No. 730,840. PATENTED JUNE 9, 1903.

W. H. PRATT.

MAGNETIC SUSPENSION DEVICE.

APPLICATION FILED OCT. 10, 1902.

NO MODEL.

Fig. 1.

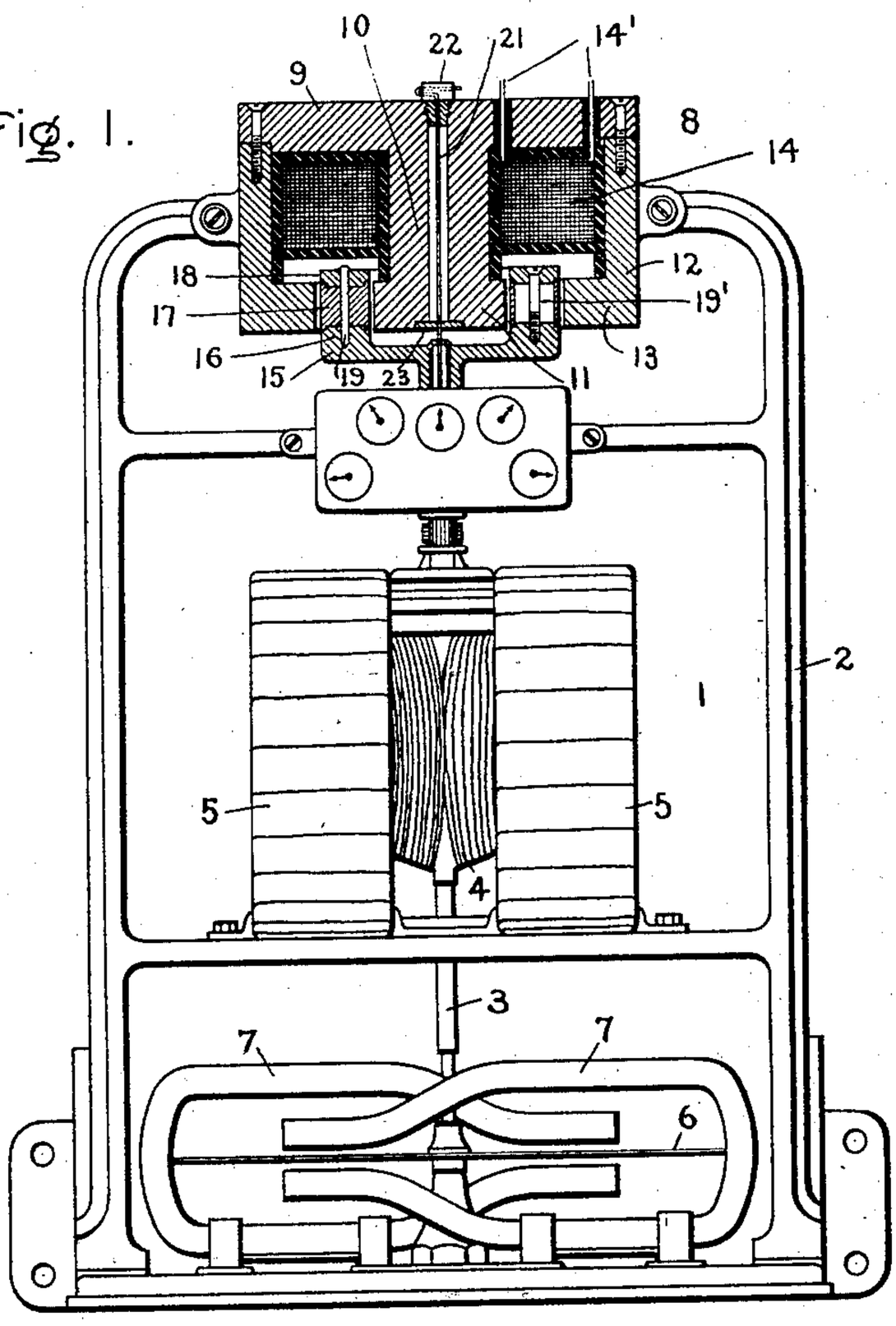


Fig. 2.

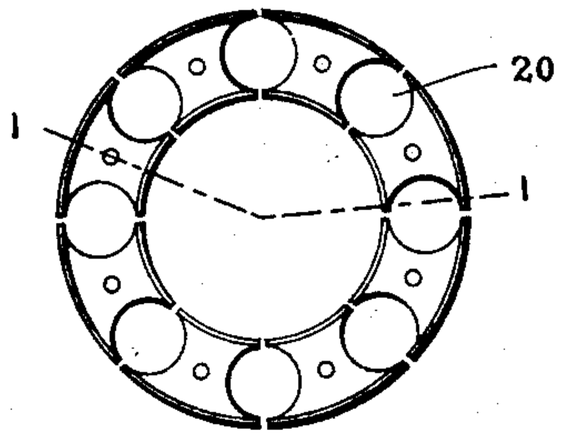
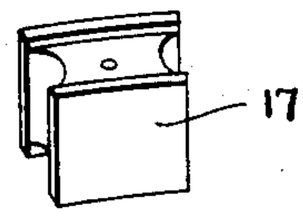


Fig. 3.



Witnesses.
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No. 730,840. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM H. PRATT, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MAGNETIC SUSPENSION DEVICE.

SPECIFICATION forming part of Letters Patent No. 730,840, dated June 9, 1903.

Application filed October 10, 1902. Serial No. 126,652. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. PRATT, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Magnetic Suspension Devices, of which the following is a specification.

My invention consists in an improved means for the magnetic suspension of shafts, such as the armature-shafts for motor-meters, in order that the friction between the shaft and its bearings may be diminished or entirely avoided.

One form of my invention contemplates the use of a sustaining-magnet, which may be a permanent magnet or an electromagnet having one of its poles annularly shaped and surrounding the other. In the preferred form of my invention the shaft to be supported is vertical, and the magnet above referred to is so arranged that the flux passes between the poles in horizontal radial lines.

The armature for the magnet above described is substantially annular in shape and lies between the poles of the electromagnet. Preferably the magnet will be carried by the casing or support, and the armature will be mounted on the shaft which is to be supported.

If the annular armature above referred to is made so as to have a comparatively small circumferential reluctance, whenever the armature is displaced sidewise there is a tendency for the flux, or part of it, to enter the armature at one side, flow half-way around the armature, and go out at the other side. This flux tends to hold the armature permanently displaced. To reduce this tendency, I have arranged the magnetic circuit of the armature in such a manner as to oppose but little resistance to the passage of a radial flux, but so as to have considerable reluctance to the passage of a circumferential flux. By this arrangement I have overcome the tendency, heretofore existing, to hold the armature permanently displaced when once accidentally displaced.

For a better understanding of my invention reference may be had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is an elevation, partly in section, the armature being sectioned on the line 1 1 of Fig. 2; Fig. 2 is a plan view, and Fig. 3 a perspective view, showing certain details of construction.

I have conventionally shown a motor-meter 1, having a casing or supporting-frame 2, in which is mounted a vertical shaft 3, having mounted on it coils 4, which, in conjunction with coils 5, carried by the casing, disk 6, carried by the shaft, and magnets 7, carried by the casing or supporting-frame, form the driving and regulating devices for the shaft.

In the upper end of the casing or support I have placed an electromagnet 8. The electromagnet 8 comprises a top portion 9, substantially disk-shaped, from the under side of which depends centrally a post 10, having a disk-shaped enlargement 11 at its lower end. The enlargement 11 forms one of the poles of the magnet. Secured to the under side of the disk portion 9 at its periphery is a substantially cylindrical portion 12, having at its lower end an inturned portion 13. The inturned portion 13 is of substantially the same thickness as the enlargement 11 and symmetrically surrounds the same and forms the other pole of the electromagnet. The winding 14 of the electromagnet partially fills the space between the standard 10 and the cylindrical portion 12 and is insulated from these portions in any suitable manner. The terminals 14′ of the winding 14 are shown as carried through the disk portion 9 by means of insulating-bushings.

A disk or spider shaped member 15, formed of brass or other non-magnetic material, is carried at the upper end of the shaft 3. On the upper side of the member 15 at its periphery an annular raised portion 16 is provided. A plurality of blocks 17, of magnetic material, are arranged on the top of this raised portion 16, as shown in Fig. 2. A ring 18, of brass or other suitable non-magnetic material, may be placed on top of the blocks 17 to hold them in position. The blocks and the rings 18 and supporting-spider 15 may be grooved to fit one another, as clearly shown in Fig. 1. A supporting-pin 19, rigidly secured to the member 15, may be provided for each block 17. The ring 18 may be fastened to the spider 15 by one or more screws 19′.

In each end of the block 17 semicylindrical recesses 20 are formed, so that when the blocks are assembled as seen in Fig. 2 each block is separated from its neighbor by a substantially cylindrical air-gap. By this construction the reluctance (passing from the magnetic flux) from one block to another is very considerable.

The shaft 3 may be made hollow, if desired, and positioned by means of a wire 21, passing axially through the shaft. In the drawings I have omitted illustration of the lower bearing for the shaft 3 and the lower support for the wire 21. The upper end of the wire 21, which passes through an axial opening in the standard 10, may be fastened to a screw-block 22, which is screwed into the upper end of the axial opening. A suitable guiding-plate 23 for the wire may be located at the under side of the pole-piece 11, as shown.

With the armature of the electromagnet formed in one solid ring-shaped body of the general outline shown in Fig. 2 and with the electromagnet of the form shown the armature would be in unstable equilibrium as regards sidewise displacement. It will readily be seen that if the armature were displaced to the left—say in Fig. 1—that the air-gap at that side between the pole-piece 13 and the armature would be decreased or done away with entirely. Similarly the air-gap between the pole-piece 11 and the armature at the right side of Fig. 1 would be diminished or done away with. The flux would therefore pass into the armature from one side of the pole-piece 13 and out at the opposite side of the pole-piece 11, thus tending to hold the armature permanently out of center. By the use of the divided armature shown, however, the reluctance to the passage of the flux in circular paths about the armature is great in comparison with the reluctance across the block 17, so that if the armature is accidentally displaced sidewise there is no considerable force tending to hold the armature displaced.

While I have illustrated and described the best form of my invention which is now known to me, I do not intend to be limited to the exact details of construction and arrangement, as they may be modified in many instances without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a magnetic suspension device, an armature formed of blocks of magnetic material separated by air-gaps.

2. In a magnetic suspension device, an annular armature arranged to have a considerable reluctance in a circumferential direction.

3. In a magnetic suspension device, a magnet having two poles, one of which surrounds the other, and an armature placed between said poles and formed of blocks of magnetic material separated from one another.

4. In a magnetic suspension device, means for producing a radial magnetic field, a shaft to be supported, and an annular armature carried by said shaft and located in said magnetic field, said armature being arranged to have a considerable magnetic reluctance in a circumferential direction.

In witness whereof I have hereunto set my hand this 7th day of October, 1902.

WILLIAM H. PRATT.

Witnesses:
DUGALD MCK. MCKILLOP,
JOHN A. MCMANUS.