

J. P. BETHKE.  
LIFTING MAGNET.  
APPLICATION FILED DEC. 4, 1917.

1,316,672.

Patented Sept. 23, 1919.  
2 SHEETS—SHEET 1.

*Fig. 1.*

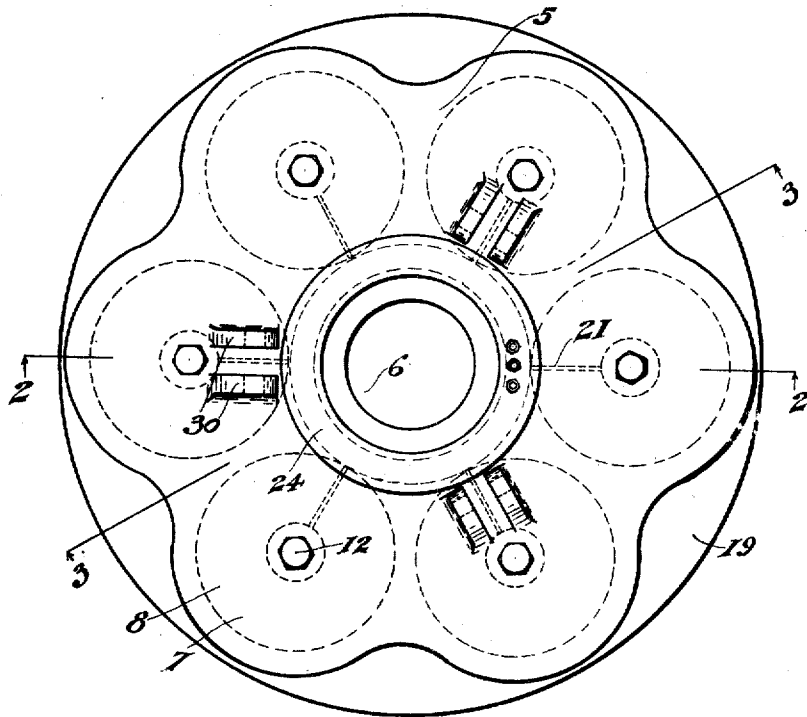


*Fig. 2.*

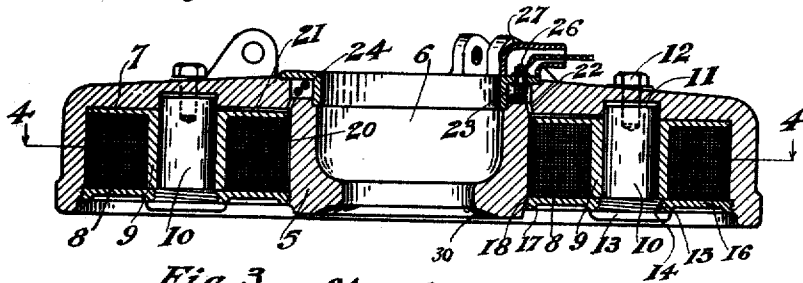
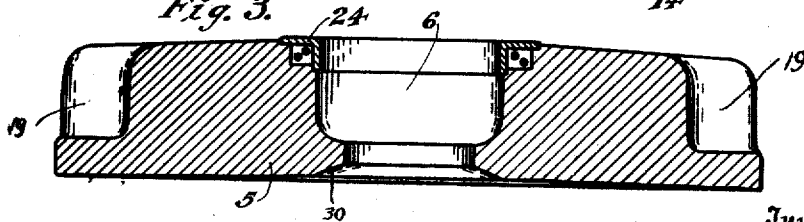


*Fig. 3.*



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*Fig. 4.*

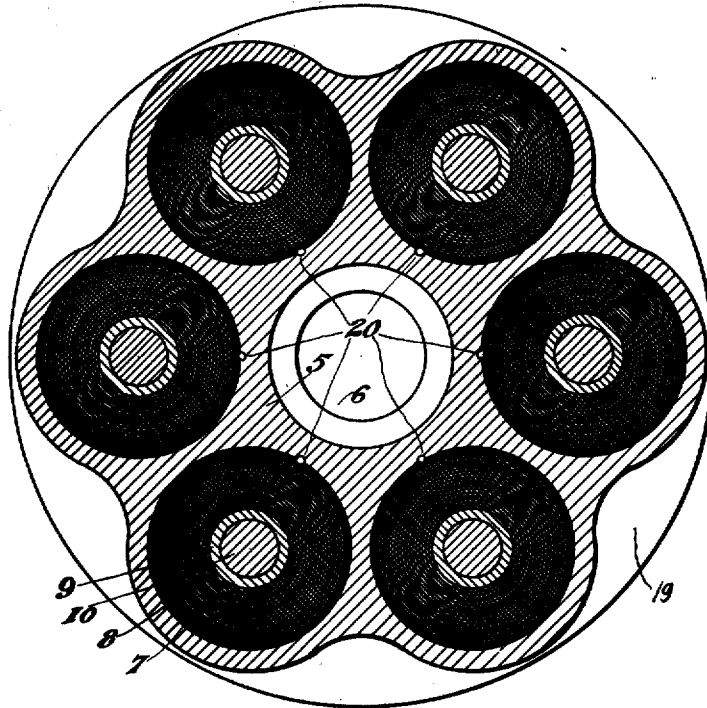
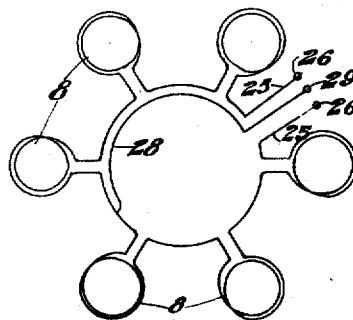


*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

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## LIFTING-MAGNET

1,316,672.

Specification of Letters Patent. Patented Sept. 23, 1919.

Application filed December 4, 1917. Serial No. 205,299.

*To all whom it may concern:*

Be it known that I, JOHN P. BETHKE, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Lifting-Magnets, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

The invention relates to lifting magnets and has for its objects to provide a magnet which will have a large lifting capacity in proportion to its own weight, one in which the coils for energizing the magnet can be economically made and readily assembled within the body of the magnet and one in which the magnet shall have its magnetic force uniformly distributed over its entire surface.

A further object of the invention is to provide means for arranging the coils in series in such a manner that direct current of varying voltage, such as, either 110 or 220 volts, may be utilized in energizing the same, without any change in the winding of the coils.

A further object of the invention is to provide heat radiating surfaces of extensive proportions as compared to the coils so that the heat generated within the coil may be readily dissipated to the outside thereof and thus allow the winding to be worked at a very high current density.

Another object of the invention is to provide a magnet in which the body is in one piece and in which the non-magnetic plates covering the coils are held in place by the cores of the coils besides being secured to the body at their outer edges.

Lifting magnets, of the type to which my invention relates, are used for the purpose of lifting heavy loads, such as large sheets of steel, large castings, billets or other magnetic material, and are usually suspended from a crane or other lifting device. In the magnets of the prior art in which the energizing winding consisted of a single coil, it has been found that the magnetic lines of force converging toward the center, concentrate there, with the result that the magnet will lift less around its outer edge than in the center due to this convergence of lines of force and consequently this type of magnet is not as efficient as one in which the

lines of force are evenly distributed over the entire lifting face of the magnet. In the present invention the arrangement of the coils in spaced relation to each other and the passage of the magnetic lines of force from the center of these coils to the inner and outer portions of the body of the magnet enable me to obtain high efficiency because of uniform distribution of the magnetic lines of force.

The invention further consists in the several features hereinafter set forth.

In the drawings:

Figure 1 is a top view of the magnet embodying the invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1;

Fig. 3 is a section taken on the line 3—3 of Fig. 1;

Fig. 4 is a section taken on the line 4—4 of Fig. 2;

Fig. 5 is a diagrammatic view of the electrical circuits for the coils.

In the drawings, the numeral 5 designates the body or frame of the magnet consisting of a single circular casting of magnetic material provided with a central opening 6, for ventilating purposes, and a plurality of coil pockets or chambers 7 which are preferably radially disposed and symmetrically arranged and spaced from each other. In the drawings I show the coil chambers arranged substantially equidistant from the center of the body of the magnet.

In each of the chambers 7 is an energizing coil 8 which is wound upon a spool 9 of magnetic material. Each spool 9 is removably mounted upon a cylindrical core 10 of magnetic material. The centers of the spools 9 together with the cores 10 constitute the inner poles of the magnets when they are in place within the body. The upper ends of the cores 10 fit into the cylindrical recesses 11 in the magnet body above the chambers 7 and are secured therein by screw bolts 12 which pass through the top of the chambers and are screwed into the ends of said cores. The lower ends of the cores 10 have enlarged flat heads 13 which serve as the faces of the inner pole pieces. Just beneath the head 13 each core is provided with a thread 14 for connection with a central threaded aperture 15 of a circular non-magnetic plate 16 which secures its coil in place and covers up the bottom of the coil.

The non-magnetic plates 16 are also threaded on their outer edges 17 to connect with threaded portions 18 of the magnet body so that said plate may be screwed and drawn up tightly into said body thereby providing a tight joint to prevent the passage of moisture into the coils. While as shown the coils are surrounded on all sides by the walls of the body, these walls are of such thickness that the heat which is generated within them will be readily dissipated and the opening in the center of the body together with the depressions 19 in the top also assist the dissipation of heat.

Each energizing coil is thoroughly insulated in any well known manner and when the coils are placed in position within the chambers they are sealed up against exposure to moisture by introducing a waterproof insulating compound to fill up the empty space as is well understood by those skilled in the art.

Vertical channels 20 and horizontal channels 21 are formed in the body in the walls of the chambers 7 to receive the conductors leading to and from the energizing coils, said channels communicating with short ducts 22 which lead into an annular recess 23 in the top of the body which is covered over by an angular annular ring 24 suitably secured to the body, said ring and recess forming an annular protected pocket in which the lead wires for the magnets are disposed and protected from injury.

Referring to Fig. 5 it will be noted that the coils 8 are connected in series and the terminals 25 are secured to binding posts 26 carried by the ring 24, said posts also serving to secure the ends of the main conductors to said magnet, these terminals being protected by a cap 27.

To provide for use of the magnet on varying current voltage without changing the coils I provide a conductor 28 which is secured to a binding post 29 and is connected to the conductor for the coils so as to divide the coil circuit and put the coils in parallel with each other. Thus when the main conductors are secured to the posts 25 the coils are in series and the magnet runs at high voltage. When it is desired to operate the magnet on a lower voltage, one of the main conductors is connected to the post 29 thus placing the coils in parallel and reducing the voltage. This permits the magnet to be operated either on a 220 or 110 volt circuit.

The top of the magnet is provided with integral lugs 30 to provide for suspending the magnet from a suitable chain or other suspension means for raising, lowering and transporting the magnet.

A further feature of the invention is the provision of an annular concave recess 30 adjacent the opening 6 and at the bottom of the body. This recess is designed to receive

and seat within it the upper end of what is called a "skull cracker ball" which is a heavy steel or iron ball used to crack up castings, old iron and billets by letting the ball fall from a considerable height, the use of the ball being clearly understood by those skilled in this art. The recess provides for an accurate centering of the skull cracker ball within the center of the magnet and thus any tendency of overbalancing the magnet which occurs in former constructions is prevented.

With this construction when the coils 8 are energized the magnetic lines of force flow from the centers of the coils or inner poles toward that portion of the body of the magnet surrounding them, the main flux passing from the inner poles toward the outer and inner portions of the body so that the lines of force are uniformly distributed on the surface of the magnet.

What I claim as my invention is:

1. In a lifting magnet, the combination of a body of magnetic material provided with a plurality of coil chambers opening into the lifting face of the magnet, energizing coils incased in said chambers, removable cores for said coils, means for detachably securing the inner ends of said cores to the body of the magnet, removable non-magnetic plates covering the bottom of the coils and heads on said cores engaging a portion of the outer faces of said plates.

2. In a lifting magnet, the combination of a body of magnetic material provided with a plurality of coil chambers opening into the lifting face of the magnet, energizing coils encased in said chambers, cores for said coils removably secured at their inner ends to the body of the magnet and having a threaded outer end portion and removable non-magnetic plates covering the bottom of the coils and having threaded bores engaging the threaded portions of said cores.

3. In a lifting magnet, the combination of a body of magnetic material provided with a plurality of coil chambers opening into the lifting face of the magnet, energizing coils disposed in said chambers, cores for said coils removably secured at their inner ends to the body of the magnet and having a threaded outer end portion, and removable non-magnetic plates covering the bottom of the coils and having threaded bores engaging the threaded portions of said cores and threaded peripheries engaging threaded portions of the body adjacent said chambers.

4. In a lifting magnet, the combination with a body portion of magnetic material having a central opening therein, of a recess in the body adjacent said opening and extending around the same, and a cover member secured to said body adjacent said recess, said recess and cover member form-

ing an inclosed channel for receiving conductor wires.

5. In a lifting magnet, the combination with a body of magnetic material having a central opening therein, of an annular recess in the top of said body adjacent said opening, an annular ring of angle iron secured to said body adjacent said recess, said recess and ring forming an inclosed channel to receive and protect the conductor wires.

6. In a lifting magnet, the combination of an annular body of magnetic material provided with a plurality of radially disposed symmetrically arranged pockets opening into the lifting face of the magnet, energizing coils incased in said pockets, said body being provided with a centrally disposed ventilating passageway and said pockets being spaced from each other and from the outer and inner sides of the body to form radiating surfaces to dissipate heat and permit the coils to be worked at a high current density, and cores for the coils centrally disposed therein and forming magnetic poles having pole faces disposed substantially in the plane of the lifting face of the magnet.

7. In a lifting magnet, the combination of a one piece annular body of magnetic material provided with a plurality of radially disposed symmetrically arranged pockets opening into the lifting face of the magnet, energizing coils incased in said pockets, cores for said coils secured to said body and forming magnetic poles having pole

faces of greater diameter than the body of the cores and disposed outwardly of the coils and substantially in the plane of the lifting face of the magnet, and non-magnetic plates covering the bottoms of the coils and held in place by a shoulder on said cores defined by the pole faces being of greater diameter than their body portion and by a connection with the body.

8. In a lifting magnet, the combination of a one piece annular body of magnetic material provided with a plurality of radially disposed symmetrically arranged cylindrical pockets opening into the lifting face of the magnet, said pockets being spaced from each other and from the outer and inner sides of the body to form relatively thin walls and the outer sides of the walls conforming to the curved outer portions of the pockets to within a comparatively short distance from the bottom of the body to form a plurality of recesses in the top portion of the body adjacent its outer edge whereby the body is provided with heat radiating surfaces of extensive proportions as compared with the coils so that the heat generated within the coils may be readily dissipated and thus permit the coils to be worked at a high current density, and energizing coils incased within said pockets and electrically connected together.

In testimony whereof, I affix my signature.

JOHN P. BETHKE.