Sept. 5, 1950 I. O. RUUD 2,521,653

ELECTROMAGNETIC DRIVING SYSTEM

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Fig. 1.

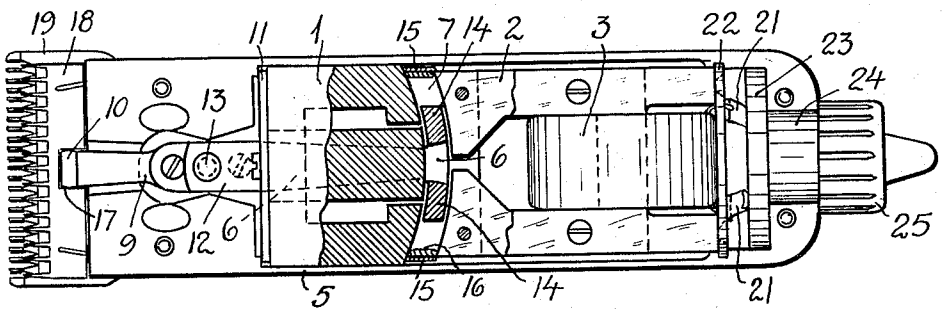


Fig. 2.

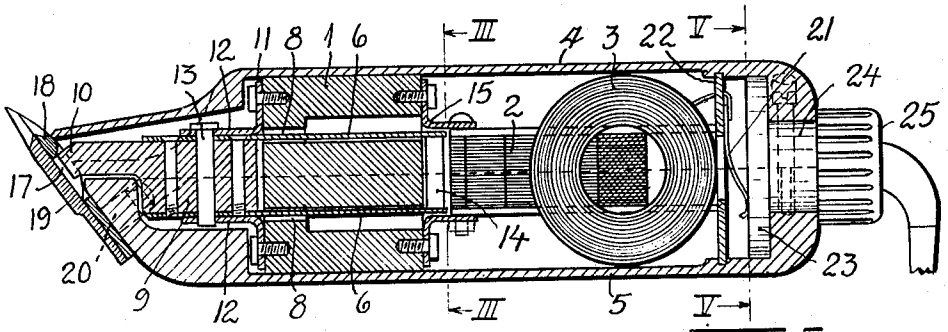
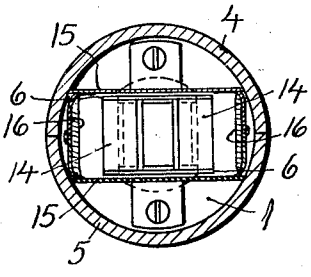
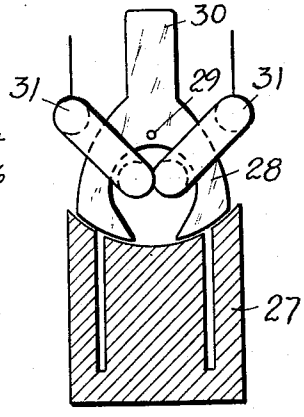
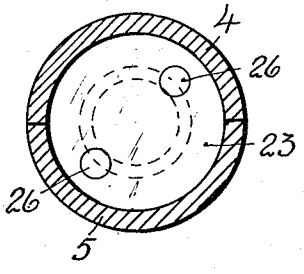


Fig. 3. Fig. 4. Fig. 5.







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ELECTROMAGNETIC DRIVING SYSTEM

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10 Claims. (Cl. 172—126)

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The present invention relates to an electromagnetic driving system especially for hair cutting machines, safety razors or the like, and which is so shaped that it may be mounted within the handle of such apparatus.

Electro-magnetic driving systems are known in which a swinging lever is disposed as the iron core in a coil adapted to be connected to a source of alternating current and mounted axially in the handle of the apparatus and has one end capable of oscillating between the poles of a permanent magnet also mounted axially in said handle, whereby the lever has a reciprocating motion imparted to it in accordance with the frequency of the alternating current employed. Further, it is known to arrange the iron core of the coil stationary and the permanent magnet attached to a swinging lever.

In these known systems a relatively small power is obtained, and owing to the construction closed magnetic circuits are not constituted so that harmful increase in the temperature may occur. The device therefore cannot be connected directly to a normal source of alternating current and a small transformer must be interposed which suitably reduces the voltage.

The present invention has for its object to provide an electro-magnetic system of the type referred to which has great effect and which in use will not become heated to a perceptible degree, even if it is connected directly to a normal source of alternating current.

The invention consists mainly in that both the electromagnet and the permanent magnet are provided with a number of operative poles.

In one embodiment of the invention the multi-poled magnets are disposed in alignment with the pole faces facing each other, one of said magnets being supported swingable and provided with a projection serving as an actuating arm.

In a further embodiment both of the multi-poled magnets are stationary, having between their cooperating pole faces a number of movable actuating pieces secured in spaced relation at the end of a common swinging lever of non-magnetic material in such a manner that each of said actuating pieces is magnetized in accordance with the adjacent pole of the electromagnet.

In the accompanying drawing a constructional form of a hair cutting machine according to the invention is illustrated by way of example.

Figure 1 shows a plan view of the machine with the upper half of the handle removed and some details in section,

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Figure 2 a longitudinal section at right angles to Figure 1,

Figure 3 a cross section along the line III—III in Figure 2,

Figure 4 a plan view of a modified embodiment of the invention, and

Figure 5 a cross section along the line V—V in Figure 2.

In the drawing 1 denotes a permanent magnet having a central north pole and a surrounding sleeve-shaped south pole, and 2 denotes an electromagnet having an U-shaped iron core with a coil 3.

The magnets 1 and 2 are disposed, with the pole faces facing each other, axially in a handle consisting of two halves 4 and 5, and at opposite sides of the central pole of the magnet 1, which has a square or rectangular cross section, are disposed levers 6 of nonmagnetic material. Said levers 6 extend in the longitudinal direction of the magnet 1 from a gap 7 between the pole faces of the magnets 1 and 2 and through slots 8 in the magnet 1 to somewhat in front of the bottom thereof. The last mentioned ends are firmly interconnected by a distance piece 9 having a head-shaped end portion 10. The assembled arms and distance piece are mounted on a pivot stud 13 supported in angle pieces 12 of a ring-shaped member 11 secured at the bottom of the magnet 1. Thus the arms form a two-armed swinging lever pivotable on stud 13.

The pole faces of the magnets 1 and 2, which are facing each other, coincide with cylindrical faces having their axis in the pivot axis of the swinging lever.

Between the ends of the arms 6 extending into the gap 7, which ends are somewhat enlarged in the breadth direction, are secured two actuating pieces 14 of magnetic material. Said pieces 14, having a cross section adapted in accordance with the curvature of the gap 7, are secured at such a distance from each other, that each of them, at the position of rest, is positioned before the middle of a gap between the poles of the permanent magnet 1, and has such a length, counted in the direction of motion, that said gap always being covered by said piece during the motion thereof.

The magnets 1 and 2 may be interconnected by means of a sleeve-shaped connecting member 15 of nonmagnetic material, and for preventing contact between the swinging lever and said member 15, rubber buffers 16 are with advantage provided for instance secured at the sides of member 15, as shown.

The head shaped end 10 of the swinging lever engages in a corresponding aperture 17 in a knife plate 18 of a hair cutting device 19, which in a manner known per se is replaceably secured at the front end of the handle by means of taps 20.

The terminals of the coil 3 are connected with contact springs 21 secured to a disc 22 disposed stationary in the handle. The free ends of said springs 21 are pressing against a rotatable member 23 having a neck portion 24, extending through the end wall of the handle, and an outer enlargement 25 serving as handle by means of which the member 23 may be rotated about its axis in order to bring two contact pieces 26 (Figure 5), connected to the terminals of leads from a source of alternating current, into and out from contact with said springs 21, whereby the current to the coil 3 may be closed or interrupted respectively.

When the current to the coil 3, by turning the switch member 23, is closed the magnet 2 is energized and the poles thereof change their polarity in accordance with the frequency of the alternating current employed. At the same time each of the actuating pieces 14 becomes magnetized in accordance with the adjacent pole of the electromagnet 2, and due to the influence thereof and of the permanent magnet 1 a reciprocating motion being imparted to the pieces 14 and thus also to the swinging lever in time to the frequency.

By the use of movable actuating pieces both of the magnets 1 and 2 may be stationary without any decrease in the effect of the apparatus, as the pieces 14 may be regarded like additional poles which are secured to the swinging lever and which by the energization in accordance with the adjacent stationary poles of the magnet 2, cooperate with the permanent magnet 1 in a similar manner as if the magnet 2 had been supported swingable. In addition, the embodiment described has the advantage of constituting an assembled unity which occupies a small room and can be housed in a convenient handle.

Instead of the use of actuating pieces 14 one of the magnets can be supported swingable as shown in Figure 4. The permanent magnet 27 is stationary and provided with a central pole and a surrounding sleeve-shaped south pole in the same manner as the magnet 1. The electromagnet 28, having an U-shaped iron core, is swingable on a tap 29 and provided with a projection 30 serving as an actuating arm. The pole faces of the respective magnets coincide with cylindrical faces having their axis in the pivot axis of the electromagnet 28. The middle of each pole face of the magnet 28 is placed before the middle of a gap between the poles of the permanent magnet 27 and the pole faces have such a length in the direction of motion that they in all positions of motion cover said gaps.

When the coils 31 of the electromagnet 28 are connected to a source of alternating current the magnet 28 will reciprocate in accordance with the frequency of the current, as above described. As will be understood the permanent magnet may be supported swingable and the electromagnet stationary.

I claim:

1. In an electromagnetic driving system, in combination, an electromagnet having adjacent poles; a permanent magnet having adjacent poles, said magnets being arranged with said poles in juxtaposition so as to leave a gap between said poles of said electromagnet and said poles of said permanent magnet; and a pole piece arranged in the gap and means for mounting said pole piece in movable relation to said electromagnet and said permanent magnet; said pole piece having a length sufficient to cover the gap between said poles of said permanent magnet.

2. An electromagnetic driving system comprising in combination a swinging lever; an electromagnet having two poles; a permanent magnet having three poles and means associated with said lever and cooperating with said magnets for imparting a reciprocating motion to said swinging lever in accordance with the frequency of an alternating current flowing in said electromagnet.

3. An electromagnetic driving system comprising in combination a swinging lever; an electromagnet having two poles; a permanent magnet having three adjacent poles and means associated with said lever and cooperating with said magnets for imparting a reciprocating motion to said swinging lever in accordance with the frequency of an alternating current flowing in said electromagnet.

4. In an electromagnetic driving system, in combination, a permanent magnet having three poles arranged in E-form, the outer two of said poles having like polarity opposite to that of the middle one of said poles; a U-shaped electromagnet having two poles, said magnets being disposed in alignment with said poles facing each other; a movable member arranged between the poles of said permanent magnet and said electromagnet; and means for mounting said member, said means cooperating with said magnets to impart a reciprocating motion to said member.

5. In an electromagnetic driving system, in combination, a permanent magnet having three poles arranged in E-form, the outer two of said poles having like polarity opposite to that of the middle one of said poles; a U-shaped electromagnet having two poles, said magnets being disposed in alignment with said poles facing each other and defining a gap; and a lever swingably mounted and having pole pieces in the gap, said magnets being adapted to impart in cooperation a reciprocating motion to said swinging lever in accordance with the frequency of an alternating current flowing in said electromagnet.

6. In an electromagnetic driving system, in combination, a permanent magnet having three poles arranged in E-form, the outer two of said poles having like polarity opposite to that of the middle one of said poles; a U-shaped electromagnet having two poles, said magnets being disposed in alignment with said poles facing each other and defining a gap between said magnets; and a swingable lever of non-magnetic material; a plurality of pole pieces in said gap connected to the end of said swinging lever, each of said pole pieces at the position of rest being placed before the middle of a gap between the poles of said permanent magnet and having a length sufficient to cover said gaps in all positions of motion.

7. A driving system as claimed in claim 6, said swingable lever extending through said permanent magnet.

8. A driving system as claimed in claim 6, said poles of said magnets and said pole pieces having faces being parts of cylinders having their axes coinciding with the pivotal axis of said swingable lever.

9. In an electromagnetic driving system in combination, a permanent magnet having three

poles arranged in E-form; and a U-shaped electromagnet having two poles, said magnets being disposed with said poles facing each other, one of said magnets being swingable in relation to the other of said magnets and having a projection for driving a tool, each of the poles of said electromagnet having the middle of its face placed before a gap between the poles of said permanent magnet and having a length sufficient to cover the gap in all positions of relative motion between said magnets.

10. A driving system as claimed in claim 9, said poles of said magnets having faces being parts of

cylinders having their axes coinciding with the pivotal axis of said swingable magnet.

IVAR OLAUS RUUD.

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