No. 807,517. PATENTED DEC. 19, 1905.

W. N. VANCE.

MAGNETIC WORK HOLDER.

APPLICATION FILED JULY 31, 1905.

2 SHEETS—SHEET 1.

Fig. 1

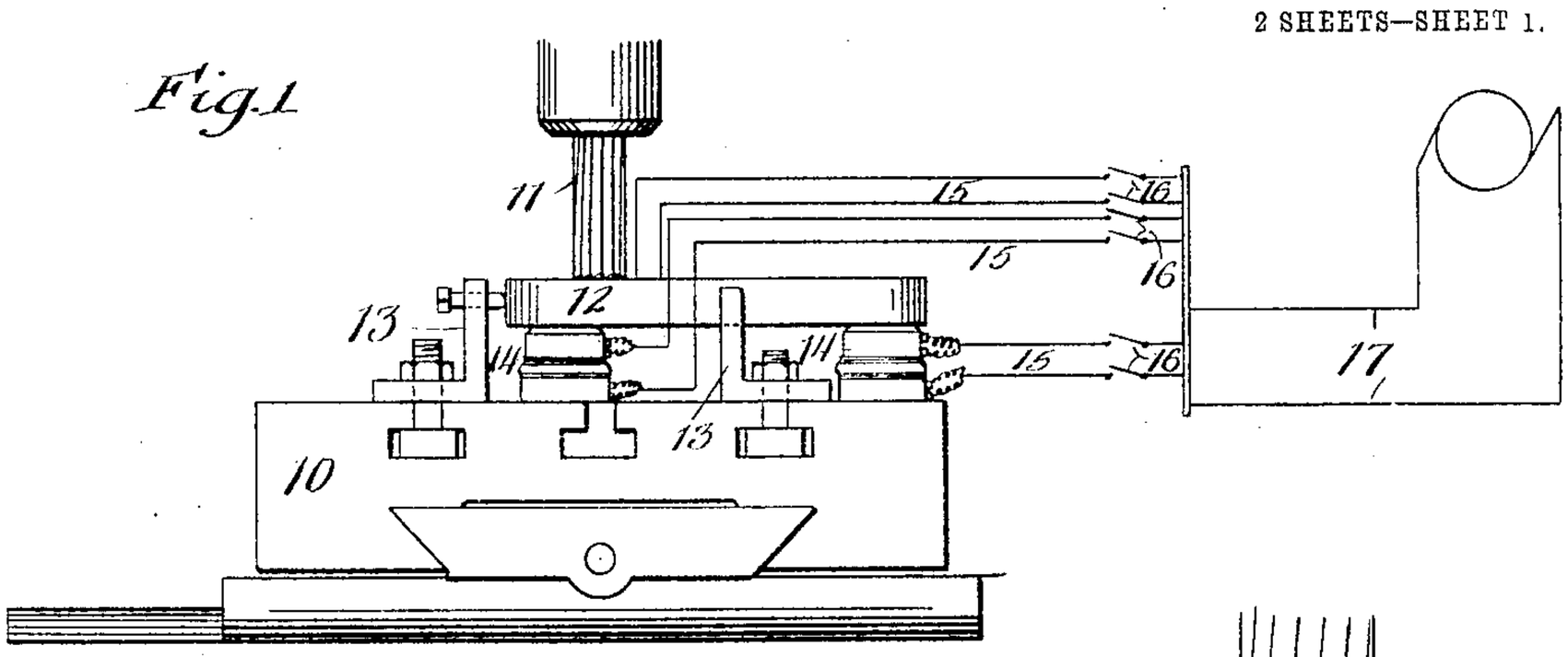


Fig. 2

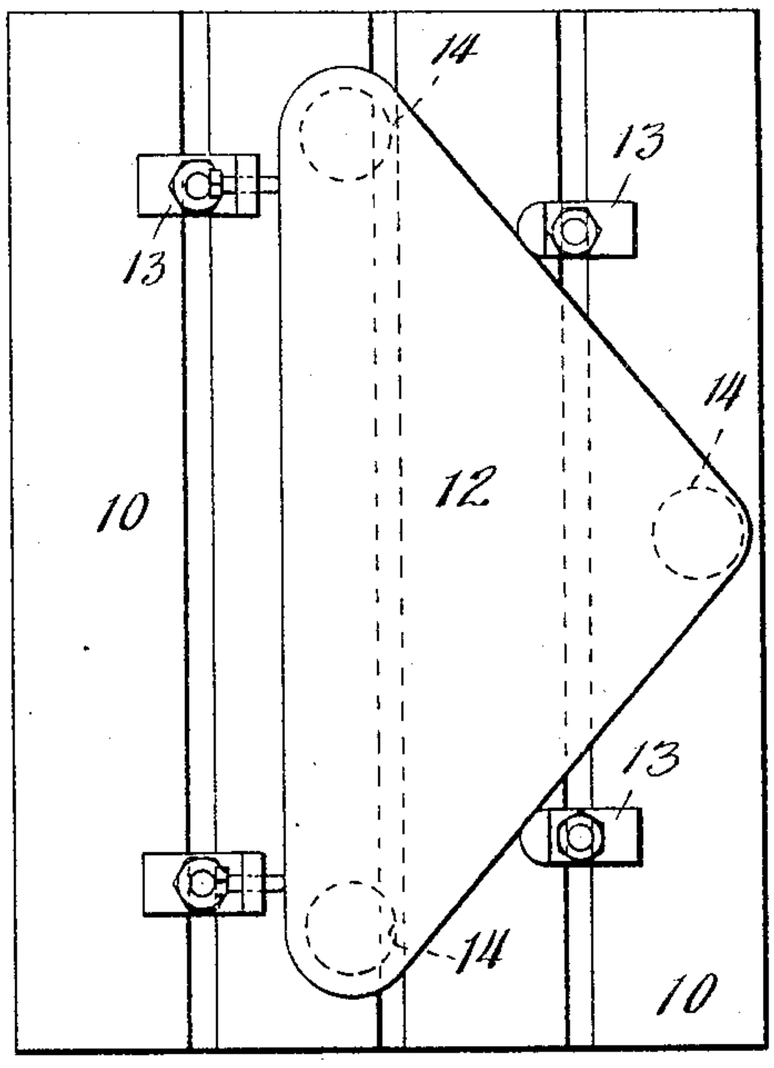


Fig. 3

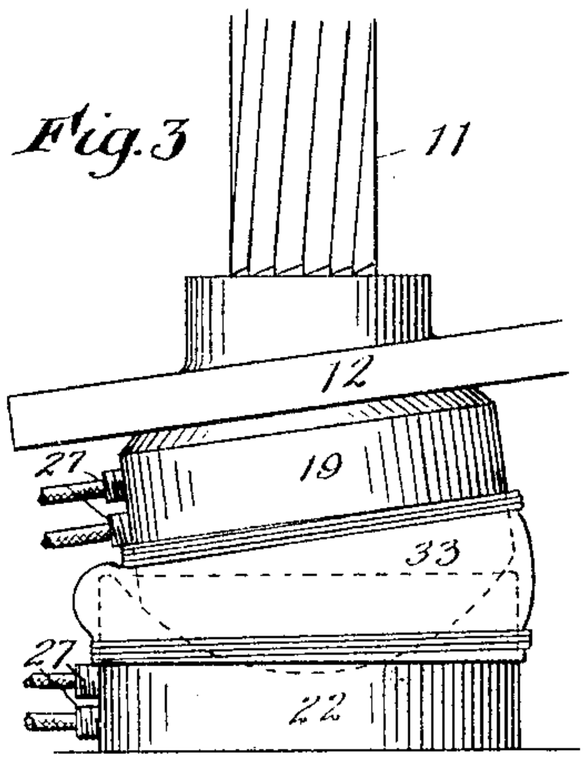
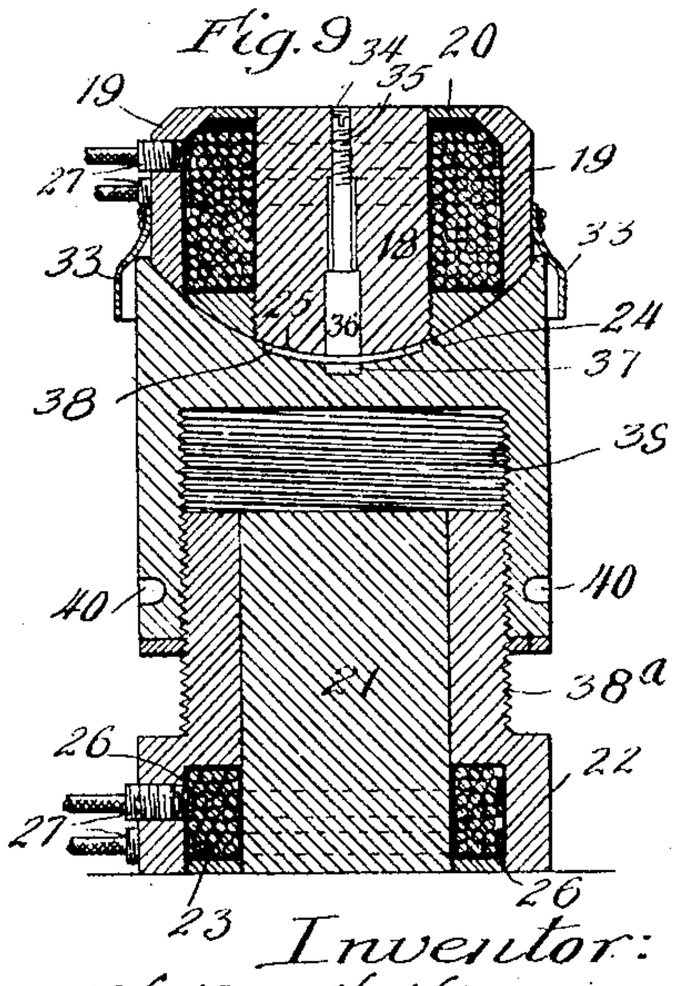


Fig. 9



Witnesses

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2 SHEETS—SHEET 2.

Fig. 4

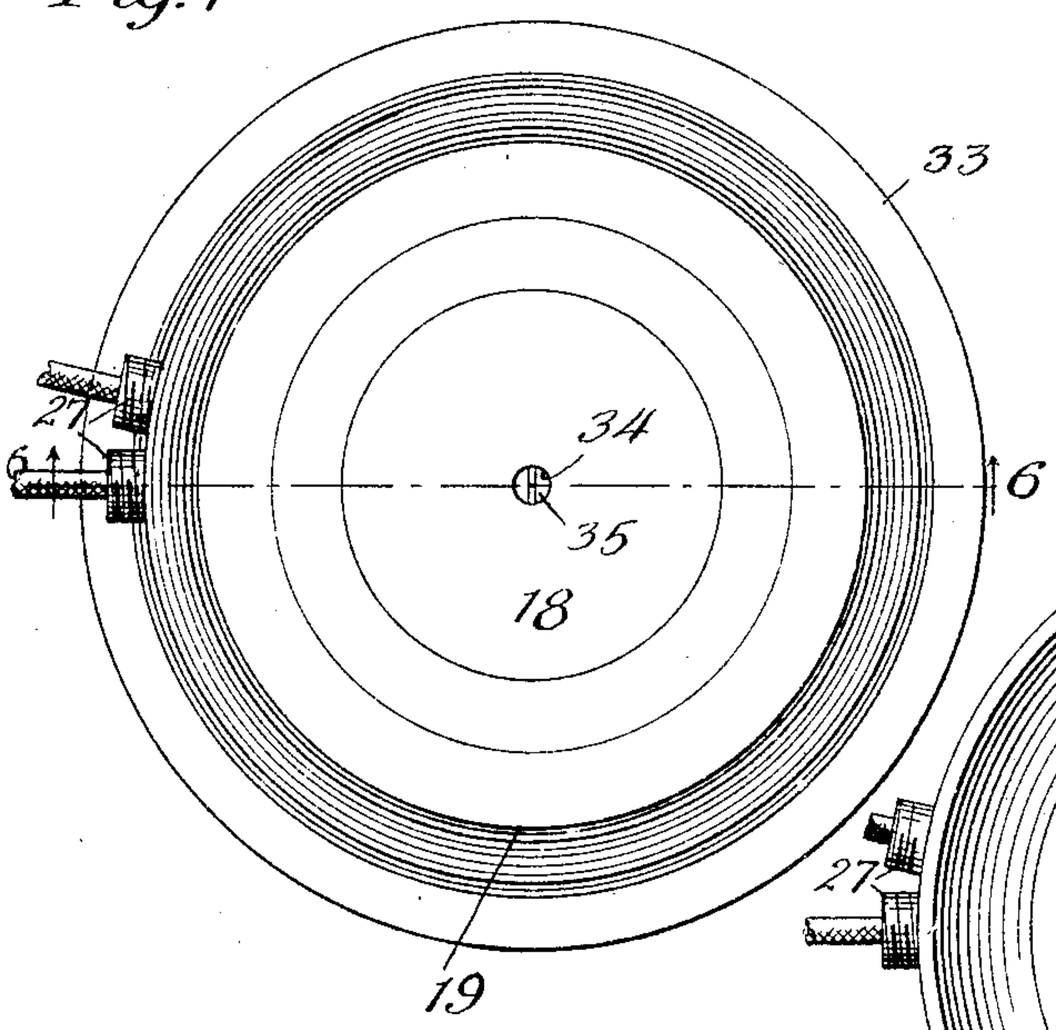


Fig. 5

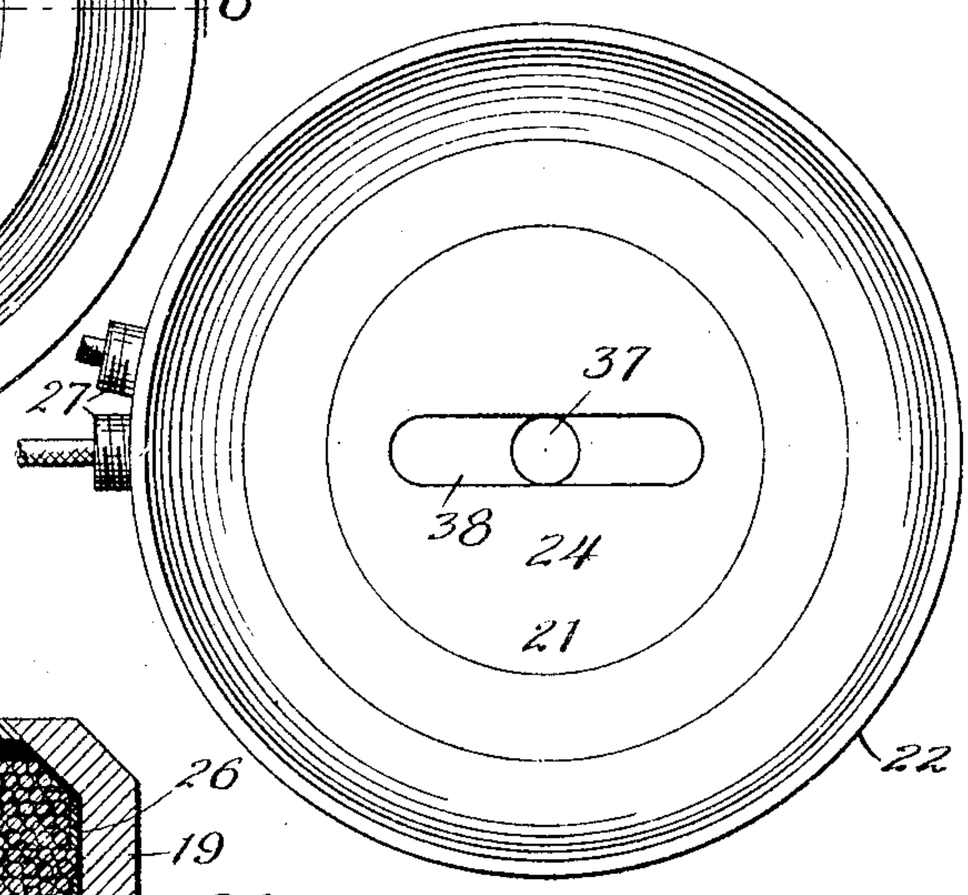


Fig. 6

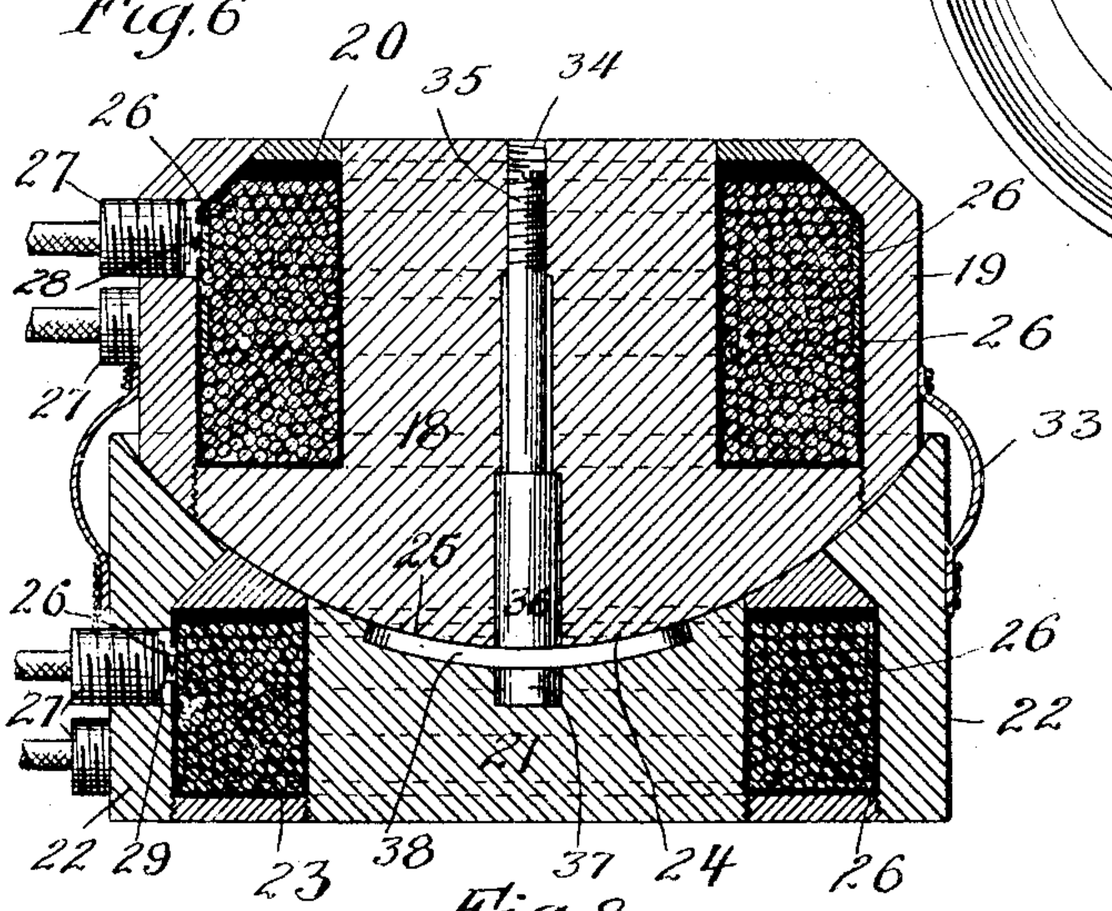


Fig. 7

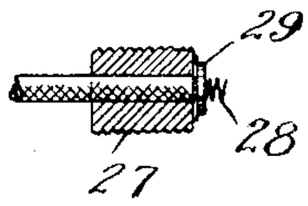
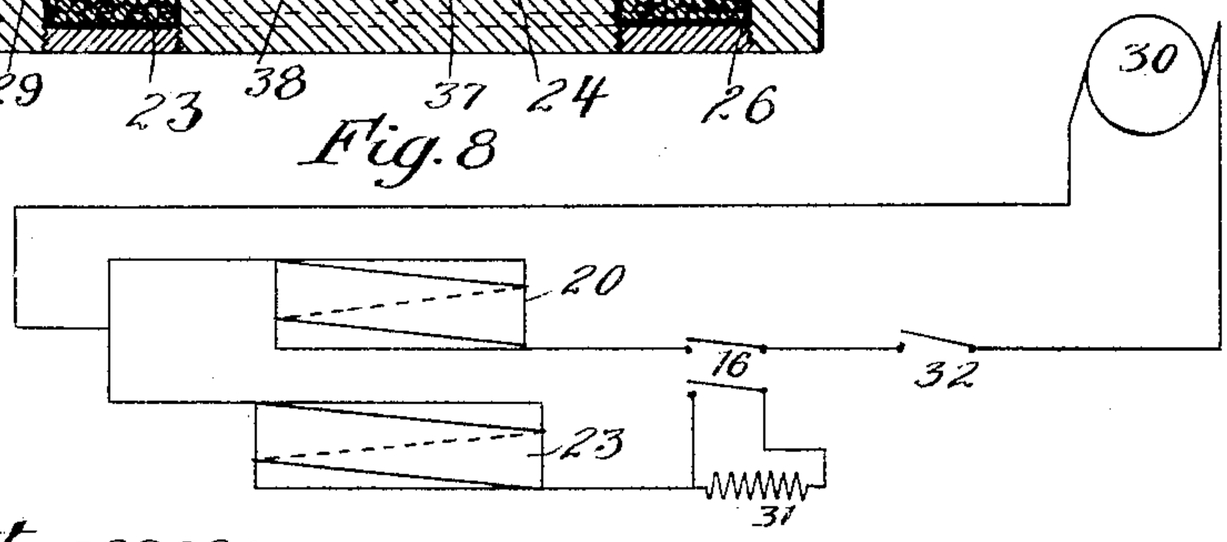


Fig. 8



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UNITED STATES PATENT OFFICE.

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MAGNETIC WORK-HOLDER.

No. 807,517. Specification of Letters Patent. Patented Dec. 19, 1905.

Application filed July 31, 1905. Serial No. 271,884.

To all whom it may concern:

Be it known that I, WALTER N. VANCE, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Magnetic Work-Holders, of which the following is a specification.

The present invention is a magnetic work-holder for holding iron to be worked upon by machine or other tools, and it is specially designed for holding work upon milling and shaping machines and machine-tools of that kind.

The nature of the invention will be fully apparent from the subjoined description and claims taken together with the accompanying drawings, that form a part of the said description.

In the said drawings, Figure 1 is a side elevation of a portion of a common form of milling or shaping machine, showing how my improved holders may be made use of in combination therewith. Fig. 2 is a plan view of the table of said machine. Fig. 3 shows an elevation of one of the individual holders bearing a piece of work engaged by a milling-tool. Fig. 4 is a top or plan of one of my individual holders, a set of two, three, or more of which are most often employed for holding a piece of work of magnetic metal to the bed of the milling, boring, or shaping machine. Fig. 5 is a similar plan view with the upper movable part taken off to show the spherical socket-joint; Fig. 6, a vertical section on line 6 6 of Fig. 4; Fig. 7, a detail of the screw connecting-plug for connecting the helix-wires to the circuit-wires. Fig. 8 is a diagram of the electric circuit. Fig. 9 is a sectional view of one of the holders provided with an elevating-screw for use in connection with such part of the work as may require a higher holder.

I have found that the best and most convenient way in which to employ electromagnetism as the means for holding a piece of iron-work to the iron-table of the milling or shaping machine is to employ several relatively small sized, individually-movable, and independently-acting electromagnets so constructed or contrived that their electromagnetic attraction is exerted both upon the iron-work to be held and upon the iron-table of the machine, avoiding all necessity for otherwise fastening the holder either to the work or to the table. I term three of these individual holders a "set," as it will usually be found possible to secure almost any piece of work with this number to the table of the machine. Of this set of three it is better that at least one shall be so constructed that it may be adjusted to different vertical heights in order to truly present the upper part of the work to the action of the machine or tool when the configuration of the work is such as to require holders of different or varying heights. So, too, because of the varying configuration of the work in the great variety of forms presented it is desirable that some or all of the holders shall be made in two parts and so put together that the upper part shall be able to rock on the lower part, so that the surface bearing and holding the work may be able to assume any required plane to fit the casting or work to be held. It may happen sometimes that a single one of the holders will be enough to hold a small piece of work, and it may also sometimes happen that the work is of such character that it is desirable to have the holder entirely rigid, with its upper surface parallel to the table, and it is convenient for this reason to provide the rocking holder with a lock device for fixing it rigidly in that position. Generally it will be found that even where the holding-magnet is made in two parts the residual magnetism remaining after the current has been cut off and the work removed will be sufficient to make the holder stick fast to the table firmly enough to prevent accidental displacement, and this residual magnetism will continue to act thus for a long time until the holder has been once detached and the magnetic circuit thus broken; but I have found it better to provide each of the individual magnetic holders with two helices, one helix to energize a magnetic circuit including the work and the other to energize a magnetic circuit including the table, one of the magnetic circuits, or both, passing through the joint between the upper and lower parts of the holder to draw the parts of the joint together. By this employment of the double circuit—that is, two magnets in one holder—it is possible to release the holder from the table without releasing it from the work or release it from the work without releasing it from the table.

In Fig. 1, 10 is the bed or table of an ordinary shaper or milling-machine. 11 is the milling-tool. 12 is the piece of work being operated upon. 13 13, &c., are the ordinary movable holding-brackets placed against the work to counter the lateral thrust of the milling-tool; but these do not hold the work down

upon the bed. 14, &c., are the magnetic holders resting on the surface of the table and supporting the work. 15 15 15 are the individual circuits to the three magnetic holders from the individual switches 16 16 16, connecting said circuits to the dynamo-circuit 17. By this arrangement the magnetism may be cut off from any one of the holders at will in adjusting the work to the table, or it may be cut off from all of them. When the current is cut off from any one of the holders, it will be found that the residual magnetism is generally sufficient to fasten the holder to the table with force enough to prevent accidental displacement. I have found this residual magnetism to thus continue to exert this sufficient force over night and into the next day. The force of the residual magnetism is, however, not sufficient to materially interfere with the adjustment of the holder upon the table, and when the grip is once broken the force is thereafter dissipated.

Referring to Figs. 3, 4, 5, 6, and 9, 18 is a cylindrical soft-iron core surrounded by the soft-iron casing 19 and having the coil 20. 21 is another similar soft-iron core surrounded by another similar soft-iron casing 22 and having another similar coil 23. The upper portion of this lower part at 24 and the lower portion of the upper part at 25 are made concave and convex in a spherical surface, the center of the sphere being preferably in the plane supporting and holding the work, so that the upper part can rock on the lower part without difficulty in adjusting the work. It will be noticed that if the center of the sphere is not in the plane supporting the work to rock the one part upon the other would require the holder to slide on the work; but if the center of the sphere be in the plane of contact between the work and the top of the holder movement may be made without sliding the work on the holder or the holder on the table. 26 26 26 26 are contact-bands, and 27 27 27 27 are contact-plugs for making electrical connection between the helices and the electric circuits. One of the plugs 27 is shown at Fig. 7, a contact-spring 28 being carried by the button 29, soldered to the end of the wire for bearing against the metal surface of the contact-band with which it is to connect.

Fig. 8 shows a diagram of the circuit through each individual holder. In this diagram, 30 is the dynamo; 20, the upper coil of the holder; 23, the lower coil; 16, the double switch; 31, a resistance inserted so that a diminished current may be maintained through the lower coil 23 when current is entirely cut off from the upper coil 20. This is to enable the holder to be held to the table when it is not held to the work in those cases where the residual magnetism is not sufficient for this purpose. 32 is the general switch which may be opened when it is desired to cut off all current from both magnets to remove the holder from the table as well as the work. 33 is a flexible apron secured to the upper casing 19 and which may also be secured to the lower casing 22, where said lower casing is not to be revolved, as in the form shown at Fig. 6.

I preferably provide some or all of the holders of each set with means for fixing the upper part so that it cannot rock upon the lower part. This feature is convenient in some cases where it is desirable, for example, to hold a rectangular piece of work in a plane parallel to the plane of the machine-table, and I also provide means whereby the upper part of the holder may be so confined in its motion as to rock only in one direction in the manner of the cylindrical joint. This is especially convenient where a long piece of work is to be mounted in the machine with one end higher than the other and it is desired to retain the work from turning in more than a single direction while being adjusted to position. Both of these capabilities are very simply given to the holder by the following means: In the vertical axis of the upper spherical part is the radial perforation 34, internally screw-threaded and containing the screw 35, the upper end of which is nicked for the screw-driver. The lower end of the screw 35 forms a plug 36 and is preferably made enlarged to constitute an engagement with the central cavity in the lower part of the holder. When the screw 35 is set down to its utmost, the lower part of the plug 36 enters the cavity 37 and locks the joint against movement in any except a circular direction, which movement will not change the plane of support of the work. Above the central cavity 37 is milled the groove 38 in a great circle of the sphere and fitted to receive the plug 36. When said plug is raised out of the central cavity 37, but not out of the groove 38, the upper part of the holder is free to rock upon the axis of the great-circle groove, operating now as a cylindric joint, and when the plug 36 is raised entirely out of contact with the lower part, as in the condition shown in the drawings, then the joint becomes a universally spherical one.

It is not necessary that all of the holders shall be made adjustable vertically; but I find it convenient to have at least one holder in each set of three made capable of vertical elongation—for example, in the manner shown in Fig. 9, wherein it will be noticed that the casing 22 is provided with a screw-thread 38^a, engaging an internal-screw-threaded section 39, the upper portion of which constitutes the concave spherical part of the joint. This internal-screw-threaded section 39 is free to turn, and being turned by means of the spanner engaging the holes 40 the entire holder may be made longer or shorter in a vertical direction to suit the requirements of the work in hand.

Having thus fully described my invention, I claim—

1. The magnetic work-holder for holding

ironwork to an iron-table, which consists of a movable electromagnet having two polar surfaces, one for engaging the work to be held and the other for engaging the table, in combination with the iron-table upon which the work is to be held, whereby the work is held in fixed relation to said table, substantially as specified.

2. The combination with the ironwork-holding table, of several independent, movable electromagnetic holders each comprising a polar surface for engaging the table, and a polar surface for engaging the work to be held, substantially as specified.

3. The combination in a set of holders comprising several magnetic holders, each having two polar surfaces, one polar surface for engaging the table upon which the work is to be held, and the other polar surface for engaging the work to be held, of one or more similar holders, each provided with means for moving the upper and lower polar surfaces toward or away from each other, and for fixing them in the adjusted positions, substantially as specified.

4. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, substantially as specified.

5. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, the joint between said two parts being a spherical one, substantially as specified.

6. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, the joint between the two parts being a spherical one, the center of the sphere being at or near the upper polar surface of the holder, substantially as specified.

7. The two-part magnetic holder having a polar surface for engaging the table, and a polar surface for engaging the work, and made so that one part may rock upon the other with a joint, and having the magnet so constructed that the joint will be held together magnetically, substantially as specified.

8. The magnetic work-holder having two helices, one energizing a polar surface which engages the work to be held, and the other energizing a polar surface which engages the table, whereby the magnetic action may be suspended at one polar surface while it is continued at the other polar surface, substantially as specified.

9. The magnetic work-holder comprising two polar surfaces, one for engaging the work to be held and one for engaging the table, and having two helices, one for energizing the one polar surface and the other for energizing the other polar surface, said holder being made in two parts jointed together and held together by the magnetic attraction, substantially as specified.

10. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, combined with means for preventing the holder from rocking, substantially as specified.

11. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, combined with means for preventing the holder from rocking, said means consisting of a screw-plug passing from one part into the other, substantially as specified.

12. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, the joint between said two parts being a spherical one which will permit the part to rock in any plane, combined with means which may be applied at will to restrict the motion of said part to rocking in a single plane like a cylindric joint, substantially as specified.

13. The adjustable magnetic holder comprising two polar surfaces, one for engaging the iron-table and one for engaging the work to be held, said holder being made in two parts, one part to rock upon the other to better adjust it to the configuration of the work to be held, the joint between said two parts being a spherical one which will permit the part to rock in any plane, combined with means which may be applied at will to restrict the motion of said part to rocking in a single plane like a cylindric joint, and means for preventing one part from rocking on the other, substantially as specified.

14. The combination with the two-part magnetic holder united by a spherical joint, of the movable radial plug carried by the convex part of the joint, the concave part of the joint being provided with a central locking-cavity and a great-circle slot to coact with said movable radial plug, substantially as specified.

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