L. D. MORRIS.

ELECTROMAGNET.

APPLICATION FILED SEPT. 17, 1917.

1,282,276.

Patented Oct. 22, 1918.

2 SHEETS—SHEET 1.

Fig. 1.

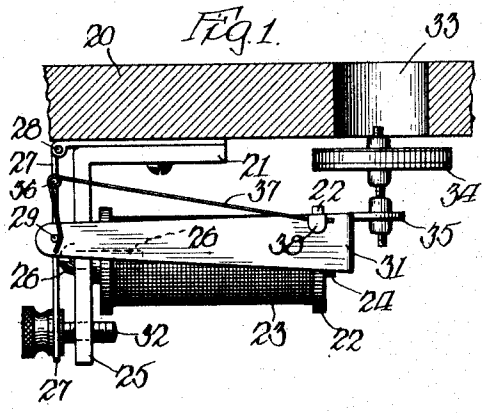
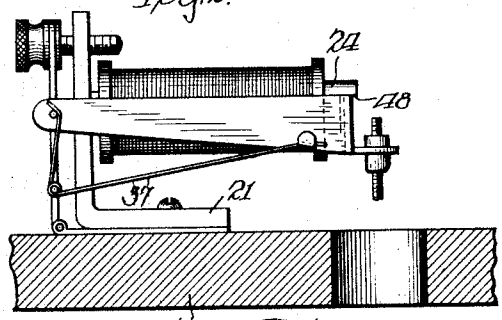


Fig. 2.



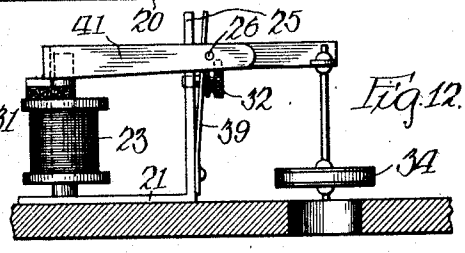


Fig. 12.

Fig. 3.

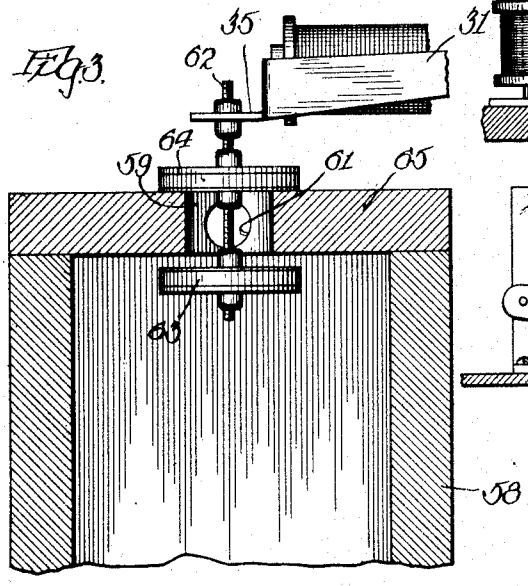


Fig. 10.

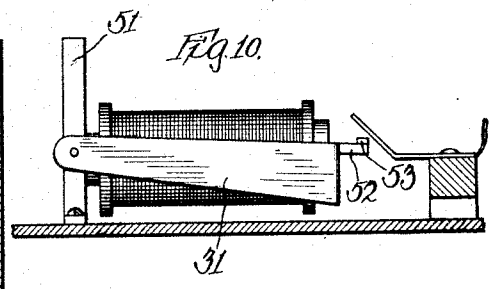
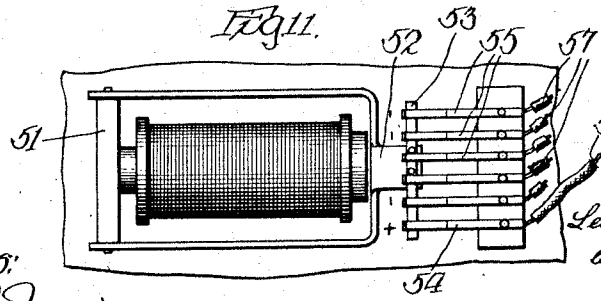


Fig. 11.



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2 SHEETS—SHEET 2.

Fig. 4.

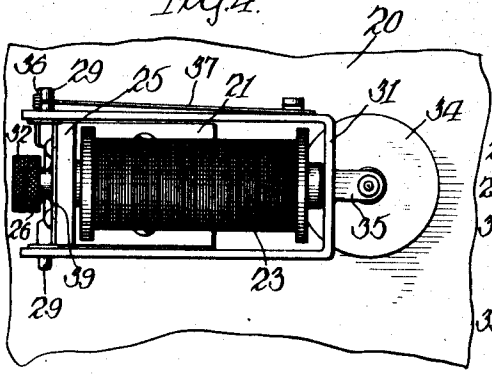


Fig. 5.

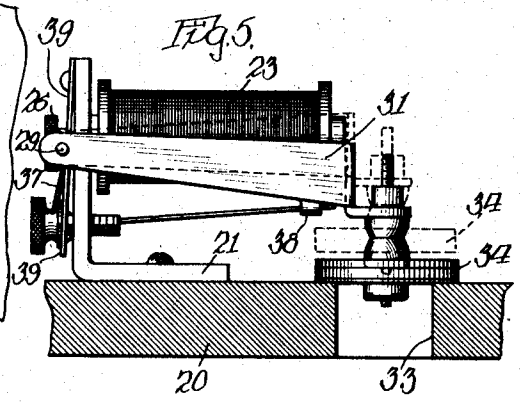


Fig. 6.

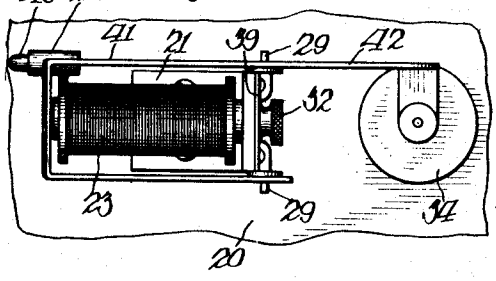


Fig. 7.

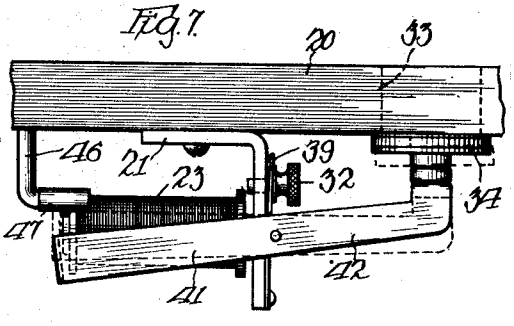


Fig. 9.

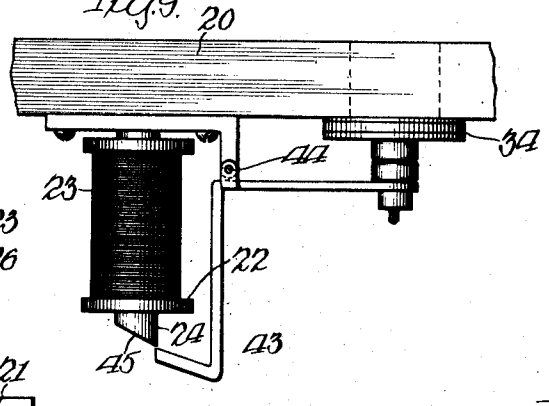
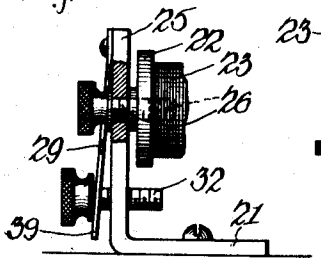


Fig. 8.



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UNITED STATES PATENT OFFICE.

LEONARD D. MORRIS, OF CHICAGO, ILLINOIS.

ELECTROMAGNET.

1,282,276. Specification of Letters Patent. Patented Oct. 22, 1918.

Application filed September 17, 1917. Serial No. 191,855.

To all whom it may concern:

Be it known that I, LEONARD D. MORRIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electromagnets, of which the following is a specification.

My invention relates to electro-magnets and has for its object the provision of an improved electro-magnet wherein the armature may be moved in substantial parallelism with the adjacent face of the magnet core and may be kept out of actual sliding contact with the core.

Another object is the provision of an improved electro-magnet, the armature of which shall be adjustable with respect to the magnet, whereby the force applied to the armature and the speed of its movement may be varied.

A further object is the provision of improved means to prevent trembling of the armature during energization of the magnet.

A further object is the provision of improved means for giving the armature and its load a normal bias in any desired direction.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings which form a part of this specification and illustrate the preferred embodiment of the invention.

In the drawings, Figure 1 is a side elevation of the invention showing it positioned in the wind-chest of a pipe organ and operatively connected to one of the puppet valves thereof; Fig. 2 is an inverted side elevation of the invention illustrating the means to prevent trembling of the armature; Fig. 3 is a sectional view of one end of a wind-trunk having a three-way air passage and a compound valve therefor, the latter being shown operatively connected to the armature of the present invention; Fig. 4 is a bottom plan view and Fig. 5 an inverted side elevation of a modification of the invention, Fig. 5 illustrating in dotted lines the position of the armature and its load during energization of the magnet; Fig. 6 is a bottom plan and Fig. 7 a side elevation of the invention, illustrating a device to prevent trembling of the armature and means for normally holding the valve forming the armature load in elevated position, Fig. 7 showing in dotted lines the position of the armature and its load during energization of the magnet; Fig. 8 is a fragmentary sectional detail view of the form of mounting for magnet and armature employed in Figs. 4 and 5; Fig. 9 is a side elevation of an electro-magnet, showing it mounted within a wind-chest and illustrating a pivoted armature which at one end carries a valve and is counterbalanced by means differing from that of Figs. 6 and 7, to hold the valve in elevated position; Figs. 10 and 11 are respectively a side elevation and a top plan view of an electro-magnet, having a bus bar mounted on its armature and adapted, when actuated, to conduct electricity from one contact to a plurality of others; and Fig. 12 illustrates in side elevation and inverted a further modification in which actual contact between the armature and core is avoided while trembling of the armature is prevented.

Reference numeral 20 indicates the upper wall of a pipe organ wind-chest, to the inner side of which is rigidly fixed an angled magnet bracket 21. Referring to Fig. 1, an electro-magnet, comprising a spool 22, a helix 23, and a core 24, is fixed to the outstanding end 25 of the magnet bracket by means of a machine bolt 26, the shank of which passes through the bracket and is threaded into the end of core 24. An armature bracket 27 is hinged to the wall 20, preferably as at 28, behind the bracket 21. The armature bracket may be a common hinge, as shown in Figs. 1 and 2, having one of its leaves bound between wall 20 and bracket 21 and having its pintle at 28; or it may comprise a leaf spring, as will be described with reference to Figs. 4 to 8 inclusive. As will be seen in Fig. 1, the armature bracket 27 carries opposite edge lugs 29, which form a shaft upon which the armature 31 is pivoted. The axis of the lugs 29 is substantially that of the magnet core 24. The armature consists of a U-member which extends from the lugs 29 behind the magnet bracket to and across the forward end of the magnet. The armature bracket is of substantially the same length as the free end 25 of the magnet bracket and has its free end slotted to receive the annularly channeled portion of an adjusting screw 32, the shank of which is threaded into the armature bracket. Rotation of screw 32 moves the armature bracket toward or from the magnet bracket and, of course, carries

the forward end of the armature farther from or nearer to the magnet core 24. This adjustability of the armature permits the application of the energy of the magnet to the armature in less or greater degree, as is desired. It also prevents a sliding contact between the core and armature and so eliminates that friction as a force affecting the actions of the armature. An air passage 33 is provided in the wind-chest wall 20 for communication of air to a pipe not shown, and is controlled by a valve 34 mounted on an arm 35 formed on the forward portion of the armature. In the playing of an organ, rapid and absolutely uniform action of the pipe valves is essential. Heretofore, in electric organs, these features have been most successfully obtained by causing the key-operated magnet to actuate a small bellows in the wind-chest, the bellows, in turn, moving the pipe valve. By this means uniformity of action was secured but at the expense of speed, the interposition of the bellows causing a noticeable delay between the striking of the key and the sounding of the pipe. It will be understood that the pipe valves of an organ necessarily vary slightly in weight and that the cross sectional areas of the passages 33 may also vary. Each of these variations affects the speed with which the valve responds to its key. By providing an adjustable armature to actuate the valve, I am enabled to bring all the pipe valves to a uniform speed of movement, for, if the valve is heavy or the air presses it to its seat very stiffly because of the large cross-sectional area of the air passage, the armature may be moved nearer the magnet core thus applying greater force to its opening movement; and, if the valve is very light or the air passage small the energy exerted on the armature may be reduced by moving it from the magnet. The valve 34 is preferably a puppet pressed against the flat under surface of wall 20 and of considerably greater diameter than passageway 33 to allow travel of the valve without uncovering the air passageway during adjustment of the armature. The armature bracket is apertured to avoid contact between it and the head of bolt 26. In Fig. 1 the armature 31 is shown in the position it takes during energization of the magnet, the valve being open. To return the valve normally to closed position, I employ a stud 36 formed on the edge of the armature bracket at a distance from one of the lugs 29. About this stud is bent a spring 37 one end of which is caught on the adjacent lug 29, the other end passing under a finger 38 formed near the forward end of the armature. Obviously, when the armature is adjusted this counterbalancing spring 37 moves with it. It is to be noted that screw 32 has a knurled portion to assist manipulation and that these knurled screws provide means for very rapidly bringing the entire action of an organ to uniformity.

Figs. 4 to 8, inclusive, and 12 illustrate a modification of the adjustable armature bracket wherein a leaf spring 39, comprising the armature bracket, is secured by one of its ends to the free end 25 of magnet bracket 21 and has its other end bent backwardly from the magnet bracket. The lugs 26 protrude from opposite sides of the spring 39 and pivotally support the armature. The adjusting screw 32 engages a slot provided in the free end of spring 39 and by its position controls the distance between the end of the armature and the end of the magnet core. In the use of the spring form of armature bracket it is not essential that the screw 32 be annularly channeled, as the tension of the spring 39 holds the armature as close to the end of the magnet as the head of the screw will permit. The stud 36, in Figs. 4, 5, and 8, also protrude from one edge of spring 39 and carries the counterbalancing spring 37 as described above in connection with Fig. 1. In Figs. 4, 5, and 8 the bolt 26 is provided with a knurled head for convenience in assembling the device.

Figs. 6 and 7 employ a modified form of armature wherein one leg of the U-shaped armature 41 is elongated as at 42 into an arm for support of the valve 34. In these figures and in Fig. 12 the magnet is mounted on the opposite side of the magnet bracket from the air passageway 33 and the armature is pivoted with its heavier two-legged end on the opposite side of the pivot lugs 29 from the valve. In this manner the heavier end of the armature counterbalances the weight of the valve and avoids the need of a counterbalancing spring such as 37 in Figs. 1, 2, 4 and 5.

Another form of counterbalanced armature is illustrated in Fig. 9, wherein the heavier depending end 43 of the armature swings about pivot 44, and, together with the air pressure below the valve counterbalances the weight of valve 34; and said end 43 swinging substantially horizontally below the lower end of the hanging magnet 23. In this figure the lower end of the magnet core 24 is chamfered as at 45 and the lower end 43 of the armature is upbent to bring these adjacent surfaces into proximity. The swing of the armature toward the magnet in Fig. 9 is limited by contact between its end 43 and the spool 22, this contact also operating to prevent that trembling of the magnet that is liable to occur when air is rushing from the interior of the windchest past the slightly opened valve into the passageway 33.

Various other means are employed by me to prevent the above mentioned trembling of the valve such, for instance, as the stop

46, shown in Figs. 6 and 7, which protrudes into the path of movement of the armature 41 when the magnet is energized and stops the armature from swinging past the axis of the core. The attractive force of the magnet will hold the armature firmly against the rubber buffer 47 mounted on the top 46. In Fig. 2 the forward end of the magnet core 24 is partially extended in the form of a segment 48 which overhangs the forward end of the armature. When the magnet is energized, contact between the armature and segment 48 arrests any trembling tendency in the armature and the valve (not shown in Fig. 2) carried thereby. Fig. 12 shows a further method of avoiding trembling in the armature and valve. In this figure the magnet core extends considerably above the upper end of the upstanding coil 23 and the U-shaped armature partially surrounds this bare upper end of the core. Normally the weight of the valve just overcomes the weight of the magnet end of the armature. However, when the magnet is energized the armature is drawn downward toward the coil and strikes a felt buffer 49 positioned between it and the top of the coil.

Figs. 10 and 11 are respectively a side elevation and a top plan view of an electric switch which may be operated by the present invention. The armature 31, pivoted at the rear of the magnet on a bracket 51 is adapted to swing across the forward end of the magnet and has an arm 52 at its forward end on which is mounted a bus bar 53 which substantially parallels the axis on which the armature oscillates. Alined above the bar 53 are a plurality of spaced electric contact fingers, the one numbered 54 receiving current through a wire 56 from any source of supply (not shown) and, when the magnet is energized, transmitting the current through the bus bar to all the other contact fingers 55, which, through their respective wires 57 conduct the current to any desired location in the organ.

In Fig. 3 is shown an organ wind trunk 58 having an air outlet 59 leading to the outer air from the interior of the trunk, and provided with an air duct 61 positioned at right angles to the outlet 59 and communicating therewith. The duct 61 is adapted to fill and empty an auxiliary pneumatic such as a small bellows for operating any desired part of a pipe-organ. The armature 31 of the device shown in Fig. 1 carries on its arm 35 a valve stem 62 which extends through the outlet 59 and carries inner and outer valves 63 and 64 respectively. When one of these valves is in contact with the end wall 65 of the wind trunk the other valve is out of contact with that wall, thus affording communication between the bellows (not shown) and the interior of the wind trunk, as shown in Fig. 3, in the elevated position of the armature, connecting the said bellows with the outside air through duct 61 and outlet 59.

While I have described my invention as applied to the operation of various parts of a pipe organ, it is to be observed that its utility is not limited to such work. Further, it is my desire not to be restricted to the precise construction shown in the drawings and above described, except in so far as the same is limited in the appended claims, as persons skilled in the art might devise modifications without departing from the spirit of the invention.

I claim:

1. The combination with an electro-magnet comprising a fixed coil and a fixed core, of an armature bracket adjustable axially of the core, and an armature pivoted at a fixed point to the bracket on an axis at right angles to that of the core, and traversing an end of said core.

2. The combination with an electro-magnet comprising a fixed coil and a fixed core, of an armature bracket adjustable axially of the core, and an armature traversing an end of said core and pivoted to the bracket on an axis at right angles to the axis of the core.

3. The combination with an electro-magnet comprising a fixed coil and a fixed core, of a U-shaped armature the cross-reach of which traverses one end of the magnet and the legs of which extend on opposite sides of the magnet to the opposite end thereof, and an adjustable armature bracket positioned at said opposite end of the magnet and to which the legs of the armature are pivoted.

4. The combination with an electro-magnet comprising a fixed coil and a fixed core, of a U-shaped armature the cross reach of which traverses one end of the magnet and the legs of which extend on opposite sides of the magnet to the opposite end thereof, and an armature bracket positioned at said opposite end of the magnet and adjustable axially of the core thereof, the armature being pivoted to said magnet bracket on an axis at right angles to and near the axis of said core.

5. The combination with a support of a rigid magnet bracket protruding therefrom, an armature bracket positioned rearwardly of the magnet bracket, an electro-magnet fixedly secured to the magnet bracket and projecting forwardly thereof, an armature traversing the forward end of the electro-magnet and pivoted to the magnet bracket, and a set-screw threaded into the magnet bracket and being connected to the armature bracket to move it, said armature bracket being movable axially of the electro-magnet.

6. The combination with a magnet bracket, of an electro-magnet projecting therefrom,

a spring fastened by one end to the bracket and extending rearwardly thereof; an adjustable fastening device securing the free end of the spring to the bracket, and an armature pivoted to the spring and traversing an end of the magnet.

7. The combination with a magnet bracket, of an electro-magnet fixed thereto, an armature bracket comprising a leaf spring fastened by one end to the magnet bracket, an armature traversing one end of the magnet core and pivoted to the free end of the armature bracket, and adjustable means for spacing the armature bracket at any desired distance from an end of the magnet core.

8. The combination with a magnet bracket, of an electro-magnet fixed thereto by one end, an armature bracket comprising a leaf spring positioned at substantially right angles to the axis of the magnet core, having its free end bent away from the magnet core and fastened by one end to the magnet bracket and positioned to swing across one end of the magnet core, and a set-screw threaded into the magnet bracket and having a head limiting movement of the free end of the armature bracket from the magnet bracket.

9. The combination with a magnet bracket and an electro-magnet projecting from one side thereof, of an armature bracket mounted on the magnet bracket and adjustable axially of the core of the magnet, an armature swingingly mounted on the armature bracket and traversing one end of the magnet core, and a counterbalancing spring carried on the armature bracket and having its free end caught on the armature to give the armature a normal bias in a given direction.

10. The combination with a magnet bracket and an electro-magnet projecting therefrom, of an armature bracket mounted near the magnet and adjustable axially of the core thereof, an armature pivoted to the armature bracket, extending forwardly of the pivot and crossing the magnet core, and a load-carrying leg on the armature extending rearwardly of said pivot, the forwardly-extending portion of the armature being heavier than its load-carrying leg.

11. The combination with a fixed electro-magnet, of an armature therefor mounted to swing across an end of the magnet core on an axis standing at right angles to the axis of the magnet core and adjustable axially of said core, and a stop limiting the movement of the armature toward the axis of the core.

In testimony whereof I affix by signature.

LEONARD D. MORRIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."