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G. H. DAVIS.

ELECTROMAGNETIC MECHANISM FOR MUSICAL INSTRUMENTS.

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Fig. 1.

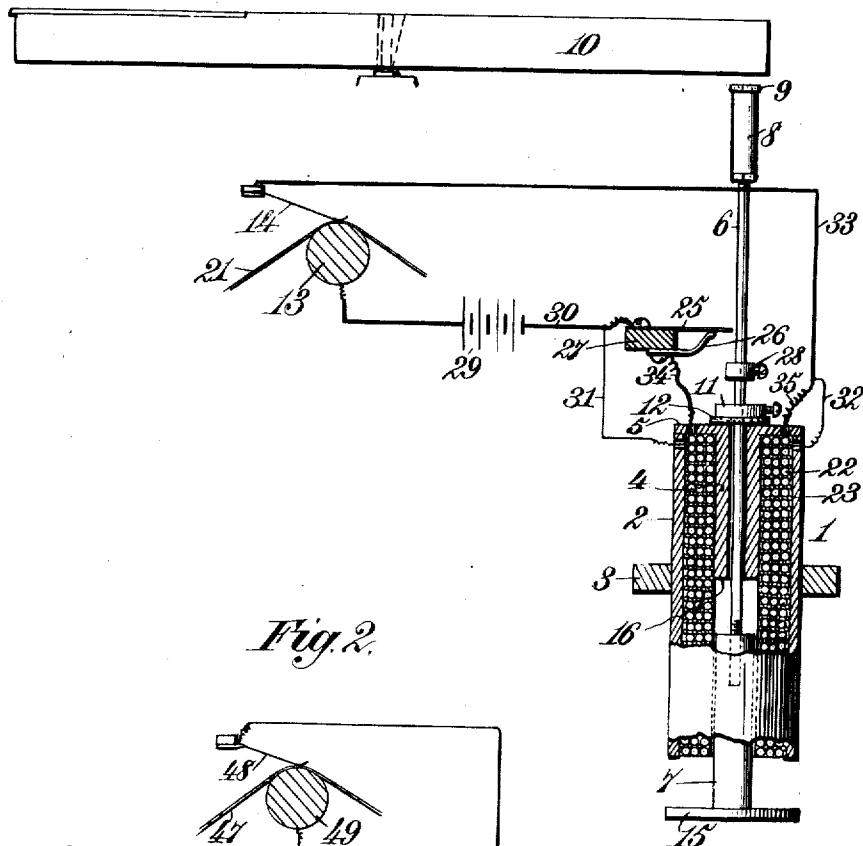
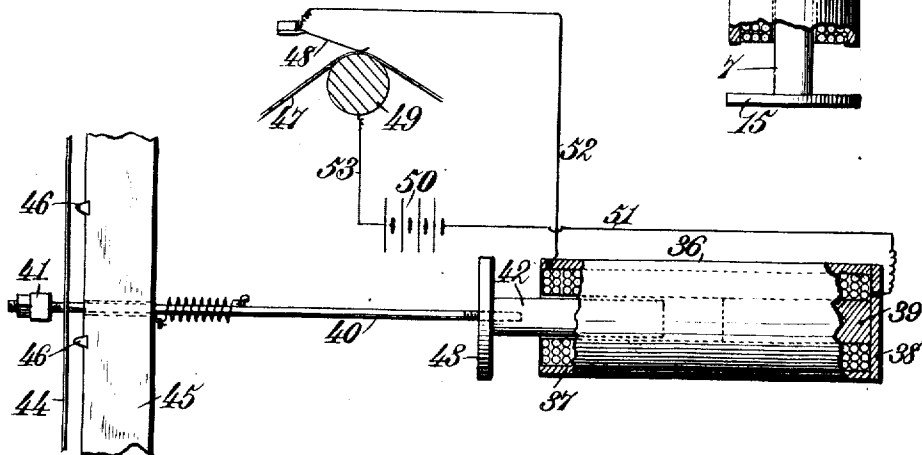


Fig. 2.



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ELECTROMAGNETIC MECHANISM FOR MUSICAL INSTRUMENTS.

No. 829,511.

Specification of Letters Patent.

Patented Aug. 28, 1908.

Application filed November 16, 1900. Serial No. 36,651.

To all whom it may concern:

Be it known that I, GEORGE HOWLETT DAVIS, a citizen of the United States of America, and a resident of the city of New York, borough of Manhattan, and State of New York, have invented certain new and useful Improvements in Electromagnetic Mechanism for Musical Instruments; of which the following is a specification.

My present invention relates to improvements in electromagnetic mechanism for musical instruments; and it consists in the combination and arrangement of parts, as will be hereinafter described.

In the prior art electromagnets have found but a limited application in practice in musical stringed instruments, since the form of magnet used was not properly designed to do the work required of it. They were weak, and consequently required a great deal of current to produce a given pull, and the range of action of the armatures was very limited.

The object of the present invention is to provide an electromagnetic mechanism which shall have a long range of action and give a powerful pull, so as to operate the desired parts with a moderate current.

In the accompanying drawings, Figure 1 represents my improved solenoid in operative relation to a piano-key, the solenoid being drawn partly in section and being adapted to push the key. Fig. 2 shows a longitudinal section of a modified form of solenoid which is adapted to pull the string of a stringed musical instrument against its fret.

In the embodiment of my invention as shown in Fig. 1 the wire helix 1 is surrounded by an iron tube or jacket 2, supported by the rail 3, in which it is secured by soldering or otherwise. Extending downwardly into the helix 1 is a stationary iron core 4, capped by an iron disk 5, soldered or otherwise secured to jacket 2. Through both core 4 and cap 5 a hole is bored, through which slides a brass rod 6. To the lower end of said rod 6 and resembling in its appearance a piston-rod is secured a core 7, which is movable in the helix 1, and upon the lower end of said core is an armature 15, which in operation cooperates with the magnetic jacket 2 to increase the pull on the core, thus giving to the rod a greater degree of force. The upper end of said rod 6 terminates in an actuating device for operating the key or other part. In this form of the invention the actuating device is a screw-cap 8, the felt face 9 of which is nor-

mally in juxtaposition to the rear end of the piano-key 10. An adjustable collar 11, faced with felt 12, is secured to rod 6 and prevents its dropping down too far, the felt face 12 acting to deaden the noise during the contacting of the parts. The circuit through the helix 1 may be closed in any desired manner; but in this case I have provided at one terminal a copper roller 13 and a contact-finger 14, between which a perforated music-sheet 21 is adapted to pass. It is obvious, however, that this may be done in any other well-known manner. The compound winding of helix 1 will be hereinafter fully described. Upon the helix 1 becoming energized the core 7 and armature 15 are attracted upwardly, carrying with them the brass rod 6, which slides freely through the stationary core 4 and causes the felt face 9 of cap 8 to impinge upon the lower surface of key 10 and force its rear end up. I impart to the magnet a long range of action and a strong pull principally by using the soft-iron secondary core 4, which in Figs. 1 and 2 is made stationary and is magnetically connected to the iron jacket 2 by the iron cap or collar 5. The entire mass of iron from the center up becomes oppositely polarized from the lower half, and thus the lower end of the secondary iron core greatly aids the helix 1 in attracting the movable core 7. The movable core 7, which is made of iron or some magnetic metal, is preferably made a little short, so that it will not strike the end of the core 4 when the circuit is closed and the core 7 completely pulled into the solenoid. This avoids the objectionable noise which would be produced if the core 7 struck the part 4. Suitable washers may be used to cushion the moving parts.

In the operation of reproducing the musical compositions represented by the perforated music-sheet 21 the magnets are frequently kept energized for a comparatively long time—as, for instance, when a long slot or perforation representing a sustained tone passes between the contact device—and with an ordinary magnet the same amount of current would continue to pass through it during the entire period of energization as was at first required to attract the core and move the rod and actuating device. After the initial movement of the core and armature, little or no power is required to keep the key up, and therefore the continuation of the maximum current is a great waste of elec-

trical energy, and to avoid such waste I have provided an improved form of economy solenoid-magnet with suitably automatically-operated connections whereby the current is reduced to about one-tenth after the magnet has done its heaviest work or the core and armature made its initial movement. An immense saving of current is not only thus effected, but the spark at the point of breaking contact is reduced to a degree whereby the charring or burning of the music-sheet and the sticking of the contact is entirely avoided.

In order to accomplish the ends just described, the solenoid-magnet, as shown in Fig. 1, is peculiarly wound and constructed, and it consists of a compound-wound spool, one winding being of heavy or large wire 22 and the other of comparatively small or fine wire 23, the latter being so wound as to occupy the spaces left between the larger wires, as clearly shown in Fig. 1, and acts as a resistance and greatly reduces the current when thrown into parallel with the larger wire in any suitable manner. This is accomplished in the present instance by arranging the larger wire 22 in a branch circuit in which is located the normally closed spring-contacts 25 and 26, which are supported upon a rail 27, the contact 25 being adapted to be acted upon by a collar 28, adjustably fixed to the rod 6. It will thus be seen that upon the solenoid-magnet being energized the core 7 and rod 6 will be forced upward, bringing the collar 28 into contact with the spring plate or finger 25 and separating the latter from the contact-finger 26 about the time the core or armature has completed its movement and is in proximity to the poles or heads of its magnet, thereby causing the current to traverse the magnet through the fine wire 23 only, said current being derived from battery 29, passing through wires 30 and 31 to the magnet and from thence through wire 32, main wire 33, and back to battery through contacts 14 and 13, whenever a perforation in the music-sheet allows of a completion of the circuit. During the initial movement of the core 7 when both the large and small wires are in circuit the current will pass in the course just described and also through the contacts 25 and 26 and wires 34 35.

In that embodiment of my invention illustrated in Fig. 2 I have shown my improved solenoid-magnet and connections arranged to pull the string of a stringed musical instrument against its fret. In this arrangement I do not show a magnet wound with large and fine wires, although I wish it understood that I may use such form of winding and also the special or a similar make-and-break device shown in Fig. 1, if so desired. In Fig. 2, then, the reference-numeral 36 designates the solenoid-magnet, 37 the magnet-jacket, having the cap 38, and stationary core 39 at one end

similar to the construction shown in Fig. 1. The connecting-rod 40 terminates at its outer end in an actuating device in the form of a button or fretting device 41 and at its other end is secured the core 42, carrying the armature 43, the said button being arranged over the string 44 of a stringed musical instrument 45, such as a banjo, having frets 46. The making and breaking of the circuit is effected through a perforated music-sheet 47 and contacts 48 and 49, similar to the arrangement described with respect to Fig. 1. The circuits, as shown, are from battery 50, wire 51, through magnet, thence by wire 52 and contacts 48 49, and back to battery, through wire 53.

The operation of the mechanism will be clear from the above description.

I am aware that solenoid-magnets with jackets and moving cores are old, and I do not claim such a magnet; but

What I claim, and desire to secure by Letters Patent, is—

1. The combination with an actuating device, of a solenoid for operating the same, the helix of said solenoid comprising two separate windings respectively of a relatively high and low resistance, an armature-core, a rod connecting said core to the actuating device, a circuit maker and breaker included in the circuit of the low-resistance winding means carried by said rod for operating said circuit maker and breaker toward the end of the movement of the armature-core for cutting out the circuit in the low-resistance winding through both the contact device and the solenoid, and a circuit-controlling device in circuit with both of said windings, said circuit-controlling device comprising a contact bar or roll and a selector-finger.

2. The combination with an actuating device, of a solenoid for operating the same, the helix of said solenoid comprising two separate windings, respectively, of a high and low resistance, the strands of which run parallel with one another, an armature-core, a rod connecting said core to the actuating device, an electric circuit including therein the high-resistance winding, a circuit-closing device also included in said circuit, the low-resistance winding being included in a branch circuit, a fixed and a movable contact normally in engagement with each other included in the branch circuit, and a projection on the said rod arranged to engage the movable contact to break the branch circuit and cut out the circuit through the low-resistance winding as the armature-core approaches the end of its movement.

3. The combination with an actuating device, of a solenoid for operating the same, the helix of said solenoid comprising two separate windings respectively, of a high and low resistance, an armature-core, a rod connecting said core to the actuating device, an elec-

tric circuit including therein the high-resistance winding, a circuit-closing device also included in said circuit, the low-resistance winding being included in a branch circuit, a
5 fixed and a movable contact normally in engagement with each other included in said branch circuit, and an adjustable projection on the said rod arranged to engage the movable contact and break the branch circuit to

cut out the circuit through the low-resistance winding as the armature-core approaches the end of its movement. 10

Signed by me at New York city, New York,
this 4th day of December, 1899.

GEORGE HOWLETT DAVIS.

Witnesses:

W. W. CRAIG,

ALFRED WERNICKE.