(No Model.)

W. P. DANIELS.

MULTIPOLAR ELECTROMAGNET.

No. 552,103. Patented Dec. 31, 1895.

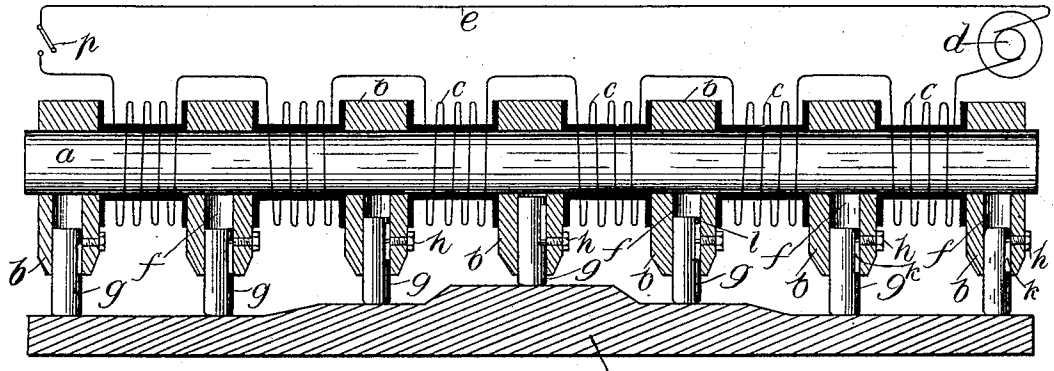

Fig. 1

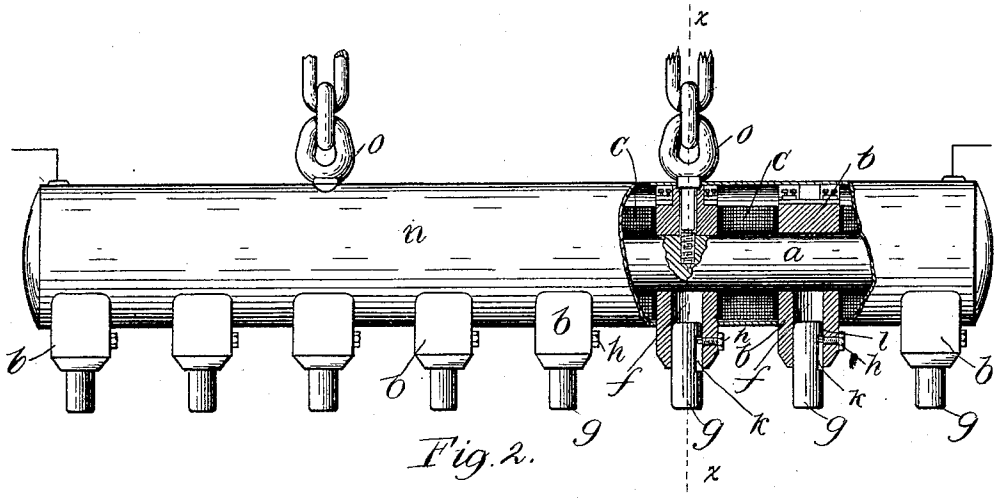

Fig. 2.

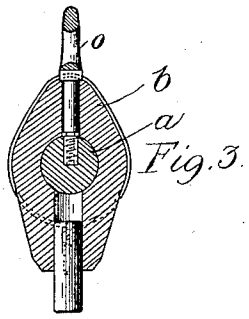

Fig. 3.

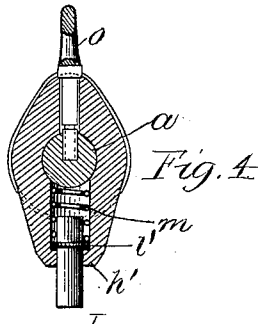

Fig. 4.

Witnesses:
Dr Will C. Sanner.
W. Clyde Jones.

Inventor:
William P. Daniels,
By Barton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM P. DANIELS, OF COLOGNE, GERMANY, ASSIGNOR TO THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA, OF CHICAGO, ILLINOIS.

MULTIPOLAR ELECTROMAGNET.

SPECIFICATION forming part of Letters Patent No. 552,103, dated December 31, 1895.

Application filed September 7, 1895. Serial No. 561,720. (No model.) Patented in Germany July 11, 1895, No. 82,855.

To all whom it may concern:

Be it known that I, WILLIAM P. DANIELS, a subject of the Emperor of Germany, residing at Cologne, Germany, have invented new and useful Improvements in Multipolar Electromagnets, (Case No. 51,) of which the following is a specification, and for which I have received a patent in Germany, dated July 11, 1895, No. 82,855.

My invention relates to a construction of a multipolar electromagnet adapted to lift large masses of iron by the attractive power of its poles, and the object of the invention is to so construct such a magnet that it shall be efficient in its application to masses of iron of large area and irregular surface, as well as to masses of small area and even surface.

The use of electromagnets for picking up and raising masses of iron in foundries and similar places has been proposed and used to a limited extent; but the ordinary magnet with two poles is serviceable in this way only for small masses of iron of inconsiderable area. The use of a multipolar electromagnet, the poles of which are held in a rigid relation to each other and to the mass of iron to be lifted, is unsatisfactory except for application to masses or structures of iron of even surface, for it is well known that the attraction of a magnet acts according to a law which is approximately that it varies inversely with the square of the distance. Moreover, when the pole of a magnet is brought directly in contact with the attracted body, the force of the power of attraction is enormously enhanced by what is termed "magnetic adhesion." By the construction of the multipolar magnet shown herein I am able to get the maximum efficiency of an electromagnet applied to large masses of iron of uneven surface, and it is thus suitable for lifting long pieces of iron, like pipes and other castings in foundries and in similar situations.

Referring to the accompanying drawings, Figure 1 shows the construction of the multipolar electromagnet in section as applied to a mass of iron with irregular surface, the windings of the cores being shown diagrammatically in connection with a source of electricity. Fig. 2 is a side elevation of the device of the invention, partly broken away. Fig. 3 is a sectional view on the line $x\,x$ of Fig. 2. Fig. 4 is a similar sectional view, showing a modification of my invention.

Similar letters of reference indicate like parts in the different views.

Upon the core a are slid a number of annular pole-pieces $b\ b$, with intervals between them upon which are wound the coils c. These coils are preferably wound upon forms slipped upon the core a alternately with the pole-pieces $b\,b$. The windings of the coils c are so arranged that alternate poles are formed. For example, starting from the left of Fig. 1, if the first pole-piece b is north the second one will be south, the third north, and so on.

The connection of the windings upon the core are shown by the line e to the dynamo or other source of current d, which is adapted to give a current of volume required to properly magnetize the pole-pieces $b\ b$.

An important feature of the invention consists in the construction of the pole-pieces $b\,b$, in which there are provided the recesses $f\,f$, which are shown of circular cross-section, though they may obviously be of different form. These recesses are adapted to receive the extensions $g\ g$, which are preferably of form to fit the recesses $f\,f$. These extensions, which I preferably make of wrought-iron, are adapted to move longitudinally in the recesses in the pole-pieces $b\ b$, their excursion being limited by the set-screws $h\,h$, which project into the recesses and into the slots $k\,k$, provided within the extensions $g\ g$. The extensions are prevented from falling out by the stop l at the upper end of the groove k, while the extensions have an up-and-down movement limited by the length of the slots. A collar l', Fig. 4, together with the contracted mouth h' of the recess, may serve the same purpose as the slot and set-screw shown in the other figures. The force of gravity will ordinarily be sufficient to withdraw the extensions $g\ g$ and bring them to the lower limit of their excursion; but a spring m may be added to insure the protrusion of the extension g. This spring is only shown in Fig. 4; but it is obvious that it is equally applicable to the constructions of Figs. 1, 2 and 3.

Covering the entire structure, I preferably provide the shell or outer covering n, through

which the pole-pieces *b b* with their extensions *g g* are adapted to extend, and for convenience in handling I provide eyes *o o*, with which the chain or other lifting-cable is adapted to engage. In the circuit connecting the multipolar magnet with the source of electricity, I provide a switch *p*, which is preferably so situated that it will be convenient for the operator who is handling the apparatus to turn the current on or off as desired.

The operation of my device will be readily understood. The structure is brought over the piece of iron to be lifted and lowered upon it so that the extensions or shoes *g g* are all of them brought into contact with portions of the surface. This results from the adjustability of the extensions or shoes in the perpendicular direction, so that the higher parts of the mass of iron which is to be lifted raise the extensions the farthest and the lower parts of the mass are reached by others of the downwardly-extending shoes. When the device is arranged so that the extensions *g g* are all in contact with the piece of iron to be lifted, *q*, the switch *p* is moved to carry the current through the windings *c c* upon the core and the resulting mutual attraction between the extensions *g g* and the piece of iron *q* is sufficient to enable the iron to be drawn up by the lifting of the magnet.

While I have shown the precise construction which I have preferred to adopt, I do not wish to be limited to the details shown, for it is obvious that numerous modifications could be made without departing from the spirit of my invention.

While I have shown the electromagnet of my invention applied to the purpose hereinbefore described, I do not desire to limit myself to such use, as it is apparent that there are other uses to which it may be successfully applied.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a lifting magnet, the combination with an electro-magnet, of a plurality of pole pieces therefor, and a yieldingly adjustable end piece or extension for each of said pole pieces adapted to engage the object to be lifted, whereby the pole pieces of the lifting magnet may adjust themselves to variously shaped objects to be lifted; substantially as described.

2. In a lifting magnet, the combination with an electro-magnet having a plurality of pole pieces, of yieldingly adjustable end pieces or extensions for said pole pieces, and suspending and lifting means secured to said electro-magnet for lifting the same, whereby the pole pieces adjust themselves to variously shaped bodies and the bodies are lifted by lifting said electro-magnet through the agency of said lifting means; substantially as described.

3. In a lifting magnet, the combination with a horizontally-extending bar, of a plurality of transversely-extending pole pieces mounted upon said bar, yieldingly-mounted end pieces or extensions provided upon said pole pieces, and lifting eyes or hooks mounted upon said lifting magnet; substantially as described.

4. In a lifting magnet, the combination with a core, of a plurality of pole pieces arranged thereon, magnetizing coils wound upon said core between said pole pieces, and yieldingly-adjustable end pieces or extensions provided upon said pole pieces; substantially as described.

5. In a lifting magnet, the combination with a core *a*, of the pole pieces *b b* mounted thereon, said pole pieces being provided with yieldingly-adjustable end pieces or extensions *g g*, and the magnetizing coils *c c* wound upon said core between said pole pieces, said coils being wound to impart opposite polarity to adjacent pole pieces; substantially as described.

6. In an electro-magnet, the combination with the pole piece *b* of the recess *f*, the extension *g*, the groove *k*, the stop *l*, screw *h*, and the spring *m*; substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

WILLIAM P. DANIELS.

Witnesses:

SOPHIE NAGEL,

WILLIAM H. MADDEN.