March 10, 1942. V. E. LEGG 2,275,448

IMPULSE TRANSMITTER

Filed April 17, 1940

FIG. 1

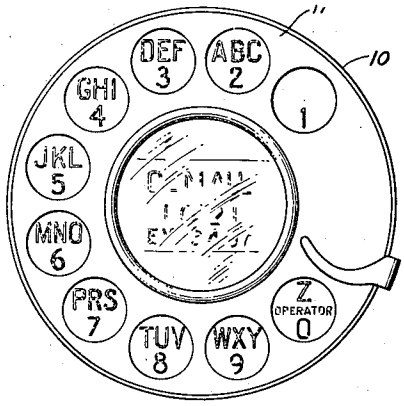


FIG. 2

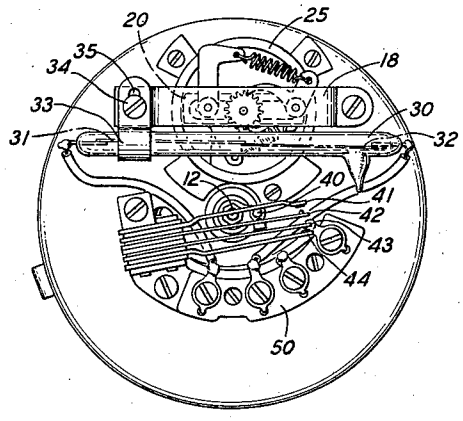


FIG. 3

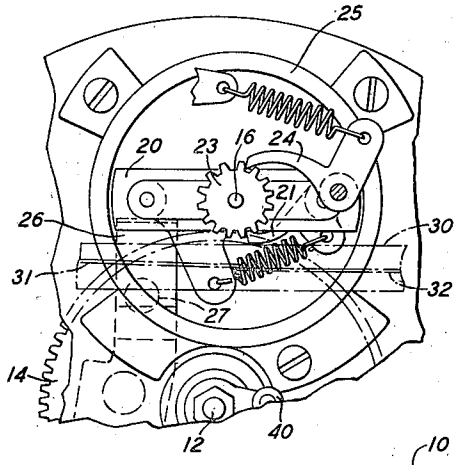


FIG. 4

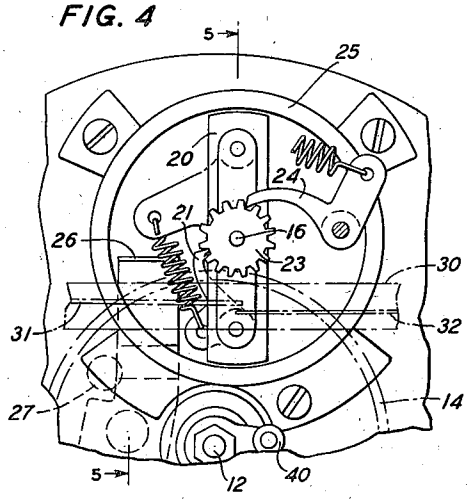
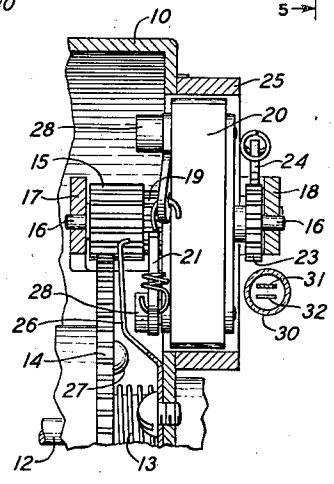


FIG. 5



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2,275,448

IMPULSE TRANSMITTER

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Application April 17, 1940, Serial No. 330,045

2 Claims. (Cl. 179—90)

This invention relates to impulse transmitters and more particularly to electrical impulse transmitters commonly known as telephone calling dials.

An object of the invention is to provide an improved device of this character.

A feature of the invention resides in an arrangement for operating the impulse contacts by a rotating permanent magnet, these contacts being made of magnetic material and preferably enclosed in a hermetically sealed tube.

A further feature resides in an electrodynamic braking device for governing the rate of producing the impulses.

In the usual calling dial arrangement the speed of operation is controlled by a mechanical governor and the impulse contacts are mechanically connected to be operated by a rotating member of the dial. Also in the usual arrangement the switch contacts are exposed within the set housing and are thus exposed to dust.

In accordance with this invention, the impulse contacts are operated by a permanent magnet carried by a rotating member of the dial. Preferably the contacts are enclosed in a hermetically sealed container which may contain a suitable gas at proper pressure or be evacuated. Preferably the switch comprises overlapping spaced finger-like flexible contacts, all or part of which are of magnetic material. The contacts are held closed when the magnet is in position to cause an appreciable magnetic flux to traverse the magnetic material of the contact members and opened when the magnet is moved to a position substantially reducing the magnetic flux traversing the magnetic material of the contact members. The bar magnet, near the magnetic contact members, having its axis of rotation through its center or neutral point and this point directly over the junction of the reed-like contact members, produces when the magnet and the contact members are in a more or less relatively parallel position, a maximum magnetic force between the members and causes their spaced overlapping ends to come together, while rotating the magnet to a position substantially at right angles to the contact members balances out the magnetic attracting force between them and permits their contacts to open. The flexible reed-like contact members are so mounted that their overlapping contact ends are spaced apart when practically no magnetic flux is passing through them. Other relative movements than rotation between the permanent magnet and the switch contact members are possible, but as the telephone dial employs rotating members, a rotary movement of the permanent magnet is particularly applicable and simple.

One form of sealed switch which meets the requirements above stated consists of a small glass tube with iron reeds respectively supported at and extending from the opposite ends of the tube into overlapping spaced relationship and attractable together magnetically. Such a switch is disclosed in the pending patent application of Walter B. Ellwood, Serial No. 198,629, filed March 29, 1938.

The electrodynamic speed governor employs the rotatable permanent magnet above mentioned and an electrically conductive surrounding housing in which eddy currents generated by the rotation of the magnet retard its rotation.

A more detailed description of an embodiment chosen for illustrating this invention follows:

Fig. 1 is a face view of the usual telephone calling dial;

Fig. 2 is an assembly view of the under-side of Fig. 1;

Fig. 3 is a plan view of the electrodynamic speed governor and the calling pulse switch mechanism when the contact members are closed;

Fig. 4 is a plan view of the electrodynamic speed governor and the calling pulse switch mechanism when the contact members are opened; and

Fig. 5 is a side and partial section view taken generally on lines 5—5 of Fig. 4.

Similar reference characters refer to the same parts in the different drawing figures.

The electrical impulse transmitter disclosed herein is of the finger-wheel type shown in patents to Forsberg 1,161,854, issued November 30, 1915, and to Dobbin and Gent 1,390,679, issued September 13, 1921. The arrangement shown in this application differs primarily from that shown in the patents referred to above by replacing the mechanically operated impulse contacts by magnetically operated impulse contacts and if desired the mechanical friction type speed control governor by an electrodynamic governor. The other parts of the dial mechanism may be substantially as shown in these patents. The chief advantages of these improvements have already been pointed out.

Referring to the drawing figures, the dial mechanism is mounted on the cup-shaped housing or base member 10. The finger wheel 11 is concentrically positioned above the housing 10 and rigidly attached to rotatable shaft 12. A

helical spring 13 concentrically positioned with respect to this central shaft 12 is arranged to restore it and the attached finger wheel 11 to their normal rest position whenever the dial is displaced therefrom for operating the impulse mechanism. A gear wheel 14, rigidly mounted on the shaft 12, engages pinion 15 rigidly mounted on shaft 16 which is journaled in bearing supports 17 and 18. The ratio of the diameters of the gears 14 and 15 is such that movement of the finger-wheel 11 from one digit to the next causes one-half a revolution of shaft 16. A bar-shaped permanent magnet 20 having a transverse hole through its center or neutral point is loosely mounted on shaft 16 but is so connected therewith that it rotates with the shaft only when the dial 11 is automatically returning to normal positon and the calling pulses are being produced. This one-way rotation of the bar magnet may be seecured by pawl and ratchet mechanism. A ratchet wheel 19 attached to shaft 16 and resiliently engaged by pawl 21 attached to the permanent magnet 20 causes the magnet to rotate in the one direction. A second ratchet wheel 23 attached to the bar magnet 20 and resiliently engaged by pawl 24 attached to the fixed bearing support 18, prevents rotation of the magnet when the dial 11 is being manually operated or set to select a certain digit. The magnet 20 should come to rest in position to hold the contact members 31 and 32 of switch 30 closed. To assure this, a leaf spring 26 attached to the base 10 is so positioned with respect to the knob 27 on the gear 14 as to be engaged when the dial is in the non-operated position. This knob moves the spring into the circular path of the lugs 28 near the ends of the magnet 20 and causes the magnet to come to rest in a position substantially parallel to the reed contacts of the switch 30. The bar magnet thus rotates only when the dial is returning to normal position and calling pulses are being produced and electrodynamic governing of the speed of rotation of the dial mechanism is taking place and comes to rest in the same angular position. The spaced and overlappingly mounted contact members 31 and 32 of the sealed switch 30 are in close proximity to the bar magnet 20. As earlier referred to herein one form of this switch element may be that known as the Ellwood relay. The portion of the operating cycle during which the contacts are closed and are opened may be determined by the positon of the relay with reference to the rotating bar magnet. This is an important feature and provision is made for adjusting the relative fixed position of the relay and the magnet. The relay switch 30 is held by support 33 which is adjustably attached to the base 10 by screw 34 or other suitable means. A slot 35 in support 33 through which the clamping screw extends permits moving the relay toward or away from the axis of rotation of the magnet 20 and thus provides for timing the operation of the switch contacts since the distance the relay is positioned from the axis of rotation determines the relative duration of closure of the contacts in an operative cycle.

Figs. 2 and 3 show the relay 30 and the bar magnet 20 parallel to each other and in such relationship that a maximum magnetic force is holding the contact reeds 31 and 32 closed. Fig. 4 shows the relay and the magnet at right angles to each other and in this neutral relationship a minimum magnetic force is exerted on the reeds and they stand apart and the circuit is opened. The bearing support 18 is omitted from Figs. 3 and 4.

A speed governor for controlling the rate at which the calling pulses are produced is necessary and as heretofore stated the rotatable permanent magnet 20 which operates the relay switch may also be used as part of an electrodynamic device for controlling the speed of operation of the mechanism. The magnet is circumferentially closely surrounded by a fixed copper ring 25 attached to the base 10. As the magnet is rotated part of its exterior magnetic field cuts the surrounding conductor 25, producing eddy currents therein, and results in damping the speed of rotation. The surrounding conductor 25 may have a bottom to add to the damping effect. Such a governing arrangement tends to cause a uniform speed of rotation and eliminates mechanical friction parts which wear out of adjustment.

Contact springs 41 and 42 supported by base 10, shown in Fig. 2, are provided for connection with the telephone set in such a manner as to short-circuit its transmitter while signaling pulses are being sent. They are allowed to close when the dial 11 is moved out of its normal position by roller 40 on a crank arm attached to shaft 12 which normally keeps these contact springs open. Contact springs 43 and 44, also operated by the action of roller 40, open the circuit through the telephone receiver when the dial 11 is moved out of its normal position. Also, as shown in Fig. 2, a terminal strip 50 to which leads from contacts 31 and 32 of the switch 32 and from contact springs 41 to 44, is provided on the outside of base 10 for making connections leading from the telephone instrument.

What is claimed is:

1. In an impulse transmitter device in which magnetically operable switch contacts are magnetically operated by means of a rotatable permanent magnet bar, a ring of non-magnetic electrical conducting material extending around said magnet bar and defining a space in which said magnet bar operates, said ring and said magnet bar being arranged to produce in said ring eddy currents during the rotational movements of said magnet bar and said eddy currents operating directly on said magnet bar to reduce the speed of rotation of said magnet bar.

2. In a telephone calling dial device in which magnetically operable switch contacts are magnetically operated by means of a centrally pivoted rotatable permanent magnet bar controlled in its operation by means of a rotatable finger-wheel, a stationary ring of non-magnetic electrical conducting material encircling said magnet bar and defining an operating space for said magnet bar, said ring being so arranged relative to said magnet bar that eddy currents are produced in said ring when said magnet bar is rotated, the eddy currents produced in said ring directly operating on said magnet bar to reduce the speed of rotation of said magnet bar so that said switch contacts are operated at a required speed.

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