L. W. DOWNES.

MAGNETIC CHUCK.

APPLICATION FILED JULY 21, 1910.

1,036,976.

Patented Aug. 27, 1912.

3 SHEETS—SHEET 1.

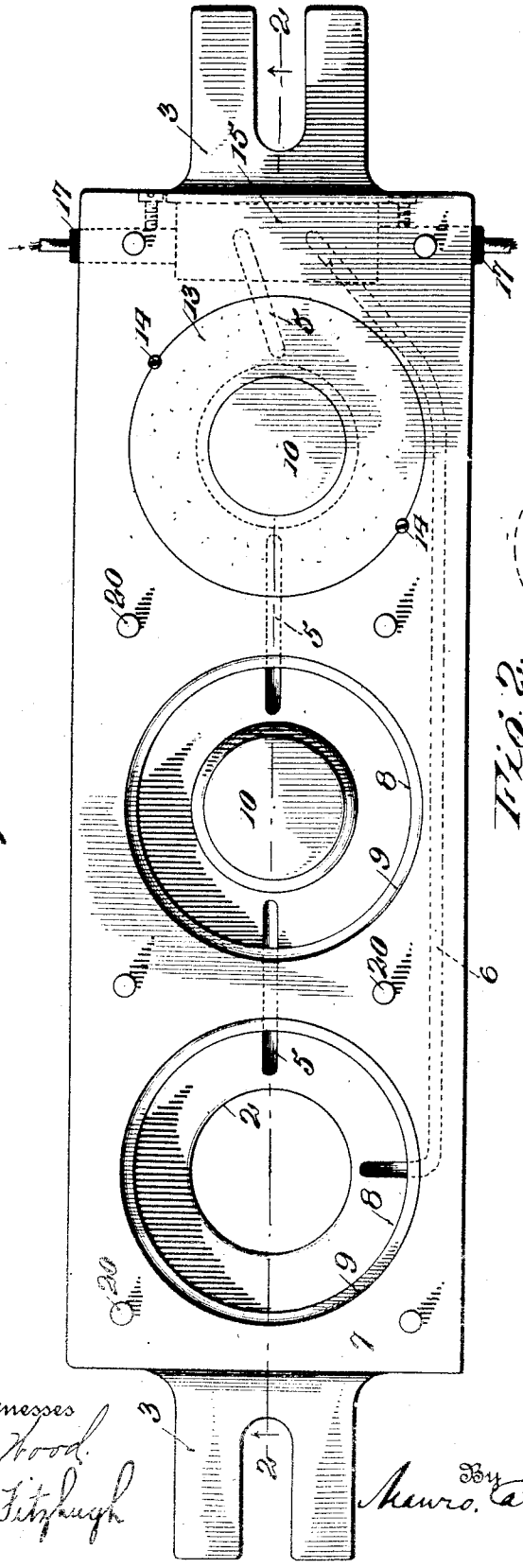

Fig. 1.

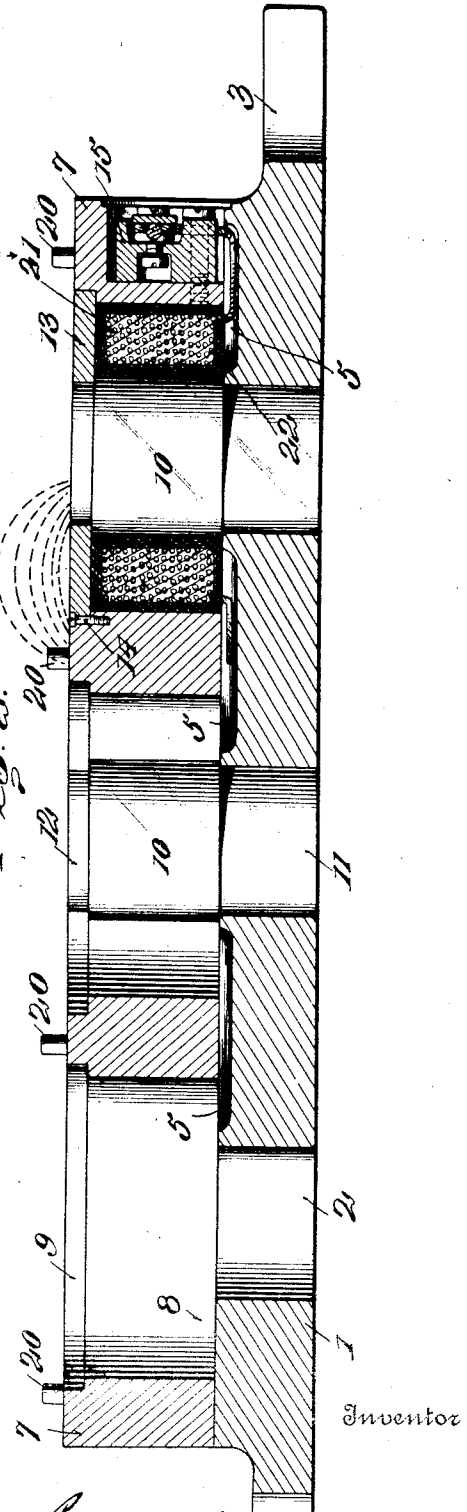

Fig. 2.

Witnesses

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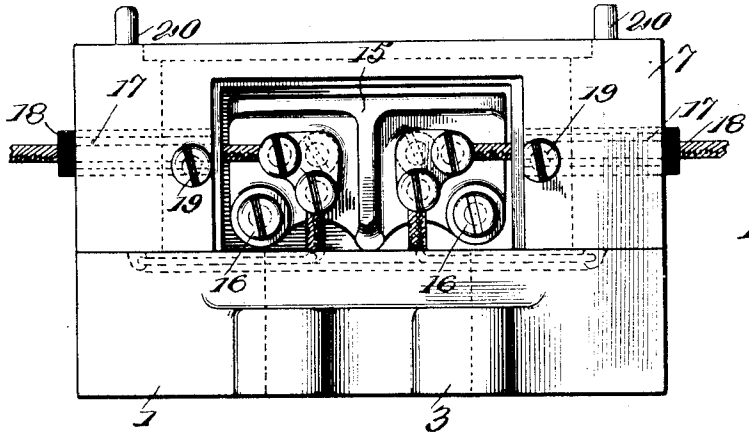


Fig. 3.

Fig. 4.

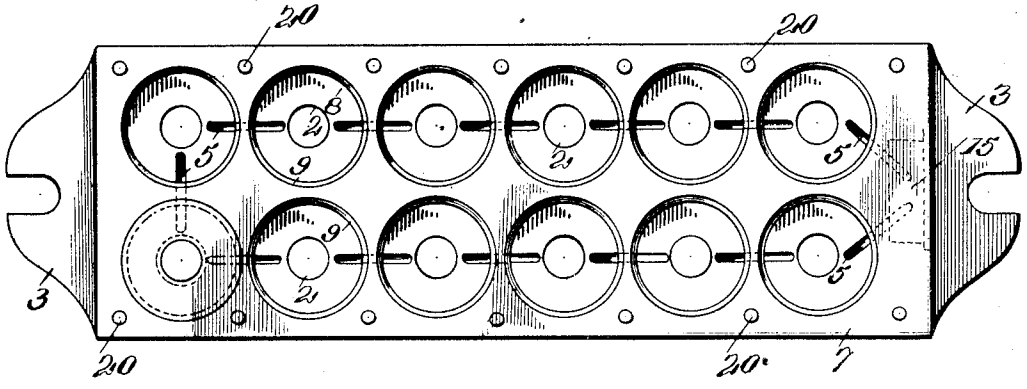
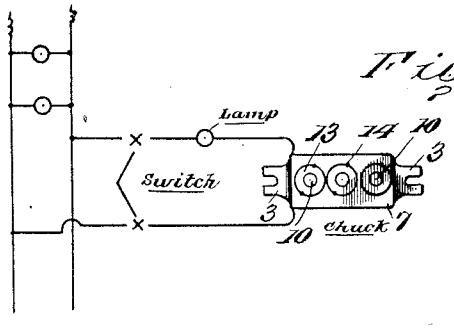


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 1.

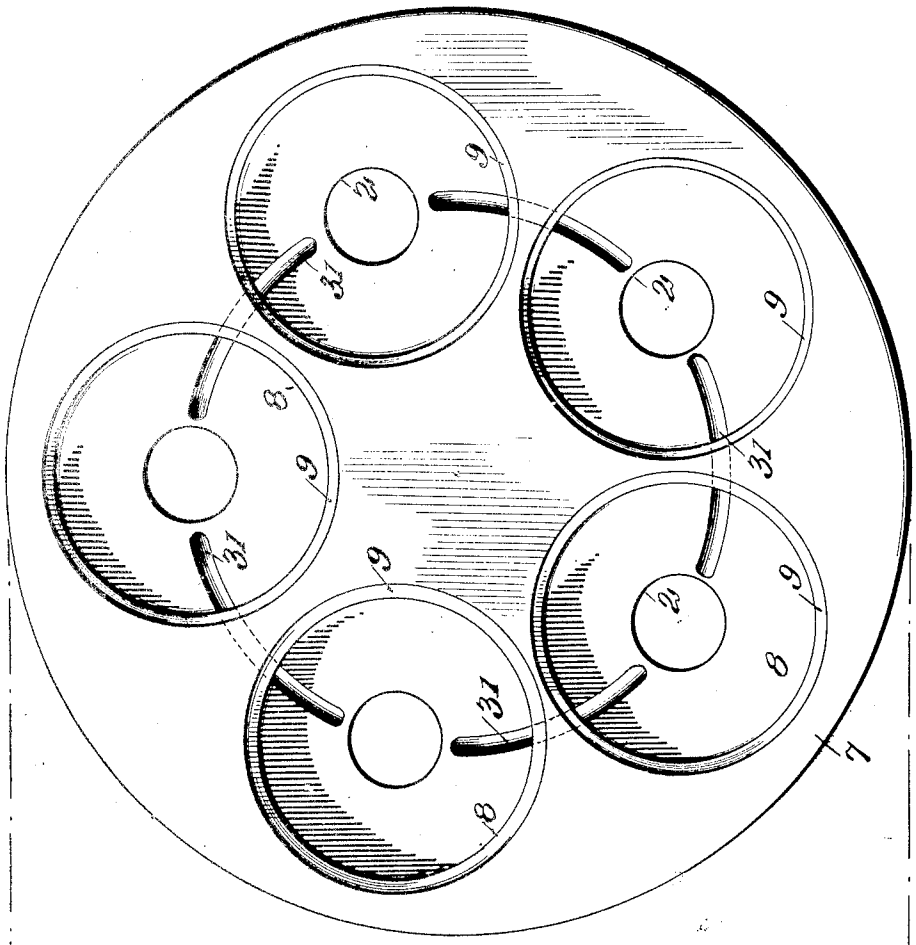
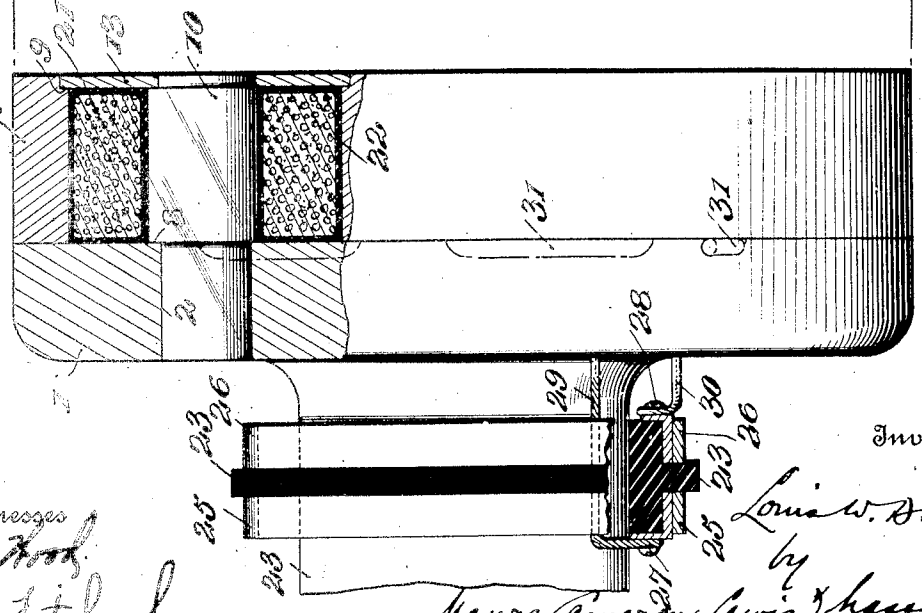


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

LOUIS W. DOWNES, OF PROVIDENCE, RHODE ISLAND.

MAGNETIC CHUCK.

1,036,776. Specification of Letters Patent Patented Aug. 27, 1912.

Application filed July 21, 1910. Serial No. 573,114.

To all whom it may concern:

Be it known that I, LOUIS W. DOWNES, of Providence, Rhode Island, have invented a new and useful Improvement in Magnetic Chucks, which invention is fully set forth in the following specification.

This invention relates to magnetic chucks for holding magnetic material in position while being subjected to machining operations, and has for its object to provide a device of this kind, which is simple in construction, capable of developing a plurality of powerful magnetic fields, and is provided with magnetic coils which may be immediately replaced by stock coils of standard sizes in case any one of them is injured by burning out or disabled by accident.

Magnetic chucks as heretofore constructed present the serious defect when the exciting coil is accidentally burned out or otherwise disabled of requiring the device to be returned to the factory for renewal of its coil, because the chuck is so assembled that the winding can not be replaced without great difficulty and loss of much time.

My invention overcomes the above objections and secures the objects named by providing a magnetic chuck with a plurality of interchangeable magnetizing coils, each of a simple bobbin round-shape or ring form, and of a standard size whereby a new coil from stock may be quickly substituted in the chuck for one burned out or otherwise needing renewal. I preferably construct the chuck with a base or supporting plate of cast- or wrought-iron, to which iron cores are made fast, the free ends of which form pole-pieces distributed in the face of the chuck. The corresponding poles are formed in a body member of iron having perforations coaxial with the magnet cores, each perforation forming an annular space around each core. In this annular space, and over each core, I slip an exciting coil made preferably of deltabeston wound wire, and secured in place by a clamping or other fastening means. These coils are of standard sizes as to dimensions, and size of wire for accommodating different kinds of chucks. The coils may be connected in series or parallel. Each coil may be removed without disturbing the others, or all the coils may be readily removed with very little loss of time by removal of the body of the chuck from its base plate.

My improvement is equally applicable to magnetic chucks designed for holding work to a movable or stationary bed plate or to chucks to be mounted on lathes. The electric connections between the coils are preferably made through channels in the body of the chuck. Connections to the source of current are made through terminal blocks or, in the case of a revoluble chuck, through slip rings.

The inventive idea may assume a variety of mechanical expressions, some of which are illustrated in the accompanying drawings which are designed merely for the purposes of illustration and not as limiting the invention, reference being had to the claims for this purpose.

In the drawings:—Figure 1 is a plan view, with certain parts removed, showing a magnetic chuck embodying my improvements; Fig. 2 is a view of the same in longitudinal, central, vertical section, on the line 2—2 of Fig. 1; Fig. 3 is an end view in elevation of the magnetic chuck shown in Figs. 1 and 2; Fig. 4 is a diagrammatic plan view showing the application of my improvements to larger chucks; Fig. 5 is a diagram showing connections with an electric supply circuit; Fig. 6 is a side elevational view with parts broken away, showing my improvements applied to a revoluble chuck, and Fig. 7 is an end elevational view of the chuck shown in Fig. 6, the parts being removed to show the interior construction.

Referring more particularly to Figs. 1, 2 and 3, I have herein illustrated a triple field magnetic chuck in which 1 is the base-plate preferably made of cast-iron, rectangular in shape and machined up, and provided with three openings or sockets 2 shown as round in the drawings, though any other form of opening may be employed. The base-plate 1 is provided with means, such as slotted brackets 3, 3, for securing it to the bed of a milling machine or other object, and with conductor receiving grooves 5, 6. Mounted on base plate 1, and secured thereto by screws or other means not shown, is an iron pole or plate 7 of either wrought- or cast-iron, having openings 8, the number of which corresponds with the openings 2 in the plate 1. These openings are preferably circular, and are larger than openings 2, but coaxial therewith, and are enlarged somewhat at their upper ends to form annular ledges 9 in the

body of the pole-piece. Into openings 2 in the bed-plate 1 are forced pole-pieces 10, two only being shown in Fig. 2. Each pole-piece 10 is preferably machined down from round wrought-iron stock into a cylindrical form having a body portion somewhat larger than the opening 2, and a lower reduced portion 11 adapted to fit snugly in said opening. The opposite or upper end of the core 10 is provided with a shoulder 12, which with the opposite ledge 9 in pole-plate 7, is adapted to support a coil retaining or sealing ring 13 of a non-magnetic metal, such as brass, which may be secured in place by screws 14. In one end of the frame member 7 I provide a recess or chamber for receiving a terminal block 15 of any preferred form, and of refractory material, such as porcelain or hard rubber, and secure the same to the wall or body of the frame by screws 16. To this block connections are made both from the energizing coils through the channels 5, 6, in the base-plate 1, and from which leads a power circuit, as shown for example in Fig. 5. I preferably bring the leads of the power circuit through side openings 17 in the pole-plate 7 and provide insulating linings 18 therein, which are secured in place by fastening means, such as screws 19. The face of the chuck is provided with means for preventing lateral slipping or displacement of the work which in this class of devices is held down by a force substantially normal to the surface, less resistance being offered by the work to forces acting in directions at right-angles thereto. In certain instances where it becomes desirable to take an unusually heavy cut from the work, it may be necessary to provide additional means to prevent lateral displacement. To this end, I may provide the face of the clutch with abutment means, such as retaining studs 20 either fast thereto or removable therefrom and distributed at short intervals. The face of the chuck will thus present a flat surface in which lie the ends of the magnet cores, the faces of the non-magnetic rings and the face of the pole-plate together with the studs or holding rim. The magnetic chuck as thus constructed is provided with a plurality of annular chambers or coil spaces around the magnet cores adapted to receive removable energizing coils. I propose to make these coils of different designs to fit chucks of different capacities, and thereby enable users of these chucks to quickly and readily replace an injured coil by a new one kept in stock, or readily procurable without necessitating the return of the chuck to the factory for repairs, or requiring the core to be removed, an operation which consumes time and requires the exercise of skill and possession of means not always present at the place where the chucks are used.

I preferably wind the coils on bobbins in form of rings with deltabeston wire and cover the ring with heat-resisting and moisture-proof material, such as Delta-sheeting, which is an asbestos paper treated with a composition suitable for rendering the paper impervious to moisture while capable of withstanding any temperature to which the coil is likely to be subjected in practice. The windings of the energizing coil are not only thus protected against moisture by a heat resisting and impervious covering, but are secured together by a wrapping so that each coil may be handled independently of a supporting spool and without disturbing the windings of the coil. While I prefer to make my coil in this manner, I do not desire to limit myself to this particular form, but may employ coils made in any other way, provided they have their windings bound or secured together and have the capability of being slipped in and out of the core spaces of the chuck to replace those injured. In Fig. 2 I have shown one such coil 21, provided with a covering 22. The coil is made of an external diameter to readily slip into the coil space 8 in the pole plate 7, and has an opening adapted to receive the core-piece 10. The ends of this particular coil enter the channel 5 and connect through them with other coils and with the terminal block 15. The several energizing coils may be connected in multiple, in series, or multiple series, according to the requirements of the service, and each coil within the coil space is retained therein by the closure or rings 13, which are made fast to the frame 7 by means of screws 14.

While the coils may be inserted in the chuck in various ways, the following manner of replacing them is preferred: Assuming that one or more of the coils has been accidentally burned out, the base plate 1 is first disconnected from the frame 7. The magnet cores 10 which are fast to plate 1 are thereby slipped from their coils leaving the latter exposed together with their connections which previously rested in grooves 5 and 6. Any one of the coils can now be readily disconnected from the set and can be replaced by a new one kept in reserve, and connected up in its place. The base-plate is then returned to its place with its cores threading the coils and its grooves over the connecting conductors. This operation takes but a moment, and can be performed by a workman unskilled in electrical matters.

From the above description of the device the operation will be readily understood.

By means of slotted bracket-arms 3 the chuck is made fast to the bed of a milling or grinding machine in the usual way. The work to be machined rests on the face of the

chuck and may be wedged against lateral displacement between studs 20. The terminals of the block 15 are connected by flexible cord conductors to a power circuit preferably through an incandescent lamp resistance in series with the energizing coils as diagrammatically indicated in Fig. 5. Several advantages are hereby gained; the lamp gives a signal that current is flowing through the coils, and furnishes an external resistance, thereby avoiding the use in small chucks of exceptionally fine magnet wires in the coils which would be necessary were the magnet coils placed directly across the ordinary lighting circuits. Larger and less expensive wire is permitted while at the same time sufficient ampere turns are secured to get the desired magnetizing force. When the current is passed through the series of magnetizing coils a plurality of powerful magnetic fields of force are established between the several magnet cores 10 and the pole-plate 7, some of the lines of which are indicated in Fig. 2. The work to be machined is placed on the face of the chuck in the path of the magnetic lines which are hereby short-circuited and firmly draw the work down and hold it firmly on the chuck face.

Should an excessive current pass through the chuck and burn out one or more coils, such coils may readily be replaced without delay by slipping the injured coil off its core in the manner above described, substituting a new one kept on hand for the purpose.

In Fig. 4 I have illustrated a similar chuck to that above described, except that the face of the chuck presents a more extended surface and is provided with a larger number of energizing coils which I find may be made smaller while securing the desired force to hold the work against the face. Economy is also effected when it becomes necessary to replace injured coils.

In Figs. 6 and 7 I have shown my improvement applied to a rotary magnetic chuck in which the base-plate 1 is cylindrical and is provided with a shank 23 on which is mounted a commutator comprising an insulating ring 23 with two metal slip rings 25, 26, held out of contact with each other by a portion of the insulating material of ring 23. The slip rings are provided with terminals 27, 28, for electrically connecting the rings through insulated conductors 29, 30, running from the magnet coils through channels 31. The coils are of the same construction and are arranged in the same manner with respect to their cores as previously described. This form of magnetic clutch, while retaining the multiple magnetic field, simplicity of construction and the feature of removable coils, enables the work to be rotated, and is particularly useful in grinding such light articles as piston-rings which require rotation while undergoing such operation.

What I claim is:—

1. A multiple field magnetic chuck comprising a magnetic pole plate having a plurality of magnet coil receiving spaces the body of said plate forming a part of the magnetic path, magnet coils for said spaces and adapted to be slipped in and out of the same, magnet cores for said coils, and a magnet core holding plate detachably secured to one face of said pole plate.

2. A multiple field magnetic chuck comprising a magnetic pole plate having a plurality of magnet coil receiving spaces the body of said plate forming a part of the magnetic path, magnet coils for said spaces and adapted to be slipped in and out of the same, magnet cores for said coils, a magnet core holding plate detachably secured to one face of said pole plate, and non-magnetic annular plates for retaining said coils in said spaces.

3. A multiple field magnetic chuck, comprising a magnetic pole plate having a plurality of magnet coil receiving spaces the body of said plate forming a part of the magnetic path, magnet coils for said spaces and adapted to be slipped in and out of the same, magnet cores for said coils, a magnet core holding plate detachably secured to one face of said pole plate and provided with channels for receiving coil connections, and non-magnetic annular plates for retaining said coils in said spaces.

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

LOUIS W. DOWNES.

Witnesses:
GEORGE W. STEERE,
E. L. SMITH.