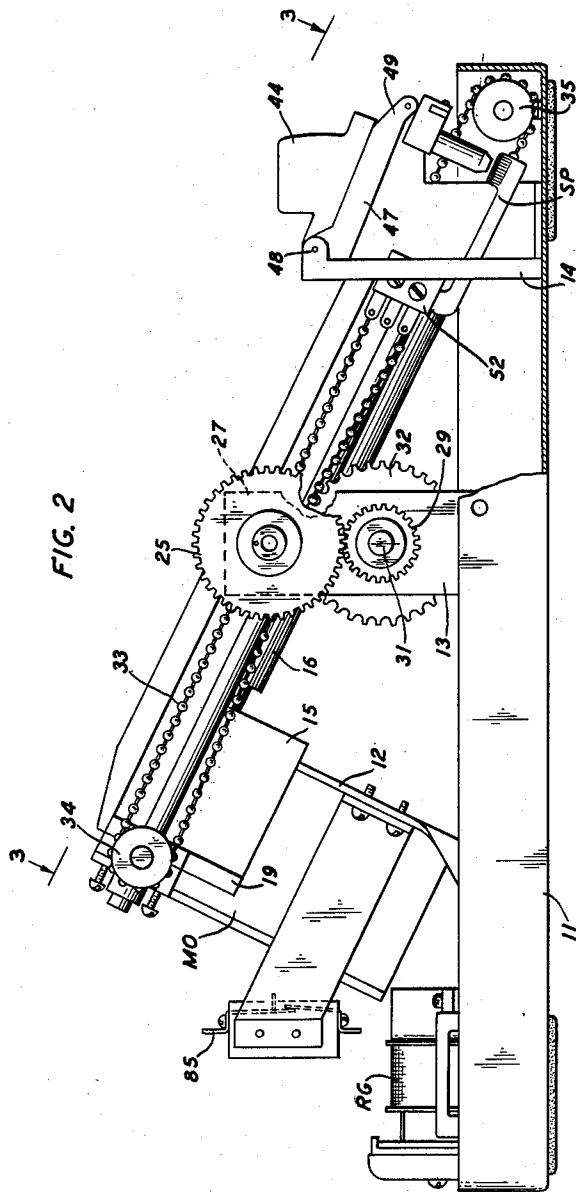
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## MAGNETIC DRUM REPERTORY DIALER

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5 Sheets-Sheet 2



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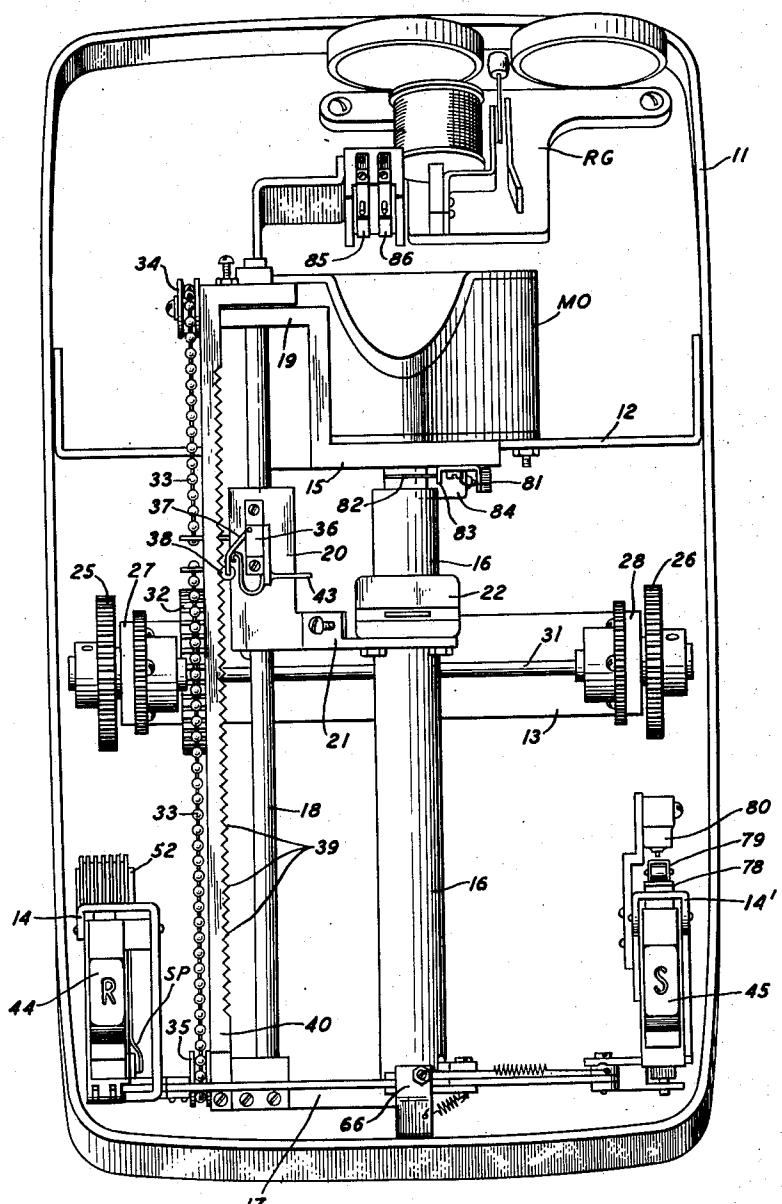
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MAGNETIC DRUM REPERTORY DIALER

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FIG. 3



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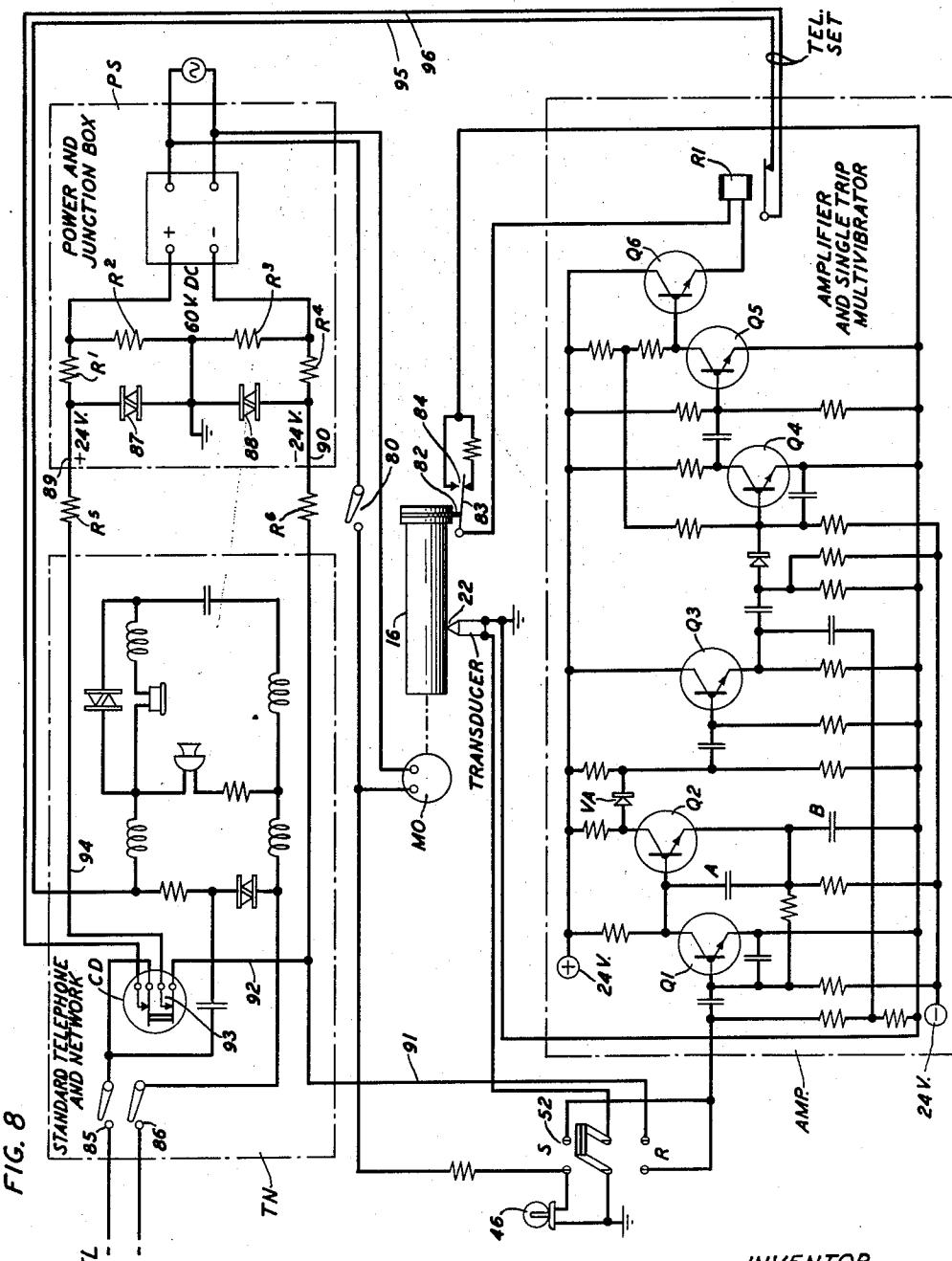
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FIG. 9

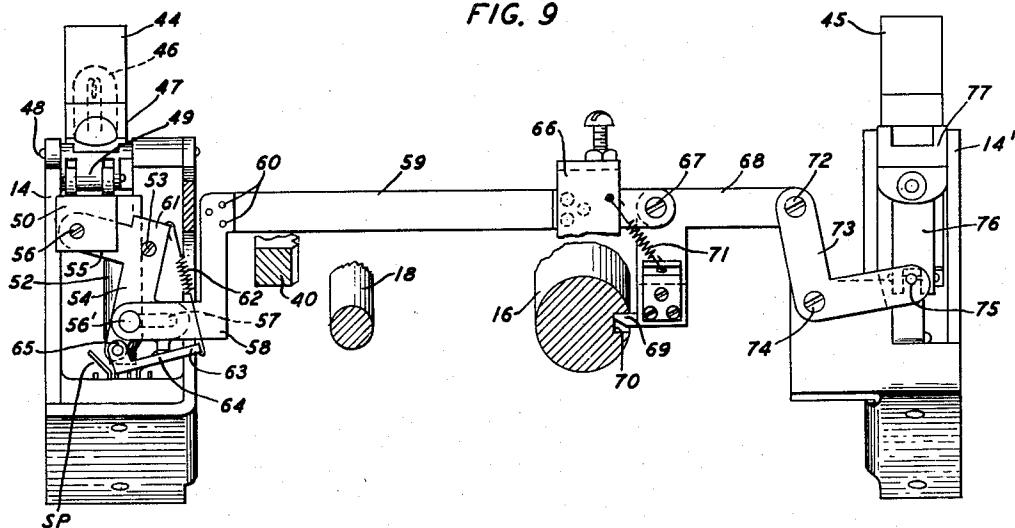


FIG. 10

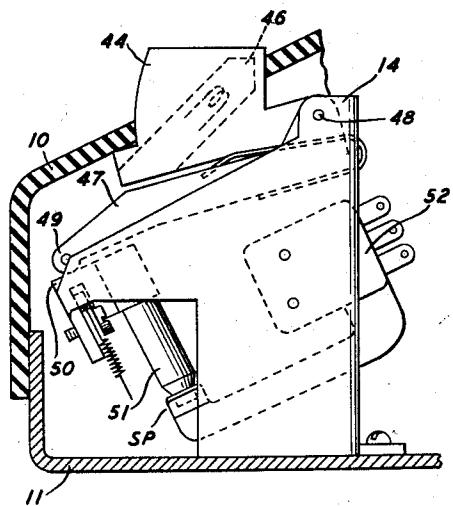
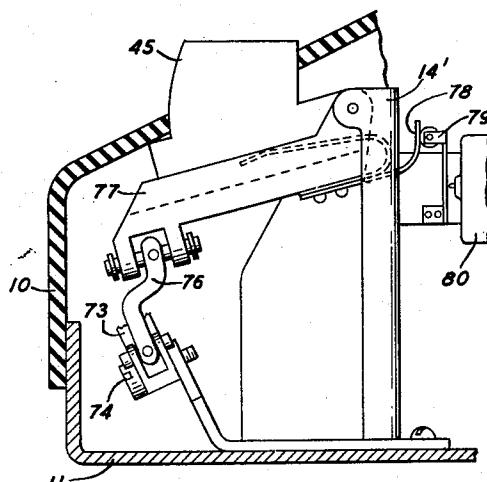


FIG. 11



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# United States Patent Office

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## MAGNETIC DRUM REPERTORY DIALER

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Filed Nov. 9, 1956, Ser. No. 621,446

5 Claims. (Cl. 179—90)

This invention relates, in general, to impulse transmitting devices, but is particularly concerned with that type of impulse transmitting device which automatically dials the subscriber's entire number in response to a single actuation by the person initiating the call. These automatic dialing devices are commonly known as repertory dialing mechanisms.

Today, in the case of a great many telephone users, a large portion of their calls are made to a limited number of stations and of these there are usually a few stations which are repeatedly called. In those instances wherein the subscribers are connected to an automatic exchange, it is necessary for the calling party to go through the time consuming operation of manipulating a calling dial successively a number of times to spell out the desired code of the called station.

In many metropolitan areas, it is necessary to use seven letters or digits in making a call, each one of which must be successively selected on the dial and the dial rotated to transmit the desired number of impulses associated with that particular letter or digit. This is a time consuming operation and is conducive to errors in dialing.

By the use of the dialing device of my invention, I provide means whereby a single action on the part of the calling party initiates the call.

The repertory dialing device of my invention contemplates the use of a magnetic drum having stored on its outer surface the magnetic patterns to be transmitted. These patterns are picked up by a suitable transducer which traverses the drum, are amplified, and reproduce the dial impulses which are consequently transmitted out over the line to actuate central office equipment to establish a connection between the calling and the called parties.

In accordance with my invention, means is provided whereby the manual adjustment of a suitable carriage and transducer, as shown by a pointer or other suitable indicating device, in cooperation with a name plate or other indicium, is effective to position the transducer in operative relation with a set of previously recorded magnetic patterns on the surface of a rotatable drum, these patterns corresponding to the code signals assigned to the designation on the name plate for that particular station.

Provision is made in my proposed repertory dialing device for automatically erasing a previously recorded designation from the drum when a new number is recorded by means of a manually operated dial associated with and forming a component part of the device.

The record circuit translates pulses from the telephone dial into reversals of current in the transducer head. These current changes are then recorded as changes in magnetization of the magnetic medium on the drum surface.

The reproduce circuit reverses the above procedure, since current changes in the transducer, induced by changes in magnetization of the magnetic medium on the drum, are changed by suitable circuitry into dial pulses.

A principal object of the present invention is to pro-

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vide an improved impulse transmitter which takes a minimum amount of time to operate and reduces to a minimum the possibilities of errors in dialing.

A further object of the invention is the provision, in an automatic dialing device, of means whereby the recorded designation codes may be readily erased and replaced by other designations without disassembling the device or requiring assistance from a skilled employee of the telephone company.

10 10 A clearer conception of my invention will be obtained from the following detailed description when read in connection with the following drawings, in which:

Fig. 1 is a view in perspective of the device of my invention with the handset in position thereon;

15 Fig. 2 is a side elevational view with the cover removed and parts broken away to show the interior structure;

Fig. 3 is a top plan view with the cover removed and parts broken away;

Fig. 4 is a diagrammatic view of a cross section of the 20 drum with the magnetic impulses impressed thereon;

Fig. 5 is a diagrammatic view and illustrates in a linear manner the impulses as shown in Fig. 4;

Fig. 6 is a view similar to Fig. 4 but illustrates a different set of impulses;

25 Fig. 7 is a diagrammatic view and illustrates in a linear manner the impulses as shown in Fig. 6;

Fig. 8 is a schematic wiring diagram disclosing the circuit arrangement for the device of this invention;

Fig. 9 is a fragmentary end view illustrating the switching 30 mechanism for the record and send buttons;

Fig. 10 is a fragmentary side view of the record button mechanism shown in Figs. 3 and 9;

Fig. 11 is a fragmentary side view of the send button mechanism shown in Figs. 3 and 9; and

35 Fig. 12 is a fragmentary view of the handset showing the combined calling dial transmitter.

The telephone call transmitter or impulse transmitting device of this invention is preferably housed in a casing or housing 10 and is suitably mounted on a base member 40 11 by means of the brackets 12 and 13. A handset HS, having a calling dial CD, mounted on the transmitter end thereof, as shown in Fig. 12, is positioned in the cradle CE in the usual and accepted manner, the weight of the handset serving to open and close a switch which 45 serves to condition the set for operation.

The calling dial CD is the same as the standard calling dial except for size and is provided with openings in its center for the passage of sound vibrations to the transmitter located directly behind. This calling dial operates 50 in the usual and well-known manner and has been located on the handset for convenience.

As shown, the handset HS is connected to the impulse transmitter mechanism by means of a cord CR.

Located in the housing 10, to the rear thereof, is a 55 ringer RG of the conventional type.

Mounted on the supporting bracket 12 is the motor MO which has secured to the inner face thereof a bracket member 15. The bracket 15 serves to support the upper end of the rotatable drum 16 constructed from a suitable non-magnetic material, such as brass, which is directly coupled to the motor and which is coated with a suitable magnetizable plating, for example a cobalt-nickel alloy, while the lower end thereof is journaled in a bracket member 17 located at the other end of the 60 housing 10. Mounted in parallel relation with respect to the drum 16, as shown in Fig. 3, and in the same plane, is the guide bar 18, the upper end of which is secured to the offset portion 19 of the bracket 15 while the lower end thereof is secured to the bracket 17.

65 Slidably mounted on the guide bar 18 is the carriage member 20 which has secured to its inner side a bracket 21 which in turn supports a transducer 22 which is cen-

trally positioned with respect to the axis of the drum 16 and is adapted to travel longitudinally in definite increments with respect thereto as the member 20 traverses the guide bar 18.

The member 20 and the associated transducer 22 attached thereto are actuated by means of suitable knobs 23 and 24 which are positioned on each side of the housing 10, as shown in Fig. 1. These knobs are connected to the shafts of the gears 25 and 26 which are journaled in the upstanding arms 27 and 28 of the bracket member 13 which is secured to the base member 11. The gears 25 and 26 are in mesh with the pinions 29 and 30 which are secured to the ends of the transversely extending shaft 31, journaled in the arms 27 and 28 of the bracket 13. Thus it will be observed that the rotation of either of the knobs 23 or 24 in either a clockwise or counterclockwise direction will cause the rotation of the gears 25 and 26, their associated pinions 29 and 30, and the shaft 31.

Fixedly mounted on the shaft 31 and positioned between the arm 27 and the guide bar 18 is the gear member 32. The teeth of this gear have been slotted around its periphery in order that the balls of the chain member 33 may mesh therewith and provide a positive drive. The chain member 33, which is made up of a plurality of balls linked together, is in juxtaposition with respect to the gear 32, in engagement therewith and passes over and around the idler pulleys 34 and 35 located on the brackets 15 and 17 with its ends secured to the carriage 20; thus the rotation of the gear 32 by either of the knobs 23 or 24 through the associated gears 25 and 26 and the pinions 29 and 30 will cause the carriage member 20 to traverse the guide bar 18 and carry with it the transducer 22.

In order that the transducer 22 will be moved and positioned over the drum 16 in definite increments, a detent 36 which comprises a spring biased pivoted arm 37, having a roller 38 on the free end thereof, is mounted on the carriage 20 with the roller 38 in engagement with the teeth 39 of the rack 40. Rack 40 parallels the guide bar 18, extends the entire length thereof, and is secured at each end to the brackets 15 and 17, as shown.

Located on the face of the housing 10, as shown in Fig. 1, is a directory plate 41 which has printed thereon a selected list of subscribers frequently called. In order that a large number of names may be accommodated in the allotted space, two columns are provided with the names in each column staggered with respect to the other; thus when a slider 42, which is used to select the party to be called, traverses upwardly or downwardly, the window therein will display only one name at a time, either in the left-hand or right-hand column.

Secured to the mid-portion of the slider and projecting downwardly through a suitable slot in the directory plate 41 is a forked member (not shown) which is adapted to straddle the pin 43 on the carriage 20. Thus when the carriage 20 is moved by the rotation of either of the knobs 23 or 24, the slider 42 will be caused to travel with it and align itself with a name in either the left-hand or right-hand column with the detent 36 and the rack 40 cooperating to position the transducer 22 in definite spaced increments as it travels over the drum 16, thereby providing a plurality of spaced-apart, equidistant positions for the transducer 22 with respect to the drum 16 which in turn provides spaced-apart circumferentially disposed paths around the drum 16.

As shown in the various figures and more in detail in Figs. 3, 9, 10, and 11, there is provided a pair of operating keys or buttons 44 and 45. The key 44 at the left of the housing designates the record or R key and the key 45 at the right designates the send or S key.

The R key 44, preferably made of transparent material, has an indicating lamp 46 located on the interior thereof, and is mounted on the pivoted arm 47. The arm 47 is pivoted at its upper end on the bearing 48

which is supported by the bracket 14 with the lower or free end 49 of the member 47 bearing against the top of the plunger 50 which in turn is supported on the return bend portion at the lower end of the bracket 14.

The lower end of the member 50 has positioned thereon an insulated member 51 which is adapted to engage the contacts SP of the switch 52, the purpose of which will be described in detail later on in the specification.

Pivotedly mounted on the bracket 14 at 53 is the bell 10 crank member 54, the extending arm portion 55 of which is pivotally connected to the plunger 50 at the point 56. The lower end of the member 54 is slotted and rides on the guide pin 56 in the bifurcated portion 57 of the angular member 58 which is secured to the transversely 15 extending lever arm 59 by the screws 60. Secured to the upper edge 61 of the member 54 is the coiled spring 62, the lower end of which is secured to the free end 63 of the arm 64 with the roller 65 on the opposite end thereof adapted to bear against the under side of 20 the bifurcated arm portion 57 and held thereagainst, the spring 62 thereby serving to bias the lever arm 59 to the left as viewed from the front of the device and to return the R key 44 to its normal position.

As heretofore described, the lever arm 59 is secured 25 to the angular member 58, extends across the structure and is slidably mounted in the guide 66 which is secured to the housing as shown in Fig. 3. The free end of the arm 59 is bifurcated and has pivotally attached thereto at 67 an angular link member 68, the downwardly extending portion of which is provided with an extending finger 69 which is adapted to engage the slot 70 in the drum 16 and held therein by means of the spring 71, as shown in Fig. 9, thereby indexing and permitting a single revolution of the drum 16.

Pivotedly mounted on the end of the member 68 at 35 72 is the bell crank member 73 which in turn is bifurcated at 74 on the bracket 14' with the free end 75 thereof pivotally connected to the vertically extending member 76 which in turn is connected to the pivoted lever arm 77 40 on the bracket 14' which supports the S key button 45, as shown in Figs. 9 and 11.

Positioned on the rear bottom portion of the lever arm 77 and extending through an aperture in the bracket 14' is a flat spring member 78 which bears against the contact arm 79 of the microswitch 80 to open and close it. When the arm 59 is actuated by either of the buttons R 45 or S it causes the finger 69 to be disengaged from the slot 70 and at the same time the link member 68 will actuate the bell crank member 73 which in turn causes the member 77 to close the switch 80, to start the motor, after the drum 16 has made one revolution the finger 69 drops into the slot 70 and opens the switch 80 through the members 68, 73 and 77.

Pivotedly mounted on the motor support 15 at 81 and 55 riding on the cam 82, located on the upper end of the drum 16, is a lever arm 83, the lower end of which is adapted to open and close the microswitch 84 for the purpose of biasing relay R1 during the starting and stopping of the motor MO to prevent the false operation 60 thereof.

Suitable circuitry and components are located in the rear of the housing 10 for performing the functions of the device of this invention and, since they form no part of the invention, they are not described in detail other 65 than to state that the usual means is provided for supplying power to the device, for connecting to the existing telephone line and for conditioning the device for operation in the usual manner by removing the handset HS from the cradle CE which operates the usual switch 70 through contacts 85 and 86.

The circuit details of the recording and reproducing mechanism heretofore described are shown in schematic and comprises, as shown in Fig. 8, a standard telephone and network TN as disclosed in Patent 2,629,873 to H. F. Hopkins. A power supply PS which comprises a

standard type of single-ended 60 volt current supply, modified by the addition of regulator diodes 87 and 88 and suitable resistors R1, R2, R3 and R4, furnishes 24 volts D.-C., positive with respect to ground over conductor 89 and negative over conductor 90 to both the record and reproduce circuits.

As shown, in the record circuit when the R key 44 is depressed, the contacts associated therewith cause the lamp 46 to light and the transducer 22, which is in juxtaposition with respect to the drum 16, is connected over the conductors 91 and 92 through dial contacts 93 over conductor 94 through resistor R5 to the 24 volt positive supply and to the 24 volt negative supply over the conductor 91 through the resistor R6, which has a greater value than that of R5.

With this connection an erase current flows through transducer head 22. Each time the dial contacts 93 open, at the beginning of a dial pulse, the current reverses and flows in the opposite direction until the contacts close again at the end of the dial pulse. Thus an erase current either negative or positive will flow during the entire recording cycle except at the opening or closing of the dial contacts. Thus, it will be observed that there is an automatic erasure of the old number as the new number is recorded.

The reproduce circuit, as shown at AMP in Fig. 8, comprises a suitable two-stage transistor amplifier comprising the transistors Q1 and Q2, with selective or voltage marginal regenerative feedback, a single trip multivibrator using the transistors Q4 and Q5, and a dialing relay R1, which is connected over the conductors 95 and 96 to the dial CD. To eliminate possible noise, which is in the nature of 60 cycles per second or higher, suitable capacitors A and B of 4 microfarads value are included in the two stages of the amplifier.

It will be observed, that with the amplifier as disclosed, the same two transistors Q1 and Q2, which are used to amplify and clean up the head output, are again used to amplify and standardize the amplitude of the pulse, thereby steepening the useful part thereof. This is accomplished by passing the voltage from the transistor Q2 through the varistor VA to a voltage divider set through a threshold just above the highest disturbance between pulse trains and is differentiated at the input of the transistor Q3 and a small part of the output of Q3 is fed back to the input of the amplifier.

The multivibrator comprises the transistors Q4 and Q5 and serves to standardize the pulse length. This is a conventional two-transistor, single-trip multivibrator. The transistor Q6 takes the output of the multivibrator to drive the relay R1. The contacts of relay R1 are connected in series with the regular pulsing contacts of the dial CD so that either may be used to perform the functions necessary for establishing the telephone connection.

#### Operation (record)

In the utilization of the repertory dialing device of this invention and assuming that the recording drum 16 is clear, as it would be at its initial installation, and that the directory plate 41 is also clear, the first operation a subscriber would perform would be to list a selection of names on the plate 41 in the spaces provided. After the subscriber has listed the desired number of names, the next step is to record the numbers corresponding to each particular name listed, in magnetic patterns on the drum 16. After the above operation is completed, the indicator 42 is positioned so that the name of the party whose number it is desired to be recorded appears in the window thereof. The handset HS is then lifted from its cradle which activates the line in the usual and well-known manner and which impresses dial tone on the line. When the subscriber hears the dial tone, he knows that the set is in condition to record his number on the drum 16 and at the same time send out the necessary impulses on

the line to establish a connection. The next operation is to depress the R button 44, which causes the plunger 51 to close the contact springs on switch 52, as shown at SP, which in turn lights the lamp 46, and starts the rotation of the drum 16, by operating the switch 80 as heretofore described, and establishes the necessary connections, as shown in Fig. 8, for the recording and transmission of the impulses both to the drum 16 and over the telephone line TL. The speed of the drum 16 is such that after the operation of the button 44, twenty seconds elapse for one revolution of the drum which permits a maximum of 200 magnetic patterns to be impressed around the periphery of the drum 16.

After the button 44 has been depressed and the set conditioned as above described, the finger wheel of the dial CD is operated in the well-known manner. This records the number on the drum 16 and at the same time sends out the impulses over the line. One complete revolution of the drum 16 causes the light 46 to be extinguished thus signifying the end of the recording cycle and the transmission of the impulses out over the line to establish the connection in the usual manner. Thus we have initiated a call to the desired subscriber and at the same time have recorded his number on the drum 16 for future use.

#### Operation (send)

When the desired number of names have been listed on the directory plate 41 and their respective numbers recorded on the drum 16, subsequent calls may be made by merely positioning the indicator 42 so that the desired name appears in the window, lifting the handset HS from its cradle, listening for dial tone, after which the S button 45 is depressed to cause drum 16 to rotate and send out the necessary impulses over the circuit, as shown in Fig. 8, to establish the desired connection.

When it is desired to replace an old number by a new one, it is only necessary to move the indicator 42 to the desired location and repeat the sequence of operation as heretofore described under the heading "Operation (record)," since the recording of the new number automatically erases the old number as the new number is recorded.

In Figs. 4 and 5 there is shown schematically how the designation A D 5 6 1 8 4 would appear as magnetically impressed on the drum 16.

In Figs. 6 and 7 there is shown how the designation 2 1 7 0 would appear on the drum 16.

What is claimed is:

50. 1. A telephone set comprising a manually operable dial, storage means having a magnetizable portion, means responsive to operation of said dial for producing on said portion a magnetic pattern representative of the number dialed, means including a transducer in cooperative relation with said portion for converting said magnetic pattern into a series of electrical pulses, a pair of line terminals, and means for connecting either said dial or said converting means to said terminals.

60. 2. A telephone set comprising a manually operable dial, a drum having a magnetizable portion, means responsive to operation of said dial for producing on said portion a magnetic pattern representative of the number dialed, means including a transducer in cooperative relation with said portion for converting said magnetic pattern into a series of electrical pulses, a pair of line terminals, and means for connecting either said dial or said converting means to said terminals.

70. 3. An automatic impulse transmitting mechanism comprising in combination a telephone set including a dial, a magnetically impressionable drum mounted in said set and rotatable about an axis, a magnetic transducer head mounted adjacent to the surface of said drum and positionably axially with respect thereto in consonance with an index, means selectively connected between said transducer and said dial for converting at least one electrical

pulse signal series initiated by a manual operation of said dial into a circumferential magnetic space pattern on the surface of said drum, a pair of output terminals, means connected between said transducer and said output terminals for converting said space pattern into an electrical pulse time signal series, means for rotating said drum, said rotating means being activated concurrently with the activation of said converting means, whereby a pulse time coded electrical representation of a telephone number may be stored and reproduced at will to activate telephone switching apparatus.

4. In an automatic telephone repertory dial signaling system, the combination which comprises a telephone, a dial, a storage means having a magnetically impressionable surface area, a magnetic transducer head mounted adjacent to said surface, said storage means and said transducer head being variably positionable with respect to one another in consonance with an index, means selectively activated and responsive to manual operation of said dial for converting an electrical pulse time signal from said dial into a magnetic space pattern on said surface of said storage means, means alternatively activated for deriving repeatedly from said space pattern an electrical pulse time signal corresponding to a pulse time signal generated by operation of said dial, and means for applying said derived pulse series to a transmission line, whereby a pulse time coded electrical representation of a telephone number may be stored and reproduced at will to activate dial telephone switching apparatus.

5. In an automatic telephone repertory dial signal system, the combination which comprises a telephone set, a dial, storage means having a magnetically impressionable surface area, a magnetic transducer head mounted adj-

cent said surface, said storage means and said transducer head being movable in a first direction relative to one another in consonance with an index, means selectively connected between said transducer and said dial for converting at least one electrical pulse signal series initiated by manual operation of said dial into a magnetic pattern on said surface extending in a second direction substantially perpendicular to said first direction, a pair of output terminals, means alternatively connectable between said transducer and said output terminals for converting said pattern into an electrical pulse time signal series, means for causing relative movement between said storage means and said transducer head in said second direction, said means for causing movement being activated concurrently with the activation of said converting means, and means for connecting said output terminals to a telephone line, whereby a pulse time coded electrical representation of a telephone number may be stored and reproduced at will to activate telephone switching apparatus.

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