Jan. 9, 1945. A. E. LILLQUIST ET AL 2,366,919

LIFTING MAGNET

Filed March 4, 1943 2 Sheets-Sheet 1

Fig. 1

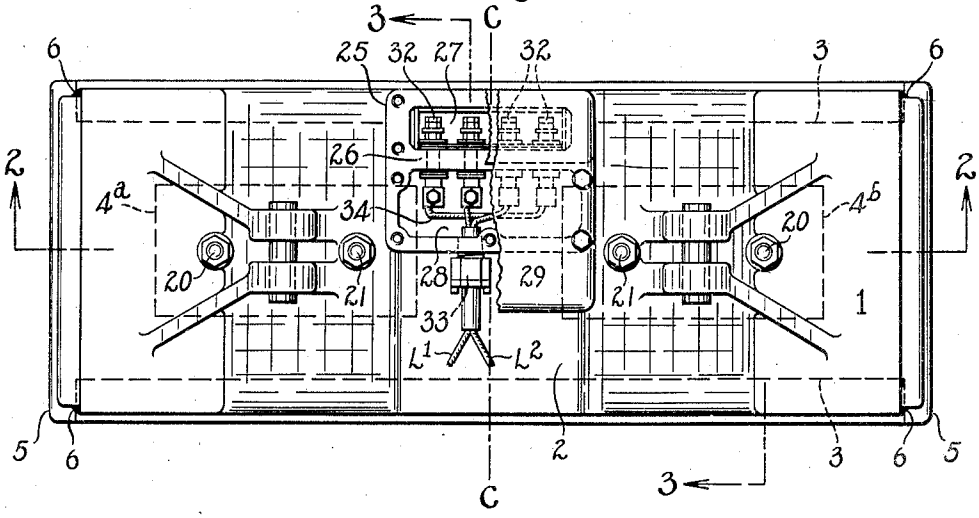
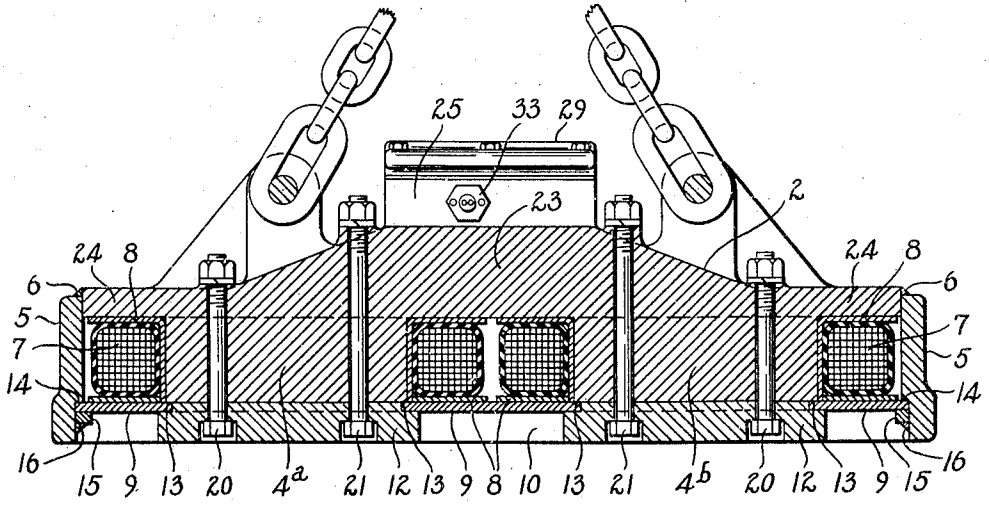


Fig. 2



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Fig. 3

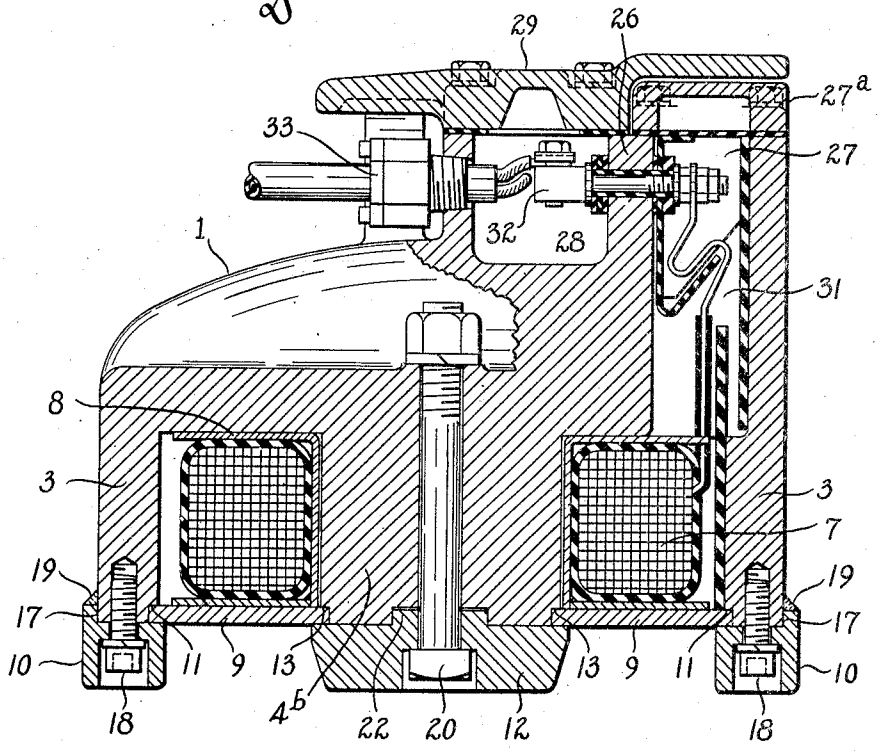


Fig. 4

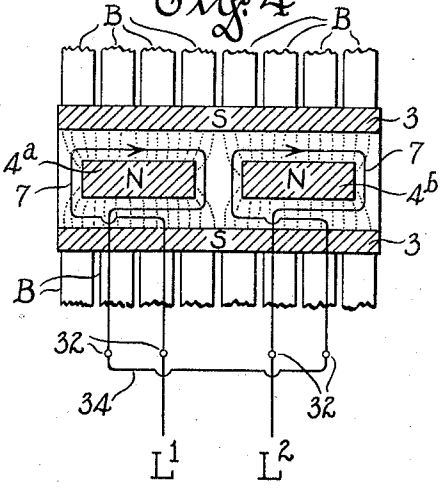
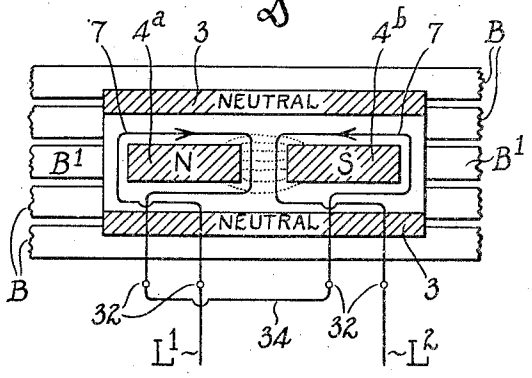


Fig. 5



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Patented Jan. 9, 1945

2,366,919

UNITED STATES PATENT OFFICE

2,366,919

LIFTING MAGNET

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Application March 4, 1943, Serial No. 477,952

6 Claims. (Cl. 175—367)

This invention relates to lifting magnets and is particularly applicable to lifting magnets of the multi-coil type.

The invention has among its objects to provide an improved multi-coil lifting magnet which is adapted to lift material such as billets or slabs in various ways.

Another object is to provide an improved lifting magnet of the aforementioned type which is capable of being operated either with a concentrated field or an evenly distributed field on its lifting face to adapt the same for different kinds of work.

Another object is to provide an elongated two-coil lifting magnet of the aforesaid character which is simple and rugged in construction, efficient and reliable in operation and capable of withstanding severe service.

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

The accompanying drawings illustrate 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.

In the drawings,

Figure 1 is a top elevational view of a lifting magnet embodying the invention with parts of a terminal box on its upper surface broken away;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view on line 3—3 of Fig. 1, and

Figs. 4 and 5 are diagrammatic views illustrating the operation of the magnet.

The lifting magnet shown in the drawings is provided with a cast magnet frame 1 comprising an elongated rectangular top wall 2 having auxiliary side pole projections 3—3 and a pair of intermediate main pole projections 4^a and 4^b formed on the underside thereof. Pole projections 3—3 extend in parallel relation between a pair of non-magnetic end plates 5—5 which are secured to opposite ends of magnet frame 1 by fusion welds 6. Pole projections 4^a and 4^b are located midway between pole projections 3—3 and as shown in Fig. 1 the same are equally spaced with respect to the center line C—C of the magnet frame. Pole projections 4^a and 4^b are rectangular in shape and each is surrounded by an insulated magnet winding 7 which is wound upon a suitable bobbin 8.

More specifically, magnet windings 7 are enclosed, supported and protected by a non-magnetic coil shield 9 which fits between pole projections 3—3 and end plates 5—5 and is provided with openings for receiving the lower ends of the pole projections 4^a and 4^b. Each of the side pole projections 3 has an elongated shoe 10 secured to the lower end thereof and coil shield 9 is clamped between said shoes and shoulders 11 formed on the inner faces of said pole projections. Also each of the intermediate pole projections 4^a and 4^b has a rectangular shoe 12 secured to the lower end thereof and coil shield 9 is clamped by said shoes against peripheral shoulders 13 formed on the lower ends of said intermediate pole projections. Coil shield 9 is also clamped against shoulders 14 formed on the inner faces of end plates 5 by bars 15 which are secured to said end walls by fusion welds 16.

Each of the pole shoes 10 is shouldered as shown at 17 to engage the outer face of its associated pole projection 3 and each is secured to magnet frame 1 by screws 18 and by a fusion weld 19. Each of the pole shoes 12 is secured to magnet frame 1 by a pair of bolts 20 and 21 and each has a tongue projection 22 formed on the upper surface thereof which fits within a groove in the lower face of its associated pole projection.

For a purpose hereinafter set forth the portion 23 of top wall 2 which extends between pole projections 4^a and 4^b is of such thickness that the cross sectional area thereof is at least equal to the cross sectional area of either of said pole projections and as shown in Fig. 2 said top wall is tapered on opposite sides of the portion 23 to provide end portions 24 of reduced cross sectional area.

As shown in Figs. 1 and 2 magnet frame 1 has a box-shaped terminal housing 25 formed on the upper face thereof which is located midway between the ends of said magnet frame and adjacent one side thereof. Housing 25 is divided by wall 26 into two compartments 27 and 28 and as shown in Fig. 3 said compartments are provided with removable covers 27^a and 29, respectively. Also as shown in Fig. 3 compartment 27 communicates with a vertical duct 31 in the magnet frame which contains the terminals associated with magnet windings 7. Wall 26 has four insulated terminal posts 32 mounted within spaced openings therein and the terminals of magnet windings 7 extend upwardly into compartment 27 and are each permanently connected to one of said terminal posts. A connector assembly 33 is mounted within an opening in housing 24 and as shown in Fig. 1, the same is provided with insulated supply conductors L^1—L^2, which extend into compartment 28. Supply conductors L^1—L^2 are each connected within compartment 28 to one of the terminal posts 32 and as shown in Fig. 1 the other terminal posts are connected together within said compartment by a bridging conductor 34.

The operation of the aforedescribed lifting magnet will now be described in connection with Figs. 4 and 5.

As shown in Fig. 4 supply conductors L^1—L^2 and bridging conductor 34 are connected to the

terminal posts 32 of the magnet so that the magnet windings 7 are connected in series across said supply conductors and are supplied with current in the same direction. Poles 4^a and 4^b are thus of like polarity and assuming that the faces of both of said poles are north, the faces of side poles 3 will become south and the magnetic field that is generated is distributed substantially uniformly over the entire face of the magnet as indicated by dotted lines. With the magnetic field distributed in this manner the magnet is adapted to lift a plurality of adjacent billets B when the same is placed at right angles to the billets as shown in Fig. 4.

In Fig. 5 the supply conductors L^1—L^2 and bridging conductor 34 are connected to the terminals 32 of the magnet so that the magnet windings 7 are connected in series across said conductors but are supplied with current in opposite directions. The poles 4^a and 4^b are thus of opposite polarity, the face of the former pole being north and the face of the latter being south. As hereinbefore set forth the portion 23 of top wall 2 which extends between pole projections 4^a and 4^b has a cross sectional area which is at least equal to the cross sectional area of either of said pole projections. Thus the entire flux generated by windings 7 passes between pole projections 4^a and 4^b without entering the side pole projections 3. The side pole projections 3 are thus rendered neutral and the entire magnetic field generated by the two windings 7 is concentrated within a narrow zone midway between said side pole projections. The magnet is then adapted to pick up a single billet B^1 from a row of billets when the same is placed upon the billets as illustrated in Fig. 5. As is apparent when the magnettic field is concentrated as shown in Fig. 5 the magnet is also adapted to lift and handle slabs or plates by contact with an edge thereof.

What we claim as new and desire to secure by Letters Patent is:

1. A lifting magnet comprising a horizontally disposed magnet frame having a pair of main pole projections and a pair of auxiliary pole projections on the underside thereof, said main pole projections being spaced with respect to each other and with respect to said auxiliary pole projections and being located in a plane midway between said auxiliary pole projections and a magnet winding mounted upon each of said main pole projections, said magnet windings being energizable to selectively render said main pole projections of different polarity for a concentrated magnetic field between said main pole projections or of like polarity for a distributed magnetic field between said main and auxiliary pole projections.

2. A lifting magnet comprising a horizontally disposed magnet frame having a plurality of main pole projections and a plurality of auxiliary pole projections on the underside thereof, said auxiliary pole projections being arranged in parallel relation, and said main pole projections being spaced and being located in a plane midway between said auxiliary pole projections, a winding mounted upon each of said main pole projections, said windings being energizable to render said main pole projections of like polarity for a distributed magnetic field between said main and auxiliary pole projections, and said windings being also energizable to render said main pole projections of alternate polarity to neutralize said auxiliary pole projections and to provide a concentrated magnetic field between said main pole projections.

3. A lifting magnet comprising an elongated horizontally disposed magnet frame having on its underside a pair of auxiliary side pole projections extending in parallel relation between opposite ends thereof, and a pair of spaced main pole projections located in a plane midway between said auxiliary pole projections, a magnet winding mounted upon each of said main pole projections, said magnet windings being energizable to selectively render said main pole projections of different polarity for a concentrated magnetic field therebetween or of like polarity for a distributed magnetic field between said main and auxiliary pole projections.

4. In a lifting magnet, in combination, a magnet frame comprising an elongated rectangular top body portion having on its under side a pair of auxiliary side pole projections extending in parallel relation between opposite ends thereof and a pair of spaced main pole projections located midway between said former pole projections, a magnet winding mounted upon each of said main pole projections, a non-magnetic coil shield extending between said auxiliary pole projections and having openings therein for receiving said main pole projection and a pole shoe secured to each of said pole projections, said coil shield being clamped by said pole shoes against shoulders formed on said main and auxiliary pole projections.

5. In a lifting magnet, in combination, an elongated magnet frame comprising an elongated rectangular top body having on its under side a pair of auxiliary side pole projections extending in parallel relation between opposite ends thereof and a pair of spaced main pole projections located midway between said former pole projections, said top body having tapered end portions and having a cross sectional area between said portions which is at least equal to the cross sectional area of either of said main pole projections, and means including a pair of magnet windings mounted upon said main pole projections for selectively rendering said main pole projections of different polarity for a concentrated magnetic field therebetween or of like polarity for a distributed magnet field between said main and auxiliary pole projections.

6. In a lifting magnet, in combination, a magnet frame comprising an elongated rectangular top body having on its under side a pair of auxiliary side pole projections extending in parallel relation between opposite ends thereof and a pair of spaced main pole projections located midway between said former pole projections, a magnet winding mounted upon each of said main pole projections, a pair of non-magnetic end plates secured to opposite ends of said magnet frame, a non-magnetic coil shield extending between said non-magnetic end plates and said auxiliary pole projections and having openings therein for receiving said main pole projections and a pole shoe secured to each of said pole projections, said coil shield being clamped by said pole shoes against shoulders formed on said main and auxiliary pole projections.

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