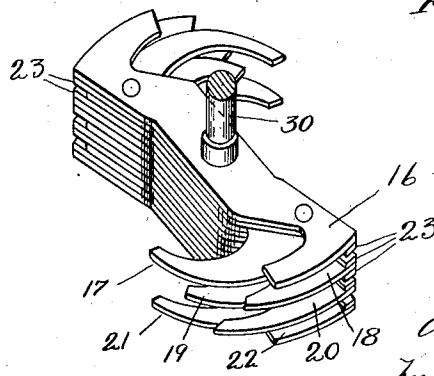
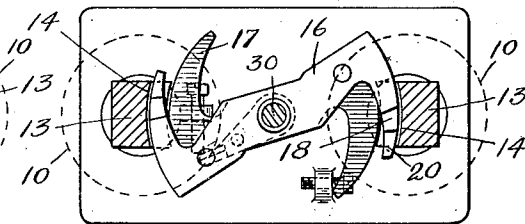
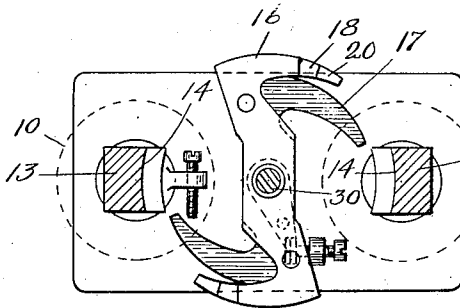
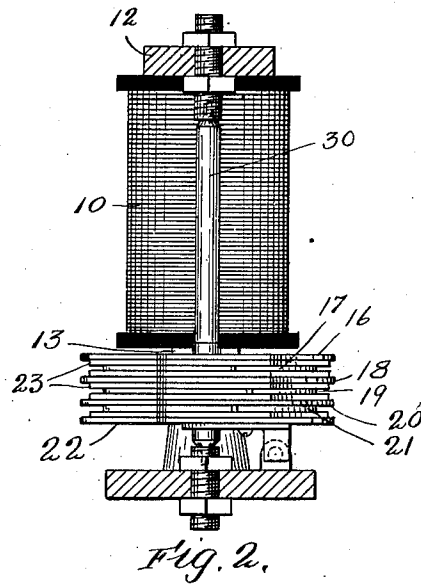
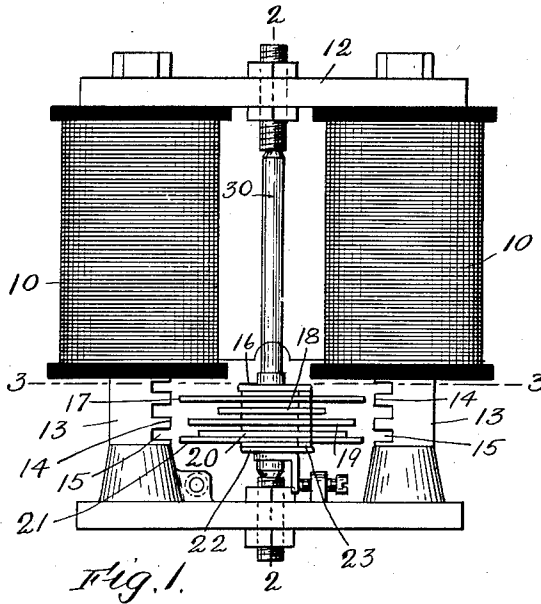


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ELECTROMAGNET.
APPLICATION FILED JUNE 6, 1912.

1,053,340.

Patented Feb. 18, 1913.

2 SHEETS-SHEET 1.



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2 SHEETS—SHEET 2.

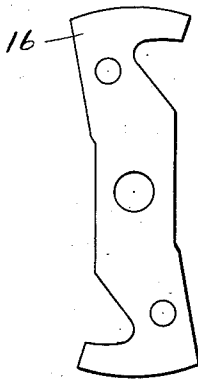


Fig. 6.

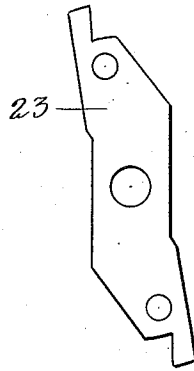


Fig. 7.

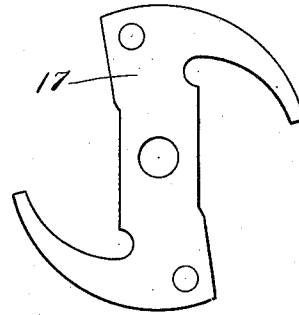


Fig. 8.

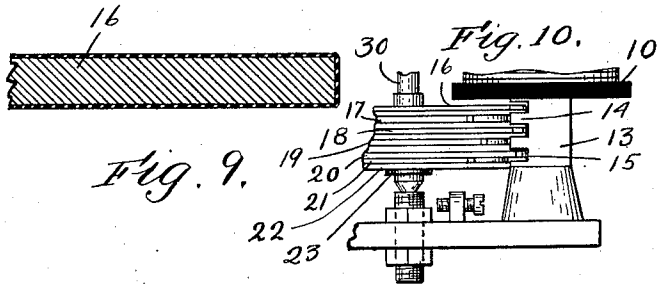


Fig. 9.

Fig. 10.

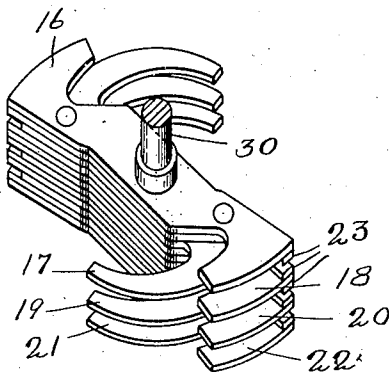


Fig. 11.

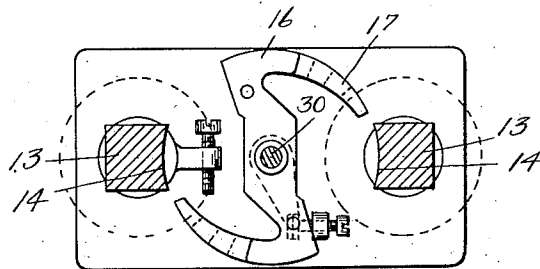


Fig. 12.

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ELECTROMAGNET.

1,053,340.

Specification of Letters Patent.

Patented Feb. 18, 1913.

Application filed June 6, 1912. Serial No. 701,977.

To all whom it may concern:

Be it known that I, ALFRED A. ZIEGLER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Electromagnets, of which the following is a specification.

This invention relates to electro-magnets; and has for its object to improve the construction of the same to the end that the armature may be given a complete quarter turn and during each unit or part of its movement will exert a powerful pull.

The electro-magnet embodying my invention may be energized by an alternating current and also by a direct current, although for the best results slight modifications may be made to especially adapt it for the different currents.

The electro-magnet may be used to operate a semaphore or other device, but is especially useful in cases where an armature having a wide range of motion is required.

Figure 1 is a front elevation of an electro-magnet embodying this invention, the armature being in its retracted position. Fig. 2 is a vertical section of Fig. 1, taken on the dotted line 2—2. Fig. 3 is a horizontal section of Fig. 1 taken on the dotted line 3—3. Fig. 4 is a view similar to Fig. 3, the armature being attracted. Fig. 5 is a perspective view of the armature. Figs. 6, 7 and 8 are details of the several plates composing the armature. Fig. 9 is an enlarged sectional view of a portion of one of the plates, illustrating the scale on its surface. Fig. 10 is a fragmentary detail of the pole-piece and armature, the latter being in attracted position. Fig. 11 is a perspective view of a modified form of armature, more especially designed for use with a magnet operated by a direct current. Fig. 12 is a horizontal section of an electro-magnet, illustrating an armature embodying this invention with a modified form of pole.

10, 10, represent a pair of magnet-coils arranged on cores connected together by a heel-piece 12, the forward ends of the cores being extended or prolonged, as at 13, to form the poles. The poles 13 are formed with opposing curved pole faces 14, and said pole faces are formed with transverse interdental spaces or grooves 15, each pole face having several such interdental spaces or

grooves. An advantage of forming the pole faces with interdental spaces or grooves is the production of a large magnetic surface; they also enable the employment of an armature having portions of different leverage, as will be described.

The armature shown in Figs. 1 to 8, inclusive, is especially designed to be used with the electro-magnet when operated by an alternating current, and said armature is made S-shape, and is composed of a pile of superimposed iron plates, partially insulated from each other and rigidly secured together. As here shown seven S-shaped plates are employed, as 16, 17, 18, 19, 20, 21 and 22, and between the several plates, or most of them, separating plates 23 are provided. Some of the plates are made longer than others, as for instance, the plates 16, 18, 20 and 22 are made longer than the plates 17, 19 and 21, and when said plates are rigidly secured together and to a center-shaft 30, the longer plates will project beyond the ends of the shorter plates, so that the outer faces or ends of the armature will be complementary with the opposing indented or grooved pole faces. The feet of the several plates, or most of them, are made of different length, but their heels are arranged in the same vertical plane, hence their toes terminate different distances from the back side of the armature. This admits of the different plates entering the magnetic-field successively and of the magnetic force acting increasingly to pull the armature in order that a full quarter turn may be given to it, and also to hold the armature in its full attracted position.

Referring particularly to Fig. 5, the feet of the short plates 17 and 21 are made longest, their toes first entering the magnetic-field; the foot of the plate 19 is made shorter than the feet of the plates 17 and 21, and next enters the magnetic-field; the foot of the plate 20 is made shorter than the foot of the plate 19 and next enters the magnetic-field; the foot of the plate 18 is made shorter than the foot of the plate 20, and next enters the magnetic field and the feet of the plates 16 and 22 are made the shortest of all and next enter the magnetic-field. The separating plates 23 are made as long as the longest plates of the set, but have heels only, which lastly enter the magnetic-field. The above

described operation takes place in case the armature is moved a full quarter of a revolution, as it is designed to do, otherwise only a portion of the operation takes place, corresponding to the extent of movement of the armature. It is obvious that the plates may be otherwise arranged than as here shown, but when the opposing pole faces are formed with interdental spaces the alternate arrangement of the short and long plates is necessary to form complementary outer faces. As a means to partially insulate the several plates from each other I prefer to take the plates as they may come from the annealing furnace, without removing the scale which is formed thereon, as shown in Fig. 9. The scale which is formed on them affords a partial magnetic insulation which I find to be quite sufficient, although other means to partially insulate them may be employed. In case the magnet is connected with a direct current the modified form of armature shown in Fig. 11 is preferably employed, although the armature above described will suffice.

Referring to Fig. 11, the armature is composed of superimposed partially insulated plates, some of which are made longer than others, but the feet of all the short plates are made the same length and the feet of all the long plates are also made of the same length.

In both forms of armature here shown, the outer faces thereof work on the inside of the magnetic-field, where the magnetic pull is the strongest.

I find, in practice, that by making the plates composing the armature of different length and forming the opposing pole faces with interdental spaces that a powerful pull is obtained, which is quite uniform during each unit of movement, and the semaphore arm or disk attached to the center-shaft or other work which it is desired to perform, will be uniformly and progressively accomplished.

In the modification shown in Fig. 12, the opposing curved pole faces are not formed with interdental spaces and consequently the plates composing the armature are all made of the same length, although their feet are of different length, and I find in practice that such form is very efficient, but not as efficient as the forms above described, either for alternating or direct current work.

I claim:—

1. The combination with an electro-magnet having opposing pole faces curved and formed with transverse grooves, of a rotatable armature of S-shape having its outer ends made complementary to said grooved pole faces, substantially as described.

2. The combination with an electro-magnet having opposing curved pole faces with transverse interdental recesses, of a rota-

table armature of S-shape composed of a pile of superimposed plates, some of which are longer than others to thus form its outer faces complementary to said pole faces, substantially as described.

3. The combination with an electro-magnet having opposing curved pole faces with transverse interdental recesses, of a rotatable armature of S-shape composed of a pile of superimposed plates partially insulated from each other, some of which are longer than others to thus form its outer faces complementary to said pole faces, substantially as described.

4. The combination with an electro-magnet having opposing curved pole faces with transverse interdental recesses, of a rotatable armature of S-shape composed of a pile of superimposed plates, some of which are longer than others to thus form its outer faces complementary to said pole faces, and some having feet longer than others arranged with their heels in the same vertical plane, whereby their toes enter the magnetic field successively, substantially as described.

5. The combination with an electro-magnet having opposing curved pole faces, of a rotatable armature of S-shape having both of its outer ends formed with feet of different length, all of said feet being arranged for movement between said curved pole faces, thereby to work on the inside of the magnetic field, substantially as described.

6. The combination with an electro-magnet having opposing curved pole faces composed of several plates made S-shape, and several separating plates, all of said plates being arranged in a pile with the separating plates between the S-shaped plates and rigidly secured together and to a center-shaft, substantially as described.

7. The combination of an electro-magnet having opposing curved pole faces, of a rotatable armature composed of several plates made S-shape and having feet of different length and several separating plates, said plates being arranged in a pile with the separating plates between the S-shaped plates and rigidly secured together and to a center-shaft, substantially as described.

8. The combination with an electro-magnet having opposing curved pole faces, of a rotatable armature composed of several plates made S-shape and several separating plates, said plates being arranged in a pile with the separating plates between the S-shaped plates and rigidly secured together and to a center-shaft and insulation between the several plates, whereby they are partially magnetically insulated, substantially as described.

9. The combination with an electro-magnet having opposing curved pole faces with transverse interdental recesses, of a rota-

table armature composed of several plates
made S-shape, some made longer than others
and several separating plates, all of said
plates being arranged in a pile with the long
5 and short plates alternately disposed to
form outer faces complementary with the
pole faces, substantially as described.

In testimony whereof, I have signed my
name to this specification, in the presence of
two subscribing witnesses.

ALFRED A. ZIEGLER.

Witnesses:

B. J. NOYES,
H. B. DAVIS.