April 2, 1935. W. KÖNIG 1,996,160

DRIVING UNIT FOR FLUID PUMPS

Filed April 20, 1934

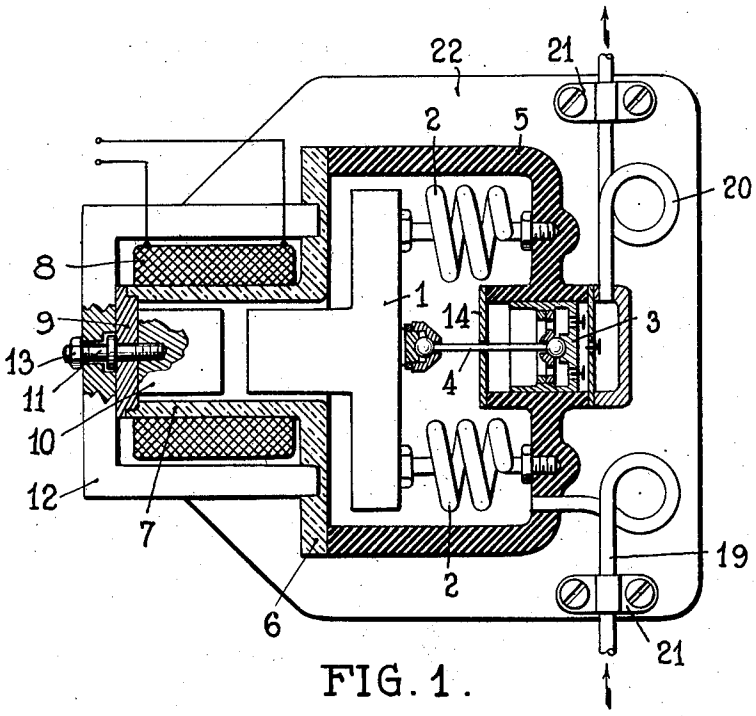

FIG. 1.

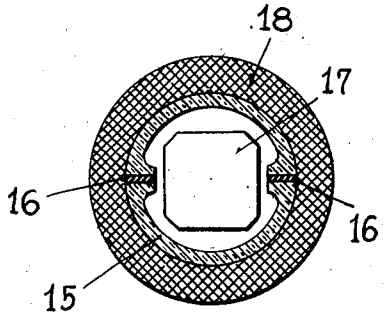

FIG. 2.

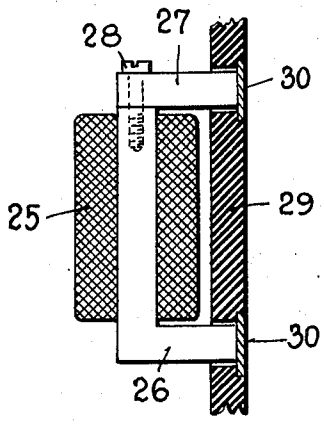

FIG. 3.

Inventor

Wilhelm König

By Sommers & Young

Attorneys

Patented Apr. 2, 1935 1,996,160

UNITED STATES PATENT OFFICE

1,996,160

DRIVING UNIT FOR FLUID PUMPS

Wilhelm König, Frankfort-on-the-Main, Germany, assignor to Alfred Teves Maschinen- und Armaturen-Fabrik G. m. b. H., Frankfort-on-the-Main, Germany

Application April 20, 1934, Serial No. 721,610
In Germany December 23, 1933

13 Claims. (Cl. 230—55)

This invention relates to oscillatory, electromagnetic, driving units for fluid pumps or compressors particularly for mechanical refrigerators, and has for its object to avoid certain difficulties and disadvantages of previously known devices of this type. The present invention consists in improvements in the mechanism disclosed in my patent, No. 1,978,866, for Fluid pumps and drive means therefor, dated October 30, 1934. In the mechanism according to said patent and also in certain other known types of mechanism having A. C. driven units, the piston is either constructed directly as the armature or core of the electromagnet, or the compressor with the oscillatory system and the electromagnetic coil are mounted in a common housing. This embodiment is not well suited to refrigerating purposes because the leakage field of the electromagnet, by reason of its varying intensity at the interior of the housing produces stray or eddy currents therein, which cause chemical decompositions and corrosions and generate heat which is particularly injurious when the compressor and coil are mounted close together in a common housing. In such cases the insulation and even the refrigerant are damaged and, in addition, the lubricating oil resinifies, which gives rise to serious disturbances. Moreover, the use of A. C. is attended with an extremely high rate of stroke, which is the cause of much noise.

The present invention is designed to obviate these defects, first, by taking precautions to preclude dangerous heating as well as the formation of eddy currents in the piston by disposing the electromagnetic coil without the housing on a sleeve closed at one end and flanged to the housing at the other. Formation of eddy currents is also avoided by limiting the leakage field of the magnet, in that iron cores are provided outside the compressor which take up the magnetic lines of force outside the machine.

As the valves make a great deal of noise, the cylinder opening toward the interior of the housing is closed off by a cover.

In addition, care must be taken to have the least possible contact between the machine and the base plate, in order to prevent transmission of the sound to the base plate and thereby to the refrigerator. For this reason, the suction and pressure pipes are made yieldable, that is, preferably formed as springs, the free ends of which are attached to the base plate or refrigerator cold box and thus aid in connecting the machine with the base plate or the refrigerator proper. It is thus possible to replace a part of the supporting springs on which the compressor is suspended, whereby the parts which serve to establish connection between the compressor and refrigerator and are capable of transmitting sound are reduced to a minimum.

Three exemplary embodiments of the invention are illustrated in Figs. 1, 2 and 3 of the drawing, in which

Fig. 1 is a sectional view through the pump and driving unit;

Fig. 2 is a sectional view showing a modified arrangement of the electromagnet; and

Fig. 3 is a sectional view showing a further modified arrangement of the electromagnet.

In the construction shown on Fig. 1, an armature 1 is connected with springs 2 of an oscillatory system, which actuates the compressor 3 through the thrust rod 4. Springs 2, in turn, are attached to a housing 5, which is closed by cover 6 of electrical resistant material, such as Nickelin. This cover 6 carries a sleeve 7 of similar material, at the exterior of which a magnet coil 8 is located. The sleeve 7 is closed by an iron bottom, or end 9, to which a core 10 is screwed by a pin 11. If alternating current passes through coil 8, core 10 and armature 1 are reciprocally attracted and thus actuate the compressor. An advantage of this arrangement consists in that the magnet coil is separated by housing 5 from compressor 3 and the coil is mounted on a sleeve flanged on one side on the housing, through which construction the coil is easily interchangeable. The compressor can thus be adjusted at any time for any desired voltage, simply by changing the coil, or in case the coil burns out, it can readily be replaced by a new one.

In A. C. compressors as heretofore constructed, it has been customary to ignore the lines of force of the magnet at the exterior thereof. The result is that a leakage field forms, which is the cause of the defects mentioned. According to this invention it is also possible to allow the lines of force, after passing from the free end of the sleeve over core 10, to pursue its own path. In order to preclude the disadvantages mentioned, a yoke 12 is provided, which carries the lines of force back to armature 1. Like yoke 12, the bottom or end 9 is also provided to facilitate the return of the lines of force to the armature as much as possible and thus reduce the formation of the leakage field. For the same reason the ends of yoke 12 are depressed in cover 6. Yoke 12 is attached to bottom or end 9 by means of screw 11 and the nut 13, so that it is possible at any time to change the coil enclosed by the

yoke. It is, of course, possible to construct the yoke differently, for example, as a housing which protects coil 8 and at the same time gives the machine a better appearance.

It has also been found that considerable eddy currents arise in the sleeve 7. These are reduced by making the sleeve of an alloy having extremely great resistance. Such materials are for the most part nickel alloys, for instance Nickelin, the electrical resistance of which is very great, or the sleeve may be made of an insulating material, for example, porcelain or bakelite, which have extremely high resistances.

In the construction of the sleeve shown in Fig. 2, the sleeve 15 is slotted or split at 16 and packed off by insulating material. Located at the interior of the sleeve and also coil 18 is a core 17. The advantageous result of this construction is that the eddy currents tending to transverse the entire sleeve circularly can no longer form, whereby these currents are very greatly reduced. Use may be made of only one slot, or more than two may be used.

In all other respects the construction of the device illustrated in Fig. 2 may be similar to that shown in Fig. 1.

Fig. 1 also shows that the cylinder can be closed off from the interior of the housing by a cover 14, which prevents the valve noise from being transmitted toward the interior of the compressor, from which it can easily pass to the exterior.

The suction pipe 19 as well as the pressure pipe 20 are both formed as springs attached by means of members such as brackets 21 to the base plate 22 and serve to replace a part of the springs which support the compressor, which lie below the housing, and thereby reduce the transmission of the sound to the base plate to a minimum. It is, of course, possible to give the suction and pressure pipe a different form. It is essential, however, that they be resilient or yieldable.

Fig. 3 shows a further form of construction of the invention illustrating particularly a modified form of electromagnet unit. In other respects the device may be similar to Fig. 1. Here the coil 25 is not mounted on a sleeve, but on an electromagnetic core 26, and the lines of force flow through the yoke 27, attached by means of the screw 28, to the armature located at the interior of the housing 29. In order to provide the most favorable passage possible, core 26 and yoke 27 are covered from the interior of the housing by iron pole shoes 30 which, corresponding in function to cover 6 on Fig. 1, also reduces the leakage field. Coil 25 is also interchangeable in this embodiment.

I claim:

1. In a reciprocatory gas pump and actuating unit therefor, a source of alternating electric energy having a uniformly varying potential, an electromagnet connected with said energy source, an oscillatory unit comprising a pump piston and an armature for the electromagnet, a resilient connection between said unit and said electromagnet, a housing enclosing the oscillatory unit, the electromagnet being mounted outside the housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet.

2. Apparatus according to claim 1 in which an iron core is provided outside the housing in proximity to the electromagnet to take up the lines of force outside the housing.

3. In a reciprocatory gas pump and actuating unit therefor, a source of alternating electric energy having a uniformly varying potential, an electromagnet connected with said energy source, an oscillatory unit comprising a pump piston and an armature for the electromagnet, a resilient connection between said unit and said electromagnet, a housing enclosing the oscillatory unit, the electromagnet being mounted outside the housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, the housing being provided with areas of low reluctance where the lines of force pass therethrough to the oscillatory unit.

4. In a reciprocatory gas pump and actuating unit therefor, a source of alternating electric energy having a uniformly varying potential, an electromagnet connected with said energy source, an oscillatory unit comprising a pump piston and an armature for the electromagnet, a resilient connection between said unit and said electromagnet, a housing enclosing the oscillatory unit, the electromagnet being mounted outside the housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, the magnet being provided with an iron core outside the housing to take up the lines of force outside the housing, said housing having low reluctance at areas where the magnetic force passes therethrough to actuate the oscillatory unit.

5. In a reciprocatory gas pump and actuating unit therefor, a source of alternating electric energy having a uniformly varying potential, an electromagnet connected with said energy source, an oscillatory unit comprising a pump piston and an armature for the electromagnet, a resilient connection between said unit and said electromagnet, a housing enclosing the oscillatory unit, the electromagnet being mounted outside the housing, the electromagnet being provided with an iron core to take up the lines of force outside the housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, the housing having recessed shoes of low reluctance material where the magnetic lines of force pass through the housing to the oscillatory unit.

6. In a reciprocatory gas pump, a source of alternating electric energy of variable voltage, an electromagnet connected thereto, an oscillatory system including a pump piston and a magnet armature, a resilient connection between said system and said electromagnet and a housing enclosing the oscillatory system, the electromagnet being mounted externally of said housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, those parts of the housing which are disposed within the field of force of the electromagnet being made of a material having a high electrical resistance.

7. In a reciprocatory gas pump and actuating means therefor, an oscillatory unit comprising a pump piston and an armature, a housing enclosing the oscillatory unit and having an extending sleeve, an electromagnet mounted on said sleeve outside the housing, a source of alternating electric energy connected with said electromag-

net, a resilient connection between said unit and said electromagnet, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the field of the electromagnet.

8. In a reciprocatory gas pump and actuating unit therefor, a source of alternating electric energy, an electromagnet connected with said energy source, an oscillatory unit comprising a pump piston and an armature for the electromagnet, a resilient connection between said unit and said electromagnet, a housing enclosing the oscillatory unit, the electromagnet being mounted outside the housing, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, an iron core extending about the magnet outside the housing to take up lines of force outside the housing, said core being detachable whereby the magnet coil is readily replaceable.

9. In a reciprocatory gas pump and actuating means therefor, an oscillatory unit comprising a pump piston and an armature, a housing enclosing the oscillatory unit, said housing having an outwardly extending sleeve, an electromagnetic coil mounted on said sleeve outside the housing, said sleeve having a slot extending longitudinally thereof, said slot being filled with electrical insulating material and a source of alternating electric energy connected with said coil, a resilient connection between said unit and said coil, said unit and its resilient connection having natural frequency of oscillation in resonance with the variations of the field of the electromagnetic coil.

10. In a reciprocatory gas pump and actuating means therefor, an oscillatory unit comprising a pump piston and an armature, a housing enclosing the oscillatory unit and having an extending sleeve, said sleeve being closed at its outer end by an iron cover, an electromagnetic coil extending about said sleeve, a resilient connection between said unit and said coil and a core for said coil directly connected to said cover, and a source of alternating electric energy connected to the coil, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the field of the electromagnetic coil.

11. In a reciprocatory gas pump and actuating means therefor, an electromagnet, an oscillatory unit comprising a pump piston and an armature for said magnet, a source of alternating electrical energy connected to said magnet, a pump cylinder, a housing for the oscillatory unit, a resilient connection between said unit and said electromagnet, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, the pump cylinder having a cover closing it toward the interior of the housing.

12. In a reciprocatory gas compressor and actuating means therefor, an oscillatory unit comprising a compressor piston and an armature, an electromagnet, a source of alternating electrical energy, a resilient connection between said unit and said electromagnet, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, a compressor cylinder, a suction conduit and a pressure conduit both connected with said cylinder, said conduits being yieldable.

13. In a reciprocatory gas compressor and actuating means therefor, an oscillatory unit comprising a compressor piston and an armature, an electromagnet, a source of alternating electrical energy, a resilient connection between said unit and said electromagnet, said unit and its resilient connection having a natural frequency of oscillation in resonance with the variations of the magnetic field of the electromagnet, a compressor cylinder, a suction conduit and a pressure conduit both connected with said cylinder, said conduits being resilient and supporting the compressor.

WILHELM KÖNIG.