

(No Model.)

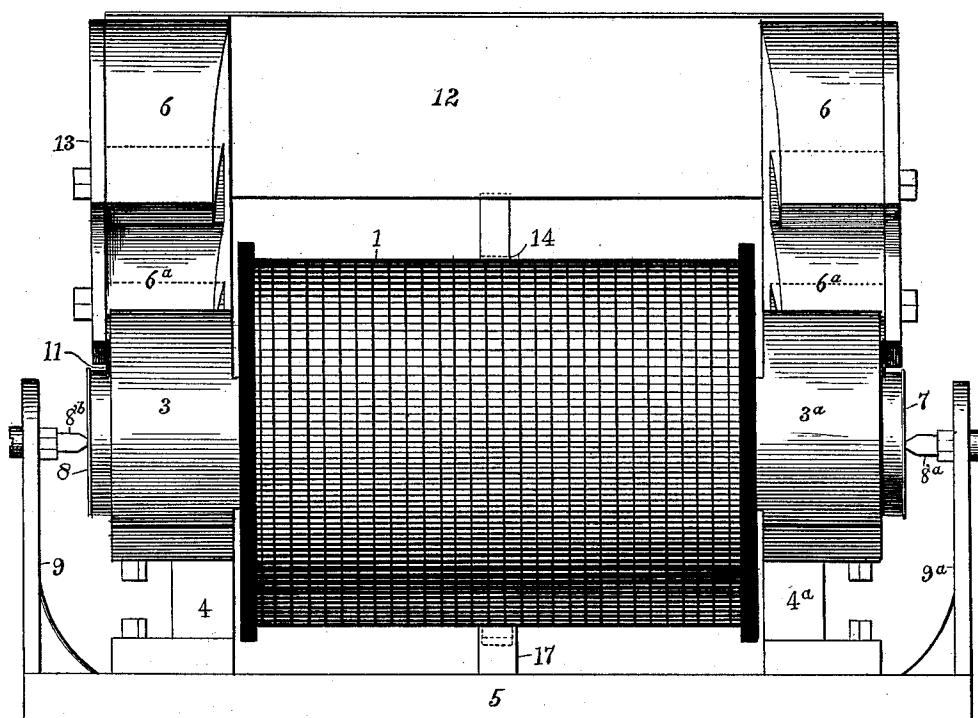
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J. WAYLAND.
ELECTROMAGNET.

No. 569,262.

Patented Oct. 13, 1896.

Fig. 1.



WITNESSES:

C. L. Belcher

Charles M. Catlin.

INVENTOR

James Wayland

BY

Roswell Head

his ATTORNEY

(No Model.)

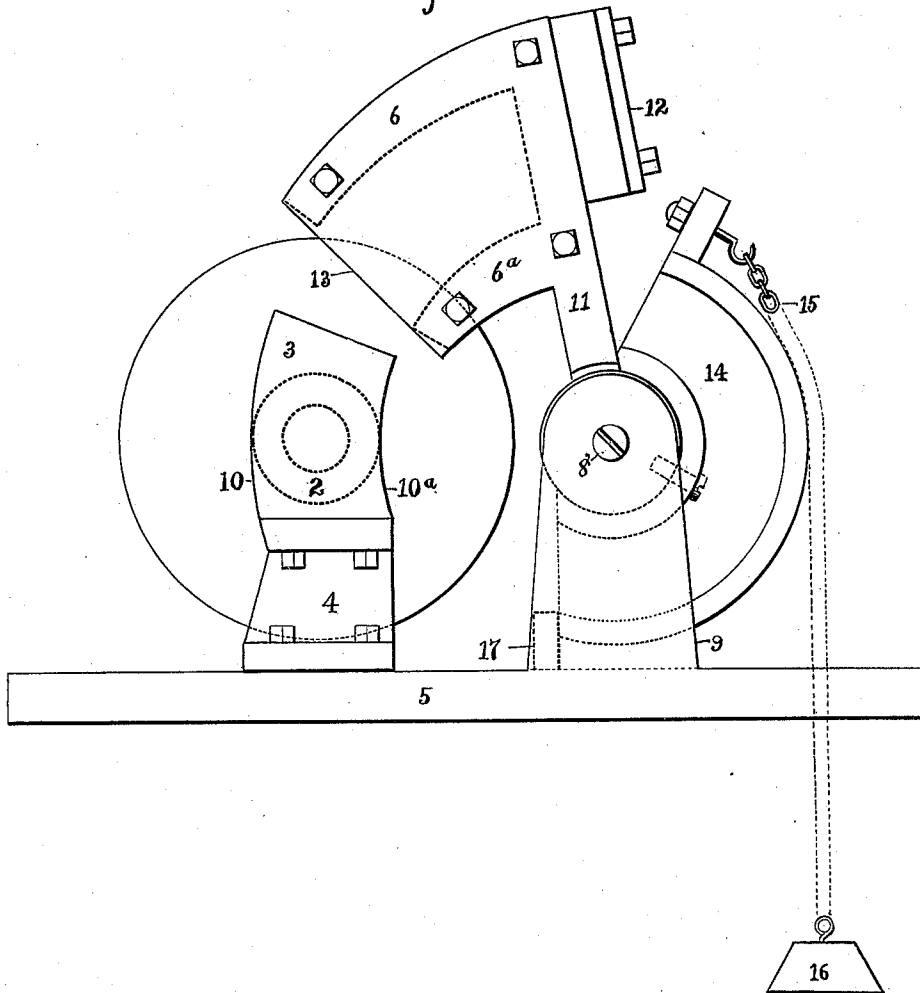
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Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES WAYLAND, OF NEWARK, NEW JERSEY.

ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 569,262, dated October 13, 1896.

Application filed December 10, 1895. Serial No. 571,658. (No model.)

To all whom it may concern:

Be it known that I, JAMES WAYLAND, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electromagnets, of which the following is a specification.

The object of my invention is to provide an electromagnet which will exert a powerful torque or pull on its armature, will admit of a long range of movement of the latter, and will develop a maximum torque upon the armature at the moment of closure of the circuit.

In carrying out my invention I provide the magnet with an armature of iron which co-operates with a plurality of faces of the pole-pieces or core of the magnet, thus utilizing to a greater extent than is possible with magnets of ordinary construction the lines of force passing through the core, and particularly those which lie in the "stray field" which exists in the air around the poles. The core is provided with iron pole-pieces, with which the armature coöperates. I preferably use a single coil or helix to excite the magnetism and a straight core provided at its ends with large pole-pieces. The armature is journaled on an axis parallel to the core and comprises two forked pieces connected together by a bar or mass of iron and secured to the axis so that when the electromagnet is excited the forks will be drawn over the pole-pieces at the ends of the core so as to straddle the same and thus utilize the attraction of a plurality of faces of the pole-pieces. I preferably also mount upon the outer side of each fork a plate of iron to utilize the attraction of the end faces of the magnet-core. The forked masses constitute a double or duplex armature and are connected together by iron, so as to form a magnetic path for the lines of force of the magnet of low resistance. This path may lie through the axis upon which the forks turn, in which case it may be a cylinder or bar of iron of about the same cross-sectional area as the magnet-core, or it may lie through an iron bar bridging the two forks, thus affording a straighter and shorter path for the lines of force which traverse the magnetic circuit thus provided. The axis is provided with a crank for utilizing the mo-

tion of the armature in any desired work. By reason of the armatures passing over the faces of the pole-pieces when the magnet is excited a gradually-increasing number of lines of force is provided with an iron path. The torque or pull is therefore greatest at the start. The top of each fork is provided with a flat face which can come into close relation to the top of the pole-piece, as, for example, a sheet of paper or other non-magnetic material may intervene, so that when the armature stroke is completed the armature will be held in a firm grip by reason of the smaller clearance between these two faces.

The features of novelty of my invention will be more particularly hereinafter described, and will be definitely indicated in the claims appended to this specification.

In the accompanying drawings, Figure 1 is a side elevation, and Fig. 2 an end elevation, of an electromagnet embodying my invention.

1 is a helix or coil of wire through which extends a soft-iron core 2, terminating at the ends of the coil in massive iron pole-pieces 3 3^a. The pole-pieces are bolted to standards 4 4^a, secured to a bed-plate 5, which supports the apparatus. Coöperating with each pole-piece is an armature of soft iron having curved wings 6 6^a, the curve being struck from the center of the axis 7, which turns on pivots or centers 8^a 8^b, mounted in standards 9 9^a. The outer and inner face of each pole-piece are also curved from the center of axis 7, as seen at 10 10^a, Fig. 2, so that the wings 6 6^a may pass over the outer and inner faces of the pole-piece. Only enough clearance is allowed to prevent binding. The wings 6 6^a may be formed of a pile of soft-iron punchings or in a single casting of iron or mild steel integral with a bar 11, connected by a good magnetic joint with the ends of a cylinder of iron 8 forming the axis, and also constituting a yoke or magnetic bridge for the armatures.

The joints of both the pole-pieces and the armature, with the cylindrical masses of which they form a part, may be made by providing sockets in the ends of the latter and forcing the pole-pieces or armature-pieces into the sockets by a suitable press. The joint is indicated in dotted lines on the pole-piece at 2 in Fig. 2. The armatures may also be

connected by a heavy strap or bridge-piece of iron 12, which leads the magnetic lines of force by a more direct route from pole to pole of the magnet, and if designed of sufficient capacity to carry all of the lines of force developed in the magnet-core by its exciting current the axis 8 may be made of non-magnetic material. Each armature-wing 6 6^a tapers, as seen in Fig. 1, toward its front end, both in thickness and breadth of face, thus shifting the center of mass toward the rear and tending to equalize the torque throughout the range of movement of the device. The outer side of the wings 6 6^a is covered with a heavy plate of iron 13, bolted fast, and this plate coöperates with the end of the magnet-core. Thus it will be seen that each armature embraces its core on three sides or faces, forming, in fact, a sort of box over the same and covering a fourth face when the armature is fully drawn up.

Upon the axis 8 is secured a crank-disk or pulley 14, to which is secured any desired connection with the work to be controlled by the magnet. As shown, a chain 15 connects with a weight 16, which merely typifies the work or load. A stop 17 arrests the backward movement of the armatures when the magnet is deenergized. In the normal position of the parts the tips of the armature-wings are a short distance from the pole-pieces.

When the circuit including the helix is closed, a powerful attraction is exerted on the armatures by reason of the effort of the magnetic lines of force to shorten, and this torque is a maximum at or near the start, which is diametrically the opposite of the conditions in magnets as commonly constructed. By suitably proportioning the wings the torque may be rendered fairly uniform. It will be noted that a long range of motion is also effected, a condition not possible with magnets as commonly constructed. It has been the practice heretofore when a considerable range of movement was required to employ an electric motor or a solenoid. The former, however, is too expensive for many uses and requires too much attention to admit of its employment in most places where magnets are

used, and the latter has the great disadvantage of yielding a weak and rapidly-decreasing torque or pull.

With my construction both range of movement and power of pull are combined in a simple and cheap structure.

An additional feature of practical advantage is that by reason of the armatures affording a path of increasing magnetic conductivity as they are drawn home by the magnet its velocity of movement is greatest at the start, which gradually decreases, permitting the armatures to come softly into contact with the top of the pole-pieces. By securing a thin septum of paper or other non-magnetic material to the top face of the pole-piece the armature will be held in a tight grip when fully drawn up because of the small clearance between armature and pole-piece at that point.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An electromagnet provided with a straight core having a polar extension at each end, a curved armature at each end embracing the lateral and end faces of each pole-piece and having an end face for engaging the top of the polar extension, the armatures being journaled to rock in a plane transverse to the core.

2. An electromagnet having a straight core, pole-pieces at the ends thereof, curved armatures coöperating with said pole-pieces and mounted to rock in a plane transverse to the core, end plates 11 of magnetic material, and iron yokes or bridges 8 and 12 connecting the end plates.

3. An electromagnet having an armature provided with wings to pass over two side polar faces, and a mass of iron connecting the wings to coöperate with the end polar face.

In testimony whereof I have hereunto subscribed my name this 7th day of December, A. D. 1895.

JAMES WAYLAND.

Witnesses:

ROBT. H. READ,
CHARLES M. CATLIN.