

April 12, 1932.

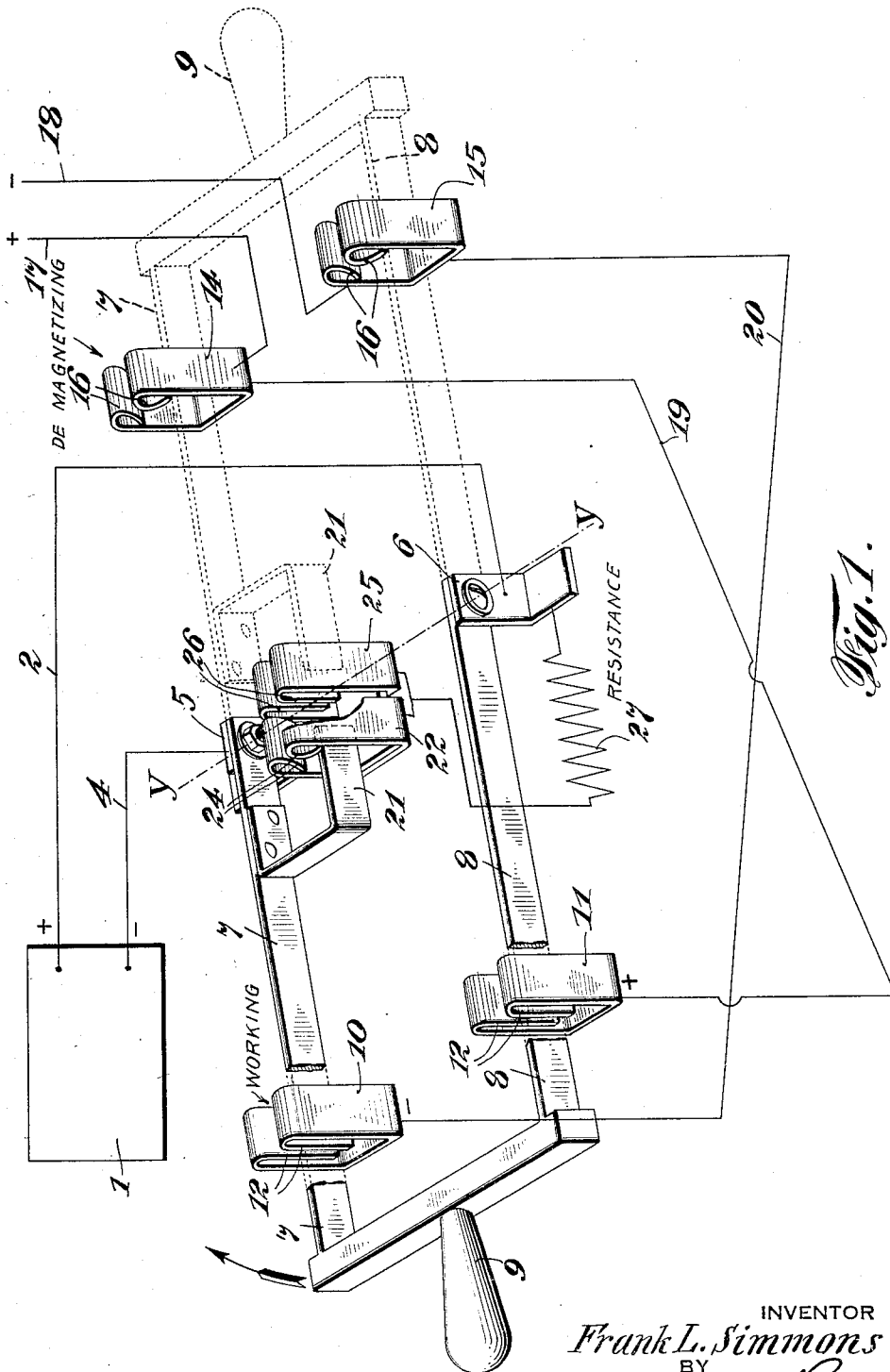
F. L. SIMMONS

1,853,642

SURGE CONTROL FOR MAGNETIC CHUCKS

Filed Jan. 9, 1930

3 Sheets-Sheet 1



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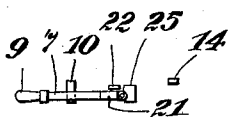
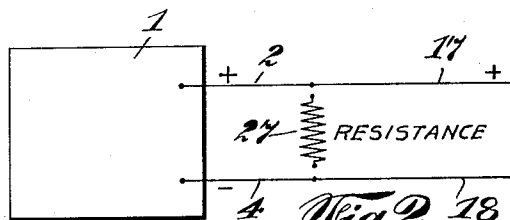


Fig. 2a.



WORKING

Fig. 2.

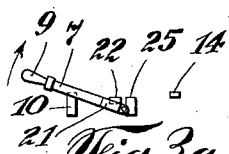
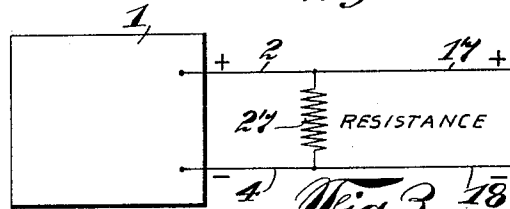


Fig. 3a.



STARTING TO
BREAK WORKING
LOAD

Fig. 3.

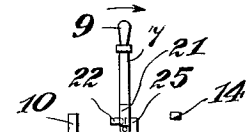
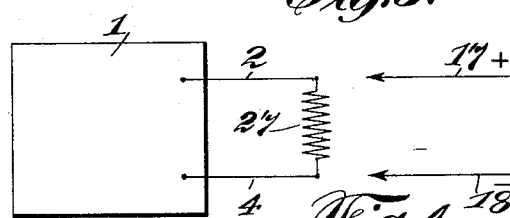


Fig. 4a.



WORKING LOAD
BROKEN

Fig. 4.

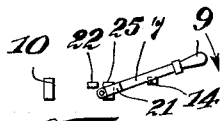
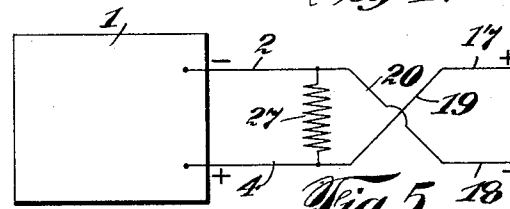


Fig. 5a.



MAKING DEMAG-
NETIZING CONTACT

Fig. 5.

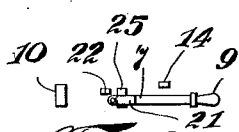
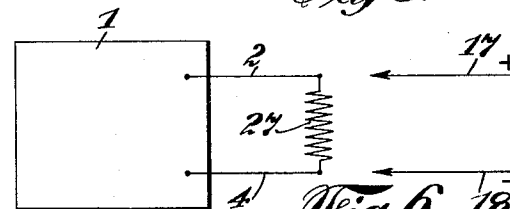


Fig. 6a.



THROW OF
SWITCH BAR
PASSED BELOW
SHORT CONTACT
BLADES

Fig. 6.

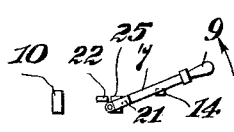
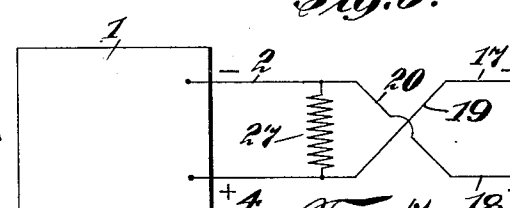


Fig. 7a.



RAISING SWITCH
REMAKING CONTACT

Fig. 7.

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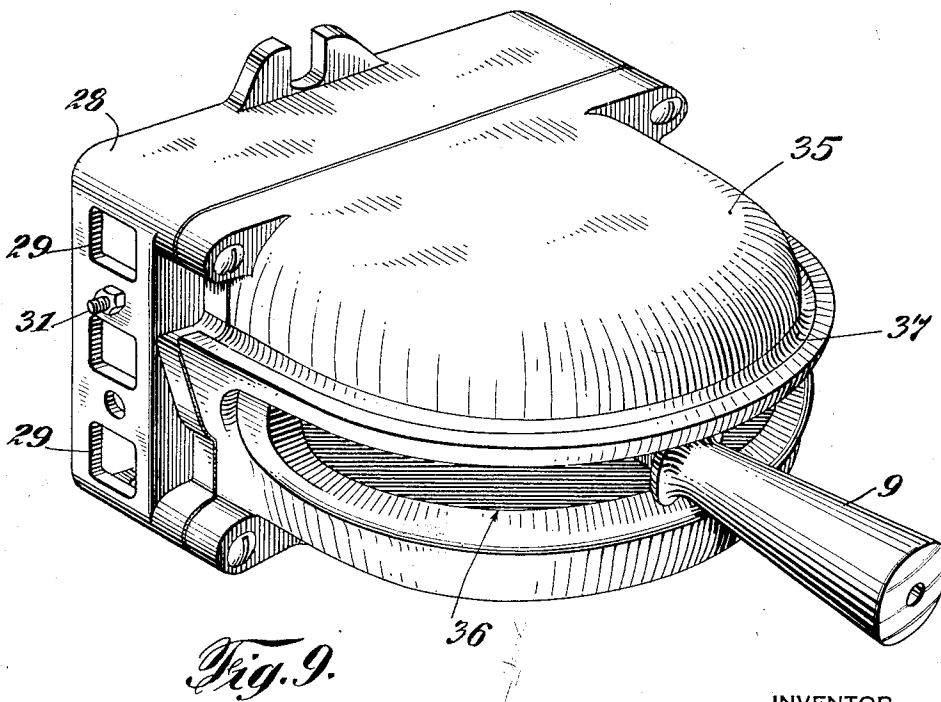
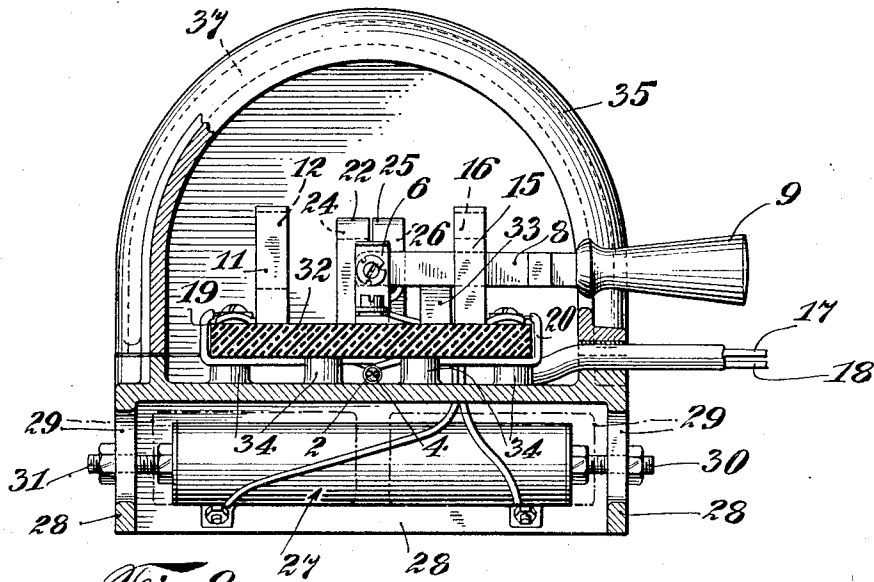
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UNITED STATES PATENT OFFICE

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SURGE CONTROL FOR MAGNETIC CHUCKS

Application filed January 9, 1930. Serial No. 419,499.

The present invention relates broadly to the electrical arts and more especially to magnetic chuck construction relating to pole changing features to obviate the electrical surge through the magnetic chuck when the electric circuit is broken or changed.

Magnetic chucks are very strong magnets which must be so designed as to occupy relatively small space on the machine tool and consequently, in order to get the desired concentration of magnetic lines through the pole pieces, it becomes necessary to use very small wires in the magnets. These small wires, therefore, cannot be covered with very heavy insulation because it occupies too much space. When a magnetic chuck is operating, there is a very concentrated magnetic field formed in the iron or steel pole pieces of the chuck. When the work is released, it is necessary to cut off the electricity and to reverse the current through the chuck in order to demagnetize the work and release the same from the chuck. When the current is broken an electrical surge takes place in the coils which is greatly in excess to the electrical voltage or pressure normally existing in the magnets while the chuck is in use. This electromotive force may puncture the thin insulation on the magnet wires in the chuck and eventually these puncture holes cause leakage of current from wire to wire thereby reducing the internal resistance of the magnets and finally causing the windings of the chuck to burn out.

These heavy destructive surges occur when the circuit through the chuck is broken and recur when the current is reversed through the chuck to demagnetize pieces on the chuck when the demagnetizing current is broken. The demagnetizing operation causes substantially as much surge through the chuck as when the original working circuit is broken. In view of the foregoing, it will be observed that the wires comprising the windings of a chuck are continually subjected to overloads and the result is the liability of the windings of the chuck being burned out relatively quickly in its useful life.

The present invention overcomes the difficulties of the known prior art by providing

electrical mechanism whereby the excess voltage due to the surge is either prevented or absorbed in such manner that it is not harmful in the operation of the chuck. This may be brought about by cutting in a resistance or capacity at the proper time in the operation of the chuck to prevent the harmful electrical surge. Where resistance means is used it is preferably so arranged with reference to the current control switch as to be cut in across the terminals of the magnetic chuck just before the main current is broken and to remain cut in across the terminals of the chuck after the main current is broken and also while the current in reverse direction flows through the chuck to demagnetize the same. Preferably, the demagnetizing current comprises two short energizations of the chuck brought about by swinging the control switch past short wiper contacts in such manner that the switch goes beyond the contacts in one direction and back through the contacts in a reverse direction. This arrangement of resistance obviates and absorbs the harmful surges and prevents breaking down the insulation.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter in the specification following by reference to the accompanying drawings forming a part hereof.

Fig. 1 is a diagrammatic view illustrating one form of device for carrying out the present invention.

Fig. 2 is a diagrammatic view illustrating the working circuit, and Fig. 2a is a diagrammatic view illustrating the working position of the switch for this circuit.

Fig. 3 diagrammatically illustrates the circuit just prior to the breaking of the working circuit, and Fig. 3a illustrates the position of the switch at this time.

Fig. 4 diagrammatically illustrates the circuit after the working circuit is broken, and Fig. 4a illustrates the position of the switch at this time.

Fig. 5 diagrammatically illustrates the circuit comprising the first demagnetizing contact, and Fig. 5a illustrates the position of the switch at this time.

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Fig. 6 diagrammatically illustrates the circuit after the break of the first demagnetizing, and Fig. 6a illustrates the position of the switch at this time.

Fig. 7 diagrammatically illustrates the circuit for the second demagnetizing contact and Fig. 7a illustrates the position of the switch at this time.

Fig. 8 is a section through the base of a switch in accordance with the present invention.

Fig. 9 is a perspective view of a switch and casing in accordance with the present invention.

Referring now to the drawings and more especially to Fig. 1, a magnetic chuck 1 is provided with an electrical circuit comprising leads 2 and 4 which are connected to the pivot brackets 5 and 6 for the blades 7 and 8 of the main switch which is provided with a handle 9. These blades are pivoted on these brackets in the middle of a suitable switch panel or support in such manner as to have a 180° movement around the axis Y—Y established by the pivot axis of the pivot brackets 5 and 6. The normal working circuit to the magnetic chuck is established through main spring contact members 10 and 11 having relatively long contact faces 12. On the opposite side of the switch base when the handle 9 is swung through 180°, the blades 7 and 8 engage demagnetizing spring contacts 14 and 15 having short contact faces 16. These contact members 14 and 15 are for the purpose of establishing a demagnetizing circuit as will be later explained. The feeder line for supplying electricity to the chuck comprises feeder lines 17 and 18, which supply direct current electricity and are connected respectively with the demagnetizing spring contacts 14 and 15. The demagnetizing spring contacts 14 and 15 are connected by cross wire connections 19 and 20 to the contacts 10 and 11 in such manner that the demagnetizing spring contact 14 is connected with the main spring contact 11 and demagnetizing contact 15 is connected with the main contact 10. From this arrangement, it will be obvious that the swinging of the blades 7 and 8 through arcs of 180° reverses the current to the chuck each time the switch blades are swung through the complete arc.

The blade 7 of the switch is provided with a short arm blade 21 which is attached to the blade 7 and is provided with a portion extending parallel to the blade 7. This short arm blade 21 cooperates with a pair of contact members set close together adjacent the middle of the switch panel so that the axis Y—Y of the main switch passes between these contact members. The contact member 22 between the axis Y—Y and the main contact 10 is provided with a short contact face 24 while the contact member 25 between the axis Y—Y and the contact 14, is provided

with a long contact face 26. The two contact members 22 and 25 are electrically connected, and a resistance 27 is connected with these contact members 22 and 25 on one end of the resistance and to the pivot bracket 6 at the other end of the resistance. The short contact face 24 on the contact member 22 is so provided that when the handle 9 has carried the blades 7 and 8 into full engagement with the main contact members 10 and 11, that the short arm blade 21 will have passed below and be out of contact with the short contact face 24. When the switch is swung in the opposite direction through 180°, the length of the long contact face 26 on the contact member 25 is such that the short arm blade 21 remains in contact with the face 26 when the blades 7 and 8 have passed entirely below the short contact faces 16 on the demagnetizing contacts 14 and 15. The central contact members 22 and 25 are placed sufficiently close together so that as the switch is swung from left to right (Fig. 1) the short arm 21 will contact with both the short face 24 on the member 22 and the long face 26 on the member 25, so that after the switch has been raised in a clockwise movement (Fig. 1) sufficiently to cause the short arm 21 to contact with the short contact face 24, a circuit is maintained through the resistance 27 during the continuing swing, in a clockwise direction, of the main switch through the completion of its 180° arc toward the right (Fig. 1).

Referring now to Figs. 2 to 7 inclusive and the corresponding Figs. 2a to 7a inclusive, the operation of the device comprising the present invention is as follows: The current from the feeder lines 17 and 18 (Figs. 2-2a) passes directly to the magnetic chuck 1 so that full line current is supplied to the chuck through the leads 2 and 4.

When the switch is moved in a clockwise direction, as soon as the switch is slightly raised (Figs. 3-3a) the short arm 21 connects with the contact 22 and thereby cuts in the resistance 27 across the feeder lines before the blades 7 and 8 have opened the circuit to the chuck through the main contact members 10 and 11.

As the switch is further moved in a clockwise direction (Figs. 4-4a) the blades 7 and 8 break the main feed current and leave the resistance 27 in series in a completed circuit with the magnetic chuck.

As the switch is swung to a further position to the right (Figs. 5-5a) the blades 7 and 8 contact with the short faces 16 on the demagnetizing contacts 14 and 15. When this happens, the current from the main feeders 17 and 18 passes through the crossed wires 19 and 20 to the leads 2 and 4 for the chuck 1. This reverses the polarity of the current to the chuck and thereby reverses the magnetic field, consequently, demagnetizing any work

on the chuck which may have assumed a substantially permanent magnetic condition. During this flow of demagnetizing current, the resistance 27 has remained in parallel across the circuit with the magnetic chuck.

A further movement of the switch to the right to complete its full 180° arc (Figs. 6-6a) carries the blades 7 and 8 below the short contact faces 16, thereby opening the circuit but leaving the resistance 27 to complete the circuit with the magnetic chuck.

The operator now raises the switch in a counter-clockwise direction (Figs. 7-7a) to bring the switch back to a vertical position in which the main circuit is again opened and during this counter-clockwise movement, the blades 7 and 8 again contact with the short faces 16 and again supply the chuck with current polarity reversed from normal working load, thereby subjecting the work to a second demagnetization. The switch stands in this vertical position until it is desired to again energize the chuck to hold work.

In the normal operation of the present device, the switch sets in the position illustrated in Figs. 2-2a and also represented by full lines in Fig. 1. The switch is set in this position as long as the chuck is in normal operation holding work in position on the chuck face to be operated on by a machine tool. When the operator desires to release the work from the chuck, he grasps the handle 9 of the switch and swings it in a clockwise direction as far as the switch will go, thereby quickly sweeping through the cycles illustrated diagrammatically in Figs. 2-2a to Figs. 6-6a. The operator then quickly swings the switch in a counter-clockwise direction for an arc of 90°. This sweeps the blades a second time past the demagnetizing contacts and leaves the switch in neutral position with the circuit open as illustrated in Figs. 4-4a.

From the foregoing explanation and diagrammatic figures, it will be observed that the resistance 27 is across the line during any substantial change of magnetism in the chuck and that this resistance completes the circuit through the chuck at all times when the feed circuit to the chuck is broken. This resistance, which is proportioned to the requirements for the particular chuck with which it is associated, completely absorbs the surge or back electromotive force built up in the chuck wirings by these changes in magnetism and voltage, and thereby prevents burning out of the windings of the chuck by perforated insulation and also burning of the switch by excessive arcs between the blades and the contacts when the feed current is broken.

Referring now more particularly to Figs. 8 and 9, the base 28 of the switch may comprise a housing provided with ventilating openings 29 from a chamber enclosing the resistance unit 27. These ventilating open-

ings permit the heat of resistance member 27 to be dissipated. The resistance unit preferably is mounted on supporting bolts 30-31 and provision is made in the base for carrying a plurality of such units. The base supports the switch panel 32 of insulating material upon which the blades and contact members of the switch are mounted. Insulation blocks 33 limit the downward movement of the switch blades after they have passed the short demagnetizing contact faces 16. Spacing posts 34 support the panel 32 above the face of the base 28 to provide wiring space and air space back of the panel. A cover 35 is mounted on the base to extend over the switch and contacts and is provided with a semi-circular opening 36, in which the handle 9 of the switch may swing. This cover 35 thoroughly protects the switch so that it prevents the switch parts from being accidentally struck and injured and also shields the workmen from danger of electrical shocks. The switch is adapted to be mounted with the arc of the switch being in a horizontal plane and is usually mounted on the side of the magnetic chuck. Magnetic chucks are frequently used on grinders and often are used with wet grinding apparatus, which means the chuck and attendant parts are covered with grinding fluid. The cover 35 protects the switch from being short circuited by the grinding fluid and a trough like groove 37 adjacent the semi-circular opening 36 is provided on the upper portion of the cover to catch and drain down the side of the casing any grinding fluid which falls upon the switch casing. This prevents the grinding fluid from finding its way into the open electrical contact parts of the switch.

Having described my invention, I claim:

1. In a magnetic chuck circuit, a magnetic chuck, a feed circuit, switching means in said feed circuit, resistance means operatively connected with said switch, said switch comprising switch blades, a pair of long main contact members cooperating with said switch blades, a pair of demagnetizing short contact members also cooperating with said switch blades, means to place said resistance means in parallel with said chuck before said switch blades break contact with said main contact members, and means to retain said resistance in parallel while said demagnetizing contact members engage with the switch blades.

2. In a magnetic chuck circuit, a magnetic chuck; a feed circuit; switching means; said switching means comprising main contact members, demagnetizing contact members, and blades; resistance means; and means to cut out the resistance means when said main circuit is completed and to place said resistance in parallel with said chuck prior to and to retain said resistance in series after breaking the main circuit and also

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prior to breaking the demagnetizing circuit and while said demagnetizing circuit is effective.

3. An electric switch comprising feed circuit contacts, said feed circuit contacts comprising a pair of long main contact members and also a pair of short current reversing contact members, a resistance unit, means for connecting said resistance unit in parallel with the output circuit both before and during making of contact with the short current reversing contact members and for opening the circuit through said resistance after complete contact is made with the long main contact members.

4. An electrical switch for magnetic chucks comprising input circuit connections and output circuit connections, said input circuit connections comprising a pair of main contact members and also a pair of current reversing contact members, a resistance unit, means for connecting said resistance unit across the output connections when the reversing current contact members become fully operative, and means to connect said resistance unit across said output connections prior to the main contact members becoming inoperative and opening the circuit through said resistance unit when the main contact members are fully operative.

5. In a magnetic chuck circuit, a magnetic chuck; a feed circuit; a resistance unit; and a switch to supply working current and a reversed demagnetizing current from said feed circuit to said chuck, said switch comprising means to connect said resistance unit as a closed loop with said chuck, and means to break the circuit through said loop when the working current is supplied to the chuck and to maintain the circuit through said loop during both the making and the breaking of the demagnetizing circuit.

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