This invention concerns an electric game and particularly one in which a ball or other object may be moved about the board by the application of different electric currents to a plurality of electro-magnets.

One of the primary objects of my invention is to provide a device in which the aforesaid magnets may be subjected to varying currents of differing strength and polarity. Still another object of my invention is to provide a device in which the plurality of electro-magnets may be selectively actuated in rapid succession. It is yet another object to provide a device in which switches may be utilized in series to vary the types of currents applied to the aforesaid electro-magnets.

Another object of my invention is to provide a device in which the players may oppose each other by attracting the playing piece from one adjacent position to another toward a selected goal by magnetic force.

Yet another object of my invention is to provide a device in which alternating and direct currents may be utilized to energize magnets.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specifications, wherein is disclosed a single exemplary embodiment of the invention, with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Figure 1 is a top plan view of a game constructed according to my invention.

Figure 2 is a longitudinal sectional view taken at lines 2—2 of Figure 1 to show the position of the magnets and the like.

Figure 3 is a view in cross section of a switch contact button adapted to be worn on the finger.

Figure 4 is a view of the contact button in use, and Figure 5 is a schematic diagram of the electrical circuits employed in the device shown in Figure 1.

Referring now to the drawings, and particularly Figure 1; the game is comprised generally of a playing board 11, two control panels 12 and 13, all of which are contained in a case 14. Surrounding the playing board 11 is a continuous trough 15 which serves to catch the ball 16 which is the playing piece adapted to be moved around the board.

The board itself comprises the plurality of squares, such as 17 and 18, in the embodiment herein disclosed; half are red and the other half black.

In each individual square is a raised button such as 19 and 20 under which is positioned one end of the core bar of an electro-magnet. This arrangement is more clearly shown in Figure 2 wherein the electro-magnets are indicated by the numerals 21 and 22.

Positioned above the board 23 is a second parallel surface 24. This surface is either of glass or transparent plastic. The playing piece 16, which is a steel ball, is placed on this surface.

In the embodiment shown, half of the electro-magnets are controlled by the switches and contact buttons on one side of the board, the switches being generally indicated at 25, 26, 27 and 28 and the contact buttons at 29 and 30. A similar arrangement of switches and contact buttons on the opposite side of the board is adapted to control the other or alternate squares on the board. It will of course be understood that contact buttons for every magnet on the board could be provided on each side of the board if those under immediate control of the supporting switches 25, 26, 27 and 28 were connected electrically in parallel relationship.

The contact buttons, such as 30 and 29, consist of a series of three metal protuberances or contact buttons, such as are shown in Figure 4. These buttons are approximately the same size as the head of a thumb tack and are of metal or any material capable of conducting electrical currents. The contact buttons are placed three in a row, as shown in Figure 4 at 29a, 29b, and 29c. To make contact between the buttons, I employ the device shown in Figure 3. This includes a rubber cup 31 which is such size as to conveniently fit over the tip of the finger, and a metal button 32 which is embedded in the outer end of the cup. It will be at once apparent, as is shown in Figure 4, that by placing the metal tip of the cup between two of the contact buttons on the board, an electrical connection is provided which permits the passage of current from one button to another. At the same time, button 32 should be of such size that it would be impossible to create a contact between all three buttons at one time.

The object of the game, from the standpoint of the players, is to move the steel playing piece or ball 16 about the board and into a trough which would be designated as a goal. Of course any game depends largely on the number of variable elements present and opportunities for selection on the part of the players, which in turn establishes a contest of skill between two or more players. In the applicant's device, the object of the player is to move the ball from one magnet to another, keeping the ball under his control, while his opponent's object is to shift the ball to a magnet which is under his control, and then attempt to move the ball from magnet to magnet to his home goal.

It will be apparent that low voltage and hence low magnetic forces applied to the various magnets in succession will permit the ball to move slowly and under full control from one magnet to another. It will also be apparent that high voltage will cause the ball to be held more firmly, attracted from a greater distance, and will also speed up the action of the ball. If the ball is held on the magnet energized by low voltage, a high voltage application to an adjacent magnet will cause the ball to move more readily. It would be further apparent that such high voltage movement will be rapid and that speed thus attained in moving the ball will make it difficult to handle and require considerable skill.

Another variable will be introduced into the action of the game by making it possible to reverse the polarity of the individual magnet at will. While a ball is not capable of holding a magnetic field for any substantial length of time, it still has a slight residual magnetic field after it has once been subjected to a magnetic force. In practice, it has been found that the steel playing piece will be attracted or repelled by a change in electrical currents and their polarity, depending upon whether it is being subjected to a positive or negative charge by an adjacent magnet.

It has also been found that the application in rhythmic succession of current pulses will cause the ball to rock
in relation to the magnet which is already holding it. For example, if the ball is being held by a positively charged magnet, the rhythmic conduction of a negative charge into an adjacent magnet will cause the playing piece to move back and forth and oscillate to such an extent that it will eventually be drawn to the negatively charged magnet. Skill is involved in timing these pulsations to a point where they are fully synchronized with the actual movement of the ball. Of course the opposing player may obstruct this action by releasing the ball at the correct time.

It of course will also be apparent that a direct current application will have an entirely different effect than the application of alternating current if it is applied to a magnet adjacent to one which is energized by alternating current. The cycle nature of alternating current prevents any magnet energized by alternating current from having as great an effect on the steel ball as a D.C. magnet of the same voltage, and also tends to reduce the residual magnetism of the ball. It is also possible to change the polarity of alternating current and therefore set up a conflict between two adjacent magnets, both energized by alternating current. This will be more fully described in reference to the schematic diagram of the device, such as shown in Figure 5.

It is also to be noted that alternating voltage may be affected by the element of magnetic lag and that the ball must first be magnetized to be attracted. This factor will affect the voltage relationship chosen as between alternating and direct current.

Referring now to Figure 5; primary power is supplied to the plug 33 which would be the conventional 115 volt alternating current present in most residential supply lines. This current is fed into a transformer 34 which is adapted to step the voltage down to a lower stage, this lower voltage being related to the final voltage present in the direct current circuits. The manner in which the magnets are wound and the nature of the core will determine the final voltage relationship between alternating current and direct current. It should be such that the power or attractive forces of the magnets are almost equalized, regardless of which current is being applied.

The first transformer stage 35 is adapted to energize the magnets with alternating current. A second step-down stage 36 is provided to secure the voltage necessary for direct current application. Direct current is achieved by passing the alternating current through the fullbridge rectifier 37 to change it from A.C. to D.C. and thence into the control switches of the two panels. The control switches include the two previously mentioned switches 25 and 26 which are three-position, single-pole switches, and the switches 27 and 28 which are single-pole, double-throw switches, also the contact buttons such as 29 and 30. The circuits also include two fuses 38 and 39.

Referring now to the specific switches; switch 25 has three positions, one of which is connected to the low voltage side of the transformer to secure an alternating current normally described as positive. This is position 40. A second position in this switch is 41 which is connected to the positive side of the fullbridge rectifier. The third position 42 is connected to the nominal negative side of the transformer going through contact button position 43 of the switch 26. In this connection, the applicant would like to point out that he is aware of the cycle nature of alternating current, but has found that a reversal of the connection in an alternating current line will vary its effect on the playing piece or ball, repelling or attracting the piece, depending on what conditions for the voltage being applied at the moment.

Referring now to the switch 26; one position has previously been described as being A.C. negative; a second position 43 is a D.C. negative, and a third position 44 is designated as an A.C. positive.

Switch 27 is a two-position switch having one side 45 positive and the other side 46 negative. Switch 28 is also a two-position switch and has one high voltage side 47 and one low voltage side 48.

Referring again to the high-low switch 28; it will be seen from Figure 5 that the low side of this switch is connected to a midpoint of the transformer, this connection being such that one-half the voltage potential of either the alternating current or the direct current side will be present. For example, a circuit from the low position of switch 28 to the core winding of the magnet, thence from contact 29b to 29c would return to switch 26, at which point the circuit could be connected to either side of the low voltage winding of the transformer to provide or to the negative rectifier. Alternately, contact could be made through buttons 29b and 29c to cause the current to be fed to the switch 25 and thence either to the A.C. positive or the A.C. negative pole or to the D.C. positive. It will be obvious that moving the finger contact button from one side to the other of the switch buttons 29 will reverse the polarity of the magnet.

If switch 28 is thrown to the low side, the buttons 29a and 29b connected, the current will then originate at the switch 26, pass through the buttons, the magnet, the switch 28, thence through the neutral wire 48a which is maintained at one-half of the potential of the full source of power of either the D.C. or A.C. circuits at the transformer. If contact is made between 29b and 29c, then the current originates at the switch 25, passes through the buttons, the magnet, switch 28, thence neutral line 48a. The purpose of changing contacts from 29a—29b to 29c—29b is to reverse polarity of the magnets. It will be understood that switches 25 and 26 will have been positioned to contact the D.C. terminals in each switch.

To set up an alternating current circuit, switches 25, 26, 27 and 28 are all employed in the following manner. Switch 25 is set with the contact arm on the terminal 42, switch 25 with a contact arm on the terminal 43, switch 27 with a contact arm on terminal 46, and switch 28 with a contact arm on terminal 47. If buttons 29b, 29c are then connected, current will originate in switch 26 at terminal 42, pass through the contact arm to terminal 46 and switch 27, thence through the contact arm and terminal 47, switch 28, then into the electro-magnet, thence through the contact buttons, thence back through fuse 39 to switch 25 and through the arm to contact 40.

If contact is then established between buttons 29a and 29b, it will be necessary to move the contact arm of switch 27 to contact 45. The contact arm of the current will then be from contact 42 of switch 26 through fuse 38, through buttons 29a and 29b into the electro-magnet, through switch 28, contact 47, then through switch 27 to contact 45, then to the switch 25 and to contact 40. To reverse the direction of movement of the alternating current in either of the foregoing set-ups, it will be necessary to move switches 25 and 26. For example, switch arm of 25 will be moved to contact 41 and, at the same time, the contact arm of 26 will be moved to contact point 44.

If the switch 26 is moved to the low side of contact 48, an alternating current of half the voltage of those previously described, may be set up. For example, if contact is made between 29a and 29b, current will then originate in switch 26 through contact 42 or contact 44, depending upon which way the switch arm has been moved. It will pass through the fuse 38, through the buttons 29a and 29b, thence through switch 28, contact 48, and back through the wire attached to 48b to the transformer. If the contact is set up between buttons 29b and 29c, the current will originate in switch 25 which may be positioned with the contact arm on either terminal 49 or 41.

The current will pass fuse 39, through the contact buttons, through the electro-magnet, through switch 28, contact 48 and the connecting wire back to the transformer.
Again at this point it will also be apparent that polarity can be changed by the movement of the switch arm 25, between contacts 40 and 41. It will also be apparent, from a study of Figure 5, that contacts can be made which will result in the absence of any electrical circuit, which situation adds another variable to the game.

It will also be apparent that the switch 27 can be used to reverse polarity of the magnet since this switch provides a means of selectively connecting either switch 25 or 26 to the magnet, these two switches having been previously set up for the desired circuit, either alternating current negative or positive. It will be understood that for purposes of reversing the alternating current circuit is to either establish or avoid communication between adjacent magnets. As previously set forth, half of the magnets are controlled by one side of the board and half by the other, the magnets being alternated on the board. If half of the electro-magnets present a north pole to the ball on the playing area, and then the other half are adjusted also to present the north pole, the ball will be drawn by the nearest magnet. Whereas, if half the magnets are energized to provide a north pole and half a south pole, the residual magnetism of the ball itself when in motion will cause the ball to be attracted by the nearest magnet of opposite polarity. The player’s object is to adjust the magnets under his control to his best advantage in relation to those under his opponent’s control. The fuses 38 and 39 are provided both to secure against overloads from the power source 33, or accidental bridging of the contact buttons such as 29a to 29c.

It will be apparent, from the foregoing description, that a number of different current situations can be effected by the manipulation of switches 25 and 26 in conjunction with the high-low switch 28, and that final current flow is determined by contacts made in series of buttons such as 29a, 29b, and 29c. As previously described, a high holding force can be applied to the magnets through the use of alternating current. This alternating current can be varied as to direction with the resulting difference in effect on the residual magnetism in the ball itself. With one setting, energizing the switch causes the ball to be repelled and in another instance to be attracted. Movement forces can be applied through use of the direct current, either to cause the ball to progress in a steady course from one magnet to another across the board to the desired goal, or in an inter-play of direct current forces between opposed magnets. The player’s ball to rock in relation to the magnet which holds it and ultimately to be drawn away from it to an opponent’s field of magnetic force. The opportunity for considerable skill in the rapid successive setting up of different circuits and the manipulation of the control buttons affords the high variation of possibilities necessary to an interesting and exciting game.

Although I have described a specific embodiment of my invention, it is apparent that modifications thereof may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. In a competitive electro-magnetic game device to be played by two opposed players, a playing surface, a steel ball adapted to be positioned thereon, a plurality of electromagnets positioned beneath said playing surface, a portion of said magnets being operatively connected to individual double-throw switches positioned on one side of said playing surface under the control of one of said players, an equal portion of said magnets operatively connected to like switches positioned on the opposite side of said playing surface under the control of the other of said players, an alternating current transformer, the secondary winding thereof being divided into two portions, a rectifier operatively connected to one of said two portions to secure direct current therefrom, the other portion thereof being adapted to provide alternating current, said secondary portions, said magnets, and said switches being operatively connected to form a plurality of separate electrical circuits adapted to be actuated separately by said opposed plungers, switch means positioned in each of said circuits adapted to selectively connect either of said winding portions to the respective magnets associated therewith, a second sub-division of each of said portions operatively connected to said magnets, and a third switch means in each of said circuits adapted to selectively alternately connect said portions or sub-divisions to said magnets, said double-throw switch means being adapted to permit the rapid making and breaking of said electrical circuits, whereby each player may selectively vary current conditions to offset variations effected by his opponent to control movement of the steel ball.

2. In a device as set forth in claim 1, said double-throw switch means comprising a plurality of adjacent buttons and manually operative means adapted to interconnect any two adjacent buttons of said group to create a circuit.

3. In a competitive electro-magnetic game adapted to be played by two opposed players, a playing surface having goals about the sides thereof, a metallic playing piece freely movable on said surface, a plurality of electromagnets positioned beneath said playing surface, each of said magnets being connected to a double-throw switch, half of said switches being positioned on one side of the playing surface under the control of one player to form one composite of circuits, and half on the opposite side of said surface under the control of the second player to form a second composite of circuits, a single alternating current power transformer having two secondary windings, means for converting the output of one of said secondary windings to direct current, a plurality of switch means, said switch means being adapted to permit selective energization of said electro-magnets by either alternating or direct current, said first named double-throw switches being adapted to permit polarity reversal at will, whereby each player may vary current in such a manner as to offset variations produced by his opponent to effect movement of the playing piece.

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