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ELECTROMAGNETIC GAME APPARATUS

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Fig. 1

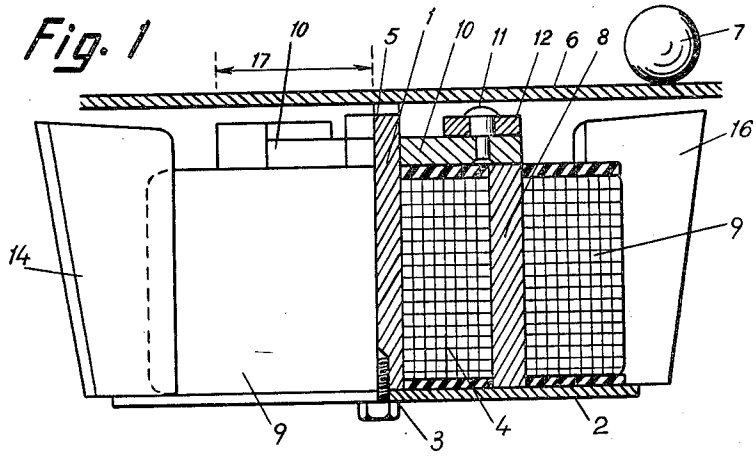


Fig. 2

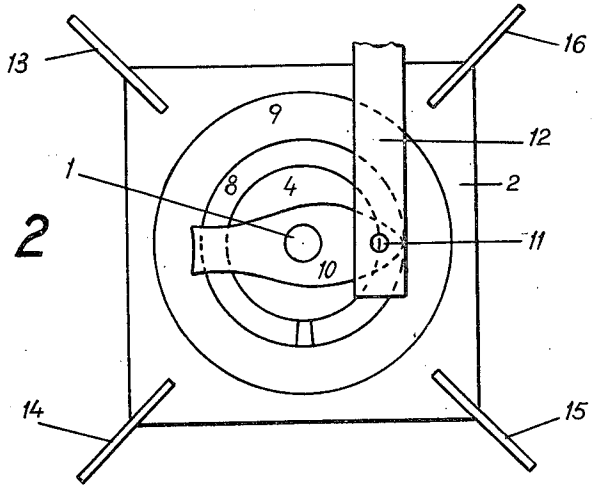
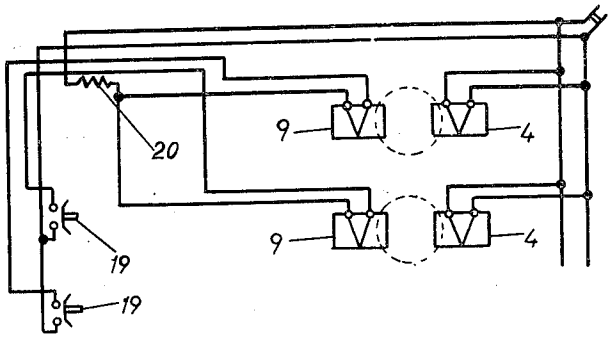


Fig. 3



INVENTOR.
F. RIBERA CASAMADA
A. MORAL ARNAIZ
F. RIBERA LLORENS
BY Hendricks, Lind & Pennie
Attorneys

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ELECTROMAGNETIC GAME APPARATUS

Felix Ribera Casamada, Alfonso Moral Arnaiz, and Felix Ribera Llorens, Palamos, Spain

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7 Claims. (Cl. 273—119)

The present invention relates to an electromagnetically operated apparatus for producing mechanical impulses of directed action.

This invention is applicable to those cases wherein a movable metallic element constituted at least partially by a magnetic material is adapted to be thrown in various directions and at different speeds.

The apparatus which is hereafter described comprises an electromagnetical means suitable to intercept the course of the movable element, provided that this comes within the range thereof, completely stopping said element and throwing it again under its electromagnetical action with a direction and speed depending mainly on the ability of the apparatus' operator.

The apparatus may be utilized alone or in combination with other such apparatus in order to obtain in either case effects and actions according to predetermined rules and to thereby constitute an amusement requiring attention and ability.

This object is obtained according to the present invention by providing at least two throwing electromagnetical devices, each of which comprises a centering electromagnet in nuclear arrangement, fixed to a supporting metallic plate for the momentary stopping and centering of the movable element in question, in combination with a throwing electromagnet having an annular core surrounding the centering electromagnet and fixed on the same supporting plate, for throwing the movable element.

The core of the throwing electromagnet is operatively correlated with a direction varying means by which the throwing of the movable element is accomplished.

The magnetic field of the apparatus is strengthened by peripheral means arranged on the support for the magnets.

The apparatus as described is placed under a metallic cover plate whereon the movable element travels.

Other and further objects of the invention will be apparent from the following detailed discussion of a preferred embodiment of the invention taken together with the accompanying drawing in which

Figure 1 is a side elevation of the electromagnetical apparatus, partially cut away to show the internal arrangement of the parts thereof;

Figure 2 is a plan view of the same apparatus taken from above the Figure 1, and

Figure 3 shows a schematic diagram of the electrical connections operatively correlating a plurality of throwing devices in connection with their electrical operating means, in a preferred embodiment.

The invention comprises an electromagnetic apparatus consisting of a central or centering electromagnet having a core 1 (Figures 1 and 2) fixed to a supporting metallic plate 2 by means of any suitable clamping fixture, for example a screw 3, such core being surrounded by the corresponding winding 4, the upper end 5 of the core being adjacent to the lower face of a covering plate 6, the parts of the apparatus being thereby concealed.

The cover plate 6 is provided to facilitate the rolling

or translation of the movable element 7 which may be spherically shaped and includes portions thereof made of magnetic material.

This electromagnet is always energized when the assembly of which it forms a part is in operation. Its electromagnetic conditions and characteristics, as well as the measurements thereof, are so chosen to provide a magnetomotive force at the upper end of the core thereof which may be restricted to an amount just sufficient to draw the movable element 7 from the electromagnet's periphery and to hold this movable element over said end with a relatively small force.

A second core 8, of annular shape, is mounted around the first electromagnet and is likewise fixed to the supporting plate by screws or other means, the corresponding winding 9 being mounted around this annular core.

This second or throwing electromagnet is incorporated in a circuit allowing it to be connected to the electric supply through an independent push-button switch or other such switch forming part of the circuit for allowing the production of current pulses for arbitrary lengths of time. When it is desirable to operate the throwing electromagnets individually, thereby avoiding the simultaneous switching on of all of the electromagnets, means are provided to allow sufficient current flow through a single throwing electromagnet winding only.

The core 1 is provided, close to the upper end thereof, with a coupling portion adapted to receive a movable armature 10 which may be operated by means of a gearing allowing the rotation of the armature through 360 degrees, or only a fraction of such rotation, as shown in Figures 1 and 2. An operating pin 11 arranged at the end of the armature 10 is connected to an operating bar 12 which may be operated from the end or any intermediate point thereof.

The armature is arranged for rotation adjacent to the upper edge of the annular core 8 and is so shaped that the upper part thereof is placed close to the protection cover 6.

By such arrangement, any drive applied to the operating bar 12 results in an angular deviation of the armature 10 which is aimed in the direction in which the mechanical throw of the movable element 7 is desired to take place.

The throwing electromagnet 8 has the magnetic field thereof strengthened by the peripheral complementary pieces 13, 14, 15, 16 which are placed in the most suitable arrangement.

From the foregoing it is easily understood that upon energization of the winding 9, the ball or movable element 7 coming within its force range, which is sufficiently great to achieve this purpose, is drawn towards the zone of greatest intensity of field and is blocked on the annular core 8. When the energizing current of said winding 9 is switched off, the movable element 7 is released and subjected to the action of the field of the centering electromagnet which then will draw the movable element until it is over the end of the core 1 thereof. If the winding 9 is now energized with a current pulse of suitable duration, this movable element will be accelerated along the traverse 17 and thrown with great speed along the direction selected by the positioning of the armature 10.

The individual apparatus described may be utilized in combination with other similar apparatus, thereby constituting an assembly applicable for many purposes such as games and amusement.

In either case, the electrical operating means, either push-buttons or the like, are suitably arranged in order that the several throwing electromagnets are operated singly. For such purpose, a connection is provided including a calibrated resistor which produces a voltage

drop preventing the performance of more than one of the throwing electromagnets.

The electrical wiring of these elements is set forth in the Figure 3, wherein the elements previously described bear the same reference characters. It will be seen that the windings 4 are permanently connected to the mains 18 while the windings 9 are connected to the same mains through respective push-button switches 19 and through the calibrated resistance 20.

The throwing devices allowing the selection of the direction in which the throwing takes place may have a range limited by two angular directions covering a given angle on the annular core, thereby giving place to a very wide range of applications, to be utilized for purposes in which the throwing of a movable game element in a given direction is contemplated as the main performance characteristic.

It is obvious, of course, that various modifications such as size and shape, as well as suitable materials can be utilized in the present invention without departing from the scope thereof as defined in the appended claims.

We claim:

1. Electromagnetic apparatus for producing directed mechanical movement in amusement or like devices, comprising a cover plate having a flat surface thereon, a movable element having a portion thereof of magnetic material and being freely displaceable on said surface, at least two throwing units under said cover plate, each unit comprising a centering electromagnet for centering said movable element with respect to the unit, and a throwing electromagnet surrounding the centering electromagnet for throwing said movable element outwardly on said cover plate from said centering electromagnet, means on said magnets for varying the direction of outward throwing over at least a fraction of the circumference of said throwing electromagnet, means electrically connected with said electromagnets for continually energizing said centering electromagnets with a current sufficient to produce a magnetomotive force just sufficient to draw the movable element over the centering electromagnet when the surrounding throwing electromagnet is not energized and for selectively energizing the throwing electromagnets with sufficient current to produce a magnetomotive force sufficient to draw the movable element passing within its range to said throwing electromagnet thereby intercepting the course of said movable element, and means connected with said energizing means for preventing the simultaneous operation of more than one of said throwing electromagnets.

2. Apparatus as claimed in claim 1 in which said centering electromagnet comprises a magnetic core and a winding therearound, a supporting plate to which said core is

fixed on the lower end thereof, the upper end of said core protruding from said winding and extending adjacent said cover plate.

3. Apparatus as claimed in claim 1 in which said throwing electromagnet comprises an annular core and a winding therearound surrounding the centering electromagnet, a supporting plate to which said annular core is fixed on the lower end thereof, the upper edge of said core being substantially flush with the upper edge of the winding.

4. Apparatus as claimed in claim 3 in which the throwing electromagnet further comprises a plurality of magnetic pieces arranged peripherally of the winding and attached to said supporting plate, thereby widening the field of said throwing electromagnet.

5. Apparatus as claimed in claim 1 in which said means for varying the direction of throwing of the movable element comprises a movable armature of magnetic material rotatably connected to the upper end of the centering electromagnet for rotation about the axis of said centering electromagnet, said armature extending over the surrounding throwing electromagnet adjacent thereto and adjacent the lower face of the cover plate.

6. Apparatus as claimed in claim 5, said means for varying the direction of throwing of the movable element further comprising annual operating means connected to said armature to impart thereto along an arc of the circumference of said throwing electromagnet a motion dependent on the amount of manual operation.

7. Apparatus as claimed in claim 1 in which said centering electromagnet comprises a magnetic core and a winding therearound, the upper end of said core protruding from said winding and extending adjacent said cover, said throwing electromagnet comprises an annular core and a winding therearound surrounding the centering electromagnet, the upper edge of said core being substantially flush with the upper edge of the winding, and the means for varying the direction of throwing comprises a movable armature of magnetic material rotatably mounted on the upper end of the core of the centering electromagnet for rotation about the axis of said core, said armature extending over the upper edge of the annular core of the throwing electromagnet adjacent thereto.

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