Jan. 20, 1953 H. E. HODGSON 2,626,310

LIFTING MAGNET

Original Filed June 20, 1949

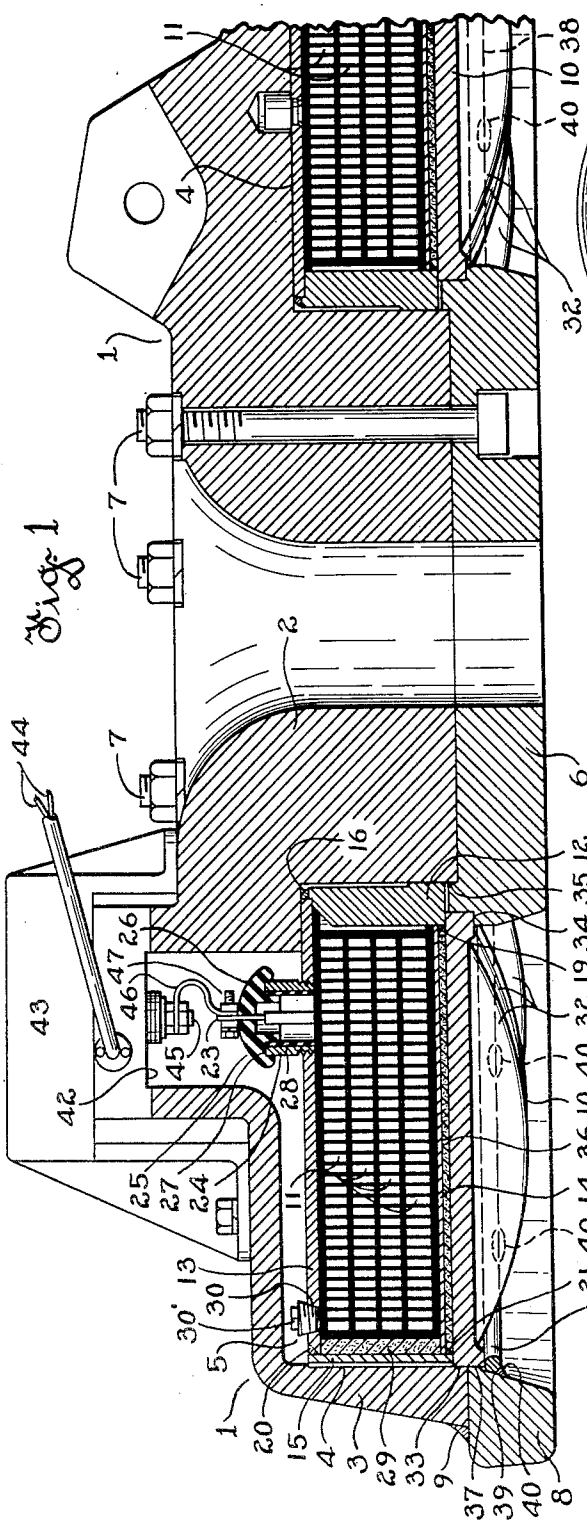


Fig. 1

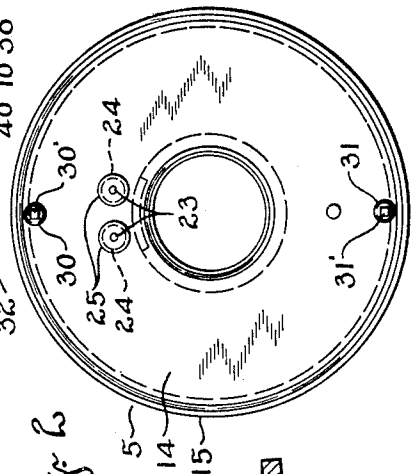


Fig. 2

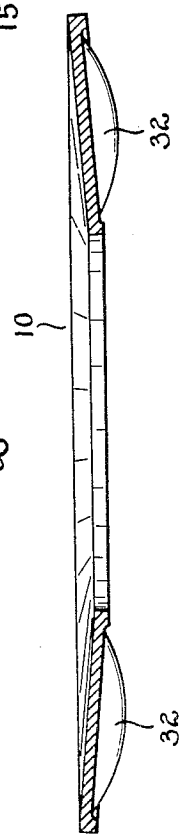


Fig. 3

Inventor
Howard E. Hodgson
By W. C. Lyon
Attorney

Patented Jan. 20, 1953

2,626,310

UNITED STATES PATENT OFFICE

2,626,310

LIFTING MAGNET

Howard E. Hodgson, Wauwatosa, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Continuation of application Serial No. 100,228, June 20, 1949. This application May 18, 1951, Serial No. 227,081

7 Claims. (Cl. 175—367)

1

This invention relates to lifting magnets and more particularly to circular lifting magnets of the type including a magnet frame having spaced inner and outer pole projections and a coil element of annular form mounted in the space between said pole projections.

The present application is in continuation of my application, Serial No. 100,228, now abandoned, which application was a continuation in part of my copending application, Serial No. 602,277, filed June 29, 1945, also abandoned.

Heretofore lifting magnets of the aforesaid type were usually provided with a coil element which required sealing within the magnet frame by an insulating fill for protection against injury by entry of moisture into the magnet frame. This sealed construction has been found objectionable in that repairs which require removal of the coil unit from the magnet frame cannot ordinarily be made by the magnet user. Thus, it is usually necessary to return the entire magnet to the manufacturer for such repairs, and this usually results in the magnet being out of service for an extended period and in high charges for shipment of the heavy magnet structure.

The present invention has among its objects to overcome the aforementioned objections by providing an encased self-contained moisture-proof unit which does not require sealing within the magnet frame and which is readily removable from the magnet frame and readily replaceable therein by the magnet user when coil repairs are required.

Another object is to provide an encased self-contained moisture-proof coil unit for lifting magnets of the aforesaid type which is mounted within the magnet frame with only an air fill between it and said frame and which is held in assembled position therein solely by a coil shield removably secured to the pole projections of the magnet frame.

Another object is to provide an encased moisture-proof coil unit having sealed terminal outlets which are of improved construction and do not require attachment to the magnet frame.

Another object is to provide an improved coil shield for the coil unit and to also provide improved means for holding the coil shield in assembled position upon the pole projections of the magnet frame.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates an embodiment of the invention which will now be described, it being understood that various modifications may be made in the embodiment illustrated without departing from the spirit and scope of the appended claims.

2

In the drawings,

Figure 1 is a fragmentary sectional view of a lifting magnet embodying the invention;

Fig. 2 is a plan view of reduced size of the coil unit illustrated in Fig. 1, and

Fig. 3 is a sectional view of reduced size illustrating the shape of the coil shield shown in Fig. 1 when the same is removed from the magnet frame.

The lifting magnet illustrated in Fig. 1 is provided with a horizontally disposed magnet frame 1 having a cylindrical center pole projection 2 and an annular outer pole projection 3 formed on the under side thereof which provide an annular space 4 for receiving a coil unit 5. The center pole projection 2 has a circular pole shoe 6 removably secured to the lower end thereof by bolts 7 and the outer pole projection 3 has a ring shaped pole shoe 8 fixed to the lower end thereof by a continuous peripheral weld 9. Coil unit 5 is held in assembled position within the annular recess 4 in the magnet frame 1 by an annular coil shield 10 which extends between the pole shoe 6 and 8.

More specifically coil unit 5 is provided with a plurality of insulated coil sections 11 of annular form which are formed of strap copper and are stacked one above the other within an enclosing casing comprising a magnetic core member 12, an annular top plate 13, an annular bottom plate 14 and an outer shell 15. Coil sections 11 are wound around the core member 12 and said core member is of sleeve form to receive the inner pole projection 2. Top plate 13 is formed of magnetic material and has its inner edge secured to the upper end of core member 12 by a continuous weld 16. Bottom plate 14 is formed of non-magnetic material such as stainless steel and the inner edge thereof is secured to the lower end of core member 12 by a continuous weld 19. Outer shell 15 comprises a strip of magnetic sheet metal having its ends welded together to provide a continuous ring. The upper end of shell 15 is secured to the outer edge of top plate 13 by a continuous weld 20 and the lower end of said ring is secured to the outer edge of bottom plate 14 by a continuous weld 21.

Coil sections 11 are connected together to form a continuous winding which is connected to a pair of terminal pins 23—23. These terminal pins extend upwardly through spaced pipe extensions 24 which thread into tapped openings

in top plate 13. Each of the pipe extensions 24 is provided with an insulating cap 25 having a center opening for receiving its associated terminal pin 23. As shown in Fig. 1 each of the cap members 25 is provided with a hemispherical top face 26 and has an annular recess 27 formed on the under side thereof for receiving the upper end of its associated pipe extension 24. Also as shown in Fig. 1 each of the pipe extensions 24 is provided with a sleeve insulating lining 28.

Coil sections 11 are sealed within the above described enclosing casing by a suitable insulating fill designated by reference numeral 29 which is preferably forced into the enclosing casing at low pressure through an opening 30 in top plate 13. Said top plate is provided with a second opening 31 for permitting escape of air from the enclosing casing during the filling operation. Openings 30 and 31 are tapped to receive screw plugs 30' and 31' which are placed therein upon completion of the filling operation.

Coil shield 10 comprises an annular casting formed of non-magnetic metal such as high manganese steel. Said shield in its free state is slightly dished as shown in Fig. 3 and has spaced radially disposed reenforcing ribs 32 formed on the underside thereof. The outer edge of coil shield 10 fits within a counterbore 33 in the lower end of outer pole projection 3 and inner pole shoe 6 is formed to fit within the opening in said shield and to provide a peripheral shoulder 34 for engaging the underside of said shield. Also the upper face of inner pole shoe 6 is provided with a circular recess 35 for receiving the lower end of inner pole projection 2.

As shown in Fig. 1 the outer marginal portion of coil shield 10 engages the lower end of outer shell 15 of coil unit 5 and the inner marginal portion thereof is held in engagement with the lower end of core member 12 by shoulder 34 on inner pole shoe 6. Coil shield 10 is thus flattened against the underside of coil unit 5 so that the outer marginal portion thereof is stressed upwardly against the lower end of outer shell 15 to securely hold said coil unit in position against the top side of the recess 4 in magnet frame 1. An asbestos supporting pad 36 of annular shape is placed between coil shield 10 and the bottom plate 14 of coil unit 5.

Outer pole shoe 8 is provided with a bore 37 for receiving the outer edge of coil shield 10 and said pole shoe carries a retaining ring 38 which abuts the underside of said shield. Retaining ring 38 is formed of round bar iron and is secured within a recessed portion 39 on the inner side of pole shoe 8 by spaced welded connections 40.

Magnet frame 1 has a terminal duct 42 formed in the upper side thereof for receiving terminal pins 23 and their associated pipe extensions 24. The upper end of duct 42 is closed by a terminal box 43 which is removably secured to the upper side of magnet frame 1. Box 43 is provided with a side opening for receiving insulated supply conductors 44 and said supply conductors are connected to insulated binding posts 45 on the underside of said box. As shown in Fig. 1 each of the binding posts 45 is provided with a flexible connector 46 which is removably secured to one of the terminal pins 23 by a clamping device 47. Connectors 46 are of such length as to enable the connection box 43 to be lifted sufficiently from the magnet frame to render the upper ends of terminal pins 23 accessible for disconnection of the clamping devices 47 when coil

element 5 is to be removed from magnet frame 1.

In connection with the foregoing it should be noted that coil unit 5 is completely encased except for outlet of coil terminals so that the same can be mounted within the coil receiving recess 4 with only an air fill between it and the magnet frame. Said coil unit is sealed within the recess 4 in magnet frame 1 by coil shield 10 and the inner pole shoe 6. However, if coil shield 10 or pole shoe 6 becomes damaged or loosened when the magnet is used in underwater salvage work water is likely to enter the coil receiving space 4. Upon entry of water into coil receiving space 4 the air in said space and in terminal duct 42 acts to maintain the water at a level within the magnet frame which is considerably below the upper ends of terminal pipe extensions 24 so that the coil sections are protected against injury by entry of water through the upper ends of said pipe extensions. Also it should be noted that water which may be driven out from the interior of the coil unit through pipe extensions 24 and which may collect by condensation in the terminal duct 42 is prevented from re-entering the upper ends of said pipe extensions by their associated cap members 25.

The above described magnet construction has numerous other advantages. For example, coil shield 10 is readily removable from the magnet frame by removing the securing bolts 7 associated with the inner pole shoe 6 and breaking the welded connections 40 between retaining ring member 38 and the outer pole shoe 8.

As is apparent, this can be readily done by the magnet user. Since coil unit 5 is not attached to the magnet frame the same can be readily removed therefrom upon removal of coil shield 5. The welded connection 9 between outer pole projection 3 and outer pole shoe 8 provides a joint of low magnetic reluctance between these parts which tends to increase the lifting capacity of the magnet. The lifting capacity of the magnet is further increased by providing the enclosing casing of the coil unit with flux carrying parts 12, 13 and 15.

I claim:

1. In a lifting magnet, the combination comprising a cast magnet frame having concentrically arranged inner and outer pole projections extending downwardly therefrom and defining an annular winding space therebetween, a metallic coil containing enclosure of annular form within said frame in said winding space and having therein a coil and insulating material completely filling said enclosure and the interstices of said coil, said enclosure having terminal outlets on the upper side thereof and being sealed except for said outlets through which vapors may escape, and means retaining said coil containing enclosure within said winding space consisting of a coil shield plate secured to the lower ends of said pole projections and extending therebetween for closure of said winding space, said coil containing enclosure having always a slip fit with said frame such that neglecting its electrical connections it is free for removal upon mere removal of said plate and hence readily removable in the field.

2. In a lifting magnet, the combination comprising a cast magnet frame having concentrically arranged inner and outer pole projections extending downwardly therefrom and defining an annular winding space therebetween, a metallic coil containing enclosure of annular form within said frame fitting said winding space and having

a coil therein, terminal outlets on the upper side of said enclosure having caps permitting escape of vapors from said enclosure but preventing entrance of condensation, said enclosure being sealed except for said outlets and having an insulating material completely filling said enclosure and the interstices of said coil therein, said insulating material by confinement within said coil enclosure being non-interfering with removal of said enclosure from said magnet frame, and means consisting of pole shoes attached to the pole projections of said frame and a coil shield plate supported by said pole shoes to afford both retention of said coil enclosure in said frame and protection of the coil in service, said coil containing enclosure being removable in a cold state following removal of said shield plate.

3. In a lifting magnet, the combination with a cast magnet frame having spaced inner and outer pole projections on the under side thereof defining an annular coil receiving recess, of a metallic coil containing enclosure of annular form fitting within said frame in said recess and having therein a coil, an insulating material completely filling said enclosure and the interstices of said coil, and a coil shield plate secured to the lower ends of said pole projections and extending therebetween for closure of said recess and retention of said coil containing enclosure therein, said plate in its free state being dished on the side adjacent said enclosure and upon securement to said frame being stressed and held in flattened position against the underside of said enclosure to prevent movement thereof within said recess, said enclosure and said frame having a slip fit such that neglecting the electrical connections of said coil it may be readily removed upon detachment of said plate.

4. In a lifting magnet, the combination with a magnet frame having spaced inner and outer pole projections on the underside thereof forming an annular coil receiving recess, of an annular shield plate extending between said pole projections and being detachably secured to said frame, and an enclosed self-contained coil unit of annular form supported in said recess in said frame solely by said plate, the latter in its free state being dished on the side adjacent said coil unit and upon securement to said frame being stressed and held in a flattened position against the underside of said coil unit to prevent movement thereof within said recess, said coil unit and said frame having therebetween only an air fill leaving said unit freely removable upon removal of said plate.

5. In a lifting magnet, the combination with a magnet frame having spaced inner and outer pole projections on the underside thereof forming an annular coil receiving recess, said inner pole projection having a circular pole shoe detachably secured thereto and said outer pole projection having an annular pole shoe permanently secured to the lower end thereof by a peripheral welded connection of low magnetic reluctance, of a detachably secured annular shield plate extending between said pole projections, a metal encased self-contained and sealed moisture-proof coil unit of annular form supported in said recess solely by said plate, the latter in its free state being dished on the side adjacent said coil unit and upon securement to said frame being stressed by engagement of the inner marginal portion thereof with a peripheral shoulder formed on said inner pole shoe and held in flattened position thereby against the underside of said coil unit

to prevent movement thereof within said recess, and a retaining ring for the outer marginal portion of said plate secured to the inner side of said outer pole shoe by circumferentially spaced welded connections which can be readily broken for removal of said retaining ring, said plate being readily removable from said magnet frame upon detachment of said inner pole shoe and breaking of said welded connections between said retaining ring and said outer pole shoe, thereby affording ready removability of said coil unit in its sealed condition.

6. In a lifting magnet, the combination with a magnet frame comprising inner and outer pole projections defining an annular coil space open between the outer ends of said projections, pole shoes for said projections and an annular coil shield for closing said coil space along a plane inset from the outer ends of said pole shoes, of a self-contained moisture-proof coil unit of form and dimensions in fully assembled state affording it a slip fit with said frame for insertion into or removal from the annular coil space of said frame when open, said coil unit comprising a magnetic core member of sleeve form to receive the inner pole projection of said magnet frame, a coil built up on and about said core member with insulation between its turns and a plate metal shell built up on said core member for complete enclosure of said coil except for terminal lead outlets and having continuous welds at its joints including its joints with said core member, said coil unit having at least certain of its plate walls of magnetic metal and after assembly being filled with insulation introduced under pressure and thereafter confined within said unit, the interfit of said unit and said coil recess being so close as to obviate need of packing therebetween, and said magnet frame having its said parts secured together for facility of removal of said coil shield thus to open said coil space for removal of said coil unit.

7. In a lifting magnet, the combination with a magnet frame comprising inner and outer pole projections defining an annular coil space open between the outer ends of said projections, pole shoes for said projections and an annular coil shield for closing said coil space along a plane inset from the outer ends of said pole shoes, of a self-contained moisture-proof coil unit of form and dimensions in fully assembled state affording it a slip fit with said frame for insertion into or removal from the annular coil space of said frame when open, said coil unit comprising a magnetic core member of sleeve form to receive the inner pole projection of said magnet frame, a coil built up on and about said core member with insulation between its turns and a plate metal shell built up on said core member for complete enclosure of said coil except for terminal lead outlets and having continuous welds at its joints including its joints with said core member, said coil unit having at least certain of its plate walls of magnetic metal and after assembly being filled with insulation introduced under pressure and thereafter confined within said unit, said coil unit having upstanding terminal leads to enter a terminal box provided in said magnet frame, each lead being provided with a surrounding metal element separate from said magnet frame and having an insulating closure permitting projection of the lead but preventing entrance of moisture, the interfit of said unit and said coil recess being so close as to obviate need of packing therebetween, and said magnet frame having its

said parts secured together for facility of removal of said coil shield thus to open said coil space for removal of said coil unit.

HOWARD E. HODGSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
392,385	Weston	Nov. 6, 1888
928,510	Eastwood	July 20, 1909
1,015,728	Eastwood	Jan. 23, 1912
1,325,914	Rowell	Dec. 23, 1919
1,334,504	Parker	Mar. 23, 1920
1,594,567	Sederholm	Aug. 3, 1926
1,844,626	Anderson	Feb. 9, 1932
2,093,149	Lee	Sept. 14, 1937
2,095,499	Hodgson	Oct. 12, 1937
2,214,732	Kraft	Sept. 17, 1940
2,366,919	Lillquist	Jan. 9, 1945
2,410,794	Wright	Nov. 5, 1946
2,476,049	Leitch	July 12, 1949

FOREIGN PATENTS

Number	Country	Date
185,265	Great Britain	Sept. 7, 1922