No. 851,663. PATENTED APR. 30, 1907.

R. P. JACKSON.

ELECTROMAGNET.

APPLICATION FILED APR. 3, 1905.

Fig. 1.

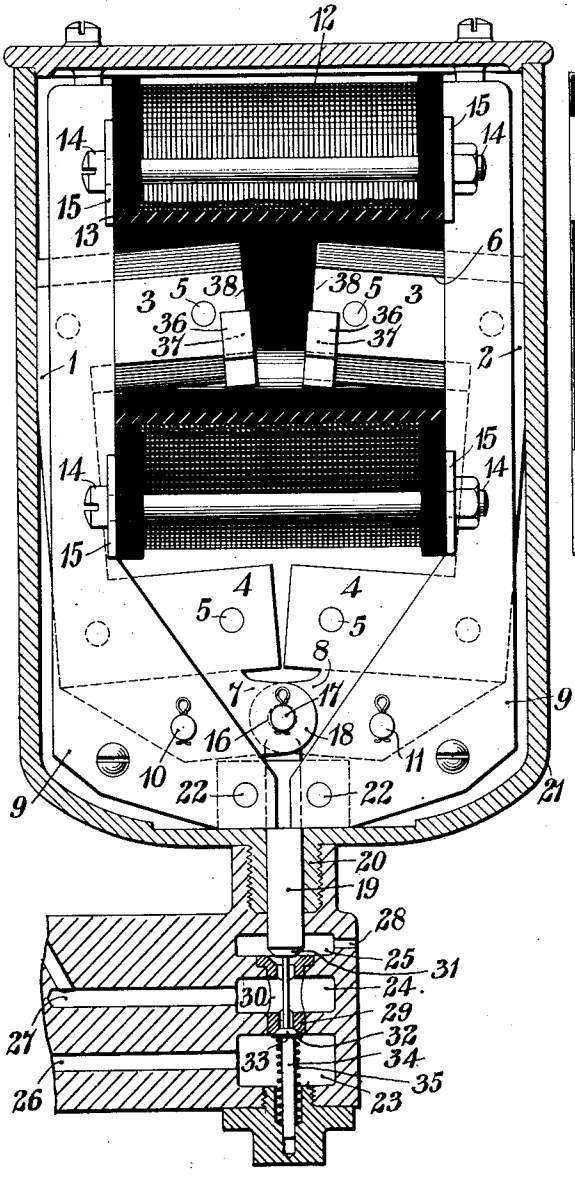
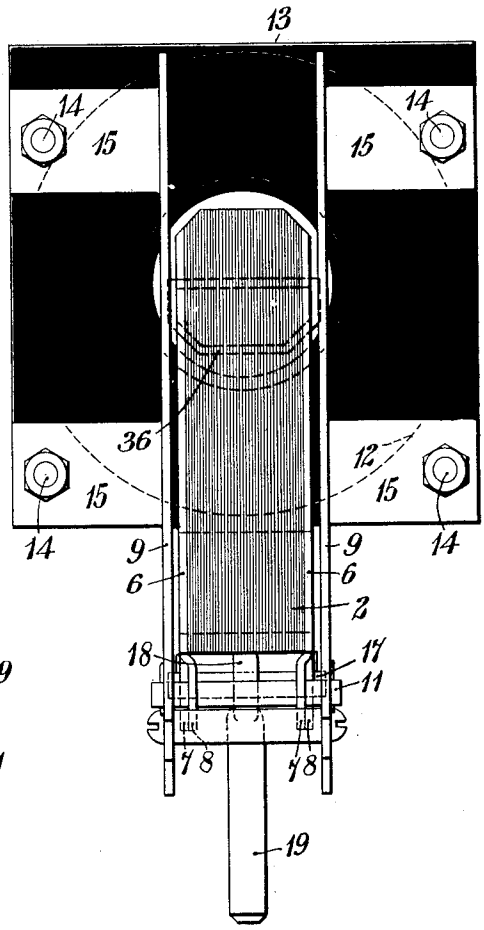


Fig. 2.



WITNESSES:

C. L. Belcher

Otto S. Schairer.

INVENTOR

Ray P. Jackson

BY

Wesley G. Carr

ATTORNEY

UNITED STATES PATENT OFFICE.

RAY P. JACKSON, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTROMAGNET.

No. 851,663. Specification of Letters Patent. Patented April 30, 1907

Application filed April 3, 1905. Serial No. 253,638.

To all whom it may concern:

Be it known that I, RAY P. JACKSON, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electromagnets, of which the following is a specification.

My invention relates to electro-magnets and particularly to such as are operated by alternating currents.

The object of my invention is to provide a novel and improved structure for electromagnets by means of which vibration between the parts of the magnet core may be rendered so slight as to be unobjectionable.

Electro-magnets which have heretofore been constructed for operation by single-phase alternating currents have embodied armatures or core sections that were movable against gravity or springs and consequently, each time the alternating current electro-motive force passed through its zero value the parts of the magnet core would separate and would be again brought together as the current rose to its maximum value. Vibration of this character is prohibited in certain classes of work while the noise due to vibration is generally objectionable in all classes of work.

My invention provides an electro-magnet the parts of which are so constructed and arranged that the vibration may be greatly reduced or actually prevented and the noise due to vibration may be rendered almost unnoticeable.

My invention is illustrated in the accompanying drawing in which

Figure 1 is a view in side elevation of an electro-magnet, constructed in accordance therewith, the inclosing casing and certain of the other parts being shown in section, and Fig. 2 is a view in end elevation of the electro-magnet shown in Fig. 1 removed from its inclosing casing.

The magnetizable core of the electromagnet comprises two sections, 1 and 2, that are composed of U-shaped laminæ the upper legs 3 of which are wider than the lower legs 4. The laminæ are clamped, by means of rivets 5, between side plates 6 that are provided with ear portions 7 and 8 which project from the outer sides of the lower legs 4.

The U-shaped sections of the core are supported in a skeleton frame work 9 with the planes of the laminæ vertical, by means of pivot pins 10 and 11 that pass through the ear portions 7 and 8 and the lower ends of the frame work 9. The axes of the pivot pins may be located either vertically below the centers of gravity of the U-shaped sections or nearer the central plane of the magnet, in order that the upper legs 3 may be moved apart by gravity, when the core is not magnetized, as indicated in Fig. 1.

A magnetizing winding 12 is mounted upon an insulating spool 13 that surrounds the upper legs 3 of the core sections and is supported in position by means of bolts 14 and bent up portions 15 of the frame work 9.

For the purpose of illustrating the utility of my invention I have shown it as applied to the operation of pneumatic valves, though it is, of course, understood that it may be employed for many other purposes.

The ends of the ear portions 7 and 8 may be provided with slightly elongated apertures 16 in which may be located a pin 17 that also passes through an eye 18 at the upper end of a valve rod 19, having a tapered lower end. The rod 19 operates in a guide provided by a screw threaded projection 20 from the bottom of an inclosing casing 21 to which the frame work 9 is secured by means of pins 22.

The screw threaded projection 20 engages corresponding screw threads in a member having inlet, supply and exhaust chambers 23, 24 and 25, respectively, and corresponding communicating passages 26, 27 and 28. Located in apertures in the partition walls of the chambers is a bushing 29 having lateral apertures 30 that open into the chamber 24 and concave valve seats 31 and 32 in its upper and lower ends for the reception, respectively, of the lower conical end of the rod 19 and of a conical flange 33 upon a rod 34 that is carried by the rod 19. When the magnet winding is not energized, the flange 33 is normally maintained in engagement with the corresponding valve seat 32 by means of a spring 35 and passage of fluid is thereby prevented from the inlet chamber 23 to the supply chamber 24. When the two portions 3 of the core are drawn together, the conical end of the rod 19 is forced downwardly into engagement with the valve seat 31 and the

flange 33 is separated from the valve seat 32. Passage of fluid from the supply chamber to the exhaust chamber is thereby prevented while free passage is provided between the inlet and supply chambers.

Since the rod 19 is normally maintained in its uppermost position by means of the spring 35, the pivotal connection thereof with the ear portions 7 and 8 may be omitted, if desired, and the upper end of the rod 19 may simply rest against properly shaped overlapping ear portions that are formed integral with the side plates 6.

If desired, my invention may be supplemented by another means for obviating or reducing vibration between the parts of the magnet core which effects displacement of the phase of a portion of the flux between the magnet pole pieces with respect to the remainder of the flux so that the reversals of polarity of the two portions of the flux shall occur dissimultaneously. Such means may comprise loops 36 of conducting material surrounding portions of the pole pieces of the magnet, the portions 37 of the pole pieces which are surrounded by the conducting structures being preferably longer than the remaining portions 38 in order that an appropriate amount of flux may be forced through the conducting loops when the two portions of the core are in engagement. This supplementary means was not invented by me and it is not essential to satisfactory operation of magnets that have the structural features hereinbefore described but practical experience has demonstrated that the loops 36 assist in reducing the hum due to the alternations of the magnetism to unobjectionable proportions.

It will be understood that the magnet may be inverted so that the pivotal supports for the core parts shall be above the centers of gravity thereof, though in such case they will preferably be located outside of vertical lines through the centers of gravity in order that when the parts are demagnetized they may be separated automatically by gravity. All other variations from what is shown, as regards the positions of the magnet members, which do not materially change the mode of operation or result, are to be considered as within the scope of my invention.

While I have shown both sections of the magnet core as movable and pivotally supported, an operative structure might be adopted in which one of the core sections would be rigidly supported and the other section be either pivotally or otherwise movably supported so as to act in accordance with the desired conditions. The shapes of the core sections and of the projecting ear portions or levers carried thereby, as well as many other of the details of construction and arrangements of the parts, may also be varied considerably from what is specifically shown and described without departing from my invention.

It will be observed that in the magnet comprising my invention there are no armatures or other weights which are entirely supported against gravity or springs by the magnetizing action exerted by the winding, and that as a result the forces tending to effect separation of the parts of the core when the magnetism reverses its polarity are greatly reduced as compared with the corresponding forces in electromagnets which have heretofore been employed. The movable parts are pivotally supported in unstable equilibrium and the magnetizing force required to effect operation of the parts of the core and maintain them in engagement may be very small as compared with that which may be necessary to raise an armature or a movable part of the core against the attraction of gravity.

In order that the masses which are most susceptible to vibration may have a large amount of inertia that is opposed to vibration I have made the upper legs of the core of greater mass than the lower legs. The operating forces of the magnet are applied at long radii from the pivotal supports of the core parts whereby they are made exceptionally effective. The air gap between the separable ends of the core sections is at all times centrally located inside the magnetizing coil, provided both core sections are pivotally supported, which tends to insure certainty and uniformity of operation.

As I have already stated, the movable core sections may be supported upon pivots that are located either above or below their centers of gravity provided the pivots are so located that gravity will move the sections apart when they are demagnetized but will be overcome by a very small magnetic pull. It will be further understood that the movable core section or sections may be mounted to move otherwise than on pivots and may be counterbalanced otherwise than as here indicated, it being merely essential that the movable section or sections shall be so constructed and mounted that a very slight magnetic pull will serve to overcome the force that is exerted in opposition to it.

I claim as my invention:

1. A core structure for electro-magnets comprising two U-shaped parts, a pivotal connection between the parts, and pivotal supports for the parts located between and below the centers of gravity thereof.

2. A core structure for electro-magnets comprising two U-shaped parts and independent pivotal supports for the parts located between and below the centers of gravity thereof.

3. A core structure for electro-magnets comprising two U-shaped parts, a pivotal connection between the parts, and pivotal

supports for the parts located below the centers of gravity thereof.

4. A core structure for electro-magnets comprising two U-shaped parts, a pivotal connection between the parts, and pivotal supports for the parts.

5. A core structure for electro-magnets comprising two U-shaped parts, a pivotal connection between the parts, pivotal supports for the parts, and a member operated by the pivotal connection between the parts.

6. A core structure for electro-magnets comprising two U-shaped magnetizable parts both of which are freely movable by magnetism and gravity and a pivotal connection between the parts.

7. A core structure for electro-magnets comprising two U-shaped magnetizable parts at least one of which is pivotally supported to be freely movable in one direction by magnetism and in the other direction by gravity.

8. A core structure for electro-magnets comprising two U-shaped magnetizable parts one leg of each U-shaped part being of greater mass than the other leg and a pivotal support for one of the parts.

9. A core structure for electro-magnets comprising two U-shaped magnetizable parts, one leg of each U-shaped part being of greater mass than the other leg and a pivotal support for one of the parts located below the center of gravity thereof.

10. An electro-magnet comprising two U-shaped magnetizable core parts two of the legs of which are pivoted together and a winding surrounding the two legs that are remote from the pivot.

11. An electro-magnet comprising two U-shaped magnetizable core parts, a pivotal support for one of said parts and a stationary winding surrounding two of the legs of said parts.

12. An electro-magnet comprising two U-shaped core parts one leg of each of which is of greater mass than the other, a pivotal support for one of said parts and a winding surrounding the legs of greater mass.

13. An electro-magnet comprising two U-shaped, magnetizable cores, a pivotal connection between the cores, and a stationary winding surrounding two of the legs of the cores.

14. An electro-magnet comprising two U-shaped, magnetizable cores, a pivotal connection between two of the legs of the cores, and a winding surrounding the other two legs only of the cores.

15. A core structure for electro-magnets comprising two U-shaped parts the legs of which have opposing faces and a pivotal support for one of the parts located below the center of gravity thereof, the most widely separable legs of the core being of greater mass than the other legs.

16. A core structure for electro-magnets comprising two U-shaped parts the legs of which have opposing faces and a pivotal support for one of the parts, the most widely separable legs of the core being of greater mass than the other legs.

17. A core structure for electro-magnets comprising two U-shaped parts the legs of which have opposing faces, a pivotal support for one of the parts, the most widely separable legs of the core being of greater mass than the other legs and a winding surrounding the legs of greater mass.

18. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs the upper ones of which are of greater mass than the lower ones, and a pivotal support for one of the core sections located below the center of gravity thereof.

19. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs, a pivotal support for one of the core sections located below the center of gravity thereof, and a winding surrounding the upper legs of the core sections.

20. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs the upper ones of which are of greater mass than the lower ones, a pivotal support for one of the core sections located below the center of gravity thereof, and a winding surrounding the upper legs of the core sections.

21. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs, a pivotal connection between two of the legs of the core sections, and a stationary coil surrounding the other two legs of the core sections.

22. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs, a pivotal connection between two of the legs of the core sections, and a winding surrounding the other legs only of the core sections.

23. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs two of which are of greater mass than the others and a pivotal connection between the legs of lesser mass.

24. An electro-magnet comprising two U-shaped, magnetizable core sections having approximately horizontal legs two of which are of greater mass than the others, a pivotal connection between the legs of lesser mass and a winding surrounding the other legs of the core sections.

25. An electro-magnet having a single coil and two movable core sections therefor that are pivotally supported to move apart when demagnetized and be drawn and held together by a slight magnetic pull.

26. An electro-magnet having a single coil

and two core sections that are movably supported below their centers of gravity and are maintained in unstable equilibrium when magnetized.

27. In an electro-magnet, a coil and a core therefor comprising two movable parts that are maintained in normally unstable equilibrium when magnetized.

28. In an electro-magnet, a coil and a core therefor comprising two movable parts that are pivotally mounted in the same plane and are maintained in normally unstable equilibrium when magnetized.

In testimony whereof, I have hereunto subscribed my name this 25th day of March, 1905.

RAY P. JACKSON.

Witnesses:
R. WIKANDER,
BIRNEY HINES.