

[54] **MAGNETIC ELECTRIC CONNECTOR**

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[73] Assignee: **Minnesota Mining and Manufacturing Company**, St. Paul, Minn.

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[21] Appl. No.: **59,812**

Related U.S. Application Data

[62] Division of Ser. No. 775,625, Nov. 14, 1968, Pat. No. 3,654,853.

[52] U.S. Cl. **339/12 R, 339/22 B, 219/495, 335/290**

[51] Int. Cl. **H01r 11/30**

[58] Field of Search **339/12, 22; 219/495, 219/447, 435; 335/290, 146, 218; 211/DIG. 1**

[56] **References Cited**

UNITED STATES PATENTS

3,324,572 6/1967 Robarge..... 339/12 R X
3,111,607 11/1963 Storch..... 317/123

FOREIGN PATENTS OR APPLICATIONS

1,031,683 3/1953 France 339/12 R

Primary Examiner—Marvin A. Champion

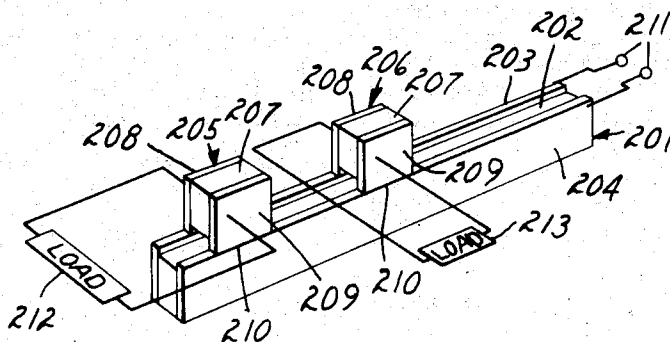
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[57] **ABSTRACT**

This invention is directed to magnetic electric connectors. Each connector is composed of at least two units. The first unit is comprised of a nonconductive permanent magnet partially encased by electrically conductive contact plates bonded or form fitted to the magnet. The second unit may be of similar construction or conversely comprise a magnetically permeable electrically conductive platen of desired configuration. When connected, the contact plates of two similar units or the contact plates of one unit and the magnetically permeable platen contact each other and act as electrical conductors. The units are held together by magnetic attraction. The juncture of the plates or the platen and plates forms an electrically conductive connection so that current from a power source connected to one unit can pass to a load connected to the other unit. Either or both units can be integrally formed with electrical appliances, devices, etc.

1 Claim, 6 Drawing Figures



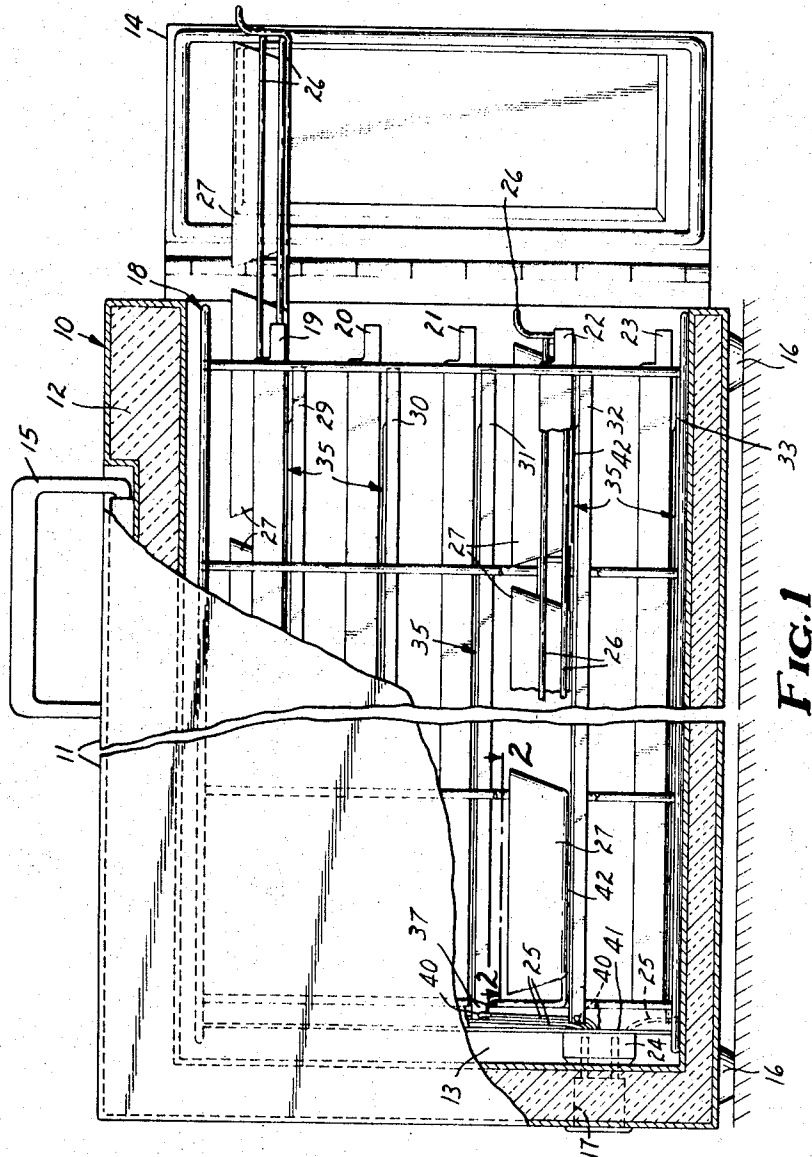


FIG. 1

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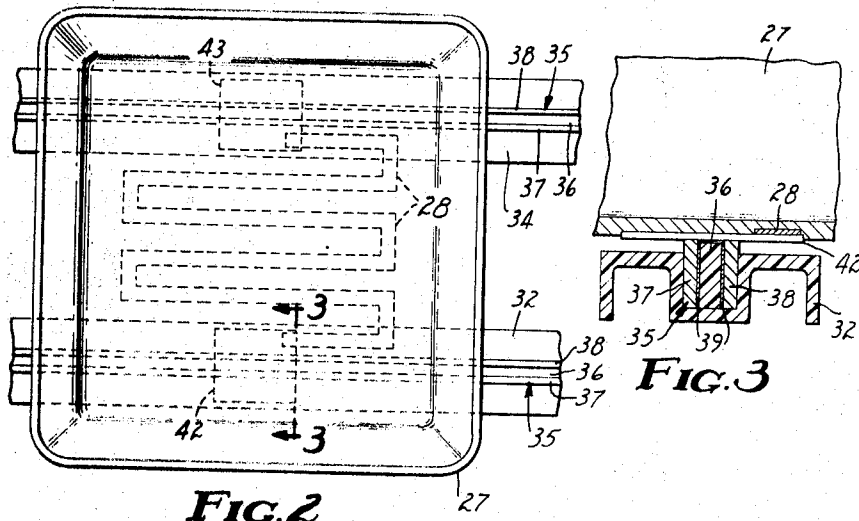


FIG. 2

FIG. 3

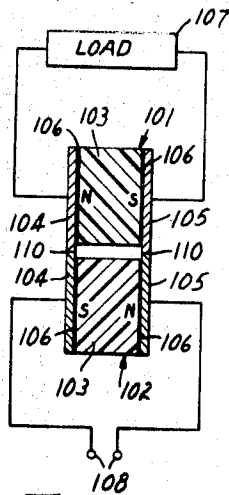


FIG. 4

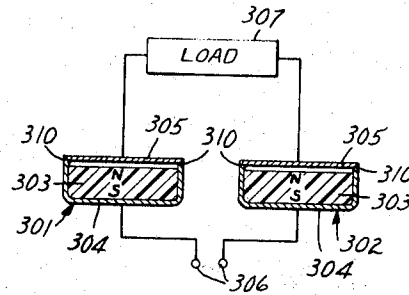


FIG. 6

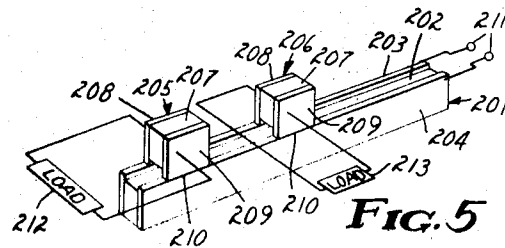


FIG. 5

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MAGNETIC ELECTRIC CONNECTOR

This is a division of application Ser. No. 775,625 filed Nov. 14, 1968 now U.S. Pat. No. 3,654,853.

BACKGROUND OF THE INVENTION

The present invention relates to magnetic electrical connectors, couplings, fittings, etc. which may be used to interconnect a power source to various load bearing circuits or to an appliance or other electrical device.

Prior art connecting devices have incorporated one or more magnets as merely one element of several component parts. None, however, show a simplified unit of two or three parts in which a magnet and electrically conductive contact plates are the only or primary components and which is adaptable to many applications.

For example, McLeod, U.S. Pat. No. 2,573,920, shows a coupling or magnetic switch comprising a plug element and plate which mount a pair of armatures on a leaf spring for movement into contact with a pair of studs 37 and 39 when magnets 41 and 42 are brought into contact with the studs. Electric current flows from the armatures through the studs and the magnets per se to a pair of outlet wires.

Buquor, et al., U.S. Pat. No. 2,788,501, shows a magnetic adapter for holding electric lamps in a socket. The adapter has a permanent magnet and armature which hold the lamp in position and complete one side of the circuit by allowing current to flow therethrough.

Tolegian, U.S. Pat. No. 3,144,527, teaches a coupling with a multiple of parts including two ceramic magnets to orient and engage mating halves of a fitting. Current is shunted through contacts 32, 33 and 34, which extend through one of the magnets, to a conductor extending through the wall of the fitting.

Bonanno, U.S. Pat. No. 3,038,139, provides a magnetic electric socket which secures a lamp by means of a magnet separated from a pair of contact shells by a layer of insulation.

Buquor, U.S. Pat. No. 2,903,667, places a magnetic connector in a lamp socket. A magnet 14 and magnetically permeable plates 20 and 22 magnetically attract and secure a plate 48 integral with the base of a lamp to secure same in position. Electric energy is conducted to the lamp by a resilient contact 41.

Wright, U.S. Pat. No. 3,363,214, and Kinnebrew, U.S. Pat. No. 2,170,287, both show a magnetic plug composed of two mating parts each containing a magnet to magnetically hold the parts together. Electrical contact is made through conventional prongs and sockets.

Jasionowski, U.S. Pat. No. 3,162,754, discloses a magnet centrally disposed between two discrete plug systems 34 to secure the contacts of a heating coil to the plugs.

As can be seen, prior art magnetic connectors each comprise a number of component parts and are directed primarily to plug in or wall type electrical fittings or magnetic bases and couplings to secure electric lamps, etc.

SUMMARY OF THE INVENTION

The electrical connectors or fittings of this invention comprise magnetic units preferably having a nonconductive permanent magnet of ceramic or rubber bonded barium ferrite material. Each magnet has one or more electrically conductive contact plates bonded, form fitted or otherwise secured contiguously over at

least a portion of the magnet's surface, e.g., bonded to opposing sides of a bar magnet. The plates are interconnected to an electric circuit or a source of current and act as the electrical conductor of the unit. Each unit is magnetically coupled with another or second magnetic unit of similar construction or with a magnetically permeable platen which comprises a metal plate of desired configuration. The plates or platen of the second unit are interconnected to the circuit or power source with which it is desired to form a connection. When the magnet of a magnetic unit is brought into juxtaposition with the magnet of a second magnetic unit or a magnetically permeable platen, the contact plates of the two units or a unit and a platen are brought into firm contact with each other by means of magnetic attraction. The contacted plates form a tight juncture with each other. When a source of current is applied to the plates or platen a current is conducted along them and across the juncture.

The units comprise essentially a magnet and one or more metallic parts (e.g., a magnet and metallic plate) and can easily be manufactured in various sizes, shapes, lengths and configurations for use in conjunction with a variety of applications. They can be used in circuit boxes to connect various circuits with a central power supply; if coated with insulating material they can be used as electrical outlet fittings; they can be used to connect electrical appliances or devices with a source of electric power or to interconnect various circuits within the appliance or device. In the latter application the units not only couple to conduct current between component parts of the device or appliance but additionally the magnetic attraction of the magnet can be used to guide movable parts of the device into position and secure them in position when electrical energy is applied. For example, the connectors are highly adaptable for use in light oven or food heating systems where food is heated or cooked in a series of individual casseroles or serving dishes. One unit of the connector can be integrally formed in the casserole per se and the other unit formed with a series of supporting rails disposed in the oven for supporting and for sliding the casseroles in and out of the oven. When the casseroles are supported by the rails the magnetic units in the rails are magnetically contacted with magnetically permeable platens in each casserole for energizing and securing the casseroles when in heating or cooking positions.

The electrical connectors of fittings are thus simple in construction and manufacture. They can be adapted to an infinite variety of applications.

DESCRIPTION OF THE DRAWINGS

Understanding of the invention will be facilitated by referring to the accompanying drawings in which like numerals refer to like parts in the several views and in which:

FIG. 1 is a side view, partially broken away, of an electric oven system employing one embodiment of the magnetic electrical connectors;

FIG. 2 is a top view along the lines and in the direction of the arrows 2 — 2 of FIG. 1 of a heating casserole in the oven system connected to a source of current by magnetic connectors;

FIG. 3 is a sectional view of the mounting of an electrical connector in the oven system of FIG. 1 as seen along the line and in the direction of the arrows 3 — 3 of FIG. 2;

FIG. 4 is a schematic view of another embodiment of a magnetic electrical connector;

FIG. 5 is a schematic view of a modification of the FIG. 4 embodiment; and

FIG. 6 is a schematic view of a further embodiment of a magnetic electrical connector.

DETAILED DESCRIPTION

The basic component of the connectors consists of a magnetic unit which is essentially a nonconductive magnet at least partially encased by electrically conductive contact plates. Each unit is magnetically coupled with either a similar unit or a magnetically permeable unit which comprises an electrically conductive plate or platen of desired configuration. The juncture of the two units form an electrically conductive connection. The contact plates of two magnetic units or the contact plates of a magnetic unit and the magnetically permeable platen serve as current conductors. A circuit is completed whenever the plates of two or more units or the plates of a magnetic unit and a platen are magnetically connected or coupled. Two magnetic units may be interconnected respectively to a load and power source or a magnetic unit interconnected to the load and the magnetically permeable platen unit interconnected to a power source or vice versa.

The uncomplicated design of the connectors permits the device to be easily adapted to many applications. They can be used to interconnect circuits; as interconnections in circuit boxes and the like, or they can be used to serve as electrical connectors in machinery, appliances, electrical devices, etc. In the latter case the connectors may be used not only to form an electrical connection but also their magnetic field may be used to secure or anchor parts of the device integrally formed with one or both units of the connector.

An example of this latter usage is shown in FIGS. 1-3 which discloses the connectros employed in a light weight heating chamber or oven system in which food is heated in a series of individual cooking receptacles or casseroles, each casserole having an integral heating element interconnected to a power source by means of the connectros. Ovens of this nature are light in weight and are especially adaptable for preparing a multiple of individual meals in aircraft. They are also highly efficient meal preparing devices for restaurants, caterers, railway dining cars and for domestic use. The oven system may be used to cook fresh or fresh frozen foods, reconstitute pre-cooked frozen foods or reheat pre-cooked foods. In all cases, food in individual or multiple meal sized portions are packed in the individual casseroles and placed in the oven system which is energized whenever it is desired to cook, reconstitute or reheat the food.

Turning to the oven system of FIG. 1-3, as an exemplary application of the connectros, FIG. 1 shows the system generally designated 10 which comprises a shell 11 and thermal insulating material 12 such as glass, wool, expanded polystyrene or the like packed around the perimeter of the shell. Shell 11 forms a hollow oven cavity 13 completely enclosed by means of a thermally insulated door 14. Shell 11 may have a carrying handle 15 and adjustable legs or supports 16. A plug connector 17 connects the oven to a suitable power source.

A rack generally designated 18 supports in array of shelves 19-23 integrally formed as a part of the rack. The rack and its integral shelves are completely removable

from shell 11 so that the individual casseroles can be placed in the racks at desired locations. Subsequently they may be brought aboard aircraft or the like in rack 18 and the rack placed in shell 11 which may be permanently mounted in the aircraft. When the rack is fully inserted in the shell, an electrical contact member 24 integral with the rack mates with plug 17 for supplying electrically energy through wires 25 to the individual casseroles via the magnetic connectors as hereinafter explained.

Each shelf 19-23 forms a suitable guide or track (e.g., a series of channel members and/or flanges) spaced along opposing sides of rack 18 at the positions 19-23 of FIG. 1 for guiding and supporting a series of slidable trays or pan members 26 (only two pan members shown in the drawings). Pan members 26 are of steel wire construction and are designed to support a series of casseroles 27 into which the food to be heated or cooked is packed. The pan members slide along shelves 19-23 for the insertion and removal of individual casseroles. Each casserole is supported or suspended in pan members 26 so that it is capable of some degree of vertical movement or "play" as pan member 26 slides along one of the shelves 19-23. Shell 11, rack 18 and its related shelves and pan members are preferably constructed of metal. It is preferred to fabricate casseroles 27 of ceramics, glass, porcelain enamel metal, high temperature metals or plastic. The casseroles are essentially of rectangular dish shaped configuration having side and bottom walls. As seen in FIG. 2, a heating element 28, which may comprise a film resistor, wire resistor, etc., is arranged in serpentine contour in or on the bottom wall of each casserole. The resistor is suitably bonded or otherwise affixed to the bottom wall and adequately electrically insulated therefrom.

The casseroles are energized by magnetic connector units embedded in a plurality of electrically insulated rails 29-33 (as shown in FIG. 1) mounted in spaced relation below each shelf 19-23. As best visualized in FIG. 2, each rail 29-33 has a companion rail laterally spaced therefrom such as rail 34 laterally spaced from rail 32. The opposing ends of each rail are suitably secured to the frame of rack 18. As can be seen in FIG. 3 each rail is constructed of a rigid dielectric or electrically insulating compound, e.g., rigid plastic material such as melamine being preferred. In cross section the rails form a series of partial convolutions to substantially embed a magnetic unit generally designated 35 which may be bonded or otherwise affixed to each rail. Unit 35 extends slightly above the upper surface of each rail and comprises a magnetic core 36 preferably composed of an electrically nonconductive material such as ceramic magnetic material or rubber compounds impregnated or bonded with particulate barium, strontium or lead ferrite (barium ferrite $\text{BaFe}_{12}\text{O}_{19}$ being preferred) crystallites or platelets. Preference is given the ferrite-rubber magnets because of flexibility and ability to be shaped in desired configurations. Rubber bonded barium ferrite composite magnetic materials marketed by Minnesota Mining and Manufacturing Company under the trademark "Plastiform" is easily fabricated and performs very satisfactorily as magnet 36.

In magnets of this nature the crystallites or platelets of barium ferrite are oriented along planes parallel to the vertical axis of magnet 36 as viewed with respect to FIG. 3. The magnetic field or flux produced by the

magnet is normal to the planes of the platelets and thus the vertical axis of magnet 36. In bar or elongated magnets the lines of flux therefore extend through the thickness of the magnet.

A pair of electrically conductive metal contact plates 37 and 38 are bonded or otherwise suitably laminated to opposed surfaces or faces of magnet 36 as seen in FIGS. 2 and 3. A satisfactory bond can be made by applying a thin layer of bonding material 39 such as a pressure sensitive adhesive to the opposed faces of the magnet as shown in FIG. 3 and compressing plates 37 and 38 against the adhesive. The upper edges of each contact plate extend a slight distance (e.g., one-sixteenth inch or less) beyond the upper ends of magnets 36 when viewed with respect to FIG. 3. Plates 37 and 38 are preferably fabricated from a magnetizable noncorrosive metal such as treated steel, suitable steel or nickel alloys, nickel, magnetic stainless steel, chrome plated steel, beryllium copper plated steel, etc.

The magnetic units 35, as affixed to each rail, comprise an integral laminated unit thereof extending substantially the full length of the rails. However, as seen in FIG. 1, the leading edge of each unit 35 terminates short of the forward end of the rails and is beveled so that the bottom of casseroles 27 will ride up on the unit when inserted into shell 11 by means of the slidable pan members 26.

Referring further to FIG. 1, the rear or trailing edge of each magnetic unit 35 is suitably affixed to the innermost end of rack 18 contiguous with the insulated rails 29-34 and the other laterally spaced companion rails not shown in the drawings. At this juncture both metallic plates 37 and 38 of each of the magnetic units 35 affixed to rails 29-33 are suitably spaced or insulated from rack 18 and connected to their respective wires 25 for supplying electric energy to both plates by means of leads 40. If desired, wires 25 may be threaded through a channel or conduit along the rear support of rack 18. Each of the units 35 contiguous with rail 34 and the other rails laterally spaced from rails 29-33 are grounded to the rack by means of a bus bar 41, or other suitable grounding connection. When units 35 of lateral companion rails, such as rails 32 and 34 of FIG. 2, are energized and grounded in the above described manner, current will flow through a circuit properly interconnected between the two rails.

Referring to FIGS. 1-3, it is seen that each terminal of integral heating element 28 of casseroles 27 connects with magnetically permeable plates or platens 42 and 43. Similar to contact plates 37 and 38, platens 42 and 43 are made of electrically conductive noncorrosive magnetizable or magnetically permeable metal. The platens form a second or the magnetically connectable unit of the connectors in oven system 10. Platens 42 and 43 may be partially embedded in the bottom wall of casseroles 27 so that their lower surface extends slightly below the surface of the bottom wall of the casseroles as shown in FIG. 3 or they may be suitably adhered to the bottom wall so that they protrude therefrom a distance equal to their thickness. When the casseroles are aligned in pans 26 over their respective rails, the magnets 36 of magnetic units 35 attract platens 42 and 43 of each casserole irrespective of its position over the rails. The magnetic attraction affixes the platens and their respective casseroles firmly to the upper edges of contact plates 37 and 38 which extend slightly above the magnets and rails. When electrical

energy is applied to contact plates 37 and 38 of rails 29-33, all plates act as conductors and current will flow therethrough and through the plates juncture or connection with platens 42 and 43. Energization of platens 42 and 43 will in turn energize element 28 of each casserole. Platens 43 being magnetically connected with contact plates 37 and 38 of the magnetic units of the laterally spaced companion rails (such as rail 34) serve as a ground connection via bus bar 41 to complete the circuit.

The attraction of magnets 36 firmly connects platens 42 and 43 with contact plates 37 and 38 so that a highly efficient electrical connection is made and casseroles 27 are firmly secured over their respective rails. Movement or vibrations of oven system 10 such as encountered in aircraft environments, etc. will not dislodge the casseroles from the rails or their electrical connections. Additionally, when current is turned off and one commences to remove casseroles 27 from shell 11 by sliding them out over the rails by means of pan members 26, the magnetic attraction between units 35 and platens 42 and 43 will continue to prevent dislodgment of the casserole during removal. While the magnetic force is sufficient to make firm electrical contact and prevent dislodgment of the casseroles, the force will not unduly restrict the sliding motion for insertion or removal. Also as platens 42 and 43 slide along the upper ends of contact plates 37 and 38 the magnetic attraction causes the platens to scrape along the plates thus forming self cleaning contacts which remove any particles of food, corrosive deposits, etc. that may have accumulated on the upper ends of the plates.

The above is but one example of how the electrical connectors contemplated by this invention can be integrated in electrical devices and appliances.

Inasmuch as the basic unit such as magnetic unit 35 in FIGS. 1-3 is primarily a nonconductive permanent magnet at least partially encased in a metallic sheath, the connectors may be made in many sizes, shapes and configurations and adapted to a wide variety of applications. Individual units such as shown in FIGS. 4-6 may be used in circuit boxes to interconnect various circuits or loads with a power source; mounted on walls, floors or other structures to form electrical connections between a source and electric appliances, illuminating devices, etc.; mounted on machinery to manually interconnect various electrical components of same, etc.

The embodiment of FIG. 4 shows a pair of magnetic units generally designated 101 and 102. These units are similar to units 35 in FIGS. 1-3 except that units 101 and 102 are each of the same or similar linear dimensions, e.g., are in the form of rectangles or squares and connect with each other rather than with a magnetically permeable platen as in the case of units 35. Units 101 and 102 both comprise a nonconductive permanent magnet 103 of rubber-bonded barium ferrite crystals such as explained with reference to magnet 36. Noncorrosive metal contact plates 104 and 105 are adhered to the opposing surfaces of each magnet by suitable means such as non magnetic rivets, conventional adhesives or the pressure sensitive adhesive layer 106.

As in the case of magnets 36, the barium ferrite crystallites or platelets of magnets 103 are preferably aligned on planes parallel with the vertical axis of the magnets as viewed with respect to FIG. 4. Inasmuch as the magnetic field is normal to the planes of the crystals and therefore with the vertical axis of each magnet

(i.e., extends through the thickness of the magnet), the magnetic poles are oriented on opposing faces of magnets 106. As seen in FIG. 4 the polar orientation of unit 102 is reversed with respect to unit 101. Additionally, in magnetic units of this nature, the magnetic field or flux will tend to concentrate and flow along plates 104 and 105 of each unit. The flow of flux upon leaving the north pole of unit 101 will flow substantially along plates 104 to the south pole of unit 102. Similarly, lines of flux will travel along plates 105 from the north pole of unit 102 to the south pole of unit 101. The flow of flux along the contact plates 104 and 105 will thus produce a concentration of magnetic attraction at the respective junctures 110 of the plates 104 and the plates 105 when the units are placed together in the position of FIG. 4. The contact plates thus form a firm connection with each other for the passage of current when electrical energy is applied to plates 104 and 105.

It was found that by slightly recessing magnets 103 from the ends of each unit's plates 104 and 105 which connect with another unit to form juncture 110, a higher concentration of flux will flow from the north pole of each magnet in the direction of the south pole of the opposing magnet than would occur if magnets 103 were flush with the ends of the plates at the juncture. Additionally, magnetic fields are known to suppress arcing that normally occurs at electrical junctures. Also no significant interference of the magnetic field was found when electric current is passed through the contact plates.

In FIG. 4, unit 101 is connected to a load bearing circuit 107 by means of a suitable connection with plates 104 and 105 and unit 102 is connected to a power source 108 via plates 104 and 105. This relationship can, of course, be reversed. When it is desired to disconnect source 108 from load 107 magnetic units 101 and 102 are manually or mechanically separated.

The FIG. 4 embodiment is adapted to be arranged in various forms of connectors. For example, corrosive resistant magnetically permeable platen units such as platens 42 and 43 of FIGS. 1-3 can be substituted for either one of the units 101 or 102. In such case, one platen would be magnetically attracted to contact plate 104 and a second platen magnetically attracted to plate 105 and a lead from the load or power source suitably connected to each platen.

A four unit system can be arranged by laterally spacing a pair of units in side by side relationship and connecting them with a second pair of units similarly oriented. In such arrangement, an additional unit would be laterally spaced from unit 101 of FIG. 4 and a second additional unit laterally spaced from unit 102. One lead from load 107 would be suitably affixed to both plates 104 and 105 of unit 101 and the other lead similarly affixed to the plates of the unit paired and laterally spaced from unit 101. Likewise one of the leads from source 108 would be affixed to plates 104 and 105 of unit 102 and its paired laterally spaced unit similarly affixed to the other lead of the source. Units constructed in this arrangement reduce the possibility of shorting when connecting or separating mating units.

If considerable magnetic force is required, a multiple of magnets 103 can be suitably affixed to each other in lateral arrangement with their polar regions oriented in alternate order and the magnets laminated between a pair of contact plates such as plates 104 and 105. Additionally, the units can be constructed with a multiple of

contact plates 104 and 105, each plate laminated between a series of laterally disposed magnets 103 to form a connecting unit with a plurality of contacts. When magnetically connected to a similarly constructed unit the several contact plates of the connecting device can be used to interconnect a plurality of leads from a power source to a plurality of leads connected to a load bearing circuit.

Referring specifically to the unit of FIG. 4, the outer surface of plates 104 and 105 can be insulated to minimize the chance of shock when the units are manually connected and separated. Additionally, the units can be mounted in adequately insulated cavity constrainers or the units per se molded or formed to assist in properly orienting the units for magnetic connection or separation and eliminating the possibility of shorting. Cavity constrainers also prevent accumulations of magnetically attracted dirt or debris, filings, small metallic articles, etc.

FIG. 5 shows a system of magnetic units similar in construction with the units of FIG. 4 except one unit has a comparatively greater extension or length. The unit generally designated 201, is essentially a long bar magnet comprising a rubber-bonded barium ferrite magnet 202 laterally encased by noncorrosive metal contact plates 203 and 204 connected to a power supply 211. Unit 201 may be suitably mounted in a circuit box, on machinery, etc. to supply power to various circuits when smaller units such as units 205 and 206 are properly magnetically connected to unit 201. Each unit 205 and 206 has a comparatively small magnet 207 and contact plates 208 and 209 which magnetically connect and join plates 203 and 204 at junctures 210. When power is applied to unit 201 from power supply 211 current flows through plates 203 and 204 and through the magnetically secured connections with plates 208 and 209 at juncture 210 of one or more of the smaller units. The small units are in turn connected to separate loads or circuits such as loads 212 and 213. Long units such as unit 201 may be constructed to hold a great number of smaller units each connected to separate circuits or devices.

FIG. 6 shows another embodiment in which the connectors of this invention can be utilized. This embodiment comprises two magnetic units generally designated 301 and 302. Each unit has a rubber-bonded barium ferrite magnet 303 encased by U or channel shaped contact plates 304 which act as conductors. Plates 304 may, as shown, be bonded or force fitted over one face and the opposing sides of magnets 303. Magnetic connection for the electrical contact is made to a pair of planar magnetically permeable platens 305 which are similar to platens 42 and 43 of FIGS. 1-3. Magnets 303 are recessed slightly from the contact edges or ends of plates 304 so that the magnets do not interfere with the electrically conductive juncture 310 between contact plates 304 with platens 305. The magnetic field of each magnet 303 flows and fans out in opposing directions along platens 305 from the north pole of each magnet to the distal ends of the U shaped contact plates 304 at junctures 310. Plates 304 direct the flow of flux to the south poles of the magnets. Plates 304 may be connected to a power source 306 and platens 305 to a load 307 or vice versa. If desired platens 305 can be substituted by a second pair of magnetic units 301, the U shaped contact plates 304 are inverted with respect to FIG. 6 and the magnets are oriented so

as to provide mutual magnetic attraction with the lower magnets 303.

The above are only a few exemplary uses to which this invention may be directed.

What is claimed:

1. A magnetic electrical connecting device comprising:
 - a. a first magnetic unit consisting of an elongated nonconductive permanent magnet of uniform cross section throughout its length, the magnetization of said magnet oriented normal to its axis of elongation providing opposite magnetic polarity on opposed faces of said magnet, said unit further having a pair of magnetizable electrically conductive metal contact plates, each plate of uniform cross section throughout its length, said plates integrally secured to the opposed pole faces of said magnet for inducing each of said plates with the same magnetic polarity as the face of said magnet integral therewith, the plates forming magnetic pole pieces in which the path of flux created by said magnet lies substantially between the plates at all points along the length of the plates;
 - b. a plurality of second magnetic units for magnetic connection with said first units, each of said second units having a non-conductive permanent magnet uniformly magnetized and a pair of magnetizable electrically conductive contact plates, each plate secured to opposed faces of said magnet, the mag-

netic poles of said magnet disposed on the opposed faces of the magnet secured to said plates to induce opposite magnetic polarity to said pair of magnetizable plates of each of said second units to that the plates of each of said second units are brought into contact with said plates of said first unit by means of the magnetic attractive force between said plates when plates of opposed polarity of said first unit and each of said second units are oriented in registry with each other, and conversely said plates of said first unit and said plates of each of said second units are repelled by the magnetic forces between the plates of said first unit and each of said second units when plates of the same polarity of said first unit and said second units are oriented in registry with each other;

- c. a first part of an electric circuit connected with each of the plates of said first unit; and
- d. a plurality of second individual parts of an electric circuit, each such individual part connected with each of the plates of each of said second units and at least two of said second units interconnected simultaneously with said first unit and each such individual part being interconnectable with said first part of said circuit to form a complete circuit therewith whenever said plates of each of said second units are brought into contact with the plates of said first unit by said magnetic force.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,750,083 Dated July 31, 1973

Inventor(s) RICHARD E. FAYLING

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The line above the Abstract, "Attorney--Kinney, Alexander, Sell Steldt & Delahunt" should read -- Alexander, Sell, Steldt & Delahunt --.

Col. 1, line 16, "For example." should read -- For example, --.

Col. 3, line 31, "connectos" should read -- connectors --.

Col. 3, line 38, "connectros" should read -- connectors --.

Col. 3, line 40, "recpetacles" should read -- receptacles --.

Col. 3, line 44, "connectros" should read -- connectors --.

Col. 3, line 48, "forzen" should read -- frozen --.

Col. 3, line 56, "connectros" should read -- connectors --.

Col. 3, line 65, "in" should read -- an --.

Col. 3, line 66, "aprt" should read -- apart --.

Col. 7, line 12, "wil" should read -- will --.

Col. 10, line 4, "to" should read -- so --.

Signed and sealed this 8th day of January 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

93

UNITED STATES PATENT OFFICE
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(SEAL)
Attest:

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