

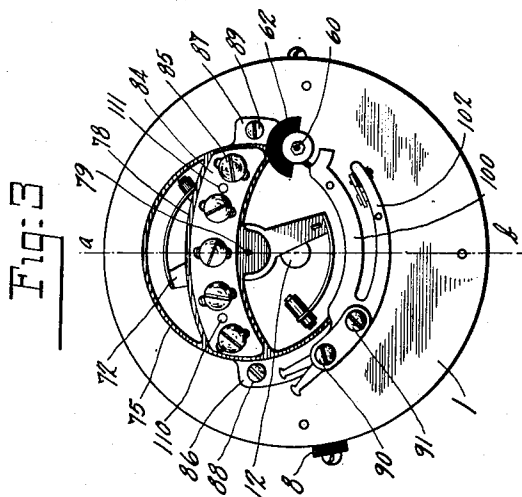
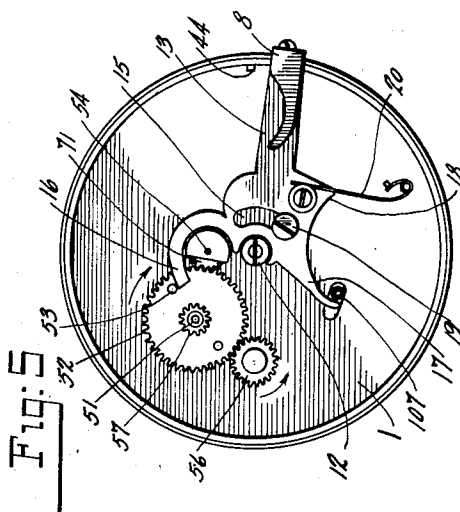
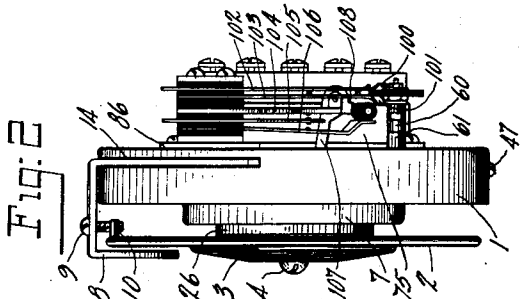
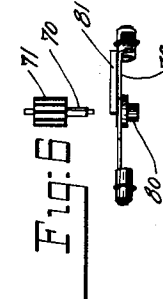
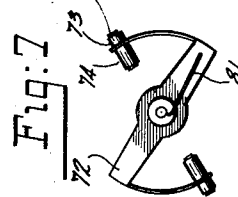
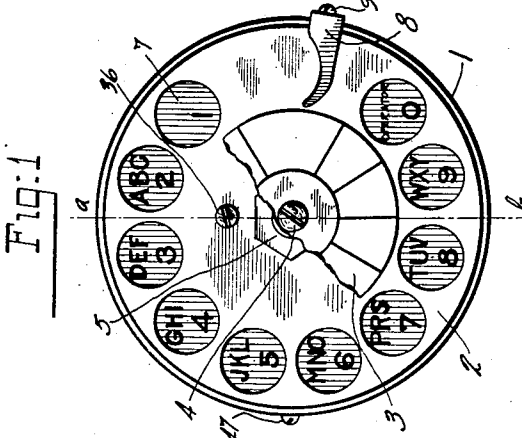
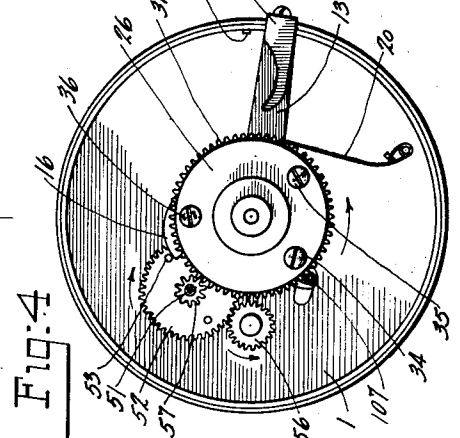
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J. G. BLESSING

AUTOMATIC IMPULSE TRANSMITTER

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—Inventor—
John G. Blessing
Chas. W. Condy. Att'y:

UNITED STATES PATENT OFFICE.

JOHN G. BLESSING, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
AUTOMATIC ELECTRIC INC., OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

AUTOMATIC IMPULSE TRANSMITTER.

Substitute for application Serial No. 525,639, filed December 29, 1921. This application filed May 13, 1922, Serial No. 560,574. Renewed May 10, 1926.

The present invention relates in general to automatic impulse transmitters, or calling devices, of the type now in common use in automatic telephone systems; and the object of the invention is to produce an improved mechanism of this character embodying a number of novel features tending to increase its efficiency and enhance its usefulness in practice.

The invention is illustrated in the accompanying drawings, comprising Figs. 1 to 19, inclusive, which are briefly described below:

Fig. 1 is a front view of the calling device with a part of the dial escutcheon plate cut away to show the means for securing the dial in place.

Fig. 2 is a side view showing the calling device of Fig. 1 rotated through an angle of 90° about the line *a-b*, and 90° about a perpendicular line passing through the center.

Fig. 3 is a rear view of the calling device, obtained by rotating Fig. 1 through an angle of 180° about the line *a-b*.

Fig. 4 is a front view with the dial and number plate removed.

Fig. 5 is similar to Fig. 4, except that the main spring assembly is removed to show the construction of the movable finger stop.

Figs. 6 and 7 show the construction of the governor.

Figs. 8 and 9 are front and side views, respectively, of the number plate and supporting ring, while Figs. 10 and 11 are detail views showing how the number plate is prevented from rotating in the ring.

Figs. 12 and 13 are detail views of the impulse cam shaft assembly, Fig. 12 being an enlarged top view of the knurled nut 64 of Fig. 13.

Fig. 14 is a sectional view of the main spring assembly with the parts separated.

Figs. 15 to 18, inclusive, are views showing further details of the spring assembly. Figs. 15 and 16 show how the main spring is utilized to retain the casing in position on the main shaft, while Figs. 17 and 18 show the ratchet connection between the main spring casing and the main gear wheel.

Fig. 19 is a circuit diagram showing how the calling device is connected up in a substation telephone circuit.

The construction and operation of the calling device will now be described.

The casing 1 is made from a sheet metal stamping cold drawn to form a shallow cup with straight sides, as shown in Figs. 1 to 5, inclusive. This casing contains the main spring assembly, shown in detail in Figs. 14 to 18, inclusive, the gears for driving the impulse cam shaft and the governor, which may be seen in Figs. 4 and 5, and the movable finger stop, shown clearly in Fig. 5. The casing is closed in front by the number plate 7, Fig. 8, in front of which is the finger hole dial 2, Figs. 1 and 2. On the back of the casing is the governor and impulse cam, together with the governor ring which carries also the impulse and shunt spring assembly, all of which may be seen in Figs. 2 and 3.

The center of the casing is drilled to receive the center post or main shaft 12 which is rigidly secured to the casing 1 by riveting, or in any other suitable manner. This main shaft is shown in detail in Fig. 16. Lying at the bottom of the casing and pivoted on the main shaft is the movable finger stop 8, which comprises the exterior portion seen in Figs. 1 and 2 and an interior portion 13, Fig. 5, which operates in the slot 14, Fig. 2, which is cut in the casing for this purpose. The shape of the finger stop is clearly shown in Figs. 2 and 5. As stated, it is pivoted in the main shaft 12 and is held in place by the screw 19 which lies in the slot 15. The screw 19 has a round shoulder just below the head which fits loosely in the slot. The function of the fingers or cams 16, 17, and 18 will be pointed out later on.

The main spring assembly, which is a complete unit by itself, goes on the main shaft on top of the finger stop, as is seen in Fig. 4. In Figs. 14 to 18, inclusive, the details of the main spring assembly are shown. This unit comprises the spring casing 22, which contains the main spring 25, together with the cover plate 26 and the main gear wheel 31. The cover plate is secured to the spring casing by means of screws 34, 35 and 36, as seen in Fig. 4. The casing 22 has a hub 23 which carries the main gear wheel 31, the latter being rotatable on the hub in one direction only due to the ratchet mechanism shown in Figs. 17 and 18. This mechanism comprises a spring pressed detent or pawl 37, pivoted on the casing, which engages with the ratchet wheel 33, which latter

is integral with the gear wheel 31. The main gear wheel 31 is held in place on the hub of the spring casing by the split ring 32 which fits in the annular groove 24.

5 In assembling the calling device the main spring assembly, minus the cover plate, is placed on the shaft 12 with the spring 25 uppermost. One end of the spring is of course attached to the casing 22, and the
10 other end is bent at right angles to permit it to enter a transverse slot cut in the end of the main shaft. With the casing and spring in place on the shaft the latter is adjacent to the recess 38 in the shaft, where-
15 upon the spring is pressed by hand or a suitable tool in a direction perpendicular to the shaft to cause the spring to enter the recess. This construction, which will be fully understood from Figs. 15 and 16,
20 serves to securely retain the spring assembly in place on the shaft. The cover plate 26 may now be placed on the casing, to which it is secured by screws 34, 35, and 36, as before mentioned.

25 The number plate and retaining ring may conveniently be explained next, as they are placed in position next after the main spring unit. Referring particularly to Figs. 8 to 11, inclusive, the number plate 7 is preferably
30 made of enameled copper and has an inner upwardly extending ring, seen in Fig. 9, around which the letters and numerals appear in a row as shown in Fig. 8. The retaining ring 40 has an annular raised bead
35 41 formed integrally with the ring, which construction produces an inner groove for holding the number plate. The number plate is prevented from rotating in the ring by means of a small piece of metal
40 42, Fig. 11, sweated or soldered in place in the groove, which engages the recess 43, Fig. 10, in the edge of the number plate. On the inside of the casing there is a projection
45 44, Figs. 4 and 5, and the retaining ring must therefore be assembled in the calling device casing so that the opening registers with this projection. The ring is then rotated a few degrees to cause the projection
50 to enter the slot 45, which holds the ring in place at this point. Cooperating with the projection 44 is a screw 47, Fig. 2, which passes through a threaded hole in the casing 1 and registers with the hole 48 on the other
55 side of the ring.

The finger hole dial 2, Figs. 1 and 2, has a central hole slightly larger than the threaded portion 28 of the main spring assembly cover plate 26, but which makes a
60 snug fit with the slightly enlarged portion 27. The dial is held in place by the nut 5, Fig. 1. Slipping of the dial on the cover plate is prevented by the raised head of the cover plate screw 36, which enters a hole
65 in the dial. The escutcheon plate 3 is held

in place by the screw 4, which enters the threaded hole 50 Fig. 14, in the cover plate.

The impulse transmitting mechanism will next be considered. The main gear wheel 31, Fig. 4, drives the pinion 57, which is
70 rigidly attached to gear wheel 52, which latter drives the impulse cam shaft pinion 56. The gear wheel 52 and pinion 57 are rotatable on a shaft 51, the lower end of which is riveted to the casing 1. The im-
75 pulse cam shaft assembly, details of which are shown in Figs. 12 and 13, comprises the shaft 60, at one end of which the pinion 56 is rigidly secured, and the fibre cam 62, to-
80 gether with suitable nuts and washers for holding the parts in place. The shaft is rotatable in the hollow stud 61 which is securely fixed to the casing 1 in the position shown in Fig. 2, by riveting or other suit-
85 able means. Endwise movement of the shaft is prevented by the small washer 63 which is held in place against the upper shoulder on the shaft by nut 64. The cam
90 62 fits over the end of the shaft on top of nut 64 and is held in place by washer 65 and nut 66. It is to be noted that independent rotation, or slipping of the fibre cam is pre-
95 vented by the knurled upper surface of the nut 64, an enlarged view of which is seen in Fig. 12. This method of securing the cam facilitates the angular adjustment thereof,
100 which is accomplished by merely loosening nut 66 and turning the cam, while at the same time it serves to hold the cam rigidly in place after it is adjusted.

The gear ratio may now be briefly explained, and it should first be observed that the finger holes in the dial are 30° apart, as are also the teeth of the ratchet wheel 33. Thus there are 12 ratchet teeth. Now the
105 main gear wheel 31 has 60 teeth and the pinion 57 has 10 teeth so if the main gear wheel is advanced in angular distance corresponding to one ratchet tooth the pinion 57 and gear wheel 52 will be advanced just
110 one half of a complete rotation. Furthermore, the gear wheel 52 has 40 teeth and the pinion 56 has 20 teeth, from which it will appear that the impulse cam shaft will make
115 a complete rotation for every half rotation of the gear wheel. It will be seen, then, that an angular advance of the main gear wheel a distance corresponding to one ratchet
120 tooth will cause exactly one complete rotation of the impulse cam. It is of course not essential that the gear wheels and pinions have the exact number of teeth specified so long as the proper ratio is preserved.

The speed regulating means or governing mechanism is mounted on the back of the casing 1, and comprises the ring 75 and the governor which is shown in detail in
125 Figs. 6 and 7. The shaft 70, Fig. 6, has affixed to it the pinion 71, which is engaged by the gear wheel 52, and has its lower bear-
130

ing in an offset portion of the casing at 54, while its upper bearing is at 79 in the bridge 78. The governor proper consists of a cross piece 72 of light springy material attached to a bearing 80 which is rotatable on the shaft 70. A spring detent 81 engages the teeth of pinion 71, and serves to drive the governor with the pinion when the latter is rotated while permitting the governor to continue moving after the pinion has stopped. The cross piece 72 has two curved arms with weights at the ends for engaging the inner surface of the ring 75. These weights are constructed in a simple manner. Referring particularly to Fig. 7, the rivet 73 has a hollow head portion which contains the leather plug 76 for frictionally engaging the ring 78. The shank of the rivet is passed through a hole in the curved spring arm, after which the cylindrical member 74 is slipped on and is held securely in place by upsetting the end of the rivet.

The governor ring 75 is provided with the two oppositely extending members 86 and 87 which are attached to the back of the casing by means of screws 88 and 89. The member 86 serves to support the impulse and shunt spring assembly, these springs being clamped to the said member 86 by means of screws 90 and 91. Springs 100 and 101 are the impulse springs, and are controlled by the impulse cam 62. There are two sets of shunt springs. One set, comprising springs 102 and 103, is for shunting the impulse springs 100 and 101 during the last two rotations of the impulse cam in calling any digit. The other set of shunt springs, comprising springs 104, 105, and 106, is for shunting the receiver and transmitter according to well known practice. It should be noted that impulse spring 100 and shunt spring 102 are in one piece, the same being true of springs 101 and 103. Both sets of shunt springs are controlled by the finger stop through the medium of bell crank lever 107, which is pivoted on the shunt spring 104 as shown clearly in Fig. 2. Spring 104 is made of heavy stiff stock. Lever 107 carries a bushing 108 which engages spring 106 in normal position and spring 102 in operated position.

The fibre terminal block 84 is also supported on the governor ring 75, and is secured to the bridge 78 by screws 110 and 111. As many binding posts 85 are provided as may be needed and grooves are cut in the sides of the terminal block to carry the wires connecting the binding posts with the impulse and shunt springs.

The operation of the calling device may now be explained. In order to tension the main spring the screw 9, Fig. 2, must be removed from the finger stop, which latter is retained in normal position by hand against the tension of spring 20, Fig. 5. The dial 2

is now given three or four complete rotations in a clockwise direction to wind up the spring 25. With tension stored in the spring when the dial is released the spring will tend to drive the main gear wheel 31 in a counter clockwise direction, but movement of the gear train is prevented by the engagement of pin 53 on gear wheel 52 with the arm 16 of the finger stop. It will be observed that there are two of these pins 53, 180° apart, corresponding to the two normal positions of gear wheel 52. The main spring being sufficiently tensioned, the screw 9 is replaced in the finger stop and the latter is released. If the dial happens to be in the position of Fig. 2 nothing will happen, but if the dial is in an off normal position, the finger stop will be immediately rotated by spring 20 to the other side of slot 14. By this operation arm 16 is withdrawn from in front of pin 53 and the gear train is released. In returning to normal the dial picks up the finger stop and returns it also, the pin 10 engaging the screw 9 for this purpose. As the finger stop reaches its normal position as shown in the drawings the arm 16 is again interposed in front of one of the pins 53 and the gear train is stopped. The position of the slot 14 should be such that the finger stop reaches the end of the slot precisely at the time pin 53 engages arm 16, so that the movement of the gear train is really stopped at two points, each of which takes a part of the strain due to the tensioned main spring.

The calling device is now operable to carry out its intended function, and for the purpose of further explanation may be assumed to be connected in a substation circuit such as is shown in Fig. 19. When the receiver R is off the hook there is a closed bridge across the line conductors 150 and 151 which may be traced by way of the calling device impulse springs 100 and 101, the transmitter T, and primary winding I' of the induction coil. The function of the calling device is to produce series of interruptions in the bridge in accordance with the digits of called telephone numbers, there being provisions for at the same time modifying the bridge circuit to exclude the transmitter T during the transmission of each series, and also for short circuiting the receiver in the secondary circuit to prevent the interruptions being heard by the subscriber. A further object to be accomplished is the introduction of a time interval between the transmission of successive series of impulses by the generation of extra interruptions at the end of each series which are rendered ineffective by the short circuiting of the impulse springs.

The precise manner in which the above mentioned results are secured may now be pointed out. Suppose that the digit 1 is

called. The angular distance from the first finger hole to the finger stop in its normal position is 30° plus the usual amount allowed for over run of the ratchet teeth, about seven or eight degrees as measured by the amount the finger stop is displaced from the horizontal in Fig. 1. Also the finger stop has a movement of exactly 60° , so that it will be seen that when the dial is operated in accordance with the digit 1 it will be rotated approximately 98° , or sufficient to move the pawl 37 past three ratchet teeth. The finger stop moves with the dial for the first 60 degrees of its movement under the influence of spring 20, and as it leaves its normal position arm 17 disengages the bell crank lever 107, thus permitting the shunt spring 106 to engage shunt spring 105 and force the latter into contact with spring 104. The finger stop follows the dial only for 60° , as stated, and at the end of the movement of the finger stop the lever 107 is moved into a new position by engagement with the finger stop at 18, whereby the bushing 108 is raised sufficiently to cause impulse shunt spring 102 to disengage impulse shunt spring 103. After the finger stop ceases its movement the dial is rotated further until its movement is arrested by the engagement of the finger with the finger stop.

Reference to Fig. 19 now will make it clear that the closure of shunt springs 104, 105, and 106 has short circuited the transmitter and the receiver, while the opening of shunt springs 102 and 103 has removed the short circuit from the impulse springs 100 and 101. The dial may now be released, and since arm 16, of the finger stop has been withdrawn from the path of pin 53, it will immediately return to normal at a uniform rate of speed under control of the governor. Since the dial was rotated far enough to cause the pawl 37 to pass three ratchet teeth, the return of the dial will operate the gear train to cause three complete rotations of the impulse cam shaft, and the impulse cam will separate the impulse springs 100 and 101 three times. The first interruption will occur before the dial has picked up the finger stop and consequently will be effective to open the bridge across the line. Before the second interruption takes place, however, pin 10 on the dial has reached the screw 9 on the finger stop and the latter has been returned sufficiently to release the bell crank lever 107 and cause spring 102 to again engage spring 103. Thus the last two interruptions are ineffective to open the bridge across the line, but their generation introduces an appreciable time interval which is intended to prevent the premature calling of the following digit. When the dial reaches its normal position the arm 17 of the finger stop operates lever 107, to separate the shunt springs 104, 105, and 106.

The operation of calling the other digits need not be explained in detail, as it will be readily appreciated that no matter what digit is called the movement of the finger stop permits two extra interruptions to be produced, which are, however, prevented from having any effect by the short circuiting of the impulse springs at the proper time.

What I claim is:

1. In an impulse transmitter, a finger hole dial and a movable finger stop, both rotatable about a common center, and two springs associated with the dial and finger stop, respectively, and normally tending to rotate said dial and finger stop in opposite directions.
2. In an impulse transmitter, a rotatable finger hole dial, a rotatable finger stop, a spring tending to rotate said dial in one direction, and another spring tending to rotate said finger stop in the opposite direction.
3. In an impulse transmitter, a rotatable finger hole dial, a rotatable finger stop, a spring tending to rotate said dial in one direction, another spring tending to rotate said finger stop in the opposite direction, and means on the dial for holding said finger stop against the tension of said second spring.
4. In an impulse transmitter, a finger hole dial rotatable forward and back, a spring operated movable finger stop, and means on said dial for holding said stop in normal position.
5. In an impulse transmitter having a finger dial, a two position finger stop, and means for automatically advancing the finger stop to its second position when the dial is operated and before the finger stop is engaged by the finger of the operator.
6. In an impulse transmitter, a finger dial rotatable forward and back, and a finger stop movable simultaneously with and in the same direction as the dial at the beginning of the forward movement thereof.
7. In an impulse transmitter, a finger dial rotatable forward and back, a movable finger stop, means for moving said finger stop simultaneously with and in the same direction as the dial at the beginning of the forward movement thereof, and means for returning said finger stop simultaneously with the dial at the end of the return movement thereof.
8. In an impulse transmitter, a finger dial rotatable forward and back, a movable finger stop, a spring for moving said finger stop during the forward rotation of the dial, and means for limiting the movement of said stop.
9. In an impulse transmitter, a finger dial rotatable forward and back, a movable finger stop, a spring for moving said finger stop with the dial as the dial is being op-

erated, means for stopping the movement of the finger stop at a definite point, and means attached to the dial for returning said finger stop to normal.

10. In an impulse transmitter, impulse springs, an interrupter device for operating said springs, a finger dial for controlling said device, normally closed shunt springs for short circuiting said impulse springs, a lever for separating said springs, a movable arm for operating said lever, and a spring and means on said dial jointly controlling said arm.

11. In an impulse transmitter, impulse springs, an interrupter device for operating said springs, a finger dial for controlling said device, normally closed shunt springs for short circuiting said impulse springs, and means including an automatically movable finger stop for separating said shunt springs when the dial is operated.

12. In an impulse transmitter, impulse springs, an interrupter device for operating said springs, a finger dial for controlling said device, normally closed shunt springs for short circuiting said impulse springs, and means including an automatically movable finger stop for separating said shunt springs when the dial is operated and before it begins to return to normal.

13. In an impulse transmitter for automatic telephone systems, subscriber controlled mechanism for producing series of interruptions in the line circuit, an automatic device for closing the line circuit over another path during the last interruption of each series, a two position finger stop, and a lever controlled by said finger stop for operating said device.

14. In an impulse transmitter, a finger hole dial, subscriber controlled mechanism for producing series of interruptions in the line circuit, an automatic device for rendering the last interruption of every series ineffective, said device comprising a pair of shunt springs and a bell crank lever for operating them, and means controlled by the said dial for operating said lever.

15. In an impulse transmitter, a finger hole dial, a pair of impulse springs, an interrupter device controlled by the dial for separating said springs a plurality of times each time the dial is operated, means operated automatically whenever the dial is operated for short circuiting said springs during the last separation thereof, said means comprising a pair of shunt springs, a lever for holding said springs apart until the last separation of said impulse springs occurs, a spring operated arm for controlling said lever, and means operated by the dial for controlling said arm.

16. In an impulse transmitter, a finger hole dial, a pair of impulse springs, an interrupter device controlled by the dial for separating said springs a plurality of times each

time the dial is operated, and means including a movable finger stop operated automatically whenever the dial is operated for short circulating said springs during the last two separations thereof.

17. In an impulse transmitter, a finger hole dial, a pair of impulse springs, an interrupter device controlled by the dial for separating said springs a plurality of times each time the dial is operated, and means effective only after the first separation of said springs responsive to a given operation of the dial for short circulating said springs during a plurality of succeeding separations, said means comprising a pair of shunt springs, a lever for controlling said springs, and a movable finger stop controlling said lever.

18. In an impulse transmitter for an automatic substation set, interrupter springs, interrupter mechanism for operating said springs, a finger dial for controlling said mechanism, a movable finger stop, contact springs for shunting the substation transmitter controlled by said finger stop at the beginning of its movement, and contact springs for shunting said interrupter springs opened by said finger stop at the end of its movement.

19. In an impulse transmitter for an automatic substation set, interrupter springs, interrupter mechanism for operating said springs, a finger dial for controlling said mechanism, a movable finger stop, contact springs for closing a circuit through said interrupter springs operated by the finger stop at the beginning of its movement, and contact springs for shunting said interrupter springs opened by the finger stop at the end of its movement.

20. In an impulse transmitter, interrupter mechanism, a finger hole dial for controlling said mechanism, a coiled spring for driving said mechanism, a housing rotatable with the dial enclosing said spring, and means cooperating with said spring for retaining the dial in position at all times.

21. In an impulse transmitter, interrupter mechanism, a shaft, a finger hole dial rotatable on said shaft for controlling said mechanism, a housing rotatable with the dial and a coiled spring in said housing for driving said mechanism, said spring constituting also means for retaining said dial in position on said shaft.

22. In an impulse transmitter, interrupter mechanism, a shaft, a finger hole dial rotatable on said shaft for controlling said mechanism, and a coiled spring for driving said mechanism, said spring constituting also means for preventing endwise movement of the dial relative to said shaft.

23. In an impulse transmitter, interrupter springs, a rotatable impulse cam shaft hav-

ing a threaded end portion, a nut having a knurled upper surface screwed tightly on the threaded part of said shaft, another nut, and a cam for controlling said springs clamped against the knurled surface of said first nut by said other nut.

24. In an impulse transmitter, a casing, a governor friction ring attached to said casing, contact springs supported on said friction ring, a bridge across said ring, and a terminal block mounted on said bridge.

25. In an impulse transmitter, a casing, a governor friction ring, interrupter springs mounted on said ring, a bridge across said ring, a terminal block for terminating the wires from said springs, said block being mounted on said bridge, and means for detachably securing said ring to said casing.

In witness whereof, I hereunto subscribe my name this 9th day of May, A. D., 1922.

JOHN G. BLESSING.