

March 12, 1929.

J. BING

1,704,783

ELECTROMAGNETIC CHUCK

Filed July 14, 1927

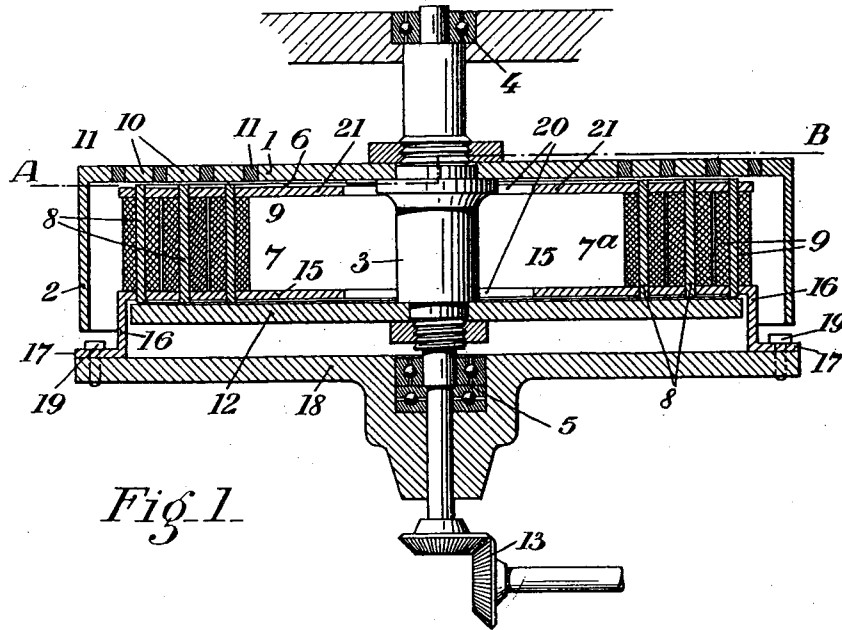


Fig. 1.

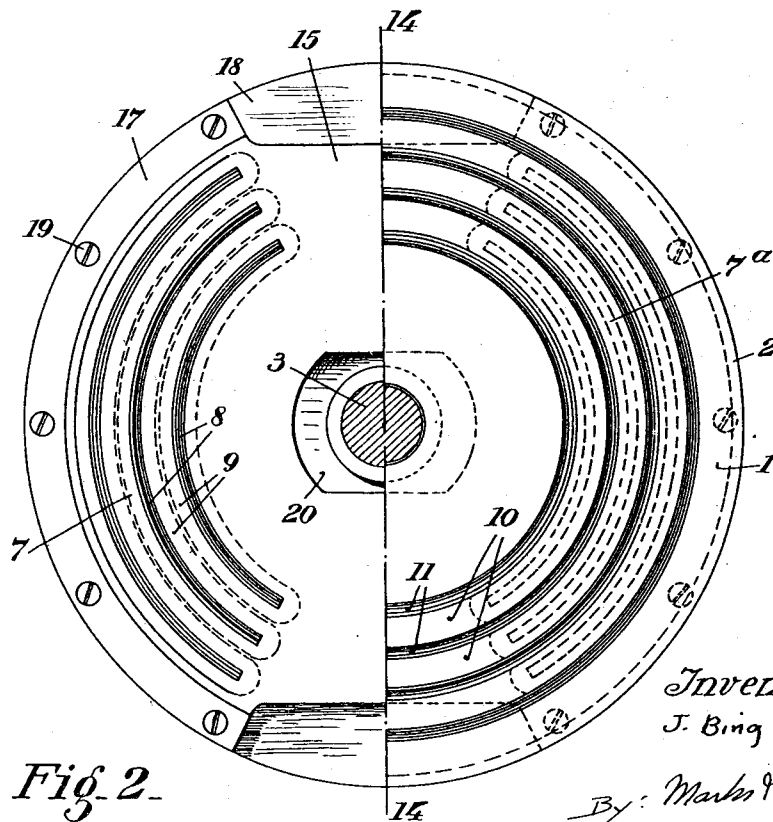


Fig. 2.

Inventor:
J. Bing

By: Mark & Clark
Attys.

Patented Mar. 12, 1929.

1,704,783

UNITED STATES PATENT OFFICE.

JULIUS BING, OF EISENACH, GERMANY, ASSIGNOR TO THE FIRM MAGNET-WERK
G. M. B. H. EISENACH SPEZIAL-FABRIK FÜR ELEKTROMAGNET-APPARATE, OF
EISENACH, GERMANY.

ELECTROMAGNETIC CHUCK.

Application filed July 14, 1927, Serial No. 205,696, and in Germany September 24, 1925.

This invention relates to electro-magnetic chucks of the type in which the work-pieces are placed in continuous succession onto a rotating chuck and after being worked upon are again taken away in succession from said chuck. In known devices of this kind the chuck consists of a casing which surrounds the magnet-winding and whose under part is fixed relatively to said winding, while the pole-plate or chuck proper, which serves for the reception of the work-pieces, is rotated and forms a cover for the casing of the magnet-winding.

This construction is connected with the disadvantage that the strong forces of attraction which are exerted by the magnet-casing upon the rotating pole-plate must be fully taken up by the bearing which is provided for the holding plate. There is furthermore a disadvantage connected with the known constructions, which consists therein that it is difficult to provide a close fit between the rotating holding plate and the fixed magnet-casing. By reason of the continuous alternate expansion and contraction of the several parts of the device which is due to alternate heating and cooling, the liquid which serves for the cooling of the work-piece may easily pass through the gap between the magnet-casing and the rotating holding plate and enter the interior of the casing, where it may cause damage by short-circuits or grounds.

My invention avoids the aforementioned disadvantages by doing away with a closed casing for the magnet-windings and by providing in addition to the rotating holding plate which serves for the reception of the work-pieces a further plate on the under side of the magnet-system, said latter plate serving as a yoke for said magnet-system and being arranged so as to be rotated together with the holding or pole-plate independently of the magnet-system.

My invention comprises further improvements regarding the exciter-windings for the magnet-system, said improvements consisting therein that two magnet-systems of opposite polarity are provided which are placed diametrically to each other thus leaving a pair of oppositely positioned neutral zones intermediate the magnet-system, whereby the work-pieces will be fully de-magnetized within said zones. In this manner the work-

pieces may be conveniently removed from the holding plate after being worked upon. This is a considerable advantage as compared with chucks of known construction, whereby the work-pieces after having passed the working zone will yet be rather firmly attached to the holding plate so that they must be taken away from the latter with some force and subsequently be subjected to a special de-magnetizing process.

In the drawings I have shown in a somewhat diagrammatical way an example of a construction of the electro-magnetic chuck according to my invention, Fig. 1 being a vertical section through the axle of the new chuck and

Fig. 2 being a section taken on the right-hand side along the line O—B and on the left-hand side of Fig. 1 along the line O—A.

In the drawing the reference numeral 1 designates the holding plate or pole-plate serving for the reception of the work-pieces. This holding plate is provided at its periphery with a flange 2 extending in downward direction and is mounted rotatably around a vertical axis by means of the axle 3. The axle 3 is mounted in ball-bearings 4 and 5 and may be set in rotation by means of the bevel gears 13. Underneath the pole-plate 1 there are provided two fixed magnet-systems 7 and 7^a, a proper air-gap 6 being left between the magnet-systems 7 and 7^a and the plate 1. The cores 8 of the magnet-systems are made in the form of hollow cylindrical sectors which are concentrically arranged with respect to the axle 3 of the device. Either group of magnet-cores comprises three cylindrical sectors, as may be seen from Fig. 2, the three sectors of one group of magnet-cores being arranged oppositely to the three sectors of the other group and all of said sectors extending approximately through an angle of 120 degrees around the periphery of the pole-plate 1. Each magnet-core 8 is provided with an exciter-winding 9 which may be supplied with electric current by means of fixedly connected conductors. Opposite to each magnet-core 8 there is provided on the pole-plate 1 a ring 10 of magnetizable material which serves for closing the magnetic lines of force generated by the magnet-systems 7 and 7^a. The rings or strips 10 of magnetizable material are separated from each other by rings or strips 11

of non-magnetizable material, for instance brass. On the under side of the device the magnetic lines of force are closed by means of the plate 12 which serves as a yoke for the magnet-systems. The plate 12 is fixedly mounted on the axle 3 below the magnet-systems 7 and 7^a, a small air-gap being provided between said plate 12 and said magnet-systems. The pole-plate 1 may therefore be rotated in unison with the yoke-plate 12 relatively to the magnet-systems 7 and 7^a. By this arrangement of the plates 1 and 12 on opposite sides of the magnet-systems 7 and 7^a the forces of attraction which are exerted between the magnet-systems and the plate 1 will essentially be compensated by the forces of attraction which are exerted between the magnet-systems and the plate 12.

The two groups of magnet-cores are supported by means of a bridge 15 which consists of brass or another nonmagnetizable material, the other parts of said bridge 15 being formed in the manner of circular sectors in accordance with the form of the magnet-cores of the magnet-systems 7 and 7^a. The bridge 15 is provided at its peripheries with downwardly directed flanges 16, and further horizontally directed flanges 17 are provided on said flanges 16. The flanges 17 are fixed by means of screws 19 to the supporting member 18 which also carries the bearing 5 for the axle 3 of the device. At its central part the bridge 15 is provided with an aperture 20 through which the axle 3 may be passed. The upper ends of the magnet-cores may likewise be rigidly connected with each other by means of a similar bridge 21, which, however, is not provided with flanges such as the flanges 16 and 17 of the bridge 15. The upper and the under parts of the magnet-cores 10 are embedded into the bridges 21 and 15 respectively, in such a manner that the ends of the magnet-cores are freely exposed and positioned oppositely to the plate 12 which forms the yoke for the magnet-systems 7 and 7^a.

In order to prevent the pole-plate 1 from exerting a one-sided magnetic pull upon the bearing 5, which would interfere with the accuracy of the work which is performed on the work-pieces, the magnet-systems 7 and 7^a are arranged exactly diametrical with respect to each other.

For automatically removing the work-pieces after being worked upon from the pole-plate or holding plate 1 it is necessary that there is no magnetic attraction within a certain zone of the plate 1. This is accomplished according to my invention by making the magnet-systems 7 and 7^a of opposite polarity, so that in the plane of symmetry 14 between the two magnet-systems the magnetic action of one magnet-system will compensate the magnetic action of the other magnet-system. By means of a stripper which operates in the well-known manner, the work-pieces may now

be removed within this neutral zone from the holding plate 1.

According to my invention the electro-magnetic chuck is further so constructed that the magnet-system will be completely closed and fully protected against any moisture as well as against cooling liquid which may pass into the interior of the device. The pole-plate or holding plate 1 will positively protect the magnet-system against intrusion of any cooling liquid by means of the flange 2 which extends downwardly from the pole-plate. Practice has shown that the pole-plate may preferably be interrupted by ring-shaped members as above described. The conformation of the magnet-systems is no essential feature of my invention. An essential feature of my invention, however, consists therein, that the chuck is composed of a fixed magnet-casing, a rotating pole-plate and a yoke-plate which rotates together with said pole-plate. A further essential feature of my invention consists therein that the magnet-systems are acting in opposite direction and that neutral zones are provided intermediate said magnet-systems. It is obvious that my invention is not confined to electro-magnetic chucks of circular form as shown in the drawing. My invention may also be used in connection with chucks of rectangular form and having magnet-systems of a conformation which may be adapted to the rectangular form of the chuck. My invention furthermore is not confined to electro-magnetic chucks having rotating pole-plates, as it may also be employed in connection with chucks having a pole-plate which is slidably arranged with respect to the magnet-system. In addition to this, my invention is not confined to the bi-polar arrangement of the magnet-system as shown in the drawing, but may also be employed with like success in connection with magnet-systems having any desired greater number of poles.

I claim:

1. An electro-magnetic chuck comprising two fixed magnet-systems of opposite polarity having the form of cylindrical sectors and positioned diametrically opposite to each other, the facing ends of said magnet-systems being equally distanced from each other, an axle concentrically rotatable with respect to said magnet-systems, a pole-plate fast on said axle and positioned on one side of said magnet-systems, and a yoke plate also fast on said axle and positioned on the other side of said magnet-systems.

2. An electro-magnetic chuck comprising a stationary magnet-system, a movable pole-plate on the one side of said magnet-system and a yoke-plate on the other side of said magnet-system, said yoke-plate being adapted to move in unison with said pole-plate.

3. An electro-magnetic chuck comprising a stationary magnet-system, a pole-plate mounted above said magnet-system for rota-

tion around a vertical axis, and a yoke-plate mounted below said magnet-system and connected with said pole-plate so as to rotate in unison therewith.

5 4. An electro-magnetic chuck, comprising a stationary magnet-system having the form of a cylindrical sector, an axle concentrically rotatable with respect to said magnet-system, a pole-plate fast on said axle and positioned
10 on one side of said magnet-system, and a yoke-plate fast on said axle and positioned on the other side of said magnet-system.

5. An electro-magnetic chuck comprising a stationary magnet-system, a pole-plate
15 mounted above said magnet-system so as to be rotatable around a vertical axis, and a yoke-plate mounted below said magnet-system and connected with said pole-plate so as to rotate in unison therewith, said pole-plate
20 having a flange projecting downwardly from its periphery and surrounding said magnet-system.

6. An electro-magnetic chuck comprising two stationary magnet-systems having the
25 form of cylindrical sectors and positioned diametrically opposite to each other, the facing ends of said magnet-systems being equally distanced from each other, an axle concentrically rotatable with respect to said magnet-systems, a pole-plate fast on said axle and
30 positioned on one side of said magnet-systems, and a yoke-plate also fast on said axle and positioned on the other side of said magnet-systems.

35 7. An electro-magnetic chuck comprising a rotatable axle, a pole-plate fast on said axle, a yoke-plate also fast on said axle at a distance from said pole-plate, and a stationary magnet-system arranged intermediate said
40 pole-plate and said yoke-plate, said magnet-

system being adapted to generate opposite polarities in diametrically opposed zones of said pole-plate.

8. An electro-magnetic chuck comprising an axle which is so mounted as to be rotatable
45 around an essentially vertical axis, a pole-plate having annular strips of magnetizable and non-magnetizable material and being fixedly mounted on said axle, a yoke-plate of magnetizable material, said yoke-
50 plate being fixedly mounted on said axle below said pole-plate and at some distance therefrom, two groups of stationary magnet-cores having opposite polarities and being of the shape of cylindrical sectors mounted intermediate
55 said pole-plate and said yoke-plate and having their facing ends essentially at even distances from each other.

9. An electro-magnetic chuck comprising an axle which is mounted rotatably around
60 an essentially vertical axis, a pole plate having annular strips of magnetizable and non-magnetizable material and being fixedly mounted on said axle, a yoke-plate of magnetizable material, said yoke-plate being fixedly
65 mounted on said axle below said pole-plate and at some distance therefrom, two groups of stationary magnet-cores having opposite polarities and being of the shape of cylindrical sectors mounted intermediate said
70 pole-plate and said yoke-plate and having their facing ends essentially at even distances from each other, said pole-plate being provided with a downwardly projecting flange surrounding said two groups of fixed mag-
75 net-cores, substantially as described as and for the purpose set forth.

In testimony whereof I affix my signature.

JULIUS BING.