(No Model.) 2 Sheets—Sheet 1.

R. T. SMITH.

ELECTRICAL APPARATUS FOR EFFECTING MECHANICAL MOVEMENTS.

No. 377,413. Patented Feb. 7, 1888.

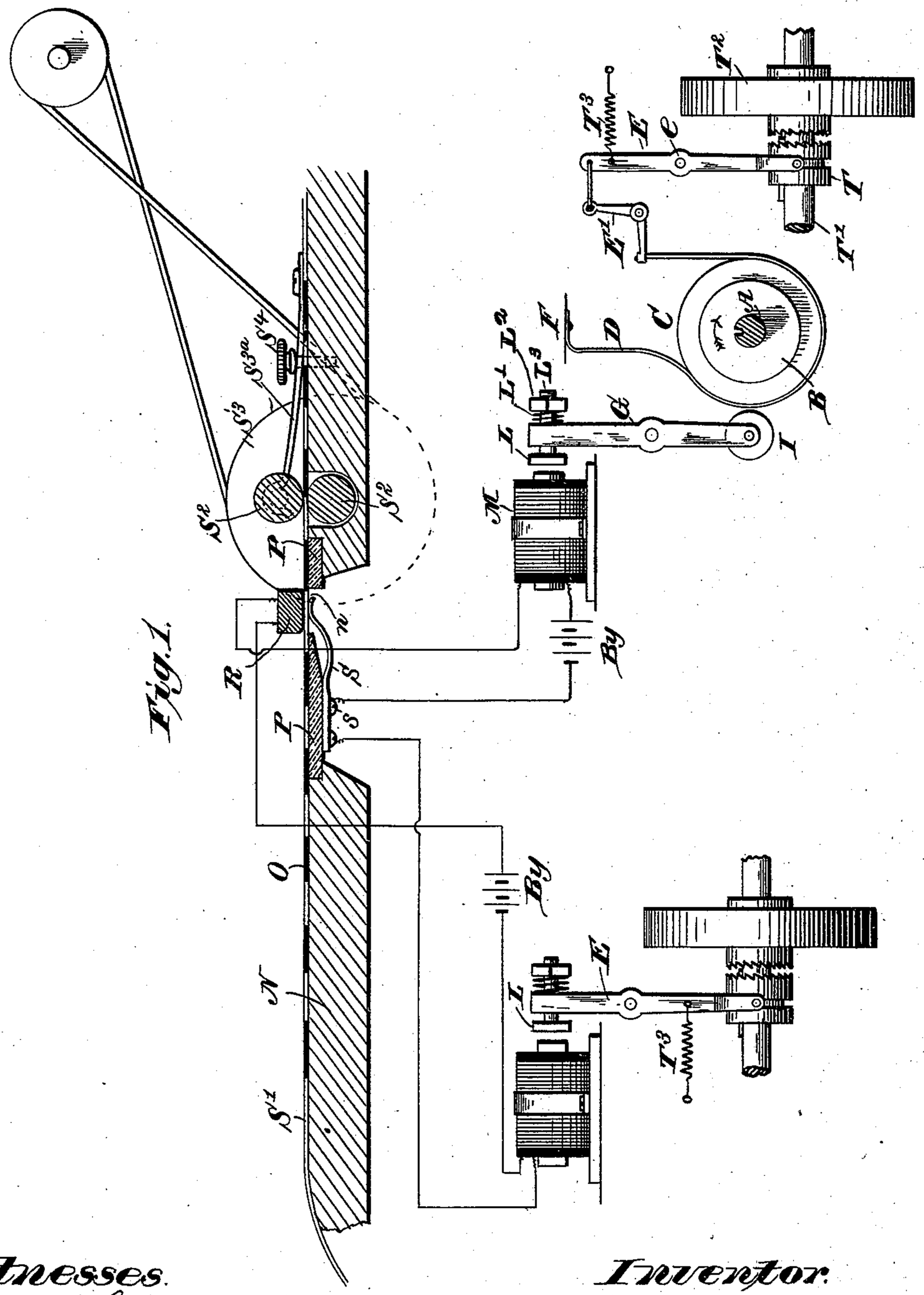

Fig. 1.

Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

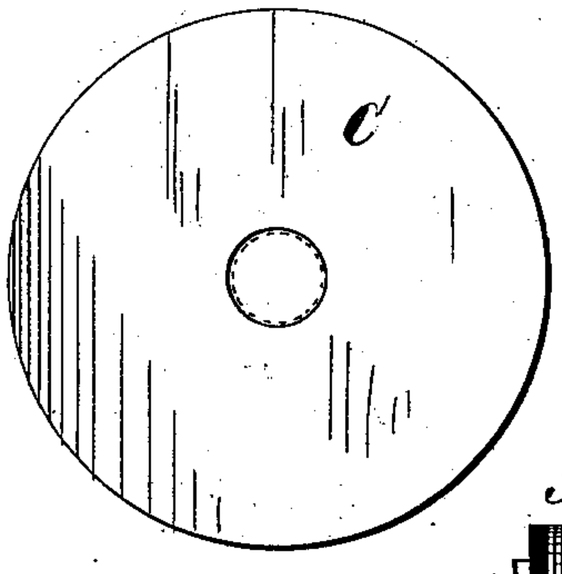


Fig. 2.

Fig. 5.

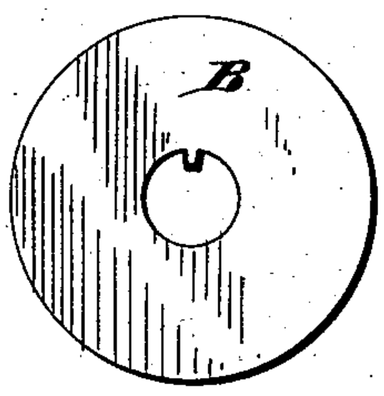
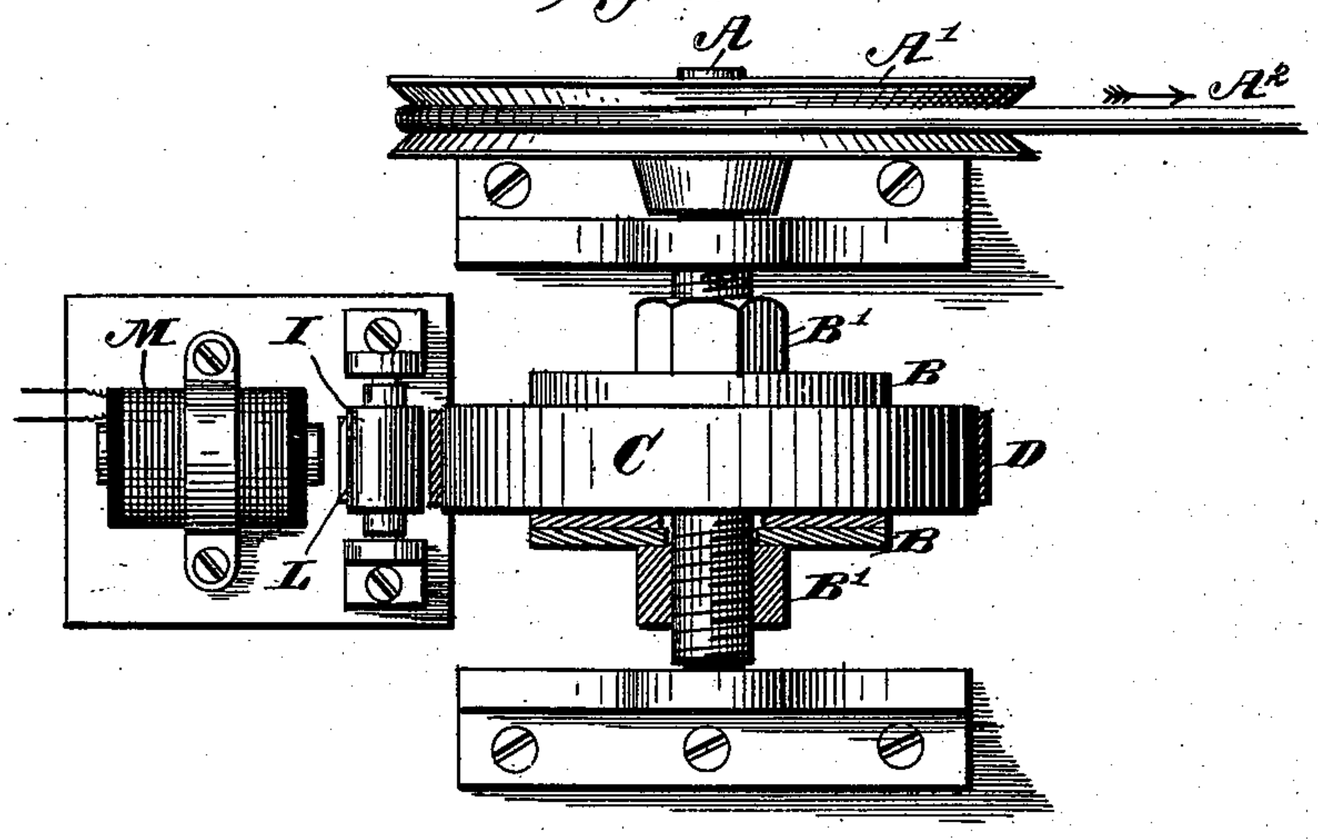


Fig. 3.



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UNITED STATES PATENT OFFICE.

ROSWELL T. SMITH, OF NASHUA, NEW HAMPSHIRE.

ELECTRICAL APPARATUS FOR EFFECTING MECHANICAL MOVEMENTS.

SPECIFICATION forming part of Letters Patent No. 377,413, dated February 7, 1888.

Application filed September 17, 1885. Renewed April 25, 1887. Again renewed November 18, 1887. Serial No. 255,521. (No model.)

To all whom it may concern:

Be it known that I, ROSWELL T. SMITH, a citizen of the United States, residing at Nashua, in the county of Hillsborough and State of New Hampshire, have invented certain new and useful Improvements in Electrical Apparatus for Effecting Mechanical Movements; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to certain improvements in electrical apparatus for effecting mechanical movements in various classes of machinery—such, for example, as the clutch by which a pulley is locked to a shaft and rotation imparted from one to the other.

It is the purpose of my invention to provide means whereby movement may be given to a mechanical element or device by the make and break of an electric circuit, said movement being automatically produced at a predetermined time or times.

It is a further purpose of my invention to so construct and combine the parts composing it that movement may not only be imparted to a mechanical element at any predetermined instant, and automatically, but that said element shall be held at its limit of motion by a positive and substantially unvarying force during any required period of time, after which it may be restored to its original position by automatic devices.

The invention consists of the several novel features of construction and combinations of parts, hereinafter fully set forth, and definitely pointed out in the claims annexed to this specification, the same constituting an improvement upon an invention for substantially a similar purpose set forth in an application filed of even date herewith.

Referring to the drawings forming part of this application, Figure 1 is a view partly in vertical section and partly in diagram. Fig. 2 is a side elevation, upon an enlarged scale, of a portion of the mechanism illustrated in Fig. 1. Fig. 3 is a plan view, partly in horizontal section, of the parts shown in Fig. 2. Fig. 4 is a detail view in side elevation of the belt-pulley shown in Figs. 2 and 3. Fig. 5 is a similar view of one of the friction disks or washers by which the pulley shown in Fig. 4 is carried.

In the said drawings, the reference-letter A designates a continuously-revolving shaft driven by any suitable means. Upon this shaft and splined to it are mounted disks B, between which is placed a pulley, C, which is loose upon the shaft, but is clasped between the disks B, which are forced against the vertical faces of said pulley by means presently to be described, sufficient frictional contact being produced thereby to cause the disks to carry the pulley with them as they revolve with the shaft. Over the pulley C is carried a belt, D, one end of which may be attached to an element to which movement is to be imparted—as, for example, to one end of a lever, E, pivoted between its ends, as at *e*, to a suitable support—or the belt may be attached to one arm of a bell-crank, E′, interposed between the belt and the lever E, whereby the line of strain of the belt is changed from a vertical to a horizontal direction. The other end of the belt may be attached to any convenient part of the machine-frame, or to any convenient support, (represented by F,) sufficient slack being allowed to prevent the belt being drawn closely against the periphery of the pulley, whereby the latter may have continuous revolution without producing strain upon the belt.

The letter G represents a lever pivoted between its ends to any suitable support located upon that side of the pulley most remote from the lever E. In one end of this lever is journaled a roll, I, which is normally in close proximity to, but not in actual contact with, the belt D, not far from the point where it leaves the periphery of the pulley. It will be seen that if by any means the roll I be thrown against the belt with sufficient force to press it lightly against the revolving pulley a high degree of frictional contact will be produced between the two extending over that portion of the pulley lying between the roll I and the point where the belt leaves the pulley on the opposite side, causing sufficient strain upon the belt to operate the lever E. Thus far the invention does not differ materially from that

shown in my concurrent application mentioned above. Upon the other end of the lever G is mounted an armature, L, and opposite thereto, within a proper distance, is placed an electro-magnet, M, having a core, *m*, which will, when the magnet is vitalized, attract the armature L and actuate the lever G.

The reference-letter N designates a table, or other suitable support, which may be located at any point relatively to the remainder of the mechanism, whether the same be near or remote. This table is divided between its ends by a broad transverse cut, and the gap thus formed is partly closed by plates P, formed of hard rubber, gutta-percha, or other non-conducting material, a narrow transverse opening, *n*, being left between the adjacent margins of said plates. Directly over this opening is placed a bar, R, formed of conducting material and supported upon insulated bearings. Mounted upon the under surface of one of the plates P is an elastic finger, S, which will, when no object is interposed, spring into contact with the bar R. This bar and the finger S both lie in the same circuit with the magnet M, one end of the wire of the coil being connected to the bar R and the other to the positive pole of the battery B*y*, the negative pole being connected by another wire to a binding-post, *s*, which attaches the finger S to its support. By this arrangement it will readily be seen that the circuit will be completed by contact of the finger S with the bar R. Over the surface of the table is fed, by any suitable means, a sheet, S′, formed of any non-conducting material and having formed therein openings O, so arranged that they lie in the same vertical plane with the spring-finger S. The sheet is led under the bar R and between it and the end of the finger. The openings are cut therein at any suitable interval, according to the frequency with which the pulley C is required to actuate the lever E or other element, and each opening is of a length proportioned to the length of time that the belt D is to remain under strain. I have shown feeding-rolls S^2 for feeding the sheet, the lower roll being driven by a pulley, S^3, on the shaft of which it is mounted, while the upper roll is mounted in elastic arms S^{3a}, the tension whereof may be varied by a set-screw, S^4, passing through the arm and tapped into the table.

The operation is as follows: As the sheet S′ advances, its imperforate portions pass between the bar R and the finger S, retracting the latter or throwing it off the bar and breaking the circuit at that point. The instant, however, that one of the openings O arrives at the point of the finger the latter springs through said opening and makes contact with the bar. The circuit being thus completed, the electro-magnet M is vitalized and attracts the armature L, thereby throwing the roll I against the belt and giving movement to the lever E, or other mechanical element to which the belt is connected.

As an illustration of one of the purposes for which my invention is adapted, I have shown the lever E as having operative connection with a clutch-box, T, splined upon a shaft, T′, and adapted to engage, when the lever E is actuated, with the hub of a pulley, T^2, loosely mounted upon said shaft. Let it be supposed, therefore, that with such an organization of mechanical elements it is necessary to hold the clutch-box T in positive engagement with the pulley during a specified period of time. When the circuit is once made and the magnet vitalized, the action of the lever is substantially synchronous, and after the lever has been moved far enough (be the distance greater or less) to effect a perfect engagement of the clutch-box the increased strain on the belt D will cause the pulley C to slip or turn between the friction-disks B, which carry it, without in any manner retarding the continuous rotation of the shaft A and the friction-disks splined thereon. The slip of these disks, however, upon the vertical faces of the pulley carried by them will produce a strain upon the belt D, which is exactly equal to the resistance required to produce such a slip, and it is evident, therefore, that during the time the roll I remains in contact with the belt the lever E or other mechanical element will be held, after its movement is effected, by a positive and substantially unvarying force at the point where its movement is arrested.

It is not absolutely essential that a belt-pulley and roll-carrying lever be interposed between the magnet and the element to which movement is to be imparted. Where the current is strong and the magnet of corresponding power, I may connect the lever E, carrying the armature L, directly to the clutch or other element, as shown at the left of Fig. 1. In this, as in the other arrangement described above, the lever is restored to position the moment the circuit is broken by a spring or equivalent device, T^3.

The continuously-revolving shaft A may be driven by a pulley, A′, mounted upon it and driven by a cord or belt, A^2. The pulley C, loosely mounted on this shaft and held between the friction-disks B, splined on said shaft, may be held, by a frictional contact subject to any required variation, by means of nuts B′, which may be turned up against said disks to force them more closely against the latter. This construction is shown in Fig. 3 of the drawings, and the specific construction of the holding-disks and their arrangement in connection with the pulley C, together with the manner of connecting them with the continuously-revolving shaft, is shown in Figs. 2 to 5, inclusive.

It is evident that I may use a number of separate circuit-breakers S with a single sheet, and I have shown in Fig. 1 two such. I may

also change the line of strain of the belt D by interposing one or more bell-cranks, E′, between the belt and the element to which motion is to be imparted; or I may employ ordinary pulleys instead of the bell-cranks.

The lever G may be restored, after operation, to its original position by means of a spring, L′, which is connected at one end to a stud or rigid support, L^2, and at the other to the lever. This spring may be coiled upon a pin, L^3, rigidly mounted in the end of the lever and moving freely in a perforation in the stud L^2.

As an example of one of the many purposes to which my invention is adapted, I have shown the lever E connected to a clutch upon a shaft, whereby the lever will automatically engage and disengage the clutch, its action and the duration of such action being timed and determined by the perforated sheet N. The apparatus may also be employed for operating the key-strikers of a key-board instrument, and for many other purposes.

I make no claim in this case to the pulley having a friction-slip, such matter being reserved for a separate application.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus for producing or converting motion, the combination, with a continuously-revolving pulley carried by adjustable friction devices, of a belt loosely carried around said pulley and attached to the mechanical element to which movement is to be imparted, a device for clamping said belt upon the surface of the pulley, and an electro-magnet by which said clamp is thrown against the pulley, substantially as specified.

2. In an apparatus for producing or converting motion, the combination, with a continuously-revolving pulley loose upon a shaft, of friction clamps or disks splined to or rigid upon said shaft and clasping the pulley between them, a belt normally loose upon said pulley, a clamping device binding the belt thereon, an electro-magnet by which said device is actuated, and means, substantially as described, for automatically making and breaking the circuit in which said magnet lies, substantially as specified.

3. In an apparatus for producing or converting motion, the combination, with a pulley and a belt normally loose thereon, of a lever carrying an idle-roll, an armature mounted upon one end of said lever, an electro-magnet adapted to attract said armature when vitalized, and a non-conducting sheet having perforations of suitable length and arrangement, said sheet being fed between devices by which the circuit is made and broken by the perforate and imperforate portions, respectively, substantially as specified.

4. In an apparatus for producing or converting motion, the combination, with a pulley loose upon its shaft, of friction clamps or disks splined upon or rigid with said shaft and clasping the pulley between them, and nuts turning upon said shaft upon one or both sides of the pulley and bearing against the friction-disks, a belt normally loose upon said pulley, a lever carrying a device for clamping the belt upon the surface of the pulley, an armature on said lever, and electro-magnetic devices for attracting said armature, substantially as specified.

5. In an apparatus for producing or converting motion, the combination, with a continuously-rotating pulley carried by friction-disks clasping its vertical faces and having continuous rotation, of a belt normally loose upon said pulley, a lever carrying an idle-roll adapted to bind the belt upon the surface of the pulley, an electro-magnet attracting an armature upon said lever, a support above which is arranged an insulated conductor connected with the magnet and with one pole of the battery, an elastic conductor which normally makes contact with the same and is connected with the other pole of the battery, and a non-conducting sheet fed between said conductors and having perforations of suitable length and arrangement, substantially as specified.

6. In an apparatus for producing or converting motion, the combination, with a lever pivoted or fulcrumed between its ends and having an armature mounted upon one end, of an electro-magnet placed opposite said armature, an electric circuit within which said magnet lies, and a non-conducting sheet having perforations of suitable length and arrangement, said sheet being fed between circuit making and breaking devices whereby the magnet is vitalized and the lever actuated at stated intervals, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

ROSWELL T. SMITH.

Witnesses:
C. E. P. SMITH,
C. L. LOVELAND.