

Dec. 7, 1971

S. F. W. CHANTRY
REVERSIBLE SIGN ELEMENT

3,624,941

Filed Dec. 29, 1969

2 Sheets-Sheet 1

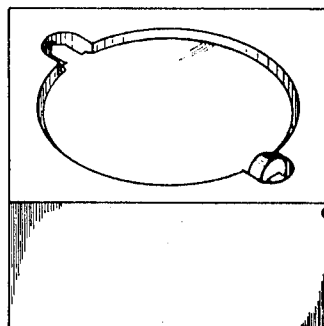


FIG. 2

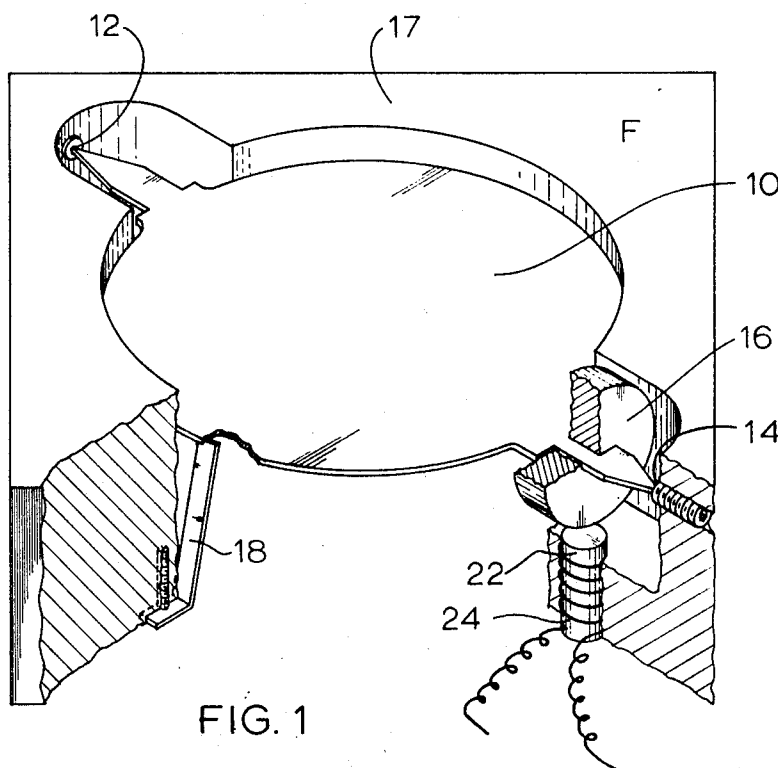


FIG. 1

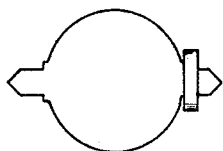


FIG. 3

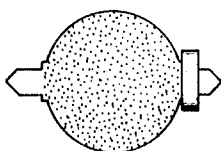


FIG. 4

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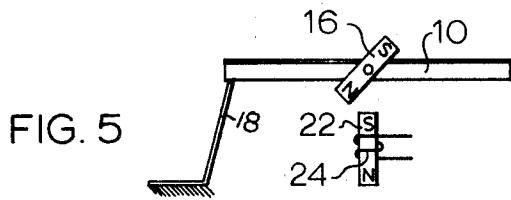
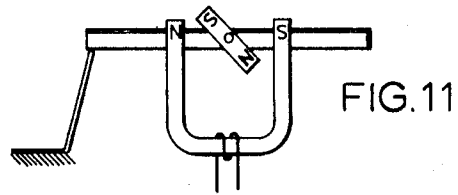
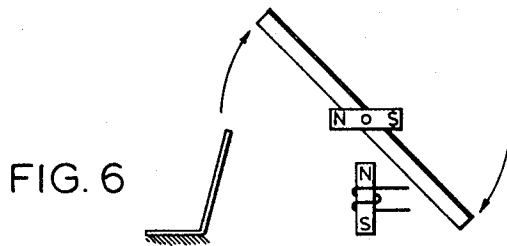
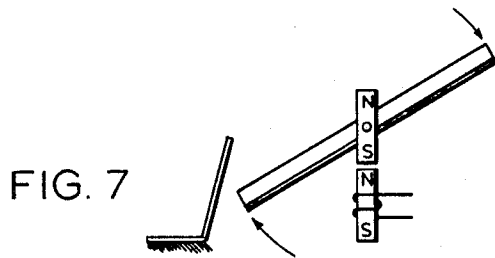
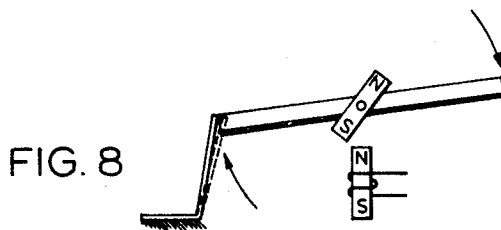
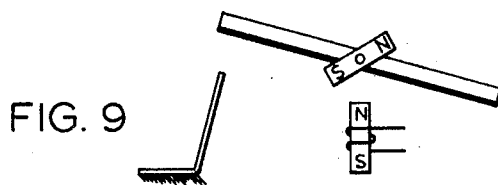
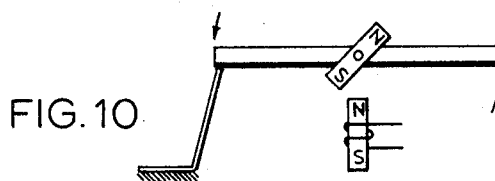
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2 Sheets-Sheet 2



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1

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REVERSIBLE SIGN ELEMENT

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6 Claims

ABSTRACT OF THE DISCLOSURE

With a magnetically actuatable reversible sign element a stationary ratchet element limits rotation in one direction and holds the element at a point where it may always be rotated by reversing an exterior magnetic field.

This invention relates to a display element of the type which is pivotally mounted and has on opposite sides visually contrasting surfaces and carrying rotatable with the element, a magnet; and where, by applying an external field in one sense, one of these surfaces may be displayed in the viewing direction and by applying the external field in the opposite sense, the other face may be displayed in the viewing direction.

A variety of display elements of this type have been developed and these elements are used frequently in large numbers as part of a display wherein selective energizing of the elements causes the contrast of the elements to portray designs, letters, numbers or other information.

Previously, one problem with signs of this type has been to obtain sufficient starting torque if the exterior field and the rotatable element magnet were allowed to align or to nearly align in each of the two alternative positions, since with complete alignment of the element field and the external field, the starting torque would be zero when the external field is reversed, to move the element to the opposite position.

It is also noted that where design modifications were provided to improve the starting torque these either introduced more complicated electromagnetic arrangements, as in applicant's co-pending application (566,115 filed July 18, 1966, for Magnetically Actuated Visual Device) or complex mechanical design to provide non-alignment of fields at limiting element positions. These expedients were expensive, and starting torque for the reversal of the display element was frequently obtained at the expense of partial mis-alignment of the display face with the viewing direction.

It is an object of this invention to provide an arrangement for display elements of this type wherein the element starting from either display orientation will start with a high starting torque on reversal of the exterior field but where the element surfaces may fully face the viewing direction in either orientation and without complex electromagnetic arrangements.

In accord with the invention therefore, the element with its opposed visually contrasting surfaces is pivotally mounted on a support and a ratchet type of stop means is provided which allows the element to rotate freely in one direction but stops its rotation in the other direction at the first encountered of either one of the orientations corresponding to the display of a surface in the viewing direction.

A magnet is located on the rotatable element for rotation therewith to cause rotation of the element due to the influence of an exterior magnetic field on the element magnet. The orientation of the magnet relative to the rotatable element is related to the orientation of the exterior field relative to the viewing direction so that for either sense of the exterior reversible field, the element can be biased by this field against the stop provided by

2

the ratchet means. It is important to the operation of the device that when biased against the stop the amount of misalignment of the fields (which creates the biasing) is less than 90° from the orientation where the element magnet and the exterior field are aligned in the same sense. In such position one of the faces will be displayed in the viewing direction and the element will remain in this position under the influence of the exterior field as long as it is applied. When it is desired to reverse the orientation of the element to display the other face thereof the exterior field is reversed which causes the element under the control of its magnet to move away from the stop in the direction where rotation is freely allowed. The force of the field applied is such that the element rotates somewhat less than 180° to a position where the fields are aligned in an additive sense but, due to its own inertia, continues to rotate past its other ratchet stop orientation from that originally limiting rotation by the element. The element then having passed its dead centre position where the magnet and the exterior field were aligned, attempts to return to such dead centre position but is stopped by the ratchet mechanism so that the opposite surface is displayed in the viewing direction with the element magnetically biased against the ratchet stop. It will be noted that the arrangement shown implies that the fields are misaligned at the time a field is reversed. This misalignment may be selected to produce the best starting torque and it is believed that a misalignment of 45° from the position where the two fields are aligned in the same sense gives the best torque on reversal of the fields.

It will be noted that the exterior field may be reversed and the rotation obtained as many times as desired, each time displaying the previously hidden face in the viewing direction.

In drawings which illustrate a preferred embodiment of the invention:

FIG. 1 shows a display element in partially broken view in accord with the invention;

FIG. 2 shows a perspective of the exterior appearance of an inventive display element;

FIGS. 3 and 4 show the contrasting surfaces of a display element;

FIGS. 5-10 demonstrate the operation of the element in reversing its position; and

FIG. 11 shows alternative magnetic control of the element.

In FIGS. 5-11 the polar axis of the magnet 16 rather than its actual shape is shown.

FIG. 1 shows an element 10 of circular arrangement pivotally mounted along its diameters at 12 and 14, on a support 16. In opposed orientations (180° apart) the element will display a white and a black surface as indicated, respectively, in FIGS. 3 and 4. The details of the pivotal mounting are not discussed, since many alternatives will be available to those skilled in the art. However simple bearings have been found adequate although jewelled and more complex bearings can be used if desired. Mounted on the support is a deflectible resilient clip 18, sloping upwardly into the path of the edge of disc 10 to act as a stop to rotation of the edge of the element in one direction (counterclockwise looking left in FIG. 1) but designed to be deflected by the disc edge on the rotation of the element in the other direction to allow free rotation of such element in such other direction. If desired the cooperating stop member on the disc may not be the disc edge itself but if desired, may be an extra tab to avoid wear on the display surface of the disc. It will thus be seen that the disc if rotating counter clockwise, looking left in the drawings, will be stopped at either of two positions and that these correspond to the display of opposed surfaces in the viewing direction which is perpendicular to the face F of support 16. Mounted on the pivot axis

3

of the disc is a magnet 16 oriented to define the polar axis transverse to the pivot axis and in the view shown, at 45° to both the plane of the disc and to its perpendicular.

A reversible field, exterior to the element is provided for control of the element orientation. This must be oriented so that when biasing the disc 10, counter clockwise left against the clip 18, the field of magnet 16 is less than 90° out of alignment (in the same sense) with the exterior field. In the preferred embodiment, the exterior field is provided by the adjacent pole of the electromagnet core 22 which is made of reversible permanently magnetizable material and set or switched in polarity by pulses through coil 24 surrounding the core 22 and energized from a source, not shown.

The core 22, in either polarity, defines a polar axis perpendicular to the plane of the disc 10 when retained against counter clockwise rotation by the stop 18 and parallel to the viewing direction and hence at 45° to the polar axis of the rotatably mounted magnet when the disc 10 is so retained by the stop 18.

With the polarities as shown in FIG. 5 it will be seen that the element is in a stable orientation with the exterior field causing the rotatable element magnet to attempt to align therewith which is prevented by the stop 18 bearing on the edge of disc 10. It will be noted that, with the disc orientation and the field polarities as shown in FIG. 5, the element and exterior field are misaligned from alignment in the same sense by less than 90°, the preferred misalignment being 45° as shown. Thus in FIG. 5 one surface (say black) of the display element is displayed in the viewing direction. When it is desired to reverse the disc to display the other surface the exterior magnet will be pulsed to reverse its polarity placing a north pole next to the rotating element. Repulsion of the adjacent north pole of the element magnet 16 with the magnetic polar axes at 45° to each other creates a large starting torque causing the rotatable element and magnet to swing in a clockwise direction and this will continue until the element and exterior fields are aligned as shown with the south pole of the rotatable magnet at its nearest point to the north pole of the exterior magnet. However the element and magnet are travelling at, approximately their maximum velocity at this point and the element passes this position. Moreover, by simple experiment and calculation the initial starting torque and the torque in bringing the element to this point may be made sufficient that the rotating element overshoots this position to a position past the point at which the opposite side of the disc 10 has passed the stop 18. At this point under the retarding counter clockwise torque exerted by the exterior field on magnet 16 over the arc travelled between FIGS. 7 and 9 the rotating element will have stopped sufficiently to have stopped the rotation of the rotatable member and due to the continuing counter clockwise torque the disc 10 is brought back against the stop 18 where it is maintained until the field is again reversed and the process is repeated. The misalignment of 45° between the magnet 16 and exterior fields (in the same sense) is preferred for approximate maximum starting torque. However the misalignment angle may be anywhere between (a) sufficiently greater than 0° for satisfactory starting torque and (b) sufficiently less than 90° that the "overshoot" taking the rotating element past stop 16 (FIGS. 8, 9 and 10) may be easily obtained.

The embodiment of FIGS. 1-10 shows the use of a single pole for orientation.

Double poles may be used on each side of a magnet such as 16 and as schematically illustrated in FIG. 11 where it is seen that the double poles define an exterior field at 90° to the viewing direction instead of parallel thereto and assuming the ratchet mechanism embodied by stop 18 to be the same, the rotatable magnet is at 90° to its position in the first embodiment to achieve the same (>0°, <90° and preferably 45°) misalignment.

4

It is also noted that in both embodiments shown, the ratchet principle is embodied by two stops on the rotatable member (the edges of disc 10), either one cooperating with the stop on the support.

It will be noted, that the invention includes the obvious alternative wherein the ratchet principle is embodied in a single stop provided on the rotatable member, and cooperating at 180° separate locations with diametrically opposed stops mounted on the support.

I claim:

1. An electromagnetically operable sign element including:

a pivotally mounted element mounted on a support therefor having two opposed display surfaces for alternative display in a viewing direction;

a magnet mounted for rotation with said element and having a magnetic polar axis having a component transverse to the pivotal mounting axis;

cooperating members on said element and said support allowing rotation of said element relative to said support in one direction and, on the occurrence of rotation in the other direction providing stops for such rotation at either of two predetermined orientations relative to said support;

said two predetermined orientations corresponding respectively to the display of said two display surfaces in the viewing directions;

means, exterior to said element, for producing a selectively reversible magnetic field, designed to encompass said rotatably mounted magnet;

said reversible field being oriented relative to the disposition of said magnetic member so that, for a given sense of said reversible field, with said element in either orientation, the polar axes defined by said rotatable element magnet and said exterior field are misaligned by less than 90° from alignment in the same sense;

whereby with said element in said rest position, reversal of said reversible field may be made to cause said element to rotate in the direction allowed by said cooperating members, to a position 180° removed from the start position.

2. An electromagnetically operable sign element, including:

a pivotally mounted element mounted on a support therefor, having two opposed display surfaces for alternative display in a viewing direction;

a magnet mounted for rotation with said element and having a magnetic polar axis with a component transverse to the pivotal mounting axis;

a latching element, mounted on said support, designed to be contacted by said pivotally mounted element at two orientations of said element which are substantially 180° from each other, measured rotationally about the pivot axis;

said latching element being designed and arranged on rotation of said element in one direction, to be deflected by said element, and without substantially impeding said element movement at either of said locations, and designed and arranged on rotation of said element in the other direction, to stop on rotation of said element at the first encountered of said locations;

wherein the orientation of said reversible field polar axis relative to the orientation of said rotatable magnet polar axis is less than 90° away from alignment in the same sense.

3. An electromagnetically operable sign element, including:

a pivotally mounted element mounted on a support therefor, having two opposed display surfaces for selective display in a viewing direction;

a magnet mounted for rotation with said element and having a magnetic polar axis with a component

5

transverse to the pivotal mounting axis for said element;
 cooperating members on said element and said support for allowing rotation of said element relative to said support in one direction and stopping rotation at either of two predetermined orientations relative to said support in the other direction;
 said two predetermined orientations each respectively corresponding to the display of one of said two display surfaces in the viewing direction;
 means for providing a reversible electromagnetic field external to said element;
 the transverse direction of said rotatable element polar axis relative to the attitude of said display surfaces being such that;
 with an element in either one of the positions where it would be held against rotation by the cooperating members, that a selection of one sense of said reversible field will tend to rotate said element in said other direction although prevented by said cooperating members whereby said element will be stably held in said position and the selection of the other sense of said reversible field will tend to rotate said element in said one direction, away from said latching element, and
 the transverse direction of said rotatable element polar axis relative to the attitude of said display surfaces being such that when said element is so stably held, the polar axes of said element magnet and of said reversible field are disaligned by less than 90° from the orientation where said axes are aligned in the same sense.

4. An electromagnetically operable sign element including:
 a display element, pivotally mounted, mounted on a support therefor having two opposed display surfaces for selective alternative display in a viewing direction, depending on the orientation of said display element about said pivotal axis;
 a mechanical connection of the ratchet type between such support and said element, designed to allow rotation of said element relative to said support in one direction, but at two substantially diametrically opposed positions of said element, to prevent rotation of said element in the opposite direction;
 said two positions corresponding respectively to the display of the two display surfaces in the viewing direction;
 a magnet mounted on said element defining a polar axis transverse to said pivotal axis;
 means for applying a selectively reversible electromagnetic field external to said element, said selectively reversible field orientation being chosen so that when said element is magnetically biased to be stationary in either of said positions, the polar axes of said element magnet and of said reversible field are disaligned by less than 90° from the orientation where said axes are aligned in the same sense.

5. A method of operating and controlling an electromagnetically operable sign element of the type including a rotatably mounted visual element designed to display surfaces of contrasting visual appearance in a viewing

6

direction, at two orientations about said pivotal axis approximately 180° separated from one another;
 and having mounted thereon for rotation therewith, a magnet defining a magnetic field with an axis transverse to the axis of rotation,
 causing said rotatable element to retain an orientation with one of said surfaces displayed in the viewing direction, by applying an external magnetic field tending, through said rotatable magnet, to rotate said element in one direction, while preventing movement of said element in said one direction at one of said two orientations, where said external field is applied in a direction that at said orientation said reversible and magnet fields are less than 90° out of alignment in the same sense;
 at a later time, reversing said magnetic field, and applying said reversed field with sufficient force that said element is rotated oppositely to said one direction to just past said other orientation and preventing the return of said element in said one direction.

6. A method of operating and controlling an electromagnetically sign element of the type including a rotatably mounted visual element designed to display surfaces of contrasting visual appearance in a viewing direction in two orientations about said pivotal axis where said orientations are approximately 180° separated from one another, means cooperating between the sign element and its support, allowing rotation of said element relative to said support in one direction but preventing rotation of said element relative to said support in the other direction, at either of said two orientations;
 said element having mounted thereon for rotation therewith, a magnet defining a magnetic field with an axis transverse to the element axis of rotation;
 causing said rotatable element to maintain one of said two orientations by applying an external magnetic field affecting said element mounted magnet to bias said element in the direction where rotation is prevented, the orientation of said external field being selected relative thereto so that at said orientation said magnet field and said external fields are less than 90° out of alignment in the same sense;
 at a later time reversing said magnetic field and applying said reverse field with sufficient force that said element is rotated in the direction wherein rotation is allowed, past the second of said orientations and is then subject with said reversed field affecting said element to bias said element against the stop.

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U.S. Cl. X.R.

40—28 C