July 12, 1932. W. A. RHODES 1,866,669

IMPULSE TRANSMITTER

Filed Aug. 25, 1931

FIG. 1

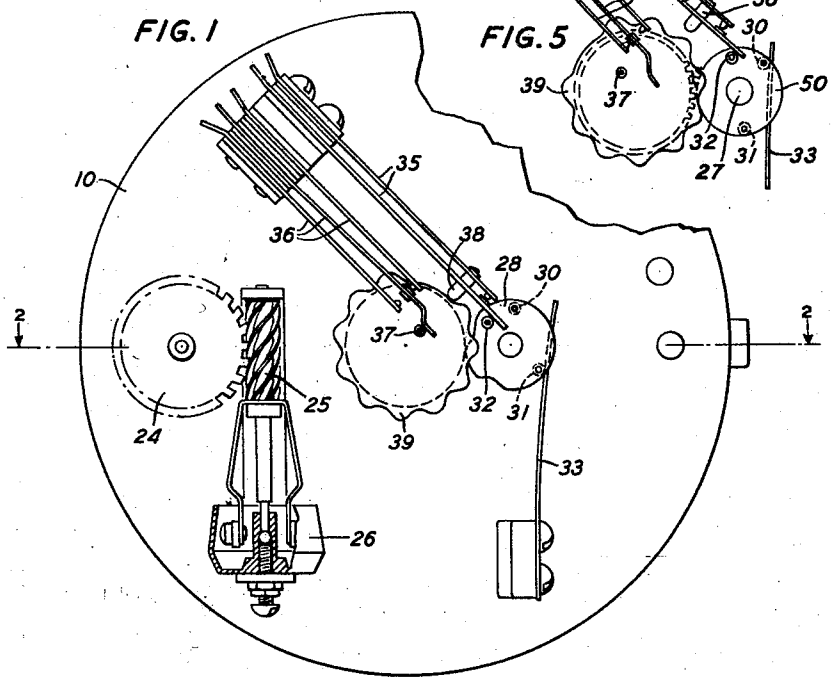


FIG. 5

FIG. 2

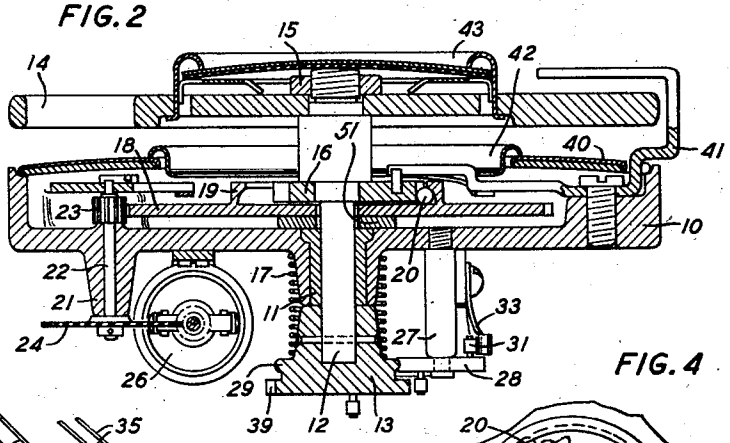


FIG. 3

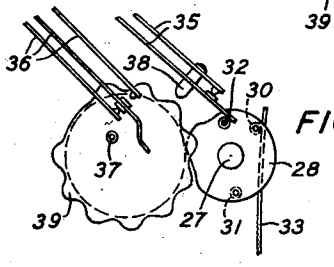
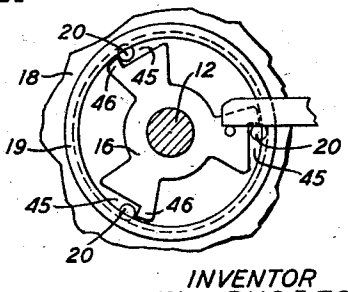


FIG. 4



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UNITED STATES PATENT OFFICE

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IMPULSE TRANSMITTER

Application filed August 25, 1931. Serial No. 559,324.

This invention relates to impulse sending devices and particularly to calling dials extensively employed in the establishment of automatic and semi-automatic telephone connections.

With the approach of mechanical and electrical perfection in the design of telephone calling dials, the trend towards noiseless operation of such mechanisms is becoming more evident.

It is accordingly, the object of this invention to provide an improved dial design which insures against objectionable operating noises and at the same time maintains the high standards of mechanical and electrical efficiency essential to such devices when employed in the establishment of telephone connections.

This object is attained in accordance with a feature of the invention by the provision of a ball clutch arrangement associated with the main shaft of the dial to transmit the rotation of the shaft to the dial governor mechanism. The introduction of a ball clutch in the telephone dial eliminates the need of a ratchet pawl commonly employed in present day dials and inherently a source of noise.

Another feature of the invention resides in the provision of friction cams as a means for masking or shunting out pulses at the beginning of the pulse train and for preventing the operation of the dial pulse springs during wind-up of the dial.

These and other features of the invention will be readily understood from the following detailed description made with reference to the accompanying drawing in which:

Fig. 1 is a bottom plan view of an impulse transmitter of the dial type embodying the features of this invention;

Fig. 2 is a section taken along the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a view of the impulse masking mechanism in its operated position;

Fig. 4 is a fragmentary plan view of the ball clutch mechanism which constitutes a feature of the invention; and

Fig. 5 is a view corresponding to Fig. 3 and shows the use of gears in place of friction cams for masking the impulses.

Referring in general to all the figures and particularly to Fig. 2, the dial casing 10 is shown as a die-casting provided with a centrally located aperture into which is rotatably fitted a sleeve member 11. A bolt or shaft 12 is adapted to be rotated in the sleeve or bearing 11 and has one end made fast, in any suitable manner, to the mechanism 13, which in reality constitutes two distinct elements, as will hereinafter appear. The upper end of shaft 12 is provided with a substantially rectangular shoulder which fits into a correspondingly shaped aperture in the finger wheel 14. A nut 15, which screws on to the threaded end of shaft 12, serves to rigidly secure the finger wheel to the shaft. A substantially cross-shaped element 16 is rigidly secured to the shaft 12 in any suitable manner and constitutes the driving member of the ball clutch.

A drive spring 17 has one end made fast to the element 13 and the other to the base of casing 10, so that when the shaft 12 is rotated by the manipulation of the finger wheel 14, the spring 17 is wound up. When the finger wheel is released, the spring unwinds and drives the dial mechanism, returning it to its normal condition.

Interposed between a washer 51 and the clutch driving member 16, is a ratchet wheel 18 which is provided with an integral circular lip 19 which constitutes a race or track in which the balls 20 are free to travel when the dial is being set, as will appear from a later description. The ratchet wheel 18 and its associated lip 19 constitute the driven member of the ball-clutch mechanism. A clearance between the element 18 and shaft 12, and the washer 51 are provided to afford freedom of movement of the element 18 relative to the shaft 12.

A casing pad or extension 21 is provided for the purpose of housing the shaft 22 on one end of which is secured a small gear 23 which meshes with the ratchet wheel 18 and is driven thereby. At its other end, shaft 22 supports a worm wheel 24 which is constantly in mesh with the governor worm 25, as

clearly seen in Fig. 1. The worm 25 constitutes a part of a well known type of governor, generally indicated by the numeral 26.

A screw-pin 27 is secured to the underside of casing 10 and supports an eccentric cam 28 in contiguous relationship with the cam portion 29 of the element 13.

As seen in Fig. 1, the cam 28 is provided with two upwardly projecting pins 30 and 31 and a depending stud 32. A resilient spring 33 is secured in any suitable manner to the casing 10 and is normally contiguous with the pin 31, serving to exert a pressure upon the pin 31 to cause the cam 28 to be frictionally engaged by the cam 29. The purpose of pin 30 and stud 32 will be set forth in the description of the operation of the dial.

A spring pile-up, consisting of the pulsing springs 35 and off-normal springs 36, is mounted on the underside of the dial casing 10, the off-normal springs being actuated by a stud 37 for purposes well known in the art. A stud 38 rigidly secured to one of the pulsing springs 35 has its free end normally in engagement with the pulsing wheel 39 and rides over the teeth thereon to effect the transmission of current pulses.

Other elements of the dial, such as the number plate 40, finger stop 41, number plate retainer 42 and card holder 43 are well known dial equipment and need not be described in detail. It is believed that Fig. 2 clearly discloses these elements and the manner in which they enter into the dial structure.

The operation of the dial may be described as follows:

In setting the dial, the operator's finger is inserted in a certain finger hole in the finger wheel 14, and the finger wheel rotated in a clockwise direction until the finger engages the finger stop 41. During this movement of the finger wheel 14 the shaft 12 is rotated and the drive spring 17 wound up. Referring particularly to Fig. 4, it will be seen that each of the three extensions of the driving member 16 is provided with a slot 45 which, in conjunction with the ratchet wheel lip 19, confines the balls 20 in such a manner that they move freely when pushed by the projections 46 which constitute a side of each of the slots 45. In this manner, when shaft 12 rotates in a clockwise direction upon the setting of the finger wheel 14, the balls move freely and do not effect a frictional engagement between the driving member 16 and the driven member 18, so that the latter remains stationary. The governor mechanism in like manner remains stationary during wind-up of the dial. When the operator's finger is withdrawn from the finger wheel hole, the tendency of the spring 17 to unwind and resume its normal condition causes the finger wheel 14 and its associated shaft 12 to be rotated in a counter clockwise direction. The clutch driving member 16, being secured to the shaft 12 rotates correspondingly, so that the balls 20 become wedged in the narrow end of the slots 45 causing them to frictionally engage the lip 19, with the result that a frictional engagement is effected between the driving member 16 and the driven member 18. The latter rotates accordingly and drives the governor mechanism through gears 23 and 24.

As the dial was being set, that is, when the finger wheel 14 was rotated in a clockwise direction, the element 13, which is secured to the end of shaft 12 and constitutes a friction cam 29 and an impulse wheel 39, experienced a corresponding movement. By virtue of the pressure exerted by spring 33 on stud 31 of the eccentric cam 28, a frictional engagement is effected between the cams 28 and 29 so that they rotate together. The contour of cam 28 is such that the frictional engagement between cams 28 and 29 is maintained only during a part of a complete revolution of the cam 29, so that cam 28 rotates only through a small arc, and during the remainder of the winding up of the dial, slides over the cam 29. As cam 28 is rotated, the stud 32 which is in engagement with the longer one of impulse springs 35 forces the impulse springs out of their normal position so that the stud 38 carried by the shorter one of the springs is moved from the path of the teeth in the pulsing wheel 39. In this manner there are no interruptions of the pulsing springs during wind-up of the dial. The position of the pulsing springs and cam 28 during wind-up of the dial is shown in Figs. 3 and 5.

When the cam 28 has been rotated through its effective arc and starts to slide, the stud 30 will have come into engagement with the spring member 33 so that both the pulsing springs bearing on stud 32 and spring 33 bearing on stud 30 tend to force the cam 28 into engagement with cam 29. When the finger wheel is then released after the setting of the dial and the cam 29, carried by the shaft 12, rotates in a counter-clockwise direction the two friction cams again become effectively engaged, so that the cam 28 is rotated back to its normal position, the stud 38 thereupon being returned to engagement with the periphery of impulse wheel 39. The stud 38 follows the contour of the impulse wheel, causing the pulsing springs 35 to be interrupted in accordance with the setting of the dial.

It will be noted that the length of the wedging arc on cam 28 determines the time at which the stud 38 is dropped back into engagement with impulse wheel 29 after release of the finger wheel. By varying this wedging arc the number of pulses which are masked after release of the dial and before pulsing begins may be altered. The same result may be obtained by varying the pro-

portion of the circumference of cam 29 which may be equipped with teeth as shown in Fig. 5, in which the element 50 corresponds to element 28 of Fig. 3. The operation of this alternative arrangement is similar to that of Fig. 3 and need not be repeated.

What is claimed is:

1. In an impulse mechanism, a rotatable shaft, an impulse wheel secured to said shaft, impulse springs operated by said impulse wheel upon the actuation of said shaft, a governor for regulating the speed of rotation of said shaft and a ball clutch interposed between said shaft and said governor for transmitting the rotational movement of said shaft in one direction to said governor.

2. In an impulse mechanism, a rotatable shaft, an impulse wheel secured to said shaft, impulse springs operated by said impulse wheel upon the actuation of said shaft in one direction, a governor for regulating the speed of rotation of said shaft and a clutch for transmitting the rotational movement of said shaft in one direction to said governor, said clutch comprising a driving member secured to said shaft, a driven member mechanically associated with said governor and means effective upon the rotation of the driving member in one direction only for frictionally coupling said driving member with said driven member.

3. In an impulse transmitter, a rotatable shaft, an impulse wheel secured to said shaft, impulse springs operated by said impulse wheel, a governor for regulating the speed of rotation of said shaft and a clutch for mechanically coupling said shaft with said governor, said clutch comprising frictionally cooperating parts effective in coupling said shaft with said governor when said shaft is rotated in one direction only.

4. In an impulse transmitter, a rotatable shaft, an impulse wheel secured to said shaft, impulse springs operated by said impulse wheel, a governor for regulating the speed of rotation of said shaft, and a clutch for transmitting the rotational movement of said shaft to said governor, said clutch comprising a driving member secured to said shaft, a driven member mechanically associated with said governor and provided with a race and means freely movable in said race when said shaft is rotated in one direction and adapted to be wedged between said driving and driven members when said shaft is rotated in another direction to frictionally couple said driving and driven members and transmit the rotational movement of said shaft to said governor when said shaft is rotated in said other direction only.

5. In an impulse transmitter, a rotatable drive shaft, an impulse wheel secured to said drive shaft, impulse springs actuated by said impulse wheel when said drive shaft is rotated, a governor for regulating the speed of rotation of said drive shaft, a second shaft, a gear mounted on one end of said second shaft for driving said governor, a second gear mounted on the other end of said second shaft, a ratchet wheel in mesh with said second gear, a driving member secured to said drive shaft, said driving member adapted to rotate with said drive shaft independently of said ratchet wheel when said drive shaft is rotated in one direction and means effective when said drive shaft is rotated in another direction for frictionally coupling said driving member with said ratchet wheel to transmit the rotational movement of said drive shaft to said governor through the media of said first and second gears.

6. In an impulse transmitter, a rotatable drive shaft, an impulse wheel secured to said drive shaft, impulse springs actuated by said impulse wheel when said drive shaft is rotated, a governor for regulating the speed of rotation of said drive shaft and a clutch, said clutch comprising a driving member secured to said drive shaft, a driven member mechanically associated with said governor, said driving and driven members cooperating to form a plurality of slots, a ball in each of said slots, said balls being freely rotatable in said slots when said shaft is rotated in one direction to permit a relative rotational movement between said driving and driven members and adapted to become wedged between said driving and driven members when said shaft is rotated in a reverse direction to effect a frictional engagement between said driving and driven members whereby said governor is actuated only when said drive shaft is rotated in a reverse direction.

7. In an impulse transmitter, a rotatable drive shaft, an impulse wheel secured to said drive shaft, a cam also secured to said drive shaft, an excentric cam, means for maintaining said excentric cam in frictional engagement with said first cam during a part of the rotational movement of said drive shaft, a pair of impulse springs normally in operative association with and adapted to be actuated by said impulse wheel, and means associated with said excentric cam and cooperating with said impulse springs for raising said impulse springs out of operative association with said impulse wheel during the rotation of said drive shaft in one direction.

8. In an impulse transmitter, a drive shaft rotatable in clockwise and counter-clockwise directions, an impulse wheel secured to said drive shaft, impulse springs, a stud secured to one of said springs and normally located in the line of travel of said impulse wheel to be actuated thereby, a cam secured to said drive shaft, an eccentric cam, a stud mounted on said eccentric cam and contiguously associated with said impulse springs, means for maintaining said eccentric cam in frictional

engagement with said first cam during a part of the clockwise rotation of said shaft to cause the stud on said eccentric cam to raise the stud on said impulse springs out of the line of travel of said impulse wheel, said first cam adapted to slide freely over said eccentric cam during the remainder of the clockwise rotation of said shaft, and means for re-effecting the frictional engagement of said eccentric cam with said first cam to cause the stud on said impulse springs to be replaced in the line of travel of said impulse wheel when said shaft is rotated in a counter-clockwise direction.

9. In an impulse transmitter, a drive shaft rotatable in clockwise and counter-clockwise directions, an impulse wheel secured to said drive shaft, impulse springs, means for actuating said springs, said means being normally in the line of travel of said impulse wheel and operable thereby, and means including a pair of friction cams for moving said spring actuating means out of the line of travel of said impulse wheel during the clockwise rotation of said shaft and restoring said spring actuating means to its normal position upon the counter-clockwise rotation of said shaft, whereupon said impulse springs are rendered inoperative during the clockwise rotation of said shaft and operative during the reverse rotation of said shaft.

10. In an impulse transmitter, a drive shaft rotatable in clockwise and counter-clockwise directions, an impulse wheel secured to said drive shaft, impulse springs, means for actuating said springs, said means being normally in the line of travel of said impulse wheel and operable thereby, and means including a pair of gears for moving said spring actuating means out of the line of travel of said impulse wheel during the clockwise rotation of said shaft and restoring said spring actuating means to its normal position upon the counter-clockwise rotation of said shaft, whereupon said impulse springs are rendered inoperative during the clockwise rotation of said shaft and inoperative for a portion of the counter-clockwise rotation at the start thereof.

In testimony whereof, I have signed my name to this specification this 24th day of August, 1931.

WILLIAM A. RHODES.