(No Model.) 2 Sheets—Sheet 1.

C. L. CLARKE.

DEVICE FOR CONTROLLING THE MOVEMENTS OF THE ARMATURES OF ELECTRO MAGNETS.

No. 343,008. Patented June 1, 1886.

Fig. 1.

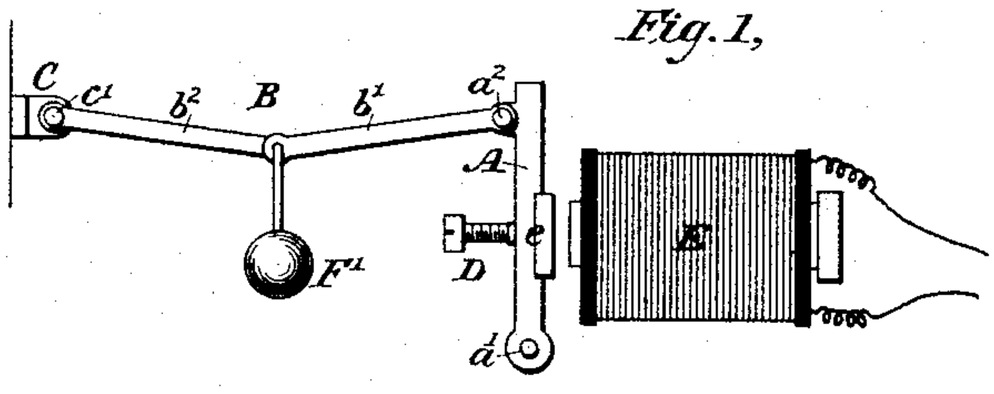


Fig. 7.

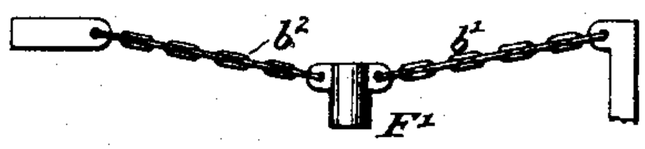


Fig. 2.

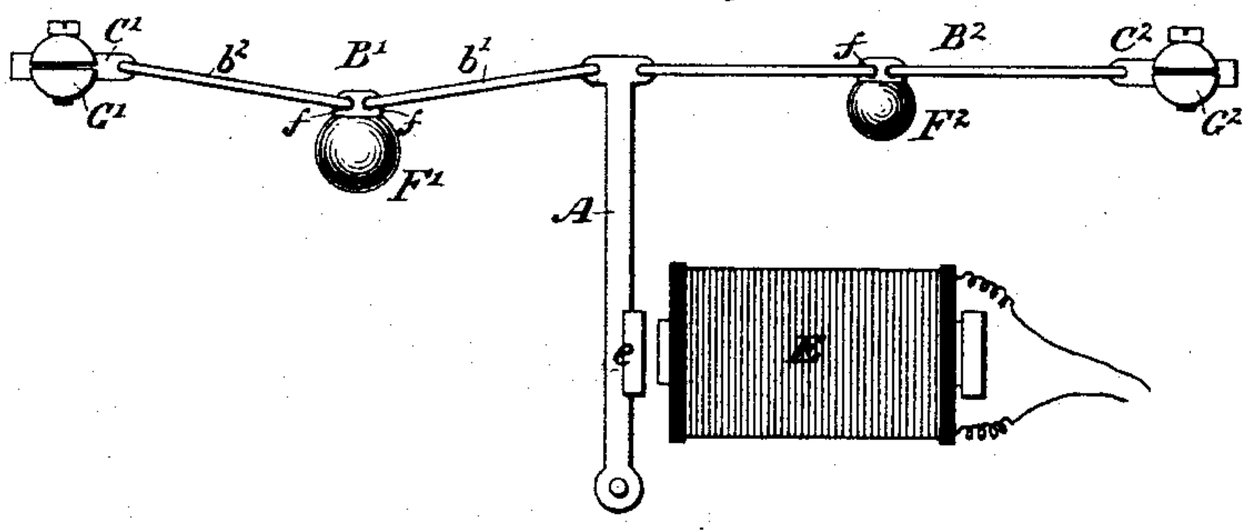
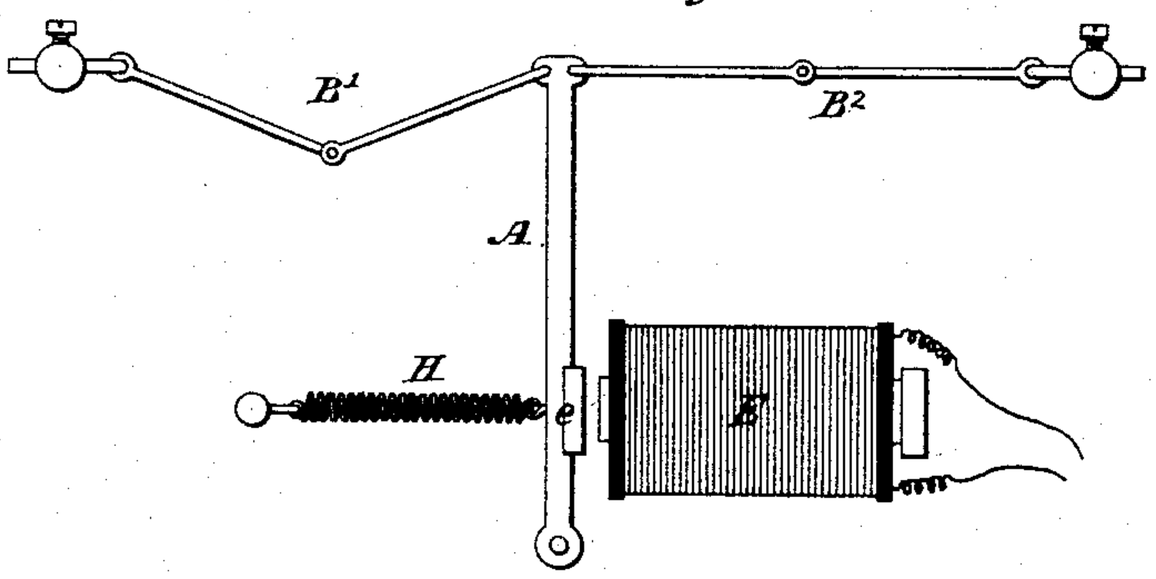


Fig. 3.



Witnesses

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(No Model.) 2 Sheets—Sheet 2.

C. L. CLARKE.

DEVICE FOR CONTROLLING THE MOVEMENTS OF THE ARMATURES OF ELECTRO MAGNETS.

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Fig. 5.

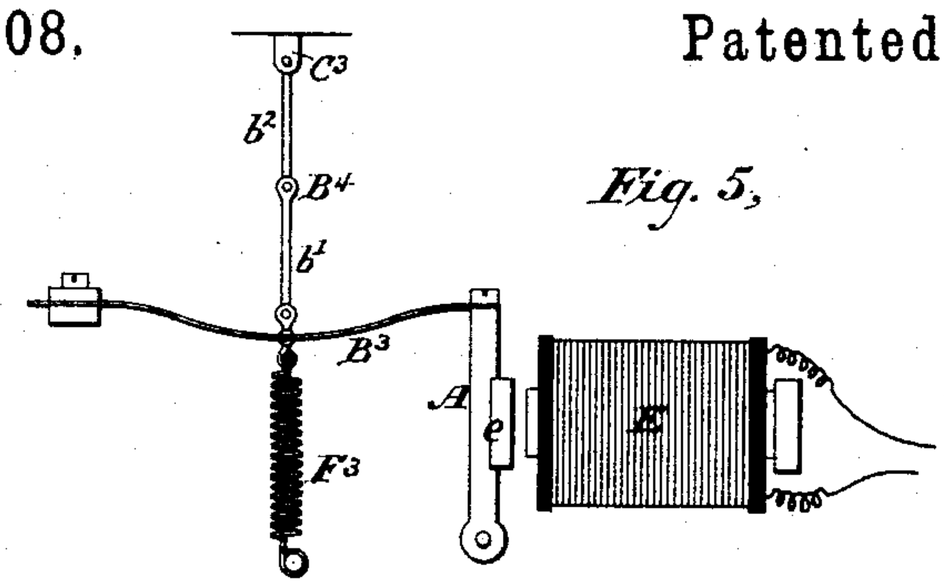


Fig. 6.

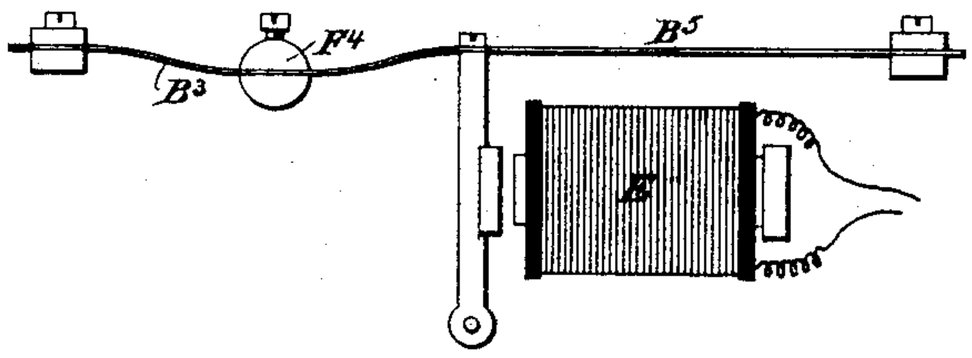
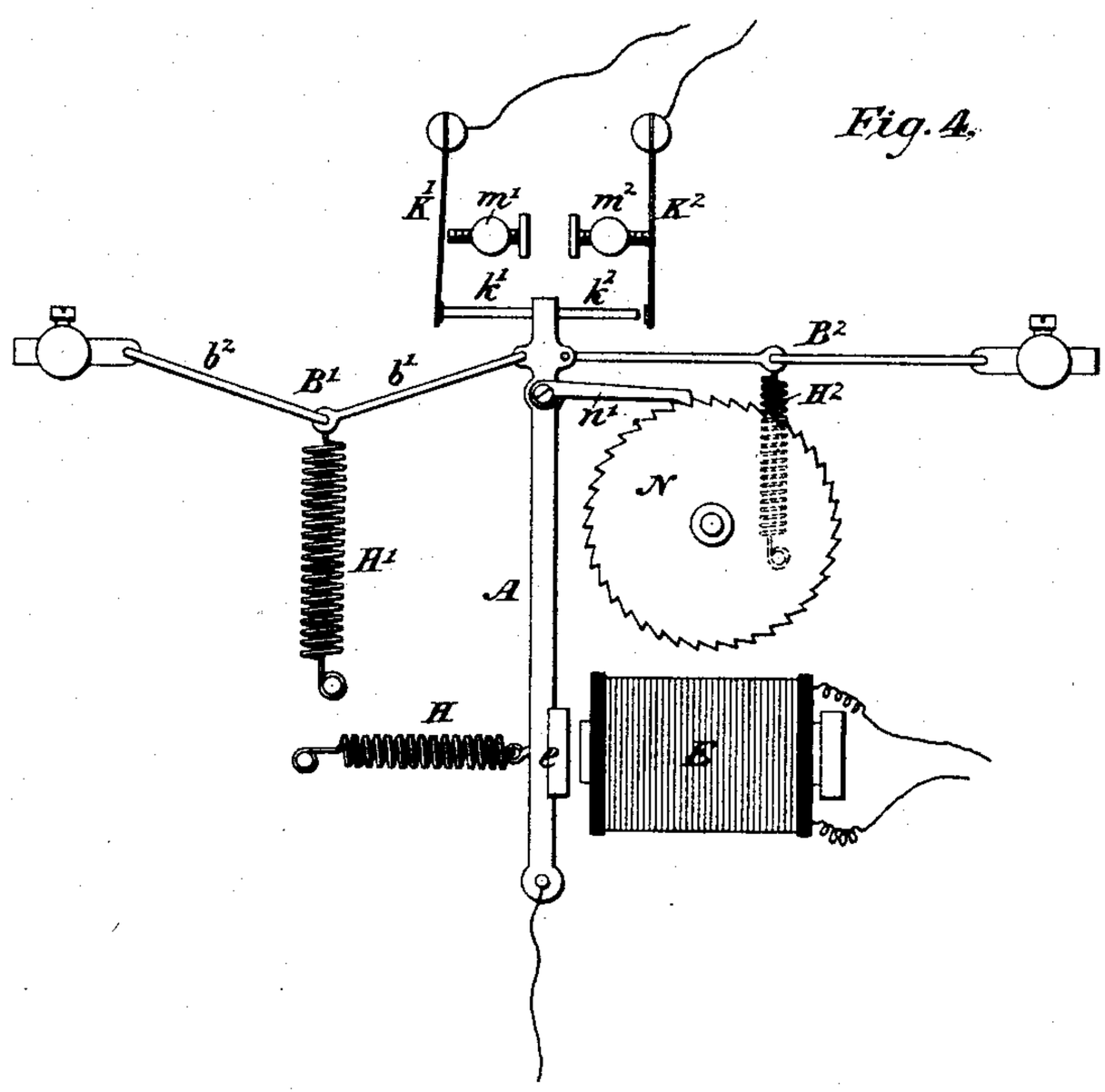


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

CHARLES L. CLARKE, OF ORANGE, NEW JERSEY.

DEVICE FOR CONTROLLING THE MOVEMENTS OF THE ARMATURES OF ELECTRO-MAGNETS.

SPECIFICATION forming part of Letters Patent No. 343,008, dated June 1, 1886.

Application filed February 20, 1886. Serial No. 192,612. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. CLARKE, a citizen of the United States, residing at Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Devices for Controlling the Movements of the Armatures of Electro-Magnets, of which the following is a specification.

The invention relates to the class of devices employed for withdrawing armatures from the poles of their electro-magnets, and for limiting the movements of the same.

It is usual to employ a retractile spring exerting a tension in opposition to the magnet for withdrawing the armature-lever when the electro-magnet is demagnetized. This necessitates the employment of limiting-stops for determining the excursion of the armature or armature-lever. In certain classes of electrical apparatus—such, for instance, as telegraphic sounders—the stroke of the lever against these stops serves a useful purpose, while in other classes of apparatus it is desirable that the movements should be noiseless—as, for instance, in instruments employed for controlling electric circuits and for operating various electro-mechanical devices.

The object of the invention is to provide means for limiting the excursion of the armatures and armature-levers in any class of electric apparatus, adjusting the retractile force exerted upon the same, and at the same time rendering their movements noiseless.

The invention consists, primarily, in applying to the armature or armature-lever of an electro-magnet a device for limiting its movement, capable of being extended a predetermined distance, and itself arresting the further movement of the same. This limiting device may be either a toggle-joint, a flexible wire or cord, a linked chain, or other equivalent device. The limit of motion is obtained when this device is straightened. The retractile force may be secured either by applying a weight or spring to the toggle or other limiting device and tending to bend the same, or to the armature itself, or the tendency to bend may be inherent in the device itself. The movement of the lever away from the electro-magnet may be determined or controlled by a similar device.

There are numerous applications of this invention and various methods of executing it. A sufficient number to clearly set it forth will be described in connection with the accompanying drawings.

In the drawings, Figure 1 is an elevation of an electro-magnet, its armature and armature-lever, provided with a limiting device illustrating the fundamental feature of the invention. Fig. 2 illustrates the method of limiting the motion in both directions. Fig. 3 illustrates an application of a retractile spring. Fig. 4 illustrates the application of the invention to an apparatus for controlling circuits and for driving other apparatus. Figs. 5, 6, and 7 illustrate various modifications.

Referring to the figures, E represents an electro-magnet, and *e* its armature. A lever, A, pivoted at a point, a', carries the armature. A toggle-joint, B, consisting of two links, b' and b^2, serves to limit the movement of the lever toward the magnet. The link b' is pivoted at one end to the lever A at a point, a^2. The remaining end of the link is pivoted to the link b^2. The remaining end of the link b^2 is pivoted to a post or other suitable support, C, at a point, c'. A suitable stop, D, which may be cushioned, is provided in this instance for limiting the movement of the lever away from the electro-magnet.

The weight of the links of the toggle-joint and its consequent tendency to bend downward into the position shown in Fig. 1 may in some instances be relied upon to withdraw the lever from the magnet; or a weight, F, may be suspended from one or other of the links or from the joint.

Instead of a stop, D, for limiting the movement of the lever away from the magnets, a second toggle-joint, B^2, similar to the joint B′, may be employed, as shown in Fig. 2. The latter is straightened when the lever moves away from the magnet and bent when it moves toward the magnet. In this instance a weight, F^2, is shown as applied to the toggle-joint B^2, but it is lighter than the weight F′, so that the latter serves to withdraw the armature when the electro-magnet is not vitalized.

A convenient form of construction is shown in Fig. 2, which consists in utilizing the weight as the connecting-link for the two links, b' and b^2. The links are provided with suitable hooks

at their ends, and the weights are constructed with holes *f*, for receiving the same. In like manner the remaining ends of the links respectively hook into the supports C′ and C² and into the armature-lever. The supports C′ and C² are preferably adjustable in suitable posts, G′ and G², and any of the well-known methods of adjustment may be applied to them.

In Fig. 3 the general form shown in Fig. 2 is adopted, with the exception that the weights are dispensed with and a retractile spring, H, is employed instead. This spring is here shown as applied to the armature-lever, and as bending to withdraw it from the electro-magnets. It is equally applicable to the form shown in Fig. 1. The spring has certain advantages in instances where it is desirable to obtain a quick movement.

In Fig. 4 there is shown, in addition to the spring employed in the last instance, two additional springs, H′ and H², which are respectively applied to the toggle-joints B′ and B². The weight of the links of the toggle-joint and the consequent tendency for it to bend downward into the position shown in Fig. 1 may in some instances be relied upon to withdraw the lever from the magnet; or a weight may be suspended from one or the other of the links or from the joint. The springs H′ and H² serve in lieu of the weights shown in Fig. 2 to bend the joints, and they may, it is evident, be employed either with or without the spring H applied to the armature-lever. There is shown also in Fig. 4 an attachment to the armature-lever for controlling the connections of the electric circuits, consisting of two contact-points, *k′* and *k²*, carried by the lever, and two contact springs or arms, K′ and K², against which the points are respectively designed to impinge. When the lever is away from the magnet, the point *k′* is against the spring or arm K′, and presses it away from its resting-stop *m′*. At the same time the point *k²* is away from the spring K², which then rests against its stop *m²*. When the lever is toward its magnet, the point *k²* is in contact with its spring K², and the point *k′* separated from its spring K′. The lever A is designed to be connected with one pole of a battery, and the springs or arms K′ and K² with conductors respectively leading to any desired forms of electrical apparatus and connected back to the other pole of the battery.

It is evident that various other methods of controlling circuit-connections may be adopted; but these need not here be described in detail.

There is also shown in Fig. 4 a pawl, *n′*, pivoted to the lever A and applied to a toothed wheel, N. It is designed that the to-and-fro movements of the armature-lever shall advance the wheel N step by step in the usual manner. It is evident that this operation will be entirely noiseless, except for the movement of the pawl upon the teeth of the wheel, and practically this will be of no importance. Other forms of pawl-and-ratchet movements are equally applicable.

In Fig. 5 there is shown, instead of a toggle-joint, a tempered spring, B³, which is capable of being drawn out of a straight line by a spring or weight, F³. The bending of the spring B³ serves, in the same manner as the bending of the toggle-joint B′, to withdraw the armature. A toggle-joint, B⁴, is shown in this instance as applied to the spring B³, for limiting the backward movement of the lever A. This is accomplished by connecting one end of the link *b′* to the spring B³, and the free end of the link *b²* with a support, C³, which is preferably adjustable. The toggle-joint is applied upon the opposite side from the spring F³, and is bent when the spring B³ is straightened, and vice versa. The toggle joint B⁴ may be used in connection with the toggle-joint B′, (shown in Figs. 1, 2, 3, and 4,) for limiting the backward movement of the armature.

In Fig. 6 there is shown, in place of the toggle-joint B⁴, a second spring, B⁵, similar to the spring B³, for limiting the movement of the armature-lever away from the electro-magnet. This organization is similar in its operation to that described with reference to Fig. 2. In this instance a weight, F⁴, is shown as applied to the spring B³. The retractile force exerted by this weight is made adjustable by rendering its position upon the spring adjustable. Thus by moving it away from the center of the spring toward either end its effect will be lessened. This method of adjustment is also applicable to the toggle-joints. Instead of employing a spring, F³, or a weight for bending the spring B³, the latter may be constructed with an inherent tendency to bend, and straightened by the pull of the electro-magnet. Instead of tempered-steel springs B³ and B⁵, wire, flat-rolled metal, catgut, or cord which will not stretch may be employed.

In Fig. 7 a short piece of linked chain is shown. This carries a weight, F′, and operates in essentially the same manner as described with reference to the other forms.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature, a support, and a limiting device consisting of a laterally-flexible mechanical connection between said support and said armature, receiving a lateral flexure when the armature is in one position and approaching a straight line as the armature is moved into the opposite position.

2. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature, a stationary support, and a mechanical connection between said support and said armature for limiting the movement of the latter, said connection having a lateral but not a longitudinal flexibility.

3. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature, two fixed supports upon opposite sides of said armature, two mechanical con-

nections respectively connecting said supports with said armature, each having a lateral but not a longitudinal flexibility, one of which connections is bent when the other is straightened, and vice versa.

4. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature and armature-lever, means for limiting the movement of said armature in one direction, consisting of a laterally but not longitudinally flexible device, and means, substantially such as described, for limiting the lateral flexure of said device.

5. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature, a rigid support, and a toggle-joint connecting said armature or its lever with said support.

6. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature, a rigid support, a toggle-joint connecting said armature with said support, and means, substantially such as described, for bending said joint.

7. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature and armature-lever, a rigid support, a toggle-joint connecting said lever with said support, and means for adjusting the distance between the support and lever.

8. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature and armature-lever, a stationary support, a laterally-flexible limiting device connecting said support with said lever, and a toggle-joint applied to said device for limiting the flexure of the same.

9. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature and armature-lever, a rigid support, a mechanical connection between said support and lever of constant length, but having a lateral flexibility, and a circuit-controlling device controlled by said lever.

10. The combination, substantially as hereinbefore set forth, of an electro-magnet, its armature and armature-lever, a rigid support, a mechanical connection between said support and lever of constant length, but having a lateral flexibility, and adjustable devices tending to produce such lateral flexure.

In testimony whereof I have hereunto subscribed my name this 19th day of February, A. D. 1886.

CHARLES L. CLARKE.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.