E. R. GILL.

SELECTIVE MECHANICAL OPERATOR.

APPLICATION FILED MAR. 12, 1906.

906,523.

Patented Dec. 15, 1908

3 SHEETS—SHEET 1.

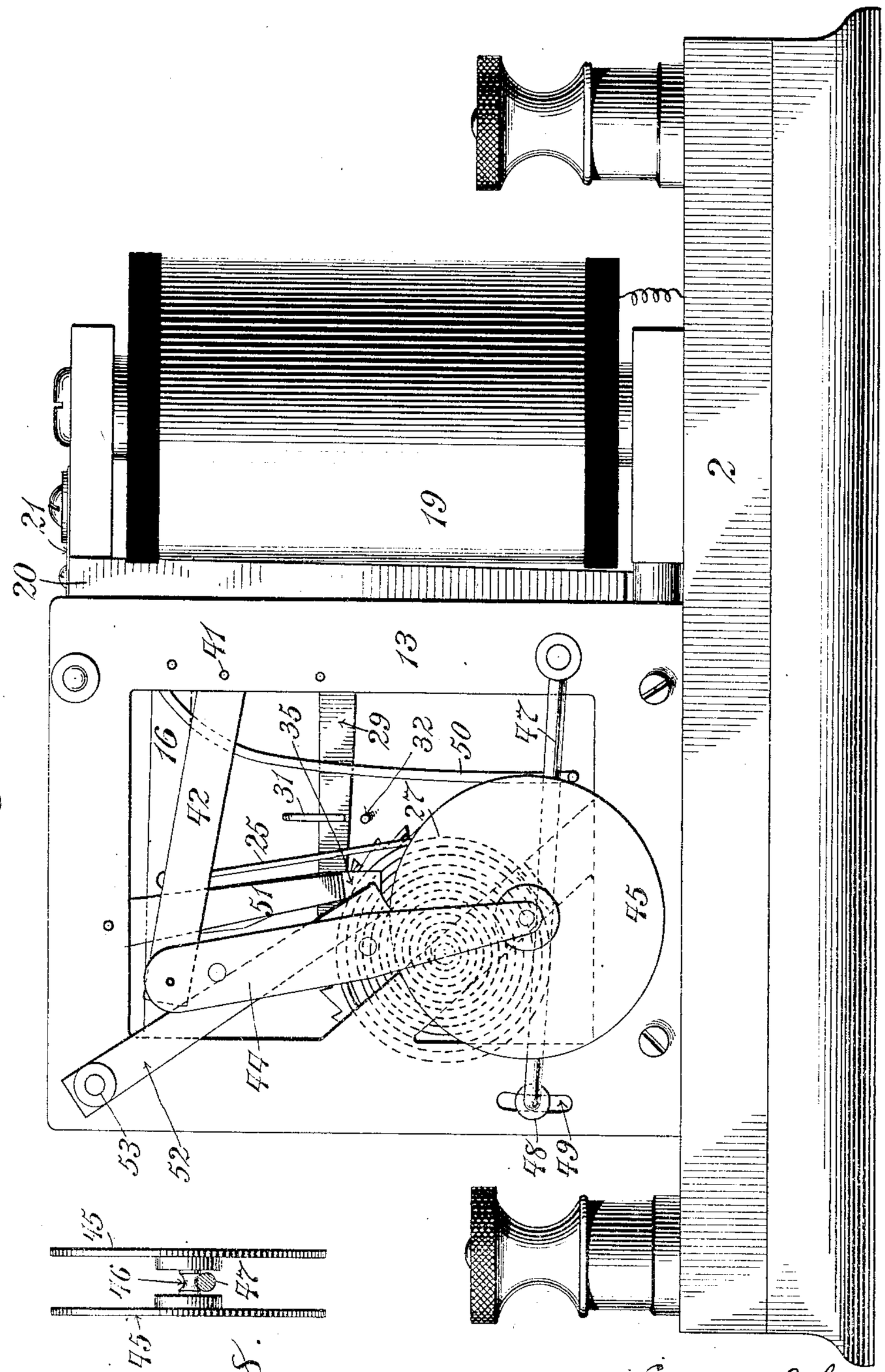

Fig. 1.

Fig. 8.

Witnesses
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By his Attorney H. MacKaye

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3 SHEETS—SHEET 2.

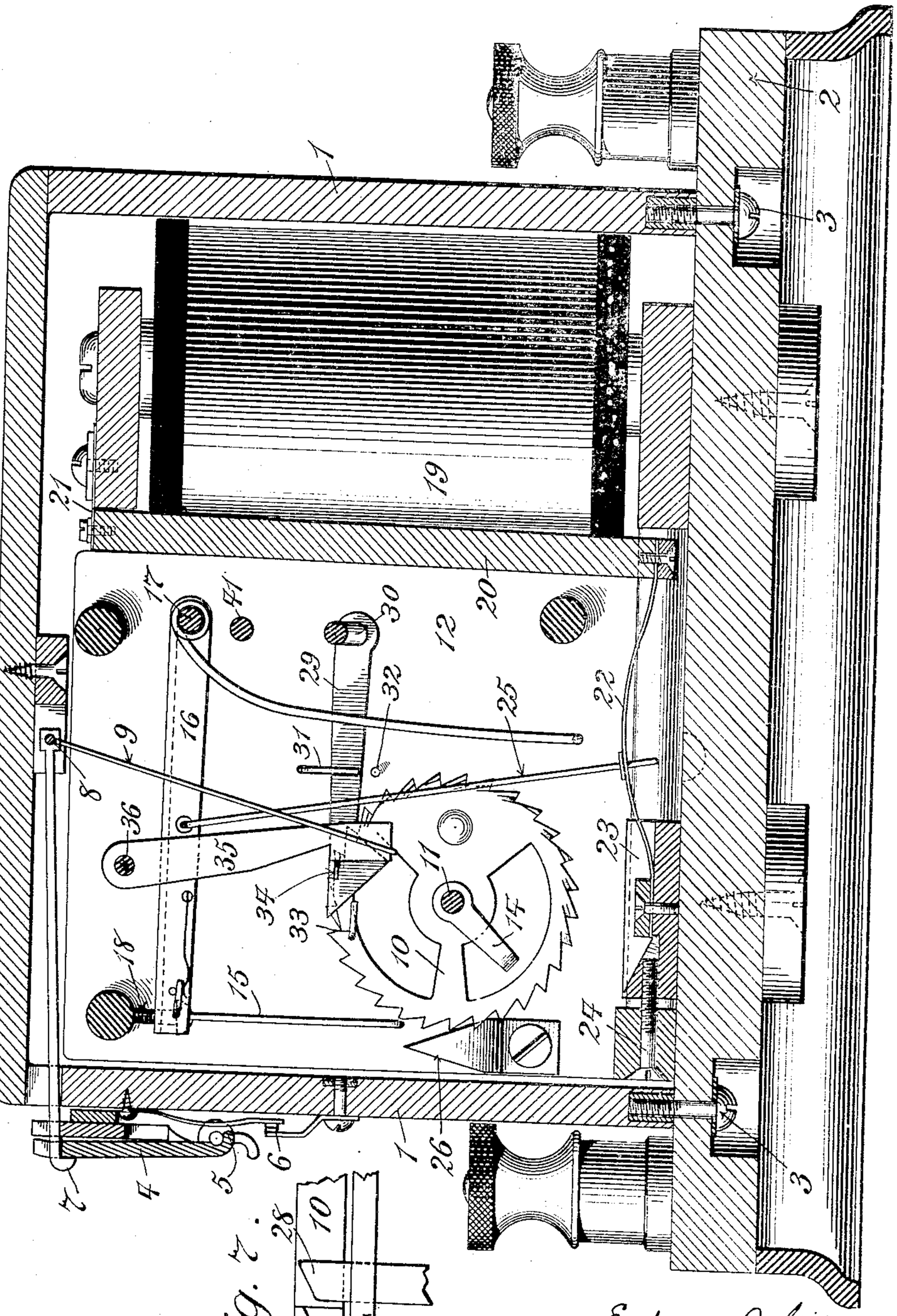

Fig. 2.

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

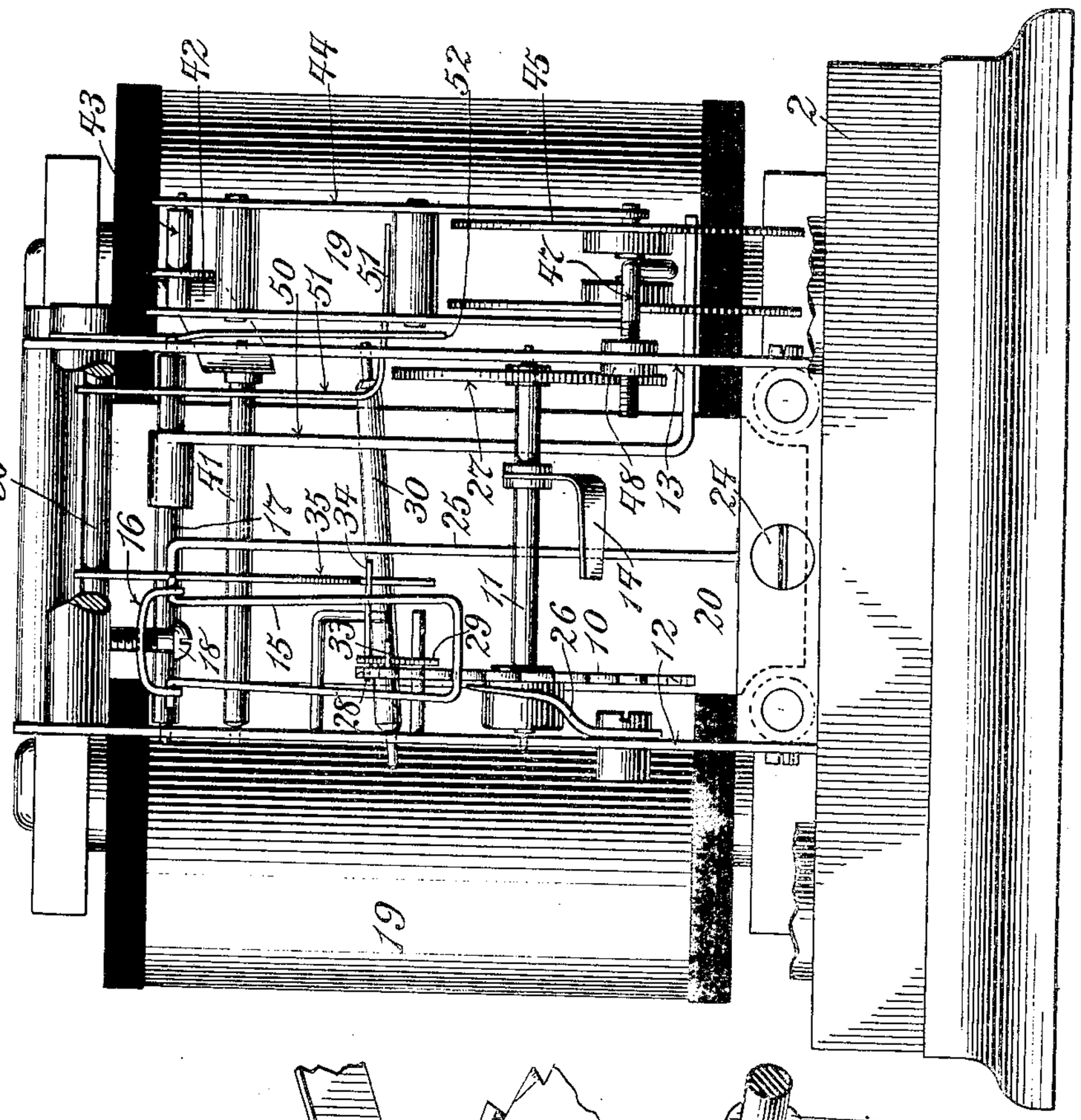


Fig. 6.

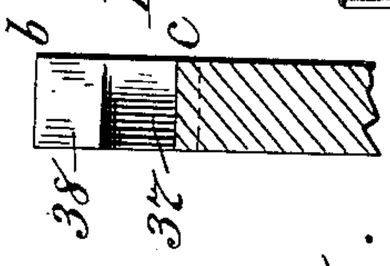


Fig. 5.

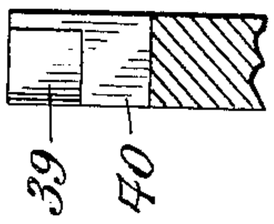
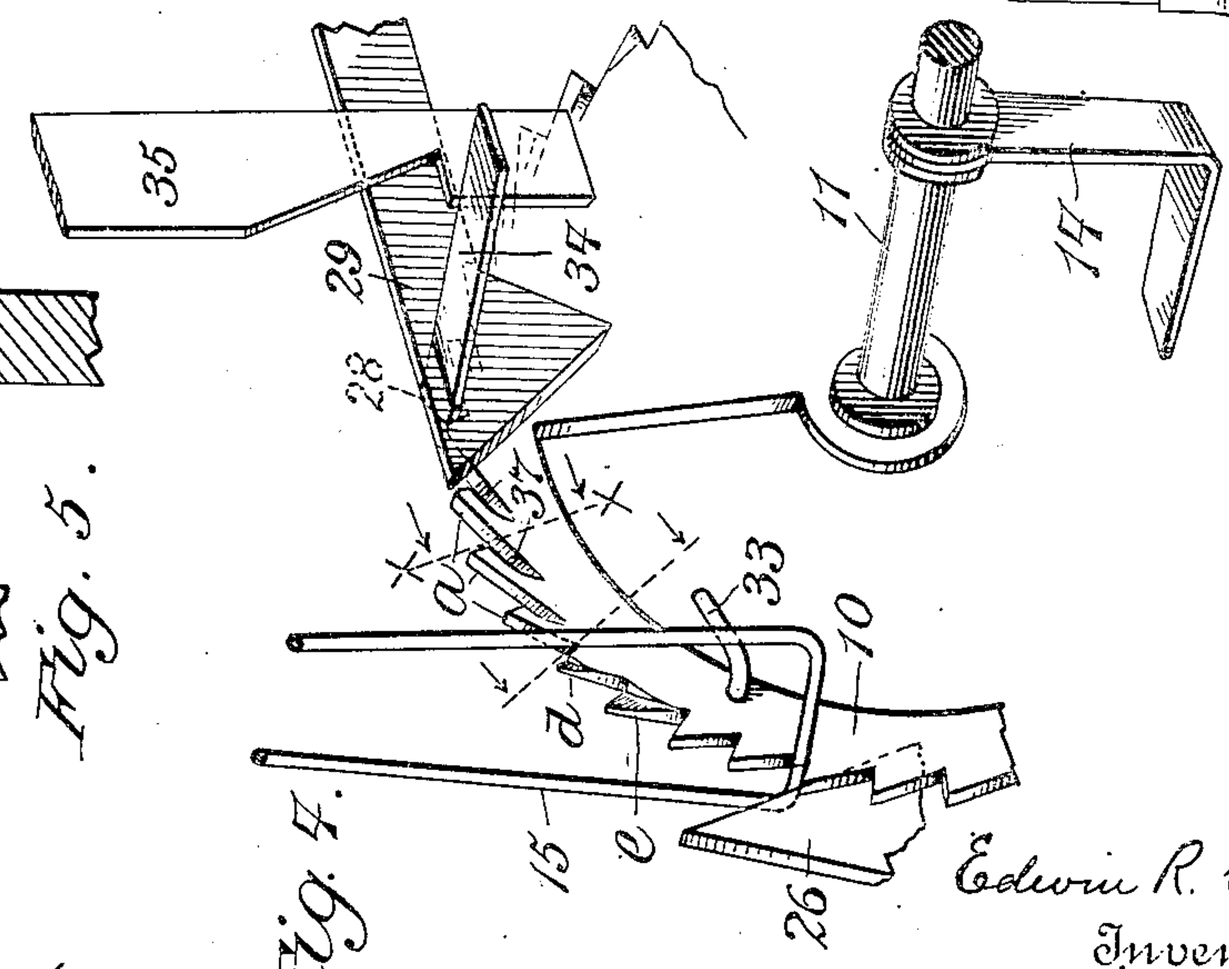


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

EDWIN R. GILL, OF YONKERS, NEW YORK.

SELECTIVE MECHANICAL OPERATOR.

No. 906,523. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed March 12, 1906. Serial No. 305,720½.

To all whom it may concern:

Be it known that I, EDWIN R. GILL, a citizen of the United States, residing in the city of Yonkers, county of Westchester, and State of New York, have invented a certain new and useful Improvement in Selective Mechanical Operators, of which the following is a specification.

This invention relates to means whereby a machine element, such as a wheel or other mechanical device, may be indirectly brought into a pre-determined position for any desired purpose.

The invention is applicable to the operation of combination locks, the sending of signals, ringing of bells, firing of explosives and like uses.

This invention is particularly useful in its preferred forms for employment in connection with telephonic and telegraphic systems. It can be operated by hand or electrically, and, in the latter case, an indefinite number of similar instruments can be placed on the same circuit and they can each be operated by a key at any point on such circuit without interfering with the others.

The operation of mechanisms at a distance by pneumatic means as well as by other agencies is well known as the equivalent for many purposes of electricity and I do not confine myself to the employment of electricity specifically in operating my improved apparatus from a distance. Indeed all those claims wherein no means for operation at a distance are called for are sufficiently broad to cover devices adapted for manual operation, and any appropriate means may be substituted for the main magnet shown.

My invention is shown in a preferred form in the accompanying drawings, wherein—

Figure 1, is a side view of a telegraph call embodying the invention, Fig. 2 is a similar view, but with a portion of the apparatus removed, Fig. 3 is an end elevation of the same, Fig. 4 is a detail enlarged perspective showing the special toothed wheel preferably used, Figs. 5 and 6 are enlarged face views of the two different kinds of teeth used, Fig. 7 is an enlarged plan view showing the relation of a tooth to the detaining pawl and Fig. 8 is an end view of a portion of the retarding mechanism.

The present invention is an improvement over that shown in my pending application for patent, Serial No. 262,135, filed May 25, 1905, whereby the mechanism is simplified and among other changes a simpler and cheaper retarded tripping device is employed to regulate the pre-arranged movements of the main machine element. While this apparatus is particularly fitted for application to telegraphic and telephonic calls it may be used for many other purposes.

It is to be understood that, although the following description is solely concerned with an electro-magnetically operated embodiment of this invention, my claims are not restricted to forms using this actuating means, except where specifically so expressed.

In the drawings, the entire device is inclosed in a casing 1, preferably of wood, secured to the base 2, either by screws 3 or otherwise. The operation finally accomplished by the pre-determined movement of the machine element (in this case a ratchet wheel) is the dropping of the shutter 4, at the bottom of which a cam-shaped beak 5, acts to open a circuit at 6, whereby any appropriate signal may be operated in a manner well known in the art. The dropping of the shutter 4 follows lifting of the retaining hook 7, carried by the shaft 8 which is turned by movement of the arm 9.

The ratchet wheel 10 is mounted upon main shaft 11, pivoted between the side plates 12 and 13 of the main frame and carrying the tripping arm 14. This arm 14 impinges upon the arm 9 when the wheel 10 is brought into the pre-determined position and thus drops the shutter 4.

The wheel 10 is adapted to rotate under the intermittent or step-by-step action of a pawl 15 which, in the form shown, takes the shape of a wire frame depending from the driving arm of lever 16 which is fixed to the shaft 17. At the outer end of this lever there is preferably carried an adjustable screw stop 18 which limits the upward travel of the arm 16.

Behind the main frame the actuating magnet 19 is placed and this preferably acts upon the main driving arm 16 through the mechanism shown in the drawings. Here an armature 20 hangs from a frictionless support 21 and is secured at its lower end to one extremity of the band spring 22, the opposite end of which is fixed to the sliding abutment 23. This abutment may be longitudinally adjusted, to give the desired tension to the spring 22, by means of the screw 24.

The natural tendency of this spring is to assume the bowed position shown in Fig. 2, thus opposing the pull of the magnet 19.

A connecting means, such as the wire 25 is secured at one end to the arm 16 and at the other to the middle portion of the spring 22. When the armature 20 is attracted it straightens the spring 22, thus drawing down the arm 16. The return of the spring 22 when the magnetic pull is discontinued serves to lift the arm 16, in preparation for another downward operative movement.

Each downward movement of the driving pawl 15 is positively arrested at the proper point by an inclined stop plate 26, so placed as to wedge the pawl 15 against the wheel 10 at the end of each stroke. By this means the wheel is locked at the end of each stroke, so as to prevent excessive movement thereof due to inertia.

At one end of the shaft 11, a spiral spring 27 is so secured as to tend to return the wheel to the starting point in the direction opposite to that in which it is driven by the pawl 15. In order to prevent this automatic return of the wheel between the strokes of the pawl, a retaining pawl 28 is employed which extends laterally from the end of a retaining lever 29 fixed to the inclined shaft 30. The pawl 28 is arranged to drop by gravity behind the teeth of the wheel 10 as these successively come into place. This is shown in dotted lines in Fig. 4 and in plan view in Fig. 7. The upper and lower limits of movement of the lever 29 are determined by the stops 31 and 32. (See Fig. 2).

On the inner side of the wheel 10, a pin 33 is provided which strikes the inclined beak on the end of the lever 29, when the wheel 10 is returned by the spring 27. This acts to lift the retaining pawl back to engage with the teeth on said wheel.

From the inner side of the lever 29 there projects a catch or shelf 34 which may be made a continuation of the retaining pawl 28, as shown in the drawing.

Directly above the catch 34 a hook 35 hangs from a shaft 36 to which it is fixed and with which it swings freely. The positions of the parts are such that, whenever the pawl 28 and catch 34 are raised, the hook 35 drops automatically into place under the catch and prevents the pawl from dropping back into engagement with the lower part of a tooth on the wheel 10. When in this position, the pawl 28 is on a level with the upper part of the teeth of the wheel 10, and the shape of the particular tooth opposite the pawl 28 will determine whether said pawl will or will not hold the wheel against the spring 27.

The teeth of the wheel 10 have preferably the forms best shown in Figs. 4, 5, 6 and 7. There are two types of teeth shown corresponding to engagement with the retaining pawl in its upper and lower positions respectively. Accordingly these two types of teeth may be appropriately and respectively designated "upper contact" and "lower contact" teeth.

The upper contact type of tooth is shown in Fig. 6 in face view and three of these are indicated in perspective at *a* in Fig. 4. In Fig. 6 the full depth of the tooth is shown from *b* to *c*. The lower portion of this tooth is cut away on a slant, as shown at 37, while the upper part, 38, of the tooth face is left intact. In Fig. 5, on the contrary, the upper part is cut away on a bevel, as shown at 39, while the lower part is left intact, as at 40. This is one of the "lower contact" teeth, and a specimen thereof is seen in perspective at *d* in Fig. 4.

In Fig. 7 is shown the relation of the bevel on either type of tooth to the inclined edge of the retaining pawl 28. It is obvious that, when a beveled tooth surface is forced backward by the spring 27 against the inclined edge of the pawl 28, this latter is forced to move laterally causing longitudinal movement of the inclined shaft 30, whose journals are made long enough to accommodate this movement. The inclined position of the shaft insures return of the retaining pawl to operative position under the influence of gravity when the same is lifted by the pin 33 impinging against the inclined edge of the lever 29, as above described.

The operation of the parts so far described is as follows: Every time the pawl 15 is depressed until arrested by the stop 26, the wheel 10 is driven forward one tooth and the lever 29 is raised by the pawl 28 riding up over a tooth of said wheel. The lifting of the catch or shelf 34 by this means allows the hook 35 to fall under said catch and, when the catch falls back upon said hook, the pawl 28 is held in such a position as to come opposite the upper parts of the teeth of the wheel 10. In this position said pawl is operative as a retaining device for said wheel only when an "upper contact" type of tooth (such as shown in Fig. 6) is opposite said pawl. When the "lower contact" type of tooth (shown in Fig. 5) is opposite the pawl, the inclined face 39 forces said pawl out of engagement and the wheel 10 returns to normal under the influence of the spring 27. In view of these conditions, it is obviously necessary to provide means whereby, when a "lower contact" tooth is opposite the pawl 28, the hook 35 may be withdrawn to let said pawl fall into engagement with the squared contact face 40, (see Fig. 5) whereby operative retaining contact is had with the pawl 28. For this purpose an automatic retarded device of any desired character is used in connection with means for withdrawing the hook 35; said retarded device being liberated by operation of the main driving pawl 15

15. In the preferred embodiment of my device which is herein shown, I employ the following novel form of retarded device, which has several marked advantages as used in this connection. Upon a shaft 41 there is carried an arm 42 extending forward to where it is pivoted by means of a short shaft 43 to a frame 44, which frame carries a retarding wheel journaled therein at its lower end. This wheel, shown in end elevation in Fig. 8 and in side elevation in Fig. 1, consists of two side disks 45, joined by a short rigid axle 46 whose diameter is made very small, so that, as said axle rolls down the inclined track-wire, 47, there shall be a considerable number of revolutions of the disks 45 for a comparatively short movement down the wire. The outer end of the track-wire 47 passes through a support 48 which can be moved up or down within the curved slot 49 in the frame 13. The degree of inclination of the track can thus be adjusted to produce various speeds in the retarding wheel.

When the driving pawl 15 is in its upper position, the returning arm 50, which extends downward from the shaft 17 and moves rigidly with it, bears upon the rims of the disks 45 and holds the retarded device in the forward position shown in Fig. 1. If the pawl 15 be depressed, the arm 50 moves to the right in Fig. 1, and the retarding wheel is free to roll down the track. Owing to the considerable rotative inertia of the disks 45, this following movement of the retarding wheel is quite slow. When the pawl 15 is again raised by reaction of the spring 22, the arm 50 pushes the retarded device rapidly back to its normal position, in this instance merely sliding the whole wheel back over the inclined track. By this expedient, inertia is made to retard movement of the wheel in one direction while, rotation being avoided, a quick return action is secured.

Upon the shaft 36 which carries the hook 35, there is fixed an arm 51, the lower end of which extends into the path of movement of the frame 44. This arm is so placed, however, that the frame 44 does not strike it until just before the disks 45 reach their lowest possible position, corresponding to the continued depressed position of the main pawl 15.

When the main lever 16 is in its upper position and the retarding wheel is at normal, as shown in Fig. 1, the arm 51 comes against the lever 52 which is connected to the main frame by a pivotal support 53, whereby said lever may be brought to any desired position for purposes of adjustment. This construction supplies an adjustable stop whereby the hook 35 may be allowed to extend more or less under the catch or shelf 34.

The operation of the device is as follows: To begin use of the special combination which causes the shutter 4 to drop the wheel is brought to the position shown in Fig. 2, wherein the retaining pawl is in engagement with the first "lower-contact" tooth, shown at *d*, in Fig. 4. In order to secure this position, the key or relay which controls the magnet 19 must maintain circuit closed through said magnet long enough to permit the retarding wheel to trip the hook 35, so as to permit the retaining pawl 28 to fall into engagement with the lower part 40 of the tooth *d*. Such is the position shown in Fig. 2. The wheel 10 is started forward from this position by four pulls of the magnet following each other so rapidly that the retarded device has not time to trip the hook 35. By this means said hook remains constantly in position to prevent falling of the retaining pawl. The first four teeth being "upper contact" teeth, the wheel is held between strokes of the pawl 15 until the position shown in Fig. 4 is reached when circuit through the magnet 19 must be maintained long enough to let the frame 44 trip the hook 35, so that the pawl 28 may drop into engagement with the squared face of the "lower-contact" tooth which is then opposite said pawl. Further rotation of the wheel 10 is accomplished by a succession of quick impulses (corresponding to engagement of the retaining pawl 28 with "upper-contact" teeth) separated into groups by occasional pauses during which the main driving pawl 15 is depressed long enough to permit tripping of the hook 35 and engagement with the corresponding "lower-contact" tooth or teeth. It is obvious that, unless the right pre-arranged system of respectively short and long pauses is adopted, the tripping bar 14 cannot be made to operate the lever 9 and drop the shutter 4. This follows from the fact that, if the pawl 28 is allowed to drop when opposite an "upper-contact" tooth, the beveled lower part of the tooth face (37 in Fig. 6) will move the pawl with its lever 29 and shaft 30, to the right in Fig. 3, thus releasing the wheel 10, which is returned to normal by the spring 27. When this happens the pin 33 on the wheel elevates the lever 29 and pawl 28, to allow this latter to once more come into the plane of the wheel. The tooth *e*, which is opposite the pawl 28, when this last operation occurs, is preferably beveled from top to bottom as shown, in order to prevent catching of the pawl as it is thrown upward. The operation above described will also result if the pawl 28 is not allowed to drop when opposite a "lower-contact" tooth.

When the tripping lever 14 has dropped the shutter 4, the lever with its shaft may be returned by any desired means, but I prefer to insure its positive automatic return by shaping that tooth which is then opposite the pawl 28 like the tooth *e* in Fig. 4. By this means, no sooner is the driving pawl 15

raised after the shutter 4 drops than the pawl 28 is disengaged as above described, releasing the wheel; and this whether the pause made after the last impulse is short or long.

In operating the magnets 19 by means of a key direct, the combination will consist in a series of closures of circuit at the key which are maintained for a shorter or longer period, and the duration of pauses between contacts will be immaterial. Where relays are used which close the operating circuit during open circuit on the main line, the key will be depressed at intervals separated by shorter or longer periods of open circuit, to make the combination, and the duration of contacts may be disregarded.

This invention is applicable to all kinds of telegraphic and telephonic systems, whether wireless or of the older types.

One advantage of this form of selective mechanism is that, by merely changing the wheel 10, the entire apparatus becomes at once capable of use with a new combination. As the combinations possible with a wheel of a reasonable size and number of teeth are almost numberless, almost any number of stations can be supplied with apparatus which is identical in all, save for the wheel 10, without duplicating combinations.

The construction is such that the device will operate on one weak battery cell if necessary.

Many changes may be made in the construction of this device without departing from the scope of this invention, and I am not to be understood as limiting myself to the details herein shown and described.

What I claim is—

1. In combination with a machine element intended to be brought to a predetermined position, a main impelling device adapted to move said element step-by-step in one direction, a magnet, an armature therefor, a bowed spring so attached to said armature as to be straightened thereby when said magnet is energized and a mechanical connection between said spring and said impelling device whereby the latter is actuated by the successive bending and straightening of said spring, substantially as described.

2. In combination with a machine element, intended to be brought to a predetermined position, a main impelling device adapted to move said element step-by-step in one direction, a magnet, an armature therefor, a bowed spring secured at one end to a fixed abutment and at the other end to the free end of said armature and a connecting rod secured at one end to said impelling device and at the other end to said spring between its ends, substantially as described.

3. In combination with a toothed wheel intended to be brought to a predetermined position, a retaining pawl for said wheel, a pivotal support for said pawl movable so as to permit said pawl to be carried out of the plane of said wheel and out of mechanical connection therewith, and means for freeing said wheel from the control of said pawl by moving the latter out of the plane of said wheel, substantially as described.

4. In combination with a toothed wheel intended to be brought to a predetermined position, a retaining pawl for said wheel, a pivotal support for said pawl adapted to be given a longitudinal movement of translation with the pawl for carrying the pawl out of operative mechanical connection with the wheel, and means for freeing said wheel from the control of said pawl by moving the pawl and pivot as aforesaid, substantially as described.

5. In combination with a toothed wheel intended to be brought to a predetermined position, a retaining pawl for said wheel, a pivotal support for said pawl adapted to slide longitudinally so as to carry said pawl out of the plane of said wheel and out of operative mechanical connection therewith, and means for freeing said wheel from the control of said pawl by moving the pivotal support longitudinally, substantially as described.

6. In combination with a toothed wheel intended to be brought to a predetermined position, a retaining pawl for said wheel, a pivot to which said pawl is attached having long journals upon which it is free to slide longitudinally, and means for freeing said wheel from the control of said pawl by causing said pivot to slide on said journals until the pawl is brought out of the plane of said wheel and out of mechanical connection therewith, substantially as described.

7. In combination with a toothed wheel intended to be brought to a predetermined position, a retaining pawl therefor and an inclined pivot for said pawl, said pivot having long journals to permit it to slide longitudinally, substantially as described.

8. In combination with a toothed wheel intended to be brought to a predetermined position and having a tooth beveled across the plane of the wheel and no wider than said wheel; a retaining pawl for said wheel adapted to engage the beveled surface of said tooth and mounted so as to be capable of moving out of the plane of said wheel and out of operative mechanical connection therewith, substantially as described.

9. In combination with a toothed wheel intended to be brought to a predetermined position, and having a tooth beveled across the plane of said wheel, a retaining pawl having an inclined face and mounted so as to be capable of movement laterally with respect to said wheel, substantially as described.

10. In combination with a toothed wheel intended to be brought to a predetermined position and having a tooth whose face is

square on its lower portion and beveled across its upper portion, a retaining pawl mounted so as to engage with either portion of said face and capable of moving laterally with respect to said wheel, substantially as described.

11. In combination with a toothed wheel intended to be brought to a predetermined position and having a tooth whose face is square on its upper portion and beveled across its lower portion, a retaining pawl mounted so as to engage with either portion of said face and capable of moving laterally with respect to said wheel, substantially as described.

12. In combination with a wheel intended to be brought to a predetermined position, a tooth on said wheel whose face is square on its lower portion and beveled across its upper portion, a retaining pawl mounted so as to be capable of movement laterally with respect to said wheel and radially so as to engage either portion of said face, and means for holding said tooth in a position to engage said beveled portion, substantially as described.

13. In combination with a wheel intended to be brought to a predetermined position, a tooth on said wheel whose face is square on its upper portion and beveled across its lower portion, a retaining pawl mounted so as to be capable of movement laterally with respect to said wheel and radially so as to engage either portion of said face and means for holding said tooth in a position to engage said square portion, substantially as described.

14. In combination with a toothed wheel intended to be brought to a predetermined position and having a tooth whose face is partly beveled across and partly square, a retaining pawl capable of movement both radially and laterally with respect to said wheel, means for holding said pawl in one radial position so as to engage with a portion of said tooth face and means for freeing said pawl from said holding means, substantially as described.

15. In combination with a toothed wheel intended to be brought to a predetermined position and having teeth whose faces are partly beveled across and partly square, impelling means for said wheel, a retaining pawl for said wheel capable of movement both radially and laterally with respect to said wheel, means for holding said pawl in one radial position and means controlled by movement of said impelling means for freeing said pawl from said holding means, substantially as described.

16. In combination with a toothed wheel intended to be brought to a predetermined position and having teeth whose faces are partly beveled across and partly square, an impelling device for said wheel, a retaining pawl for said wheel capable of movement both radially and laterally with respect to said wheel, means for holding said pawl in one radial position, a retarded device for freeing said pawl from said holding means and means controlled by movement of said impelling device for controlling action of said retarded device, substantially as described.

17. In combination with a toothed wheel intended to be brought to a predetermined position and having teeth partly beveled across and partly square, a retaining pawl mounted upon a sliding pivot, a hook for supporting said pawl in one radial position, a retarded device for tripping said hook and an impelling means for said wheel adapted to control operation of said retarded device, substantially as described.

18. In combination with a toothed wheel, a retaining pawl therefor, a hook for supporting said pawl, a pivoted retarded device for tripping said hook and an inertia wheel carried by said retarded device, substantially as described.

19. In a device of the class described, a retarded means comprising an inclined track, a pivoted frame and an inertia-wheel having an axle of small diameter, rolling on said track and journaled in said frame, substantially as described.

20. In a device of the class described, a retarded means comprising two inertia disks joined by an axle of small diameter, in combination with an inclined track for said axle, substantially as described.

21. In a device of the class described, a retarded means comprising two inertia-disks joined by an axle of small diameter; in combination with a track for said axle, pivoted at one end and having a support at the other end which is adjustable as to height, substantially as described.

22. In a device of the class described, a retarded means comprising a pivoted arm, a depending frame pivoted to the end of said arm, an axle of small diameter journaled in said frame, two inertia-disks fixed to the ends of said axle and an inclined track for said axle, substantially as described.

23. A toothed wheel, a retaining pawl therefor, a hook for said pawl, a shaft for said hook and a tripping arm extending from said shaft; in combination with a retarded device comprising an inertia wheel having an axle of small diameter, an inclined track for said axle and a pivoted support in which said axle and wheel are journaled and mounted so as to come into operative contact with said tripping arm, substantially as described.

24. A toothed wheel, a retaining pawl therefor, a hook for said pawl, a tripping arm operatively connected with said hook, a pivoted impelling means for said wheel and an arm operated by said impelling means, in combination with an inclined track, a re-

tarded device adapted to roll down said track in one direction to make contact with said tripping arm and to slide back in the other direction when pushed by said arm operated by the impelling means, substantially as described.

25. A toothed wheel, a retaining pawl therefor, a hook for said pawl and a main impelling device for said wheel; in combination with a retarded means for tripping said hook comprising an inertia wheel, an inclined track on which said wheel is free to roll in one direction and means connected with said impelling device for causing said wheel to slide back to normal position on said track without revolving, substantially as described.

26. As an article of manufacture a toothed wheel having some of its teeth with faces beveled on their upper parts and square on their lower parts and some of its teeth with faces square on their upper parts and beveled on their lower parts, substantially as described.

27. In a device of the class described, a toothed wheel, a retaining pawl, a supporting lever therefor capable of movement laterally with respect to the wheel and having an inclined edge at its free end and a pin on said wheel adapted to strike said inclined edge and lift said lever and pawl when the wheel revolves in one direction, substantially as described.

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Witnesses:
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