Oct. 10, 1950 J. W. IRBY 2,524,804

APPARATUS FOR DEMONSTRATING THE EXISTENCE OF MAGNETIC LINES OF FORCE

Filed Feb. 2, 1949 2 Sheets-Sheet 1

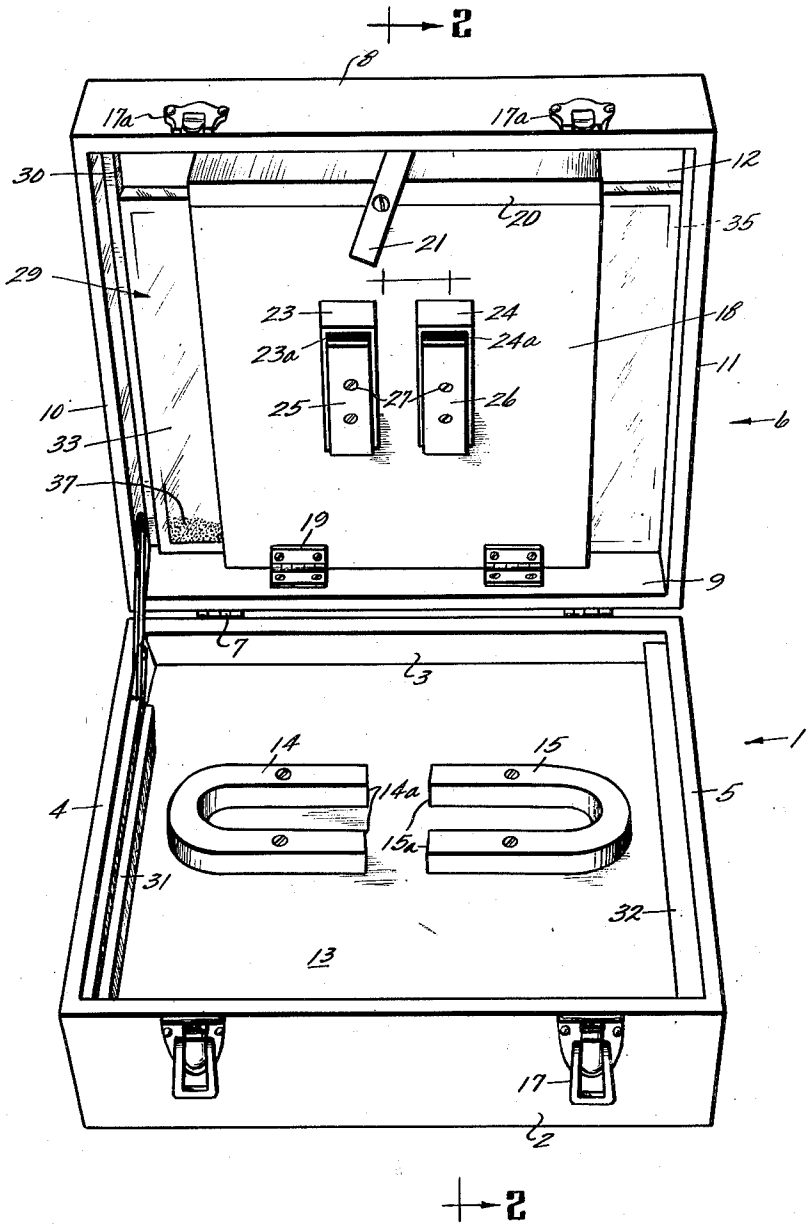


Fig 1

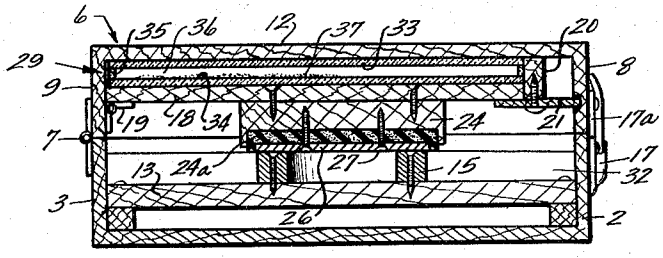
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Fig 2



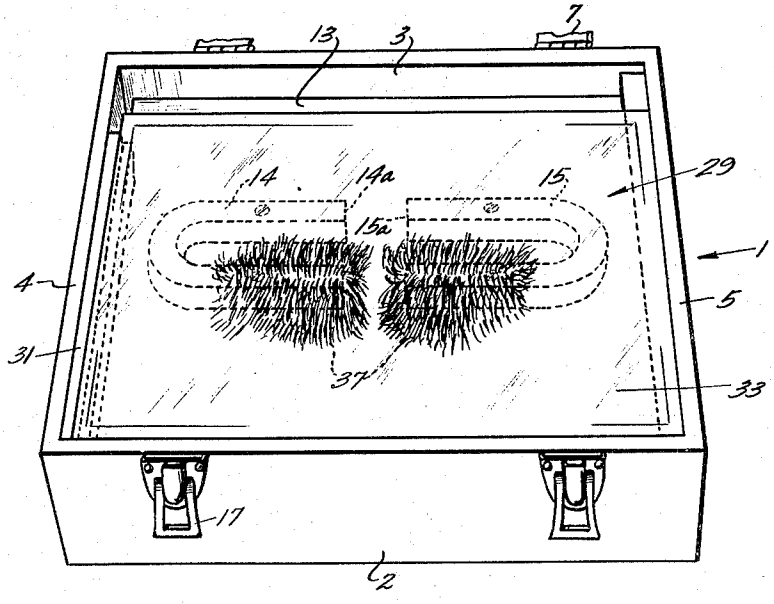


Fig 3

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APPARATUS FOR DEMONSTRATING THE EXISTENCE OF MAGNETIC LINES OF FORCE

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4 Claims. (Cl. 35—19)

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The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

My invention relates generally to educational devices, and more particularly to instruction devices for demonstrating the existence and position of magnetic lines of force between the poles of magnets, having for one of its objects the provision of a compact, self-contained educational or demonstration kit with a permanent magnet, and "keeper" means for the magnet movable to and from operative contacting position across the poles of the magnet, together with transparent, substantially rigid, envelope means containing finely divided iron particles or ferrous powder, and supporting means for holding the magnet and envelope means in cooperative demonstrating position, with the envelope disposed horizontally above the magnet or in non-operative position in spaced relation to the poles of the magnet while the "keeper" means is in contact with the poles of the magnet.

A further object of my invention is the provision of sealed envelope or container means having spaced non-metallic, parallel, transparent side walls, enclosing a quantity of finely divided ferrous particles and supporting means fixed with respect to the magnet means for rigidly supporting the envelope means in juxtaposed horizontal relation above the poles of the magnet, and hinged supporting means, swingable relative to the magnet means, having keeper means mounted thereon for yieldable contacting engagement with the poles of the magnet when the hinged supporting means is swung in one direction, and means on the hinged supporting means for supporting the envelope in a predetermined spaced relation to the poles of the magnet when the keeper means is in contact with the poles of the magnet.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings, in which like reference characters refer to like parts in the several figures.

Drawings

Fig. 1 is a perspective view of my improved demonstrating apparatus, with the cover raised, and the transparent envelope retained in non-operative position by the keeper supporting means, so that when the cover is closed the keeper will be moved into contact with the poles of the magnets.

Fig. 2 is a vertical longitudinal sectional view

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taken approximately on the plane indicated by line 2—2 in Fig. 1, illustrating the cover in closed position with the keeper means in contact with the poles of the magnet and the transparent envelope retained within the cover, in spaced, parallel, non-operative relation to the poles of the magnets.

Fig. 3 is a perspective view of my demonstrating apparatus, with the cover removed, and the transparent envelope in the operative position above the poles of the magnets.

In the drawing the reference numeral 1 denotes a rectangular case or box of wood or other suitable material having front and rear end walls 2 and 3, and opposite side walls 4 and 5, a rectangular cover 6 being provided, hinged to the case 1 at 7, the cover 6 having front and rear end walls 8 and 9, side walls 10 and 11, and a top closure panel 12.

Located within the case 1, downwardly spaced below the top edges of the front and rear end walls 2 and 3 and the side walls 4 and 5, is a horizontally disposed non-metallic magnet supporting panel 13 on which a pair of permanent "horse shoe" magnets 14 and 15 are secured, their respective magnetic poles 14*a* and 15*a* facing each other in relatively spaced relation. One or both of the magnets 14 and 15 may be mounted for individual relative adjustment if desired. The upper side faces of the magnets are preferably disposed to lie in the same horizontal plane, parallel to the supporting panel 13. A collapsible corner brace 16 is provided for supporting the cover 6 in open or raised position as shown in Fig. 1 of the drawings, latch members 17 being fixed on front wall of the base or box 1 for latching engagement with cooperating latch keepers or shoulder projections 17*a*, fixed on the front wall of the cover or lid 6, to hold the cover tightly closed.

A keeper supporting panel 18 is provided, preferably narrower than the distance between the side walls 10 and 11 of the cover, the panel 18 being hinged at one edge to the inner face of the rear wall 9 at spaced points 19, in spaced parallel relation to the under side of the top 12, the panel 18 being thus supported at one edge by the hinges 19, and at the opposite edge by a ledge or strip 20, secured to the under side of the top 12, in spaced parallel relation to the front wall 8. Retainer means is provided for the keeper panel 18, comprising a centrally pivoted bar 21, pivoted at 22 on the ledge member 20, the bar 21, and cover 6 forming means for lifting and retaining the keeper panel 18 within the cover 6, when the cover is

raised, and in operative position when the cover is closed.

Secured to the keeper panel 6, directly above the poles 14a and 15a of the magnets 14 and 15, when the cover is closed, are a pair of spaced parallel rectangular blocks 23 and 24. Superimposed on the blocks 23 and 24 are sponge rubber pads 23a and 24a, upon which are mounted soft iron "keeper" plates 25 and 26 for the respective magnets 14 and 15, providing yieldable supporting means to resiliently urge the keepers into firm contact with the poles of the magnets when the cover 6 is closed, as shown in Fig. 2 of the drawings. Each of the keepers 25, 26 is apertured at longitudinally spaced points to loosely receive a pair of headed retainer screws 27, secured in the blocks 23, 24 with the heads of the screws limiting the outward movement of the keeper plates when the cover 6 is raised as shown in Fig. 1, the screws 27 being positioned to lie between the spaced extremities of the magnets 14 and 15 when the cover 6 is closed.

The space between the keeper panel 18 and the top 12 receives a transparent sealed envelope 29, as best seen in Fig. 2, and described later in detail, the keeper panel 18 constituting means for retaining the envelope 29 within the cover in predetermined spaced relation to the magnets 14—15 when the cover is closed, a spacing strip 30 extending along one side of the cover limits the lateral shifting of the envelope 29, while the ledge strip 20 retains the envelope 29 against relative shifting in the transverse plane.

A pair of supporting strips or ledges 31 and 32 are secured along the opposite side walls 4 and 5 of the base 1, below the upper edges thereof at a distance substantially equal to the thickness of the envelope 29 so that when the envelope 29 is deposited on the ledges 31 and 32 the lower surface of the envelope is in juxtaposed horizontal position above the poles of the magnets, preferably in closely spaced relation to the upper side faces of the magnets, permitting the envelope 29 to be shifted or oscillated on the ledges 31 and 32 without striking or scraping the sides of the magnets.

The transparent envelope, as best seen in Fig. 2, comprises upper and lower panels or plates 33 and 34 of rigid thin non-metallic sheet material, such as glass or "Plexiglas," the sheets being spaced apart in parallel relation at their edges and sealed by an annular strip 35, preferably of the same material. The space 36 between the plates 33 and 34 contains a predetermined quantity of finely divided ferrous particles, as indicated at 37, such as soft iron filings or iron powder, the quantity being sufficient to substantially cover at least a major portion of the inner surface of the lower plate 34 when the powdered material is uniformly spread while the plates are in horizontal position. At least one of the plates is transparent so that the ferrous particles or powder 36 can be observed therethrough, when the envelope is in demonstrating position above the poles 14a and 15a of the magnets.

In demonstrating the existence, position, and direction of the magnetic lines of force in fields of the magnets 14 and 15, the cover 6 is first raised as shown in Fig. 1 to lift the keepers 25 and 26 from the poles 14a and 15a of the magnets 14 and 15. The keeper supporting panel 18 is then reelased and temporarily swings downwardly to release the envelope 29. The envelope 29 is then removed and deposited onto the rails or supports 31 and 32, directly above magnets, with the transparent plate facing upwardly, the keeper supporting panel 18 being again latched in position within the cover 6. The envelope 29 may be manipulated or shaken either before or after placing the same on the rails 31, 32 to spread the iron particles as uniformly as possible over the envelope surface. The iron particles will be "attracted" to form the usual patterns demonstrating the existence of the magnetic lines of force, well known in physics, as illustrated in the well known experiment or demonstration in which iron filings are poured on the surface of a sheet of paper resting on the poles of a magnet and the paper is shaken.

My transparent envelope however, having the loose iron particles sealed therein between the two parallel non-metallic plane surfaces or plates, eliminates any buckling, bending, or snapping of the supporting surface for the fine particles, which usually occurs when a single flexible sheet is employed, and it is not possible to spill or lose any of the ferrous particles, nor can they spill onto the surface of the magnets, making their removal difficult and time consuming. My improved demonstrating device, or kit, can be rapidly set up, the demonstration completed, and the apparatus quickly closed with no danger or spilling or loss of the ferrous material, and no appreciable reduction in the magnetism in the magnets during use or storage can occur, due to the automatically replaceable keepers for the magnets when the cover is closed while the device is not in use.

I claim:

1. In an educational device for demonstrating the position and extent of lines of force of a magnet, a rectangular box-like casing having a hinged cover, a horizontal support within the casing, a magnet mounted horizontally on the support next to the same, a magnet keeper yieldably mounted on the hinged cover in yieldable contacting engagement with the poles of the magnet when the cover is closed on the casing, and movable with the cover to a spaced, out of the way position relative to the poles of the magnet, a substantially rigid thin box-like envelope of non-magnetic material having spaced parallel side walls, at least one of said side walls being transparent, a quantity of finely divided magnetically attractable particles sealed within the box-like envelope, in sufficient quanttiy to at least uniformly cover a major portion of the bottom of the envelope when the lower side wall of the envelope is horizontal, and means on the horizontal support for fixedly supporting the said envelope thereon with the transparent side wall uppermost and the opposite side wall in horizontal juxtaposed relation above the poles of the magnet.

2. In an educational device, a rectangular casing, a rectangular cover hinged thereto, a magnet supporting panel disposed within the casing and spaced below the top edge thereof, a permanent magnet fixed to the supporting panel with its magnetic poles in juxtaposed parallel relation to the panel, a keeper panel hinged within the cover in spaced relation to the magnet supporting panel and the poles of the magnet, a metallic keeper yieldably mounted on keeper panel for yieldable contacting engagement with the poles of the magnet when the cover is closed, a pair of spaced parallel transparent plates including spacing means therebetween extending around the edges to form a sealing enclosure, a quantity of finely divided iron particles loosely

disposed between the transparent plates sufficient to at least partly uniformly cover the surface of one of the side plates when the envelope is horizontal, spaced parallel supporting ledges fixed on the opposite sides of the interior of the casing above the magnet supporting panel to support the transparent envelope within the casing in juxtaposed relation above the magnet and parallel to the said magnet supporting panel.

3. Apparatus as claimed in claim 2 including transparent envelope supporting and retaining means carried by the interior of the cover between the inner surface of the cover and the keeper supporting panel for rigidly supporting the envelope between the interior of the cover and the keeper panel, with the keeper in contacting engagement with the poles of the magnet.

4. In an educational device for demonstrating the existence of a magnetic field of a magnet, the combination of a panel support, a permanent magnet fixed on the panel support with its magnetic poles disposed next to the panel support in parallel relation thereto, metallic keeper means for the magnet, a keeper supporting panel pivotally connected to the panel support to swing toward and away from the poles of the magnet, resilient mounting means on the keeper supporting panel yieldably mounting the keeper in contacting engagement with the poles of the magnet when the keeper panel is swung toward the magnet, and a substantially rigid rectangular envelope comprising a pair of spaced parallel thin flat non-metallic side plates one of which is transparent, sealing and spacing means extending between and around the edges of the flat plates to close and seal the space between the adjacent side plates, an appreciable quantity of finely divided iron particles loosely deposited within the closed space between the side plate, and means for supporting the envelope rigidly relative to the panel support for the magnet with one of the flat plates of the envelope in closely spaced adjacent relation to the poles of the magnet and in a horizontal position, whereby the pattern formed by the iron particles between the poles of the magnet can be observed from above, through the transparent side plate, and means for supporting the transparent envelope in a predetermined non-operative position spaced from the poles of the magnet and parallel to the keeper supporting panel, when the magnet keepers means is in contact with the poles of the magnet.

JAMES W. IRBY.

REFERENCES CITED

The following references are of record in the file of this patent:

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