Feb. 5, 1946.　　J. E. BOSH　　2,394,360

CALLING DEVICE

Filed Nov. 28, 1941　　2 Sheets-Sheet 1

Fig.1

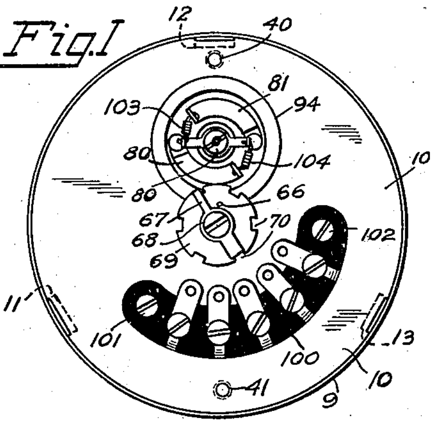


Fig.2.

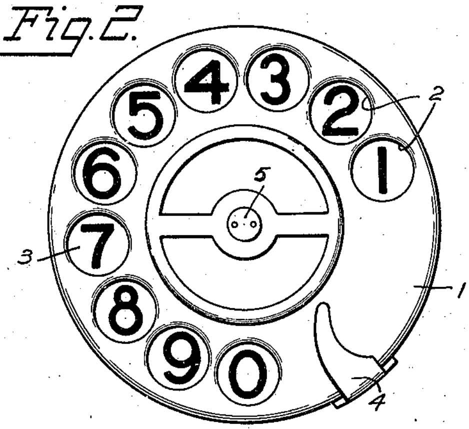


Fig.3

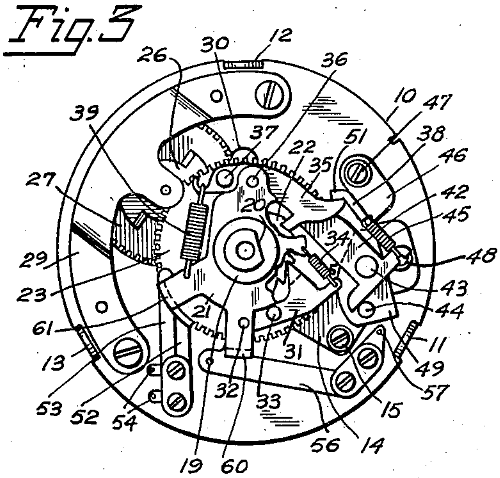


Fig.4

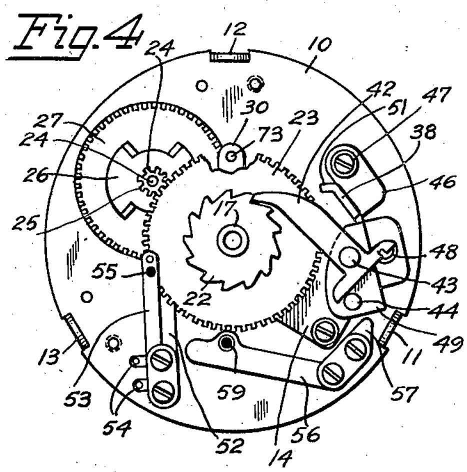


Fig.5

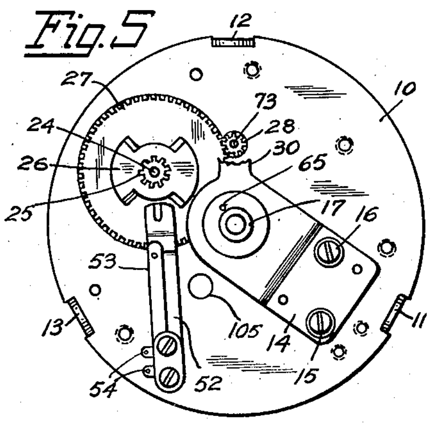
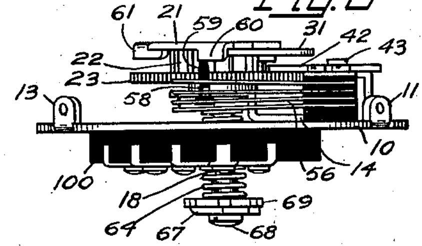


Fig.6



Inventor:

James E. Bosh

By C. P. Sofer

Atty.

Feb. 5, 1946. J. E. BOSH 2,394,360

CALLING DEVICE

Filed Nov. 28, 1941 2 Sheets-Sheet 2

Fig. 7

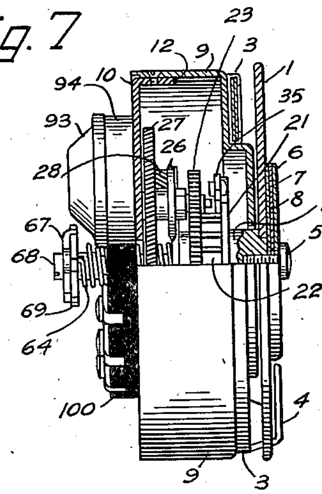


Fig. 8

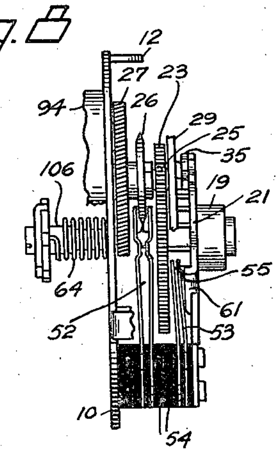


Fig. 9

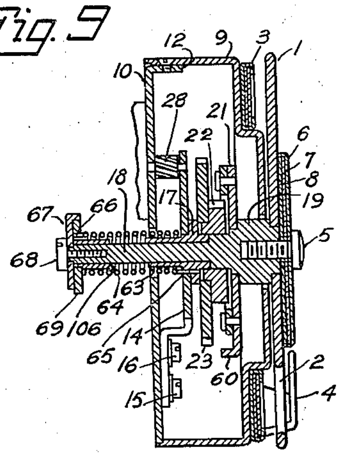


Fig. 10

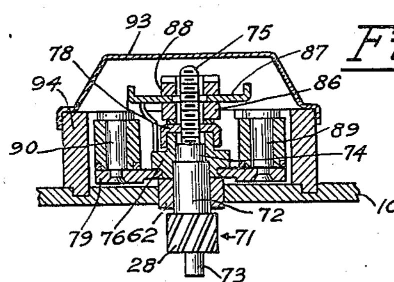
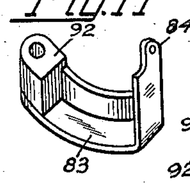


Fig. 11



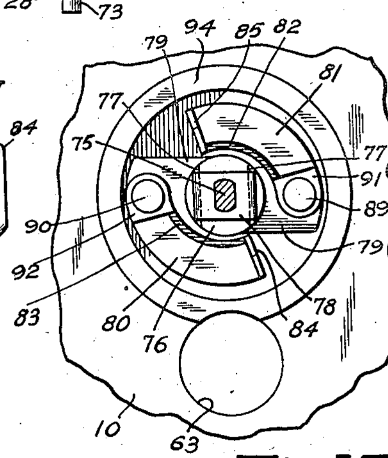
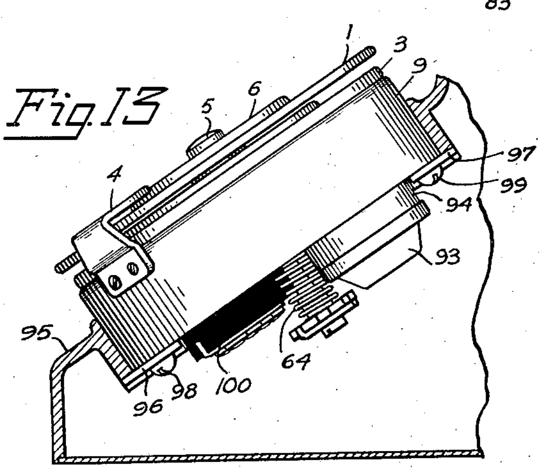


Fig. 12

Fig. 13



Inventor:
James E. Bosh
By C. P. Sofer
Atty.

Patented Feb. 5, 1946

2,394,360

UNITED STATES PATENT OFFICE

2,394,360

CALLING DEVICE

James E. Bosh, Berwyn, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill., a corporation of Illinois

Application November 28, 1941, Serial No. 420,871

2 Claims. (Cl. 179—90)

This invention relates to calling devices of the dial type commonly used in automatic telephone systems to transmit trains of impulses corresponding respectively to the digits in desired telephone numbers, and for similar purposes in signaling systems generally.

One object of the invention is to produce a new and improved dial-type calling device capable of withstanding prolonged hard usage without losing its adjustment.

A further object is to produce a calling device which is quiet in operation and in which the parts are sturdily constructed to insure long life.

A general feature of the improved calling device is that the relatively delicate contact springs and the governor parts are fully enclosed to protect them against inadvertent bending, jamming, or fouling incidental to the transportation and installation of the calling device, and incidental to the repair or maintenance of the telephone substation set or other equipment in association with which the calling device may be installed.

A specific feature is that the case or housing of the calling device is in the form of an inverted cup closed by a rear plate, upon the inside surface of which are mounted the principal moving parts of the calling device, as well as the various assemblies of contact springs, all of which are thus within the case and are thereby protected against unintentional interference.

A further specific feature is that the otherwise exposed parts of the governor, mounted on the rear of the above-mentioned back plate, are protected from accidental interference and from foreign particles by being provided with an individual enclosure or housing.

Another feature is that each of the pawls is provided with a non-metallic stop which avoids noisy metallic clicks otherwise occurring during operation of the calling device.

Other objects and features of the invention will appear as the description progresses.

Referring now to the accompanying drawings, comprising Figs. 1 to 13, they show sufficient views of a calling device constructed in accordance with the features of the invention to enable the invention to be understood:

Fig. 1 is a rear view of the improved calling device, with the protecting cover removed from the governor;

Fig. 2 is a front view of the calling device;

Fig. 3 is a front view with the dial and the housing cup removed, showing the parts lying in front of the back plate 10;

Fig. 4 is a further front view with the drive plate 21 and attached parts removed to afford a view of the parts lying underneath;

Fig. 5 is a still further front view with additional parts removed;

Fig. 6 is a view of the device as seen edgewise from below, with the dial and housing cup removed, along with certain other parts;

Fig. 7 is a view, partly in section, as seen from the left in Fig. 2;

Fig. 8 is a view as seen from the left in Fig. 2, with the dial and housing cup removed and with certain parts broken away;

Fig. 9 is a sectional view as seen from the left in Fig. 2, showing the principal structural parts;

Figs. 10, 11, and 12 are enlarged views of portions of the improved governor mechanism; and

Fig. 13 is a left side view of the improved calling device installed in a telephone desk stand 95, fragmentarily shown in section.

As shown in Fig. 2, the control portion of the calling device is the dial 1, which is provided with ten finger holes 2 beneath which lies the numeral ring 3, having the illustrated numerals 1 to 9 and 0 thereon. The dial 1 may be rotated in a clockwise direction by placing a finger in the desired one of the finger holes 2 and pulling the dial around until the finger encounters the finger stop 4. When released, the dial 1 proceeds under stored spring power to the normal position illustrated, generating on its return movement a number of impulses depending upon which finger hole was used for the operation.

As seen in Figs. 7 and 9, the dial 1 is mounted on the front or hub portion 19 of the main shaft 18, and held there by the retaining screw 5. Screw 5 also retains card holder 6, along with transparent card protector 7 and instruction card 8.

The back plate 10, shown in profile in Fig. 1, is fitted flush into the rearmost portion of the cup-like housing 9, as shown best in Figs. 7 and 9. The back plate is provided with three attachment lugs 11, 12, and 13, indicated in dotted outline in Fig. 1 and shown in Figs. 3 to 5. Each of these lugs may be attached to the casing 9 by a countersunk screw, as indicated in Figs. 7 and 9.

As shown best in Figs. 5 and 9, a centrally located main bearing 17 is firmly mounted in main-bearing bracket 14. The main-bearing bracket 14 is secured to the front of back plate 10 by screws 15 and 16. The main-drive assembly, consisting of the main-drive gear 23 (Figs. 3, 4, and 9) attached to ratchet wheel 22, has a central opening enabling it to receive the upper or forward end of the main bearing 17. The main shaft 18 has a reduced portion which passes through the central opening in the main bearing 17 to a stop against the shoulder abutting the end of the main bearing. The enlarged main-shaft portion following the shoulder assists in aligning the drive assembly comprising parts 22 and 23.

The drive plate 21 (Figs. 3 and 9) is attached securely to the hub 19 of the main drive shaft 18 to enable the turning and stopping of the main drive gear **23** to be controlled from the main drive shaft **18** through action on ratchet wheel **22**, rigidly attached to drive gear **23**.

The forward end of the hub portion **19** has a flat part **20** thereon as seen in Fig. 3, enabling the dial **1** to be locked or keyed to the main shaft by being provided with a central opening of corresponding non-circular shape.

The driving of the ratchet wheel **22**, to thereby rotate the main drive gear **23**, on the return or counter-clockwise movement of the dial **1**, is accomplished by drive pawl **31** (Fig. 3) pivoted to the drive plate **21** at **32**, and urged inwardly toward ratchet wheel **22** by coil spring **34**. Pawl **42**, secured to portion **49** of bracket **46** at pivot **43**, is provided to prevent forward or clockwise movement of the drive assembly when the dial **1** is being turned in a forward or clockwise direction toward the finger stop **4**. For this purpose, the pawl **42** is provided with a coil spring **45** (Fig. 3) urging the free end of the pawl into association with the teeth of ratchet wheel **22**.

Brake pawl **35**, pivoted at **36** on the drive plate **21**, is provided to enable the return motion of the dial **1** and attached parts, together with the main drive gear **23** and attached ratchet wheel **22**, to be stopped definitely when the returning dial reaches its illustrated normal position. The brake pawl has an inner or heel portion which contacts the rear face of one of the teeth of ratchet wheel **22** to stop the movement of the latter. This engagement is brought about during the return movement of the mechanism when the outer or cam portion of pawl **35** engages the inwardly inclined cam portion **38** of the compound bracket **46**, secured to back plate **10** by screws **47** and **48**. The return movement is abruptly terminated when the outer portion of brake pawl **35** contacts the steeply inclined stop portion **51** of bracket **46**.

The main drive gear **23**, when rotated, turns the impulse pinion **25**, attached to impulse shaft **24** (Figs. 4, 5, 7, and 8). Shaft **24** carries the impulse cam **26** and the governor-drive gear **27**, being pivoted at one end in the back plate **10** and at the other end in the impulse-shaft bracket **29** (Figs. 3 and 8). The impulse cam **26** normally stands in a position as illustrated in Figs. 2 to 5, with respect to the impulse contact springs **52** controlled thereby. The free end of the pair of contact springs **52** (seen in edge view in Fig. 8) is normally opposite one of the two cut-away portions of the cam **26**. The impulse contacts **52** can thus be momentarily separated by either lobe of the cam **26** by half a rotation of the impulse-cam shaft.

The shunt springs **53**, seen in edge view in Fig. 8, are mounted in the same stackup or assembly with the impulse springs **52**. The impulse springs and shunt springs may be connected in multiple with each other by suitable wiring or strapping between the terminals **54**. The purpose of shunt springs **53** is to enable the last impulse of a train generated at springs **52** to be rendered ineffective by shunting the springs **52** under the control of shunt cam **61**, affixed to the drive plate **21**. Shunt springs **53** are normally maintained in contact with each other by pressure of cam portion **61** (Figs. 3 and 8) on insulating stud **55** (Figs. 4 and 8) affixed to the outer of the two springs **53**.

As shown in Figs. 3, 4, and 6, a stackup **56** of off-normal springs is provided. A stud **58** (Fig. 6) is affixed to one of the off-normal springs, and an insulating portion **59** is fastened to the stud **58**. This insulating portion **59** is controlled by off-normal cam **60**, affixed to the drive plate **21**, to enable the off-normal contact springs **56** to shift their position when the dial is moved from its normal position.

As shown best in Fig. 9 (see also Figs. 6 to 8, and 13), the main spring **64** furnishes the motive power for returning the dial and related mechanism to normal position pursuant to the generation of a desired train of impulses during the return movement. This main spring **64** surrounds the portion of drive shaft **18** to the rear of the main-bearing bracket **14**, as well as surrounding a portion of the main bearing **17**. At the opposite end, the spring **64** surrounds the inwardly extending thimble or guide portion **106** of adjustment washer **69**. At its forward end, the spring **64** is attached to the main-bearing bracket **14** at **65** (Figs. 5 and 9), while the other end of spring **64** is attached to the adjustment washer **69** at **66** (Figs. 1 and 9).

Adjustment washer **69** is retained against rotation relative to shaft **18** by adjustment arm **67**, whose forwardly turned end portion normally rests in one of the notches **70** (Fig. 1) provided around the periphery of washer **69**. Arm **67** is held firmly in place on the rear end of shaft **18** by screw **68**. The spring **64** is preferably under slight longitudinal compression, whereby it tends to urge shaft **18** rearwardly and to hold adjustment washer **69** against bracket **67**.

When the rotational tension of spring **64** is to be adjusted, the washer **69** may be pushed forwardly along the shaft **18** to bring the notches **70** free of the forwardly turned end portion of arm **67**, whereupon the washer **69** may be rotated in either direction the desired amount to impart the desired restoring tension to spring **64**. The new position of washer **69** is retained by locking the concerned notch **70** over the end of arm **67**.

It is to be noted that the central opening **63** through the back plate **10** is large enough to permit the spring **64** to pass through this opening and be attached to the bracket **14** as described. By this arrangement the spring is enabled to be longer than it would be if required to be attached to the rear face of the back plate **10**, whereby less variation in spring tension occurs between the beginning and end of the return movement of the dial.

The speed of the return movement of the mechanism is limited by a governor shown at **94** (in Fig. 7 for example) protected by the pressed sheet-metal cover **93**. This governor is of the magnetic-weight type, being an improvement on the governor shown in the pending application of George R. Eaton, Serial No. 374,432, filed January 15, 1941.

The governor includes a shaft indicated generally at **71** in the enlarged cross-sectional view (Fig. 10). Portion **72** of this shaft is journaled in the bearing member **62**, secured in an opening through the back plate **10**, while portion **73** is journaled in extension **30** (Figs. 3 to 5) of main bracket **14**. Governor shaft **71** is driven by pinion **28** from governor drive wheel **27**, affixed to impulse-cam shaft **24**.

The rotating system of the governor includes a pair of magnet weights **80** and **81** (Figs. 1 and 12). These weights cooperate with the friction ring **94**, affixed to the back plate **10** as indicated in Fig. 10. Friction ring **94** is preferably of soft iron or other similar highly permeable, magnetically soft material.

The rotating assembly of the governor includes the hub portion 76 (Fig. 10), which has a central opening receiving the reduced-diameter portion 74 of the shaft 71. Hub portion 76 is provided with a pair of cut-away or flat portions 77 (Fig. 12) with which the downwardly turned ends of torque arm 78 make contact to prevent relative rotation of parts 76 and 78. Relative rotation of part 78 and the threaded shaft portion 75 is prevented by the non-circular contour of the shaft portion 75 as shown in Fig. 12; coupled with the corresponding contour of the opening through part 78. The governor shaft is thus effectively keyed, through part 78, to the hub 76.

The weight arm 79 is rigidly secured to hub 76 and is provided with pivot pins 89 and 90 for the two weights.

The above-mentioned parts of the rotating system are held in assembled relation by nut 86, the assembly being drawn tight against the shoulder at the junction of shaft portions 72 and 74. The spring-adjustment arm 87 (Figs. 1 and 10) is adjustably held in from turning around the shaft portion 75 by the retaining nut 88.

The magnetic weight portions 80 and 81 (Figs. 1 and 12) are preferably cast of a magnetically hard alloy of high coercivity, in order that small weights shall have a relatively great magnetic attraction. This magnetically hard material, however (such as the well known aluminum-nickel-cobalt alloy with steel), is very nearly completely unmachineable because of its extreme mechanical hardness. This material, therefore, must be cast in simple shapes and attached by some means other than by drilled holes. For this reason, the saddle arrangement indicated clearly in Fig. 11 is provided. In this arrangement, the saddle portion 83 may be formed of sheet metal, for example; and the block bearing portion 92 (of common rolled stock) may be soldered, brazed or otherwise secured to the portion 83. Bearing portion 92 has the illustrated bearing hole therethrough for bearing pin 90. The construction of the opposite weight saddle is similar. The precast magnetic weights 81 and 80 are laid into the saddle portions 82 and 83 and secured in place as by soldering. The portions 84 and 85 are attachment points for governor springs 103 and 104, shown best in Fig. 1. The other ends of these springs are attached to the ends of the adjustment arm 87.

The tension of both governor springs 103 and 104 can be conveniently adjusted at the same time by slightly loosening the adjustment nut 88 and turning the adjustment arm 87 to a desired new location, in which new location the arm is held by retightening nut 88.

In the operation of the governor, the springs 103 and 104 hold the retarding weights 80 and 81 out of contact with the magnetic ring 94 until the speed of the movement reaches the value for which the springs 103 and 104 are adjusted. At this point the centrifugal action causes the weights 80 and 81 to come sufficiently near the magnetic ring 94 that the magnetic attraction of the weights 80 and 81 draws them into firm engagement with the ring, thus effectively braking the velocity. The peak velocity is thus critical and largely independent of the amount of force being applied to urge the mechanism to greater speed, because the "grabbing" effect of the magnetized weights introduces a large braking effect at the critical velocity.

The opening 105 (Figs. 1 and 5) through the back plate 10 enables wires connected to terminals 54 of the spring combinations 52 and 53, and to terminals 57 of the off-normal springs 56, to be brought through the opening 105 and connected (as by soldering) to the terminals extending inwardly from the arcuate terminal block 100, seen best in Fig. 1.

Referring to Fig. 13, the device 95 may be a telephone desk stand provided with the usual opening therein for receiving the rear portion of the calling device. This opening ends in an inwardly turned ledge as indicated, which stops the inward movement of the calling device. The mounting strips 96 and 97 lie in grooves in this ledge and are held to the rear plate of the calling device by retaining screws 98 and 99.

As is apparent from the foregoing description in connection with the drawings, the principal moving parts of the calling device and the parts likely to be disturbed in their state of adjustment by inadvertent contact made during transportation, handling, and installation of the calling device, or during repair of the equipment with which it may be installed, are enclosed within the housing cup 9 by the back plate 10. The two portions of the calling device sometimes requiring routine adjustment, such as to compensate for wear or for climatic variations, are exposed on the rear of the device behind the back plate 10. These are the main driving springs 64 and the governor included within ring 94. The main driving spring may be adjusted as previously pointed out by depressing and turning the notched adjusting washer 69. This spring is sufficiently rugged in its construction that no special protection thereof is deemed to be necessary. The governor, however, is provided with the cover 93 shown in place in Figs. 7, 10, and 13, protecting the governor against inadvertent interference. This cover 93 may be removed when desired, to permit the hereinbefore described adjustment of the governor to be made.

Operation

The operation of the calling device to transmit a train of impulses will now be described. For this purpose, it may be assumed that a train of impulses corresponding to the digit 8, and consisting of eight momentary interruptions, is to be transmitted. For this purpose, the operator may place a finger in the finger hole of the dial 1 above the digit 8 on the numeral ring 3, followed by a rotation of the dial in a clockwise direction until the finger strikes the finger stop 4. The finger is then removed from the dial, allowing the dial to return to normal position under the propulsion of the main spring 64.

As the dial 1 is brought forward, in a clockwise direction, the main shaft 18 is thereby turned against the tension of the main spring 64. The turning of the hub portion 19 of the main shaft turns the drive plate 21. The turning at this time of driving wheel 23 and ratchet wheel 22 is prevented by pawl 42 (Fig. 4).

The drive pawl 31, secured to drive plate 21 at pivot 32, rides over nine teeth of ratchet wheel 22 during the forward movement of the dial, one tooth more than the digit value of the dial operation. Each time pawl 31 passes over a tooth, spring 34 brings the pawl sharply toward the ratchet wheel 22, but metallic clicking in this operation is prevented by the non-metallic stop pin 33 which engages the periphery of the drive plate soon enough to prevent the point of ratchet 31 from clicking or snapping against the ratchet wheel.

During the forward movement of the dial, drive plate 21 also carries the brake pawl 35 in a counter-clockwise direction. The pressure normally imparted to pawl 35 by cam surfaces 38 and 51 to hold the pawl tightly against the inclined face of one of the teeth of ratchet wheel 22 is thereby relieved, and the pawl moves outwardly sufficiently to clear the teeth of the ratchet wheel.

Upon the initiation of the forward movement, and before the drive pawl 31 has passed over the first tooth on ratchet wheel 22, the off-normal cam-portion 60 (Figs. 3 and 6) of drive plate 21 disengages the insulating stud 59, permitting the off-normal springs 56 to shift, to thereby set up the usual altered circuit conditions conducive to effective impulse transmission.

Also upon initiation of the forward movement, the elongated cam portion 61 of drive plate 21 (Figs. 3, 6, and 8) begins to move over the surface of insulating bushing 55 attached to the uppermost spring of the shunt pair 53. The contact between cam portion 61 and stud 55, however, is prolonged until after the ratchet 31 has passed over the first tooth of the ratchet wheel 22. This contact, however, is broken before the pawl 31 passes over the second tooth, whereupon the springs 53 (seen in edge view in Fig. 8) separate, thereby taking the shunt off the impulse springs 52, the springs 52 and 53 being intended to be connected in multiple as previously brought out.

When the dial 1 is released (after pawl 31, Fig. 3, has passed over nine teeth of ratchet wheel 22), the inner portion of pawl 31 engages the rear face of the ninth tooth passed over. Therefore, during the return movement of the dial 1 and attached main shaft under the propulsion of main spring 64, the ratchet wheel 22 and attached main drive gear 23 are rotated in a counter-clockwise direction through an angular distance corresponding to nine teeth on ratchet wheel 22. The velocity of the return movement is controlled by the governor, illustrated in cross-section in Fig. 10, whose drive pinion 28 is rotated by governor drive gear 27 on impulse-cam shaft 24. The impulse-cam shaft in turn is driven by the attached pinion 25, through the motion of the main drive gear 23.

The impulse-cam shaft 24 makes a half revolution for each movement of the gear wheel 23 equal to the space of one tooth on ratchet wheel 22. Since the main drive gear is rotated an angular distance equal to nine teeth on the ratchet wheel 22, on the return movement, four and one-half revolutions of the impulse-cam shaft 24 occur. A lobe of cam disc 26 passes between the impulse springs 53 and momentarily separates them during each half revolution of the impulse cam shaft. The impulse springs 52 are thus momentarily separated nine times on the return movement of the calling device. Ordinarily, speed of the return movement is so regulated that the impulses are generated at the rate of about ten per second.

The first eight separations of the impulse contacts 52 are effective, but the ninth and final separation of the springs 52 is rendered ineffective by shunt springs 53, which are reclosed following the eighth separation, when the cam portion 61 again contacts insulating stud 55 (Figs. 4 and 8) to again bring shunt springs 53 into contact.

During the return movement, when the ratchet wheel 22 and related parts are being driven in a counter-clockwise direction, teeth of the ratchet wheel 22 successively pass under pawl 42 (Figs. 3 and 4), causing this pawl to be successively raised against the tension of spring 45 and lowered into the next succeeding notch in the ratchet wheel. Mechanical clicking is prevented during this operation by the non-metallic stop 44 which prevents the free end of pawl 42 from striking the next succeeding tooth when dropping over the rear face of the tooth passing under it.

As the dial (together with its attached parts, including drive plate 21) approaches normal position, the outer part of brake pawl 35 (Fig. 3) engages the cam portion 38 of bracket 46 and is turned in a clockwise direction about pivot 36 against the tension of spring 39 to bring the free end of the pawl radially inward. As the return motion continues, the brake pawl is brought closer and closer to the rear face of the currently underlying tooth of ratchet wheel 22 (the ratchet wheel and the drive plate are traveling together at this time) until the tooth is engaged or nearly engaged. When the normal position is reached, the outer portion of brake pawl 35 is forced abruptly inwardly by cam portion 51 to jam it against the last-mentioned tooth of ratchet wheel 22, thereby stopping the forward motion of ratchet wheel 22 and of drive plate 21. The motion of all parts of the calling device is thereby arrested.

I claim:

1. In a dial-controlled impulse sender, an enclosing case containing dial-controlled mechanism for controlling the generation of series of impulses, a central shaft within said case extending through an opening in the front of the case and through an opening in the rear thereof, said shaft being journaled in a bearing within said case, said shaft having a normal position from which it is rotatable by said dial when the dial is turned, said mechanism being controlled by said shaft during its return to normal position for causing a train of impulses to be generated, a main spring for returning said shaft to normal position, said main spring surrounding the rear portion of said shaft from a point outside of said case to a point lying within said case, the inner end of said spring extending through said opening in the rear of the case and being attached to a part affixed to the case, while the outer end of said spring is adjustably attached to said shaft.

2. In a dial-controlled calling device, a dial rotatable a variable angular distance in one direction from a normal position to prepare for the generation of a train of impulses on its return movement, means including a pivoted pawl and a ratchet wheel to permit the forward movement of the dial to occur without a corresponding movement of the impulse generating mechanism, and means for preventing mechanical clicking of the pawl on said ratchet wheel during the forward movement of the dial, said means including a rigid non-metallic stop device so located as to stop the pivoting movement of the pawl toward the ratchet wheel before it has engaged the ratchet wheel after having slipped over a tooth thereof, said stop device being located a distance from the pivot of the pawl which is substantially less than the length of the pawl, whereby the tendency of the pawl to produce a clicking noise when stopped is lessened by the reduced velocity of the part with which the stopping engagement is made.

JAMES E. BOSH.