H. W. GOFF.

ELECTROMAGNETIC STEP BY STEP MECHANISM.

APPLICATION FILED DEC. 20, 1919.

1,403,767.

Patented Jan. 17, 1922.

2 SHEETS—SHEET 1.

Fig. 1

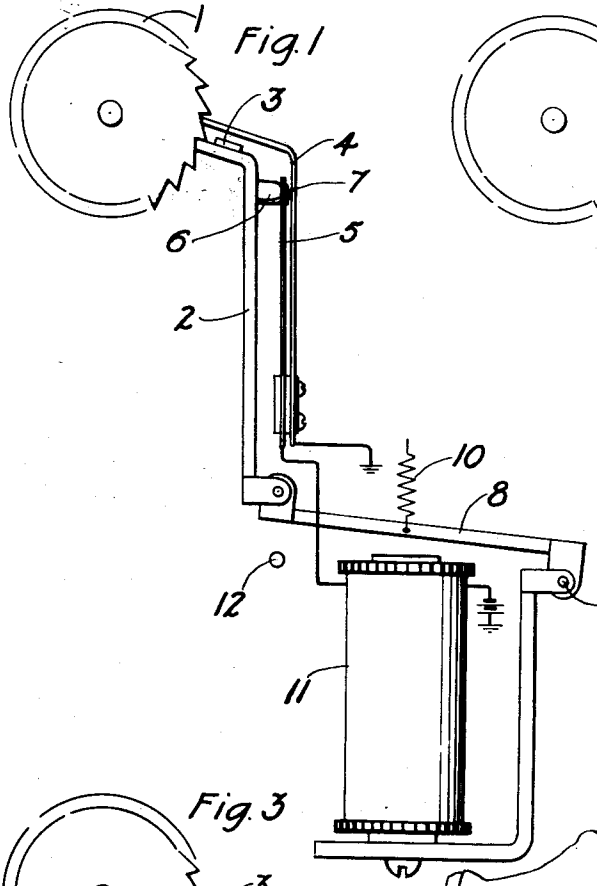


Fig. 2

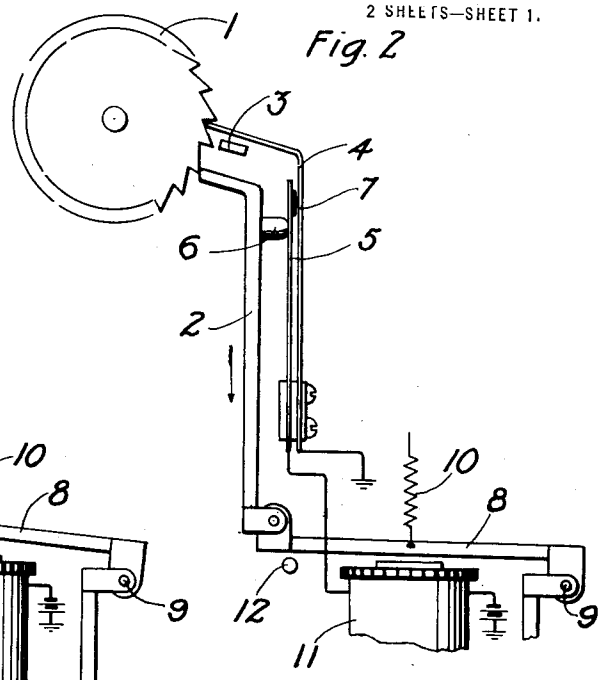


Fig. 3

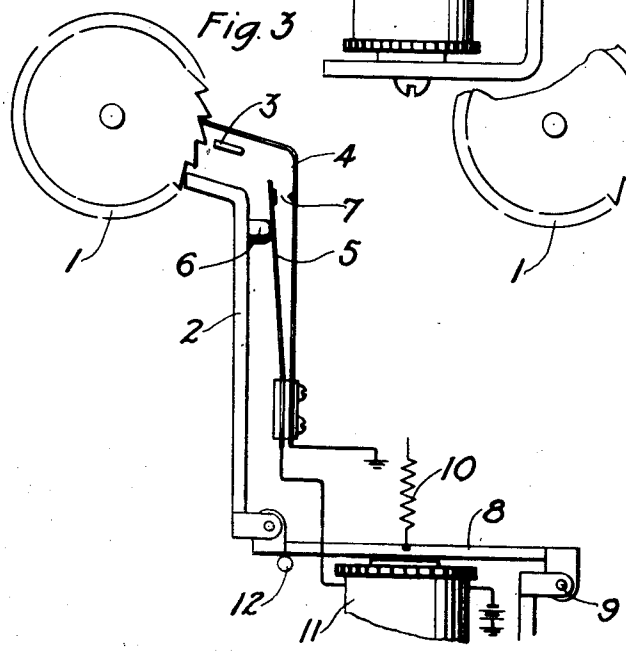
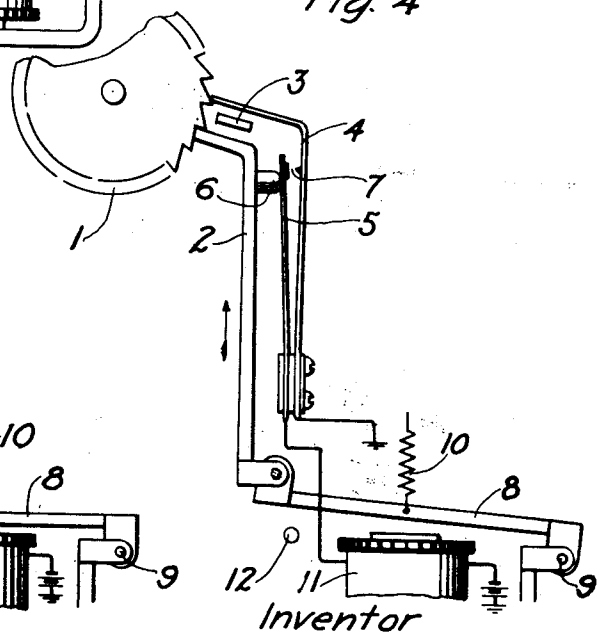


Fig. 4



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2 SHEETS—SHEET 2.

Fig. 5

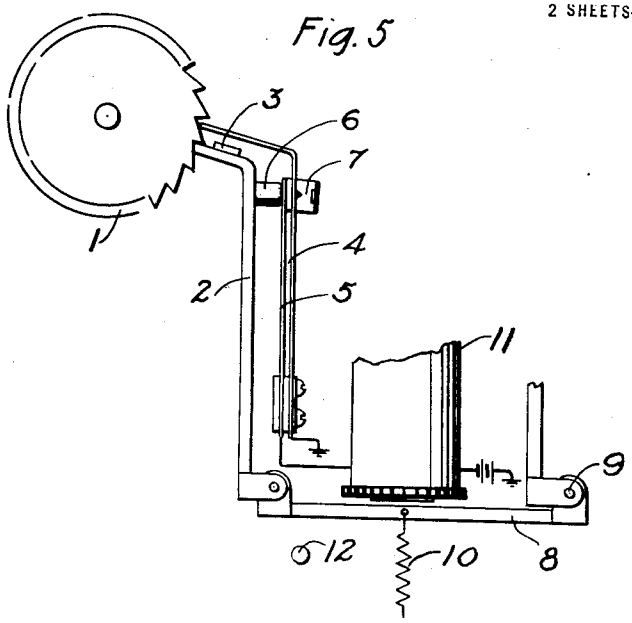
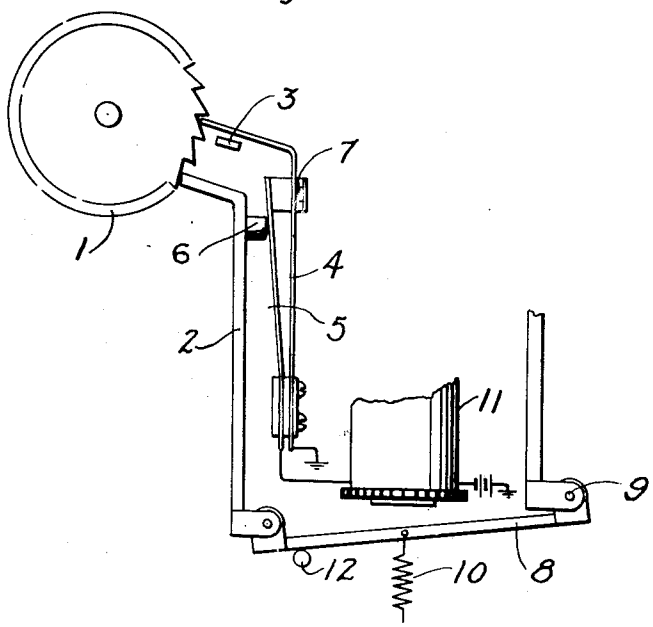


Fig. 6



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC STEP-BY-STEP MECHANISM.

1,403,767. Specification of Letters Patent. Patented Jan. 17, 1922.

Application filed December 20, 1919. Serial No. 346,367.

To all whom it may concern:

Be it known that I, HAROLD W. GOFF, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Electromagnetic Step-by-Step Mechanisms, of which the following is a full, clear, concise, and exact description.

This invention relates to step-by-step mechanisms of the type employing electromagnetic means for actuating a ratchet member. More particularly it relates to means for controlling the energizing circuit of such a mechanism.

The object of this invention is to provide an improved step-by-step mechanism in which the operating electromagnet is energized at the beginning and maintained energized to the end of each stroke in one direction of a stepping pawl and then deenergized and so maintained throughout the return stroke of the stepping pawl.

A further object is to provide such a mechanism in which the stepping pawl cannot start a driving stroke until it has actually engaged a succeeding tooth of the ratchet member and cannot start a retractive stroke until an associated holding pawl has likewise actually engaged a succeeding tooth of the ratchet member.

A still further object is to provide such a mechanism in which only one make and break contact is employed.

This invention comprises a ratchet member, an armature to which a stepping pawl, adapted to actuate the ratchet member is pivotally attached, an electromagnet adapted to actuate the armature and a spring adapted to retract the armatures, a combined holding pawl and contact spring, the function of which as a pawl, is to prevent backward movement of the ratchet member and as a contact spring to cooperate with a second contact spring to make and break the circuit of the actuating electromagnet. The operation of the contact between the afore-mentioned contact springs is under the joint control of the stepping pawl and the holding pawl. The apparatus can be arranged so that the stepping pawl is actuated forwardly by the electromagnet and retracted by the afore-mentioned spring in which case, the contact is closed during the forward movement or it can be arranged in the reverse order in which the stepping pawl is actuated forwardly by the spring and retracted by the electromagnet in which case the contact is open during the forward movement and closed during the retractive movement.

A particular feature of this invention is that only one make and break contact is employed, and that jointly controlled by both the stepping pawl and the holding pawl with the result that the stepping pawl cannot be actuated forwardly after the completion of a retractive stroke until it has dropped into a succeeding tooth of the ratchet member, and further that the stepping pawl cannot be started on a retractive stroke until the holding pawl has dropped into a succeeding tooth of the ratchet member at the completion of each forward stroke of the stepping pawl.

Referring to the drawings, Figs. 1, 2, 3 and 4 illustrate one embodiment of this invention in which the stepping pawl and armature are driven forwardly by a spring attached to the armature and retracted by an electromagnet. Figs. 5 and 6 illustrate an embodiment in which the stepping pawl is driven forwardly by an electromagnet and retracted by a spring.

In Figs. 1, 2, 3 and 4, 1 is a ratchet member, 2 is a stepping pawl, 3 is a fixed stop for the stepping pawl, to limit its forward stroke, 4 is a combined holding pawl and contact spring, 5 is a second contact spring cooperating with the combined holding pawl and contact spring 4 to operate contact 7, 6 is a lug, preferably of insulating material, attached to stepping pawl 2, 8 is an armature pivoted at 9 and pivotally attached to stepping pawl 2, 10 is a spring attached to armature 8 for driving the stepping pawl forwardly, 11 is an electromagnet co-operating with armature 8 for retracting the stepping pawl and 12 is a fixed stop for the armature 8 to limit its retractive stroke.

In Fig. 1, the stepping pawl 2 is shown in its extreme forward position against stop 3 and about to be retracted. Holding pawl 4 has just dropped into the recess of a succeeding tooth thereby closing contact 7 in the circuit of electromagnet 11 which upon being energized retracts its armature 8 thereby retracting stepping pawl 2. During its retractive stroke, it will be seen (referring to Fig. 2) that stepping pawl 2

travels in a direction parallel to contact spring 5, and contact 7 is held closed by the lug 6 bearing on contact spring 5 throughout the entire retractive stroke. At the end of its retractive stroke (see Fig. 3), stepping pawl 2 drops into a succeeding tooth thereby releasing contact spring 5 and breaking contact 7 whereupon electromagnet 11 is deenergized and the next forward stroke of the stepping pawl is begun.

During the forward stroke (see Fig. 4), holding pawl 4 rides on the sloping back of a tooth and its contact point is deflected away from the contact point of the contact spring 5 which latter is at the same time being deflected toward the contact point of holding pawl 4, by the movement of lug 6 and stepping pawl 2. These contact points, are however, held apart until the end of the forward stroke when the holding pawl drops into a succeeding tooth. It will be seen then that the stepping pawl cannot start on a forward stroke until it has actually dropped into a succeeding tooth and that it cannot start on a retractive stroke until the holding pawl has likewise actually dropped into a succeeding tooth.

The embodiment of this invention as illustrated in Figs. 5 and 6 differs from that of Figs. 1 to 4 inclusive, in that it is so arranged that the stepping pawl 2 is actuated forwardly by the electromagnet 11 and retracted by the spring 23. In order to accomplish this result, contact 7 is arranged so as to close at the beginning of each forward stroke and open at the beginning of each retractive stroke. This is done by providing contact spring 5 with a U shaped lateral projection, extending around holding pawl 4 and carrying a contact point which cooperates with a contact point on the back of holding pawl 4.

In Fig. 5, the stepping pawl 2 has reached the limit of its forward stroke and is bearing against fixed stop 3. Holding pawl 4 has just dropped into a fresh tooth, thereby breaking contact 7, deenergizing electromagnet 11, and the stepping pawl 2 and armature 8 are about to be retracted by spring 10. During the retractive stroke, contact 7 is held open by virtue of lug 6, bearing against contact spring 5, and at the end of the retractive stroke, contact 7 is closed by virtue of stepping pawl 2 dropping into a fresh tooth (as shown in Fig. 6), allowing contact spring 5 to deflect to its normal position. Throughout the forward stroke contact 7 is held closed by holding pawl 4 which is deflected to the right by the ratchet tooth with which it is in contact.

What is claimed is:

1. In a step by step mechanism, a toothed ratchet member, a stepping pawl and a holding pawl for said ratchet member, an electromagnet adapted to actuate said stepping pawl, a circuit including a source of current for said electromagnet and a solitary interrupter for said circuit jointly operable by said holding pawl and said stepping pawl to maintain the circuit closed throughout the movement in one direction of said stepping pawl and to maintain the circuit open throughout the movement in the other direction of said stepping pawl.

2. In combination, a toothed ratchet member, a stepping pawl for actuating said ratchet member, a holding pawl for said ratchet member, a spring for advancing said stepping pawl, an electromagnet for retracting said stepping pawl, a contact on said holding pawl, a contact spring interposed between said stepping pawl and said holding pawl, and operatively associated with the contact on said holding pawl, said contact spring operable by said stepping pawl to maintain engagement with the contact on said holding pawl throughout a retractive step, and said holding pawl operable by said ratchet member to maintain its contact out of engagement with said contact spring throughout the forward stroke of said stepping pawl, and a circuit including a source of current for said electromagnet, said circuit including said holding pawl and said contact spring.

3. The combination with a ratchet member of a stepping pawl in actuating relation to said ratchet member, a spring for operating said stepping pawl in a forward direction, electromagnetic means for retracting said stepping pawl, a holding pawl for said ratchet member, a contact on said holding pawl, a contact spring interposed between said stepping pawl and said holding pawl, and operable by said stepping pawl to engage and maintain contact with the contact on said holding pawl throughout the retractive step of the stepping pawl, said stepping pawl further operable to release said spring whereby the latter disengages said holding pawl contact upon dropping into a fresh tooth at the end of the retractive stroke, said holding pawl operable by said ratchet member to move its contact away from said contact spring throughout the forward movement of said stepping pawl, and further operable to move its contact into engagement with said contact spring upon dropping into a fresh tooth at the end of the forward stroke, and a circuit including a source of current for said electromagnetic means, said circuit including said holding pawl and said contact spring.

In witness whereof, I hereunto subscribe my name this 16th day of December A. D., 1919.

HAROLD W. GOFF.