No. 835,942. PATENTED NOV. 13, 1906.

A. C. EASTWOOD.

LIFTING MAGNET.

APPLICATION FILED AUG. 30, 1905.

2 SHEETS—SHEET 1.

Fig. 5.

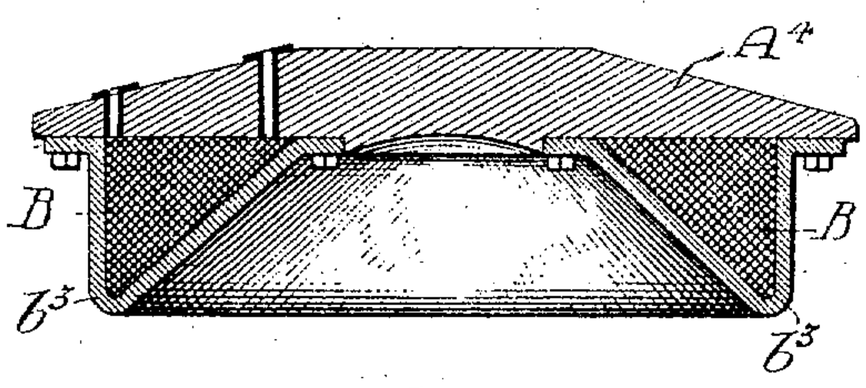


Fig. 1.

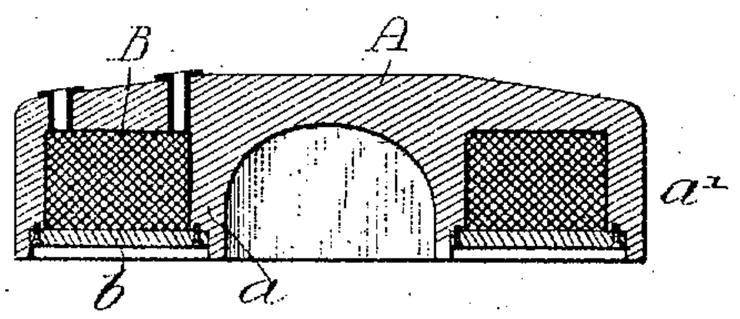
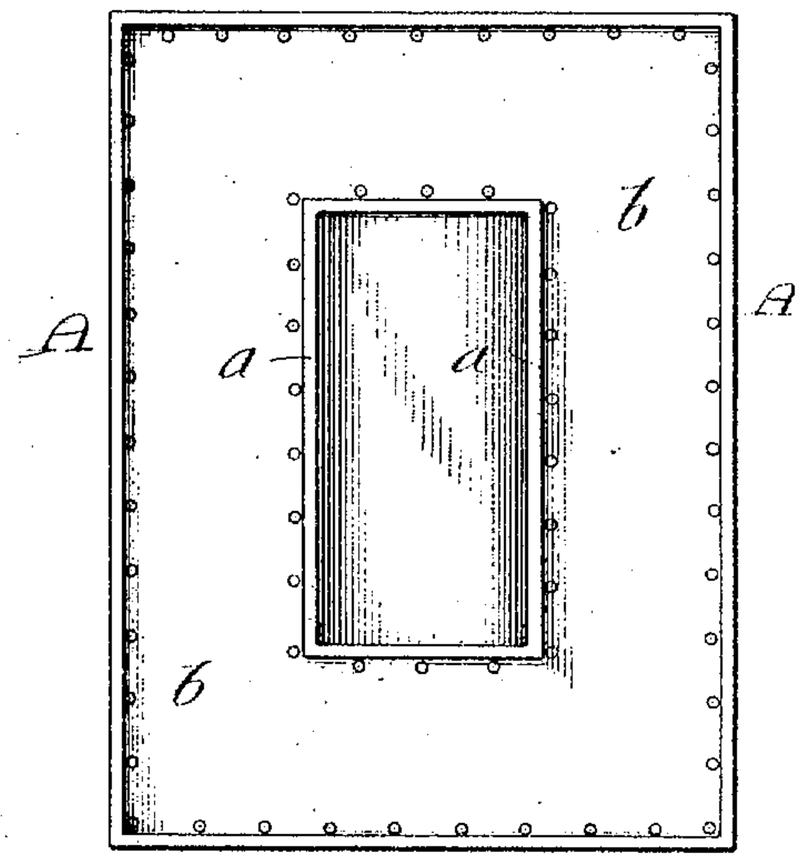


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

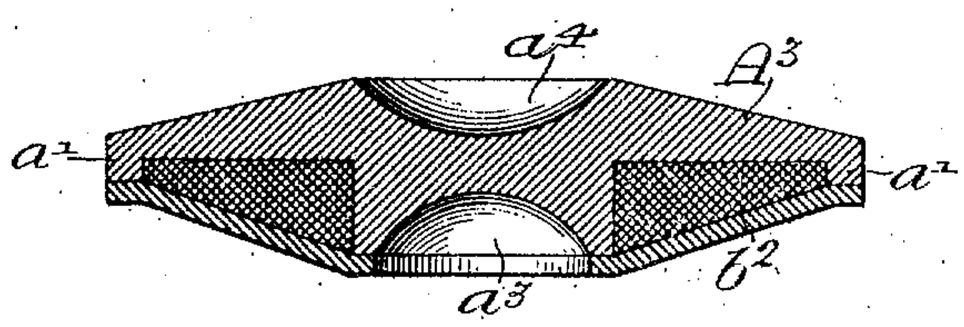
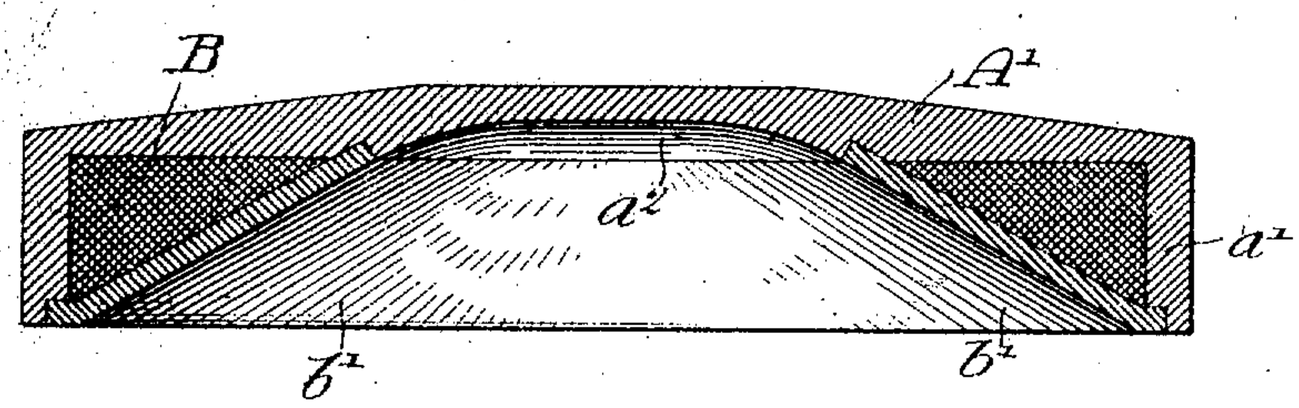


Fig. 3.



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UNITED STATES PATENT OFFICE.

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LIFTING-MAGNET.

No. 835,942. Specification of Letters Patent. Patented Nov. 13, 1906.

Application filed August 30, 1905. Serial No. 276,418.

To all whom it may concern:

Be it known that I, ARTHUR C. EASTWOOD, a citizen of the United States, residing in Cleveland, Ohio, have invented certain Improvements in Lifting-Magnets, of which the following is a specification.

The object of my invention is to provide a magnet for the lifting and transportation of articles of steel or iron—such as pig or scrap iron, bolts, nuts, nails, turnings, &c.—of such construction that its weight shall be relatively small proportionately to the weight of the load or the body of material lifted by it.

This object I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of one form of my invention, illustrating one construction of framework whereby the above-noted objects may be secured. Fig. 2 is an inverted plan view of the magnet shown in Fig. 1. Fig. 3 is a vertical section of a magnet in which the central pole-piece has been omitted and the central part of the frame hollowed. Fig. 4 is a vertical section of a lifting-magnet in which the central pole-piece, as well as the center of the frame, has been made hollow, in addition to which the frame has been constructed with but a relatively small annular pole-piece; and Fig. 5 is a vertical section of a form of magnet in which the annular pole-piece has been altogether omitted.

So far as I am aware prior to my invention of the lifting-magnet shown and described in United States Patent No. 794,086, granted to me July 4, 1905, the load to be lifted constituted only the armature of the lifting-magnets hitherto known to the art, it being considered necessary to bring portions of the magnet into intimate contact with the load of magnetic material to be lifted. If the core of an electromagnet be defined as that portion of a magnetic circuit which is within the magnetizing-coil, then in that form of lifting-magnet described in my above-mentioned patent it will be noted that the load of magnetic material to be lifted constitutes not only the armature of the magnet, but also forms a portion of the core. According to my present invention I carry this idea still farther and so design the magnet that the load to be lifted constitutes a relatively large portion of the magnetic circuit, attaining this result by hollowing the central core, by omitting it altogether, by hollowing the center of the frame, or by partly or wholly omitting the annular pole-piece of the magnet. By this means it will be seen that I am enabled to construct a relatively powerful magnet, which, however, is of but small weight compared with the weight of the material which it is capable of lifting.

In Figs. 1 and 2 of the above drawings, A represents the iron or steel frame of one form of my improved lifting-magnet, which may be described as consisting of a supporting-frame, from which project downwardly a central pole-piece *a* and an annular pole-piece *a'* in such manner as to form between them an annular recess, in which is contained the magnet-winding B, this latter being held in place by a ring-shaped plate *b*, screwed or bolted in position, as desired. The central pole-piece *a* in the present instance is recessed or hollowed, so that the amount of material in it is less than would be required for the magnetic circuit of the winding B. This recess may be of rectangular section, as shown in Fig. 2, or of circular section, and it will be understood that the frame of the magnet may be of rectangular shape, as shown in said figure, or of circular form, without departing from my invention. Under operating conditions if this magnet be used to lift and transport borings or turnings bolts, nuts, nails, or other relatively small pieces of steel or iron such material will be drawn into the recess of the central pole as well as held to the brass cover-plate between the central and annular pole-pieces, and because of said recessed pole-piece *a* space will be provided for the reception of a greater body of material than could be handled if this were a solid. At the same time the weight of the magnet will be materially less than otherwise, so that the amount of material carried by a magnet of given weight will be greater than has hitherto been the case.

In Fig. 3 I have shown the frame A' of the magnet as formed without any central pole-piece and with its center hollowed, as indicated at a^2. The magnet-winding B in this case is so formed that the number of its turns increases from the center outwardly and are protected by a frusto-conical brass ring *b'*. The outer pole *a'* in this case is similar in construction to that shown in Fig. 1.

In Fig. 4 I have shown a form of my invention in which the frame A^3 has the central pole-piece made with a recess a^3 in its

lower face and a second recess a^4 in its upper face. In this form of magnet I so arrange the winding that the number of its turns decreases from the center outwardly and omit all but a very small portion of the annular pole-piece a'. With such a construction I employ an outwardly-convex ring b^2 of non-magnetic material situated between the edge of the central pole-piece and the annular pole a'.

In its ultimate form the magnet might be made as shown in Fig. 5, there being in such case merely a disk A^4 of iron or steel serving as the supporting-framework, to which the winding B is held by means of a brass casing b^3, consisting of an annular portion, from the lower edge of which there extends inwardly and upwardly a frusto-conical portion. It will be seen that this magnet is particularly adapted for use for the transportation of finely-divided material, which when the coil is energized is not only drawn into the interior of the winding—*i. e.*, within the casing b^3—but is also held to the outside or ring portion of the casing in such manner that it takes the place of the annular pole-piece employed in the other forms of my invention, and so completes the magnetic circuit of the winding.

It is essential that the reluctance of the magnetic circuit of a magnet for lifting bulk magnetic material be high before the attachment of a load and be materially reduced by the addition of the load. The more incomplete the magnetic circuit of the magnet the higher will be its reluctance and the less iron or steel will be required in its construction. Consequently its weight will be less, and if the material to be lifted can be made to form a relatively large portion of the magnetic circuit of the winding a larger weight of it may be lifted by a magnet of given weight. It will therefore be seen that by means of my invention the weight of a magnet compared with the weight of material which it will lift is reduced in a compound ratio.

I claim as my invention—

1. A magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a plate of magnetic material, an annular winding held to the under side thereof, and an inclosing casing for such winding, the same consisting of a shell of non-magnetic material extending from the plate within the winding to and around the lowermost portion of said winding, said plate having a recess in the center of its under side, substantially as described.

2. A magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a frame including a plate of magnetic material having a winding carried on its under side, and a casing of non-magnetic material for the winding, said casing having a frusto-conical portion extending inside said winding and being provided with a cylindrical flange portion extending around the outside thereof, with means for holding the casing to the plate, substantially as described.

3. A magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a plate of magnetic material having a central pole-piece, a winding extending around said pole-piece, and means for holding said winding in place, the pole-piece being cut away so that its area of cross-section is less than that properly required for the magnetic circuit of the winding, substantially as described.

4. A magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a frame including a plate of magnetic material having a central pole-piece, a winding extending around said pole-piece, and a metallic casing held to the plate for maintaining the winding in position, said casing extending inside the winding and around the outside edge thereof, substantially as described.

5. A magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a plate of magnetic material having a central pole-piece, a winding extending around said pole-piece, and a casing held to the plate for maintaining the winding in position, said casing extending inside of the winding and around the outside edge thereof, and the pole-piece being cut away so that its area of cross-section is less than that properly required for the magnetic circuit of the winding, substantially as described.

6. A magnet consisting of a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a substantially flat plate of magnetic material, a winding projecting from one face thereof, the magnetic circuit of the winding being open and substantially incomplete on one face and its outer side, substantially as described.

7. A magnet consisting of a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet consisting of a body of magnetic material and an annular winding supported so as to project from one face of said body, the

central portion of the body being recessed in order to concentrate the magnetic flux and forming a pole-piece for the winding of less cross-sectional area than that properly required to carry such flux, substantially as described.

8. A lifting-magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet including a frame of magnetic material and an annular winding held to the under side thereof, said frame having a recess in the center of its under side, substantially as described.

9. A lifting-magnet constituting a complete article of manufacture and constructed for the simultaneous transportation of a number of detached pieces of magnetic material, said magnet including a plate of magnetic material having a recess in the center of its under side, a winding substantially concentric with said recess, and means for holding said winding to the plate, substantially as described.

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

ARTHUR C. EASTWOOD.

Witnesses:

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C. W. COMSTOCK.