(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 556 954 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93300420.2**

(51) Int. Cl.[5]: **G09F 9/37**, G09F 9/30

(22) Date of filing: **21.01.93**

(30) Priority: **18.02.92 US 837474**

(43) Date of publication of application:
25.08.93 Bulletin 93/34

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **DAYCO PRODUCTS CANADA INC.**
46 Norelco Drive, Weston Road
Ontario M9L 1S3(CA)

(72) Inventor: **Browne, John**
1573 Princeton Crescent
Oakville, Ontario L6H 4H7(CA)

(74) Representative: **Cowan, David Robert**
E.N. Lewis & Taylor, 5 The Ouadrant
Coventry CV1 2EL (GB)

(54) Display device.

(57) Diametrically pivotal disk (16) is electromagnetically driven to display bright (ON) or dark (OFF) sides and has an optic fibre (122) rearward of the disk. The disk is provided with a cut out (110) to allow emission from the fibre in the ON position of the disk and the disk is shaped to prevent emission of light from the fibre in the OFF position of the disk.

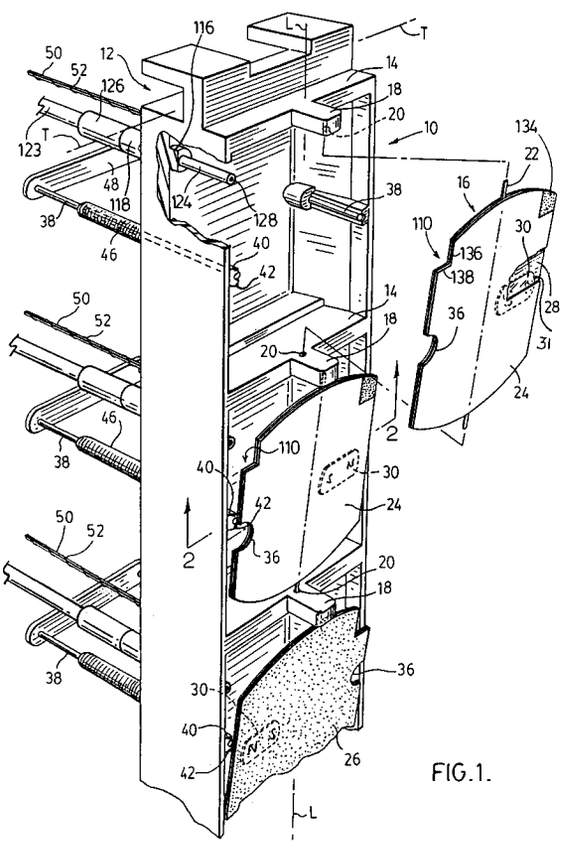


FIG.1.

EP 0 556 954 A1

This invention relates to a display or indicating device using a disk having contrasting opposite sides for selective display, in a viewing direction for use in displays or indicators, and utilizing at least one optic fibre end which is displayed to the viewing location in one disk orientation, which, in most embodiments corresponds to the display in the viewing direction of the lighter side of the disk. The viewing direction coincides with intended viewing locations. In one alternative of the present invention the disk is designed to obscure a single fibre end in the other position of the disk. In another alternative of the invention there are two fibre bundle ends and one will be displayed and one obscured in each position of the disk. In the latter alternative the color of the light emitted by each fibre end will be chosen having regard to the color of the side of the disk simultaneously displayed.

The term 'disk' herein defines a relatively flat body defining a median plane. It need not be circular. In preferred aspects herein the disk is elongated with parallel sides and preferably rounded ends.

By the term 'optic' fibre herein is included a single large fibre or a bundle of fibres arranged: at one end to receive light from a source, to conduct light to the vicinity of the disk described herein. In this application there is no discussion of the disk-remote end of the fibre or the source of illumination, both of which may be conventional.

'Forward' herein is from the device toward the intended viewing location and 'rearward' is in the opposite direction.

The type of display device with which the invention is concerned provides a disk or pattern area from an array of disks for viewing from a viewing location which is at the centre of possible viewing positions whose locus is a cone with its apex at the disk or pattern area. The cone need not be a surface of revolution although it usually will be. The subject display or indicating device will be adapted to rotate about 180° between limiting positions to display a contrasting pattern areas to the viewing location in two limiting positions of disk rotation. In the main embodiment the disk will display a light side in an ON limiting position and a dark side in an OFF limiting position and in the ON position the light side will be visible due to reflected ambient light. In addition in the ON position the disk or pattern area will be adapted to allow the light from an or optic fibre to supplement the reflected ambient light.

Such a device is disclosed in European Patent Application 86,401,583.9 filed July 16, 1986, Publication number 0,210.913. (application '913 hereafter). In application '913 a electromagnetically driven disk rotates on its diameter to display a brighter or a darker side. An optic fibre end is placed behind the disk which is apertured so that in its 'ON' attitude the light from the fibre shines through the disk to augment the effect of the reflected ambient light; while in the 'OFF' attitude of the disk the disk or an appendage thereof masks the fibre to viewers. A disadvantage of the apertured disk was that, if near 180° rotation was used, the fibre must be at least the radius of the disk rearward of it, meaning that the cone of light from the disk was very small or the aperture must be too large reducing the disk's ambient light reflectant area. If substantially less than 180° rotation was used special appendages to the disk had to be provided to mask the fibre to the viewer in the OFF position.

U.S. Patent 5,055,832 (Patent '832 hereafter) dated October 8, 1991, and commonly owned with this application overcomes the specified disadvantages of application '913 by providing a contrastingly colored disk rotatable through approximately 180° and provided with a radially inwardly directed notch extending in from a peripheral edge to a location near to but on one side of the disk axis. When the lighter side of the disk was displayed the fibre shone through the inner end of the notch to attract the viewer's attention. When the darker side of the disk was displayed, the fibre end was obscured by an area of the disk. The described arrangement of the notch could be used because the permanent magnet, rotatable with the disk, and driven to cause such rotation, was located at one axial end of the disk, so that the drive core did not tend to interfere with disk rotation nor did automatic winding techniques used for winding the energizing coil for the drive coil, tend to interfere with the fibre or its mount, thus allowing the use of the centrally directed notch.

However other disks are driven by a pair of cores having ends displaced transversely relative to the pivotal axis and acting on a magnet within the plan view area of the disk itself to rotate the disk through approximately 180°. The construction required that the one edge of the disk, approximately midway axially therealong, to rotate past the core and core mounts between limiting positions. An Example of this is shown in U.S. Patent 4,577,427 dated March 25, 1986 (Patent '427 hereafter) and commonly owned with the present application. The contents of this patent will be referred to herein but is incorporated herein by reference. Since one edge of a disk driven by two cores had to be notched to allow the disk to rotate past the cores and core mounts, and since the automatic winding techniques were desireable for the cores, a spacing was required between the core and the optic fibre. Thus the nearly centrally directed notch could not be used.

By 'axial end' of the disk it is assumed that the disk dimensions may be referred to as 'axial, width and thickness' instead of the usual 'length, width and thickness' and 'axial' means, measured parallel to the disk pivotal axis.

This invention therefore provides a disk rotatable about 180° between two limiting position wherein it displays, respectively, its contrasting sides to a viewing location. An optic fibre is located to be near the outside edge of the disk and rearward thereof in one of the disk's limiting positions and, near such edge, at one axial end of the disk. The disk is shaped to obscure such fibre end (to the viewing location) in one (usually the OFF) position of the disk. On the opposite side of the disk axis at a location being the mirror image, across the disk axis, of the disk area which obscures the fibre end, is a cut out forming a continuation of the edge of the disk what allows the disk, rotating in either direction between limiting positions to pass the fibre and its mount or support. Since the cores are no closer than midway along the axis of the disk and the fibre is at one end, there is sufficient spacing for automatic winding of the cores.

The 'corner' location of the cut out at one axial end of the disk and at maximum spacing from the axis has advantages beyond good spacing from the core.

The notch for passing the fibre mount is to be made as small and preferably as far from the center as possible since it derogates from the display area and hence the appearance of the disk. For minimum notch area the notch is preferably defined by one edge parallel to the rotational axis. The other edge is preferably about 90° thereto. If the pivotal axis of the disk is at an angle to the perpendicular to the fibre optic axis the transverse edge will or may be angled to be slightly above or below 90°.

Preferably for a number of applications, such as bus signs the disk is made longer in the axial than in the radial direction as best shown in patent '427.

When the non-notched edge of the disk is covering the fibre end the lighter side of the disk faces the fibre end. Reflection of the light of the fibre, back from the disk may with some disk backgrounds create random light reflections for the viewer and derogate from the appearance of the indicator or display. The area on the lighter disk side, which receives the disk radiation is therefore sometimes darkened to absorb the light and absorb such random reflections. This is a reduction of the area of the bright side of the disk which may be tolerated in some applications.

The permanent magnet is preferably mounted, within the periphery of the disk in plan view. The magnet is preferably mounted so that in each limiting position one pole of the magnet rests close to one of the drive cores. Although the magnetic force, between the permanent magnet and the drive core will, at adequate spacing, vary inversely as the square of the distance between them, there is a lower limit to the proximity to which the magnets may be brought. This is because, with the cores used (although they are of relatively high remanence) the permanent disk magnet, at a certain proximity, will overcome the core magnetism and latch to the core. Thus the spacing at a limiting position must be sufficient to avoid this. (For the wide variations of core materials and consequent remanent magnetism, and the wide variety of permanent magnets and spacing this distance must be empirically determined). For tolerance control purposes the spacing once determined should therefore be maintained by a projection of the core mount (not the core itself to avoid bringing disk layer thickness into the calculation). For tolerance control purposes, the fibre end should not be used as a stop. Hence a means must be provided for locating the fibre end rearward of the disk in that limiting position where the disk area obscures the fibre.

In drawings which illustrate a preferred embodiment of the invention.

Figure 1 is a perspective view from the front of display or indicator elements in accord with the invention.

Figure 2 is an end, partially sectional, view of an element of Figure 1.

Figure 3 is a rear perspective view of a strip of display or indicating elements as shown in Figure 1.

Figure 4 is a partial side view of the elements of Figure 1 with some components missing.

Figure 5 is a partial end view showing the relation of the magnetic members.

Figure 6 is a sectional side view showing the relative location of the fibre end to the other components.

Figure 7 demonstrates the insertion of a fibre bundle in its mount.

Figure 8 demonstrates the geometry of the cutout.

Figure 9 shows a perspective view from the front of elements each with two fibres.

Figure 10 and 11 show schematically the disk of Figure 9 in respectively contrasting orientations.

Figure 1 shows the frame 10 running longitudinally along direction L and such frame at each end, in the preferred embodiment, is provided with means defining mounting grooves 12 which allow a plurality of frames 10 to be mounted side by side on transverse coupling members received in grooves 12, to form an array. The transverse direction is indicated by lines T - T. An analogous

method of mounting longitudinally extending display frames is shown in U.S. Pat. No. 3,942,274 dated Mar. 9, 1976 to Winrow although, in that patent, the transverse grooves are forwardly directed.

It will be understood that the letters L, T, define a display plane in such a device and that the perpendicular P to such plane (Fig. 6) is directed toward the viewing location and is the reverse of the intended viewing direction. When speaking of intended viewing directions and locations it must be realized that these are in the centre of a cone of viewing positions which will vary in various applications where within such cone the display or indicator is clearly displayed.

It will also be noted that in the preferred (but not all) applications, the disks are at an angle A to the intended viewing direction so that their pivot axes may overlap. This angle would normally be between 3° and 10° but will be selected to be small enough so that the disk faces may be seen from the intended viewing location. For example if the elements were on a sign over a freeway, the intended viewing direction for a car driver might be at 5° above the horizontal. Thus the direction P and the direction of the optic fibres would be at a descending angle of 5° to catch the eye of the motorist while the angle A° would be (say) 3° below this.

In the drawings, the frame 10 defines transverse walls 14 at each end and located between adjacent ones of the longitudinally disposed disks 16. Each transverse wall 14 is provided with a forwardly directed mounting projection 18. Adjacent mounting projections 18 are provided with facing wells 20 to receive the disk 16 spindles 22. As best shown in Fig. 4 the facing wells 20 of adjacent projections 20 are displaced in the forward direction to tilt the disk pivot axis to the vertical a sufficient degree so that the wells 20 on opposite sides of a projection 18 overlap in a vertical direction (that is are laterally displaced from each other relative to the row direction). The wells, as previously explained will normally be displaced to produce an angle A of the spindle axes to the vertical of about 3°.

In the preferred form of the invention the disk is of the type disclosed in U.S. Pat. Nos. 3,871,945 ('945 hereafter) dated Mar. 18, 1975 and (its divisional) 3,953,274 ('3274 hereafter) dated April 27, 1976, both commonly owned with this application and both naming as inventors Winrow et al. The disk is thus made of 3 layers laminated together, the middle layer is apertured in the shape of and to receive a magnet of approximately the thickness of such middle layers. It will be obvious that this method of construction allows the preferred assymetric disposition of the magnet to the extent desired without inconvenience since the middle layer is merely punched at the selected location and the magnet inserted during the construction of the disk. In the patented construction, moreover, the middle layer is shaped to provide projecting spindles which form the mounting spindles of the disk. (It should be noted that each of the outer layers may have sub-layers. The outer layer corresponding to the dark side is usually dark tape thereover to produce the dark outer surface on the ultimate disk. The opposite side of the disk will customarily have a sub-layer of vinyl colored to the bright color required and sub-layer being an outer transparent protective casing. In general however the disk is assembled as a three layer lamination, the myler-dark covered sub-layers being applied as a single layer to one side of the central layer and the vinyl-protective covering sub-layers being applied as a single layer to the other side of the central layer.

Although the inventive aspects defined herein are suited to the previously patented laminar disk, it must be emphasized that in the broad aspects of the invention, including the aspect of tilting the disk axes relative to the row axes and the aspect of stopping the disk with a contact inward of the disk edge are not limited to use of the patented disk.

The disk 14, preferably constructed as defined in U.S. Patents '945 and '3274 comprises a lamination of three layers. Each of the two layers 24 and 26 may be made from two sub-layers. The light side layer 24 is usually an inner sub-layer of vinyl colored for the light color designed with an outer transparent protective sub-layer. The dark side layer 26 is usually a single layer of tape to provide the dark color. The middle layer 28 is preferably of mylar to correspond to that of the magnet 30. The mylar layer has sufficient strength that it supports the extending stub shafts 22 which are formed as an integral part of the middle layer. The stub shafts 22 may be inserted in wells 20 by slightly bending the resilient (due to the resiliency of the mylar) disk to achieve insertion.

As best shown in FIG. 1 the middle layer 28 is provided with a slot shaped to receive the permanent magnet 30 which is preferably made of the copper-nickel-iron alloy cunife magnetized to provide a magnetic axis in the median plane of the disk transverse to the pivot axis defined by spindles 20. The poles 'N' and 'S' of the permanent magnet are indicated in the drawings.

The recess in the middle layer 28 of the disk and the magnet therein are preferably located so that it is transverse to the pivotal axis and displaced to be all on one side of the pivotal axis at about the midway point between the stubs 22. On the edge opposite the outer (here 'N' pole of the magnet) is provided a notch 36 for a purpose to be

hereafter discussed.

The disk is preferably made longer than it is wide to take advantage of the fact that in many applications, such as bus signs, there is more available space in the vertical than in the horizontal dimension so that the height of the disks is increased to give greater visibility.

The shape of the disk is a compromise. An oval disk terminating in semicircles at each end would give a better visual impression than a rectangle for disks collectively defining a diagonal. However, the oval disk does not use as much of the available display area as desired. Therefore, the compromise shape with curved end and corners as shown is used.

As noted the use of overlapping wells and angled spindles allows more complete use of the available display space in a row by allowing the disks to be placed more closely together.

Actuation for the disk to turn it to one or the other orientation is provided by a reversible magnetic field forming means, exterior to the disk and acting on the permanent magnet 30. The exterior field forming means in the preferred embodiment is provided by a pair of core members 38 of high carbon, steel, having a relatively high remanence. The core members 38 are fixed in position on each side of the frame and extend through bores therein to project rearwardly of the frame, as shown and forwardly to the vicinity of the disk (and magnet) locus when the disk is displaying one or the other of its contrasting sides in the viewing direction. The molded plastic frame provides on each side inwardly facing abutments 40 each of which partially surrounds a core 38 adjacent the core forward end. As shown in FIG. 2 the forward end of each abutment 40 has a forwardly and inwardly sloping surface which is located forward of the forward end of core member 38 and provides a pair of stops or knuckles 42 shaped to contact the disk 16 inwardly of its edge. The disk contacting surface of the knuckles or stops 42 is as small as possible in humid conditions surface tension will fold the dot in place if the contact area is too large.

The contact is made inwardly of the disk 16 edge because the construction of the disk sometimes leaves a small (not visible) accretion of adhesive or tacky material at the edge. The inwardly displaced contact does not contact such material and the risk of the disk sticking is therefore reduced.

A knuckle 42 stops the disk at a limiting position which is a location spaced from the core 38 end because it is preferred to use high carbon steel for the pole pieces. This material, although of relatively high remanence is of lower remanence than some core materials (such as vicalloy) previously used in controlling display disks. With the high carbon steel cores 38, therefore, care must be taken that the spacing between the ends of cores 38 and the permanent magnet 30 of the disk is such that the permanent magnet cannot alter the magnetic polarization of the core 38 and to cause latching of the disk. Accordingly, knuckles 42 are shaped to achieve the desired spacing which will be determined in accord with the cores 38 and magnet 30 used.

The disk opposite magnet 30 is provided with the notch 36 shaped to clear core 38 and abutment 40 during rotation of the disk.

It should be noted that, although the spacing of the core end from the magnet in stopped position is important, this is customarily achieved by measures exterior to the disk. Preferably during assembly the frame 10 is maintained in a clamp while tooling associated with the clamp inserts the cores to a stop intrinsic to the tooling and clamp. The core 38 is then held in place by friction.

In accord with the novel features introduced by this invention the optic fibre arrangement in the device will now be discussed. With the exception of the core notch 36 and the fibre cut-out 110 the disk is preferably symmetrical about the pivotal axis.

The cut-out 110 is located on the same edge as notch 36 and as far as possible from the core notch 36 and is thus located at one axial end of the disk. Thus if the disk were square or rectangular, both of which are within the scope of the invention the cut-out 110 would be located in a corner of the disk and the position shown is analogous to the corner given the disks rounded ends.

A bore 114 in the rear wall of casing 10 is continued on each side of the rear wall in a forward boss 116 and a rearward boss 118. Since the direction of the optic fibre is quite important, the bore 114 is a close fit for the fibre ferrule. The optic fibre 122 (which is itself a large bundle of tiny fibres) or may be a single large fibre particularly if of plastic with suitable optic qualities is covered by a plastic protective sheath 123 and extends from a light source, not shown, to a metal ferrule which encloses the bundle leaving its radiation output end 128 open. The ferrule comprises a wider rearward cylinder 126 and a narrower forward cylinder 124, defining between them the forwardly facing shoulder 130. The thinner cylinder 124 makes a friction fit with the walls of the bore 114 and the outer wall 132 of the rear boss acts as a stop for shoulder 130 to determine the location of the output fibre end 128. The location of fibre end 128 is not particularly critical but (to avoid acting as a stop for the disk) it must be rearward of the area 134 (which is a mirror image of the cut-out 110 across the pivotal axis) when area 134 blocks the light from the fibre end 128 in the OFF limiting position.

Fibre end 128 must be then rearward of the disk because disk magnet 30 to core 38 spacing is critical and this is determined by stops 42 acting on the disk surface.

The cut-out 110 is dimensioned to allow the light from the fibre end to reach the viewing location in the ON limiting position of the disk. The notch area is kept to a minimum because it detracts from the appearance of the dot in the ON position. Thus in the preferred shape of the cut-out the edge 136 is parallel to the pivotal axis and the edge 138 is approximately perpendicular thereto. If the display element were to have the pivotal axis perpendicular to the viewing direction a true perpendicular edge 138 would be used with the location of edge 138 (as in the preferred embodiment) chosen to clear the fibre optic and its support when travelling between limiting positions, and in the ON position to allow passage of the radiation from the optic fibre end in the desired cone about the viewing direction. (In most cases the specified cone for the optic fibre used has a 15° included angle, that is a surface of revolution 7 1/2° from the intended viewing axis).

Where, as here, the pivotal axis of the disk slopes at 3°-10° to the plane L-T of the array, the edge 138 for a cut-out in the top corner must slope at a little greater than 90° (see Figure 8) to edge 136 to clear the fibre bundle and mount, and if a lower corner fibre and cut-out were provided than the edge 138 could be slightly less than 90° to edge 136 and still clear the fibre end mount and allow passage of the radiation cone from the fibre.

The mirror image area 134 of the disk blocks the light from the fibre from the viewer in the OFF position of the disk. It is found that with certain finishes for the inside of frame 10 a certain amount of light from the fibre is sometimes reflected from the lighter side of the disk and then randomly reflected about the disk-wall in casing 10 so that some of this radiation reaches the viewer with a consequent derogation in the sign appearance. Accordingly the area 134 on the lighter side of the disk, is preferably provided with a blackened absorbing coating to greatly reduce reflection. For this purpose the further derogation from the disk appearance in ON position because of the blackened area is accepted. For specific purposes the blackened area may be larger or smaller than cut-out 110.

Cores 38 project rearwardly of the frame and mount energizing windings 46 which magnetize the cores in the desired polarity. The bridging member 48 of iron having soft magnetic qualities is attached to the cores 38 rearwardly of windings 46 to complete the magnetic circuit between the cores 38. Terminal posts 50 are mounted to project rearwardly from the frame corresponding to each core 38 and designed at their rearward end for connection to an electrical circuit, not shown. The leads 52 to the windings 46 are preferably soldered to terminal posts 50 at the latter's rearward end. The windings 46 are connected in series so that energization to the paired terminal posts will magnetize the paired cores 38 so that one core forward end is north and the other south. These polarities are simultaneously reversed to rotate the disk.

The windings 46, and cores 38 are preferably wound by automatic machinery requiring a minimum radius about each core for the winding head. It is such radius that requires that the boss 118 for the fibre be as far as possible from the nearest core, in this case in the 'corner' of the disk for a central core notch. This is also the reason why the cut-out 110 for the fibre cannot, in any preferred arrangement, be combined with the core notch. The extended bosses 118 and 116 for the fibre ferrule are, in turn required to provide a degree of accuracy to the radiation from the optic fibre.

In other constructions than the 'sandwich dot' of U.S. patents '945 and '3274 the core could be at one axial end of the disk and the fibre and fibre notch could be at the other axial end of the disk. However with the sandwich dot, the magnet is dropped in a well, to be surrounded with a sandwich layer so cannot be too close to a corner.

The permanent magnet 30 is preferably a relatively flat metal magnet made of cunife with its magnetic axis and location as indicated. The location and orientation mean that the radially outward pole 'N' in the drawing is the driven element for operation of the device while the radially inward pole takes no material part in the operation.

In many applications it would be adventageous to use a flat magnet with its polar axis perpendicular to the plane of the disk. However metal magnets are not usually suitable when so magnetized and plastic magnets may be so magnetized but are too weak when used with the sandwich dot.

With the disk axes sloped, as shown in FIG. 4 the assymetric arrangement of the disk, as shown in FIG. 1 aids in the operation of the disk. As noted, with any of the disks, a notch and cut-out removed from one side and the magnet is displaced toward the other. The weight bias in favour of the magnet displacement side together with the axial tilt assists the disk to start to turn as soon as the core is reversed to release at from a limiting position. This renders operation of the disk more certain.

As illustrated in FIG. 5 the permanent magnet 30, in its rest limiting position of FIG. 2 has its outer edge 31 (corresponding to the N pole) within a 45° truncated core whose axis is perpendicular to the disk rest position and which expands from the core end in the direction of the disk. The

location of the outermost edge 31 of the permanent magnet is indicated E the boundaries of the cone, as they appear in FIG. 5 are defined as CR and CL respectively. It will be obvious that the outer edge 31 of the permanent magnet is well within this cone. The practical result is that on reversal of the core magnetism the repulsive force from the core on the magnet is more nearly perpendicular to the disk than parallel, giving a good starting torque to the disk and avoiding the necessity of providing an extra bias magnet. The cores 38 are of course located so that the same effect occurs when the disk is in its opposite limiting position to that shown in FIG. 2, that is with the N end of the permanent magnet to the left and the notch to the right. Obviously the geometrical relationship will hold true where as shown the cores 38 are symmetrically disposed with respect to the pivotal axis.

As previously noted the feature just described, and that relating to the stop for the disk inboard of the disk apply to disks used singly as well as to a plurality of disks in rows; and both features apply to disks whether or not their pivotal axes are perpendicular to the viewing direction or at a slight angle to the perpendicular.

In operation the disk is rotatable approximately 180° between its ON position (with the notch 36 and cut-out 110 to the left in Figure 1) and OFF position with the notch and cut-out to the right in Figure 1, rotation being in the sense which moves the notch 36 and cut-out 110 farthest from the viewing location, i.e. to the rear of the pivot axis. The cores are magnetized as indicated in FIG. 2 (indicated by the dotted 'N' and 'S'). The fibre ends 128 will each be constantly illuminated. The disk would have rotated to and remained in the ON position of the middle disk in Figure 1. The light from the fibre shines through cut-out 110 to capture the attention of the viewer within a cone about the intended viewing direction. The lighter side of the disk will be displayed and will usually correspond to the color of the fibre radiation. The opposite darker side of the disk will usually correspond to the color of the frame and associated hardware. When windings 46 are energized to reverse the polarity of the cores the disk, under the control of the radially outward here 'N' pole of permanent magnet 30 will rotate (counter-clockwise in Figure 2), with the notch passing one then the other core 38 and its mount and the cut-out passing the fibre top, 128 and ferrule 124 until the non-notched edge of the disk is resting on the left hand stop 42. The disk is now in the OFF position with the area 134 blocking, to the viewer, the light from the optic fibre and the dark side of the disk displayed. The disk will remain in that position until the polarity of the cores is again switched, at which time it will again rotate to the ON position rotating so that the notch and cut-out again pass rearward and farthest from the viewer.

In all aspects of the invention the polarity of the permanent magnet may be reversed and the operations and advantages will be the same, the positions of the disk being obtained by opposite magnetizations of the cores.

As an alternative to the preferred embodiment Figure 9 shows a second optic fibre with end 128A with supporting boss 116A (aligned rear boss is not shown) the second fibre has a location at the opposite axial end of the disk and the opposite side of the pivotal axis from fibre 128 with supporting bosses 116A (rear boss 118 is not shown) from bosses 116, 118 with an additional cut-out 110A to clear the fibre bundle and boss 116A. With this arrangement, the disk will display one fibre 128 in one limiting position and the other fibre 128A in the other limiting position. Thus, for example (Figure 10) one fibre 128 and its co-displayed side 24 may display red to the viewer and in the other disk orientation (Figure 11) the other fibre 128A and its co-displayed disk side 26 green. The array background will have whatever color is most suitable. The electromagnetic drive will be the same as that described in relation to Figure 1.

The application has discussed the use of the disk with a 'corner' notch for an optic fibre in terms of the preferred disk form of patent '427. However many alternatives are considered within the scope of the invention. As previously stated the axes may be parallel to the array instead of slanted as in patent '427. The axes may bear any orientation. The magnetic drive may be different, for example on a magnet or the end of the disk as in patent '832.

Claims

1. Display or indicating device defining a viewing location comprising:

a pivotally mounted disk displaying lighter and darker colors on opposite sides and rotatable over an approximately 180° range between limiting positions in which respective ones of said opposite sides are displayed in the viewing direction,

selective moving means adapted to selectively move said disk between limiting positions,

optic fibre mounted on a mount with its end directed approximately in said viewing direction, and its end just rearward of a first location on said disk, in the limiting position which displays said lighter side,

said first location being adjacent one edge in said axial direction of said disk and just inward of the widest radius of said disk,

said disk being provided with a cut-out corresponding to said first location adapted to avoid said optic fibre and mount in rotating between said limiting positions, and

a second location on said disk located to obscure said fibre end to the viewing location in the other position of said disk.

2. Display or indicating device as claimed in claim 1 wherein said cut out is defined by an edge parallel to said axis and an edge at about 90° thereto.

3. Display or indicating device as defined in Claim 1 or 2 wherein said disk is longer in said axial direction than in a radial direction.

4. Display or indicating device as claimed in any one of the preceding claims wherein the otherwise lighter side of said disk is darkened in the vicinity of said second location to reduce reflection therefrom of light from said optic fibre end.

5. Display or indicating device as claimed in any one of the preceding claims wherein said selective moving means comprises a permanent magnet located on said disk with its polar axis having one pole remote from said pivotal axis,

a pair of core members located rearwardly of said disk and having energizing windings and each having a supporting mount,

each of said core members having ends directed generally toward said viewing location,

said core ends being each located to be rearward of the location of said one pole in one of the limiting positions of said disk,

a notch in the edge of said disk located further from said viewing location in movement of said disk between limiting positions, and

said notch being shaped to allow rotation of said disk, between limiting positions, clear of said cores and mounts.

6. Display or indicating device, as claimed in claim 5, wherein stops formed integrally with said core mounts are provided to limit rotation of said disk at each limiting position, said stops being located to sufficiently space said core end from said magnet at each limiting position so that said magnet cannot latch to the adjacent core end.

7. Display or indicating device as claimed in claim 5 or 6 wherein said fibre end is located to be rearward of said disk when in the limiting position displaying its darker side.

8. Display or indicating device as claimed in claim 5, 6 or 7 wherein said magnet is arranged with its polar axis transverse to said axis and said other pole is located adjacent said pivotal axis.

9. Display or indicating device defining a viewing location comprising:

a pivotally mounted disk displaying contrasting colors on opposite sides and rotatable over an approximately 180° range between limiting positions in which respective ones of said opposite sides are displayed in the viewing direction,

means adapted to selectively move said disk between limiting positions,

a first optic fibre mounted on a mount with its end directed approximately in said viewing direction and its end just rearward of a first location on said disk in one limiting position,

said disk being provided with a cut-out designed to expose said first fibre end to the viewing direction in said other limiting position and to allow rotation of said disk between limiting positions,

a second optic fibre mounted on a mount with its end directed approximately in said viewing direction and its end just rearward of a second location on said disk in the other limiting position, and

said disk being provided with a cut-out designed to expose said second fibre end to the viewing direction in said one limiting position and to allow rotation of said disk between limiting positions.

10. Display or indicating device as claimed in claim 9 wherein said selective moving means comprises a permanent magnet located on said disk with its polar axis having one pole remote from said pivotal axis,

a pair of core members located rearwardly of said disk and having energizing windings,

each having a supporting mount,

each of said core members having ends directed generally toward said viewing location,

said core ends being each located to be rearward of the location of said one pole in one of the limiting positions of said disk,

a core notch in the edge of said disk located further from said viewing location in movement of said disk between limiting positions, and

said core notch being shaped to allow rotation of said said disk, between limiting positions, clear of said cores and mounts.

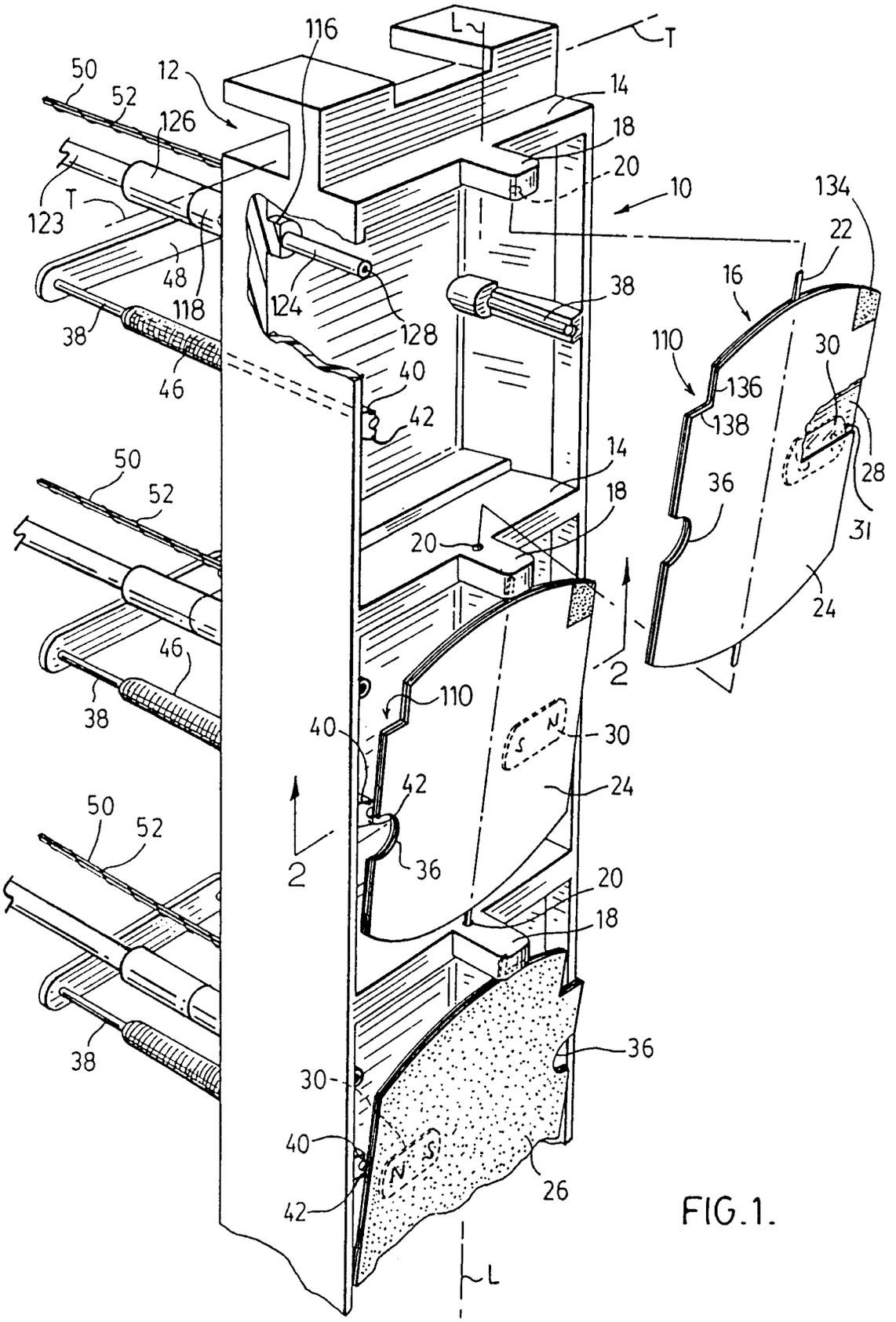

116
L
T
50
12
52
126
14
18
20
10
134
123
T
22
48
118
124
128
38
16
110
30
136
138
40
42
14
28
36
18
31
20
24
2
110
40
30
42
24
36
20
18
30
40
26
42
L

FIG.1.

FIG. 2

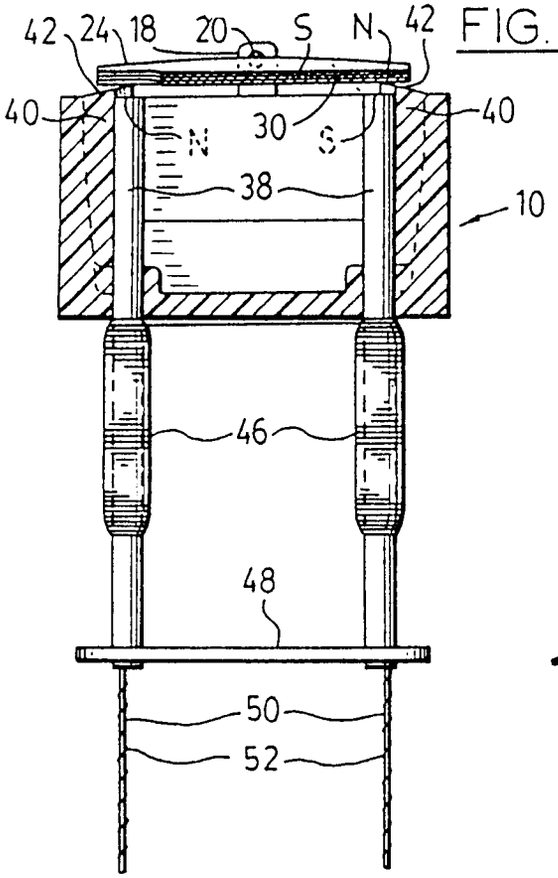
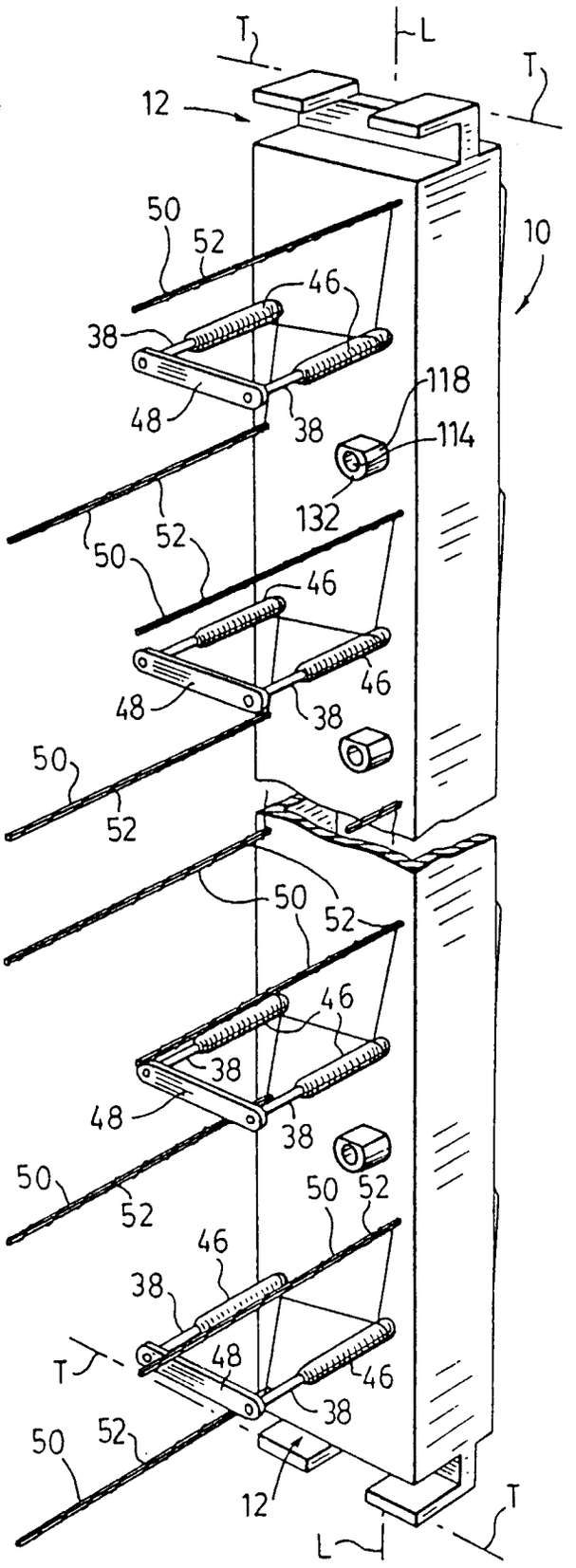


FIG. 3



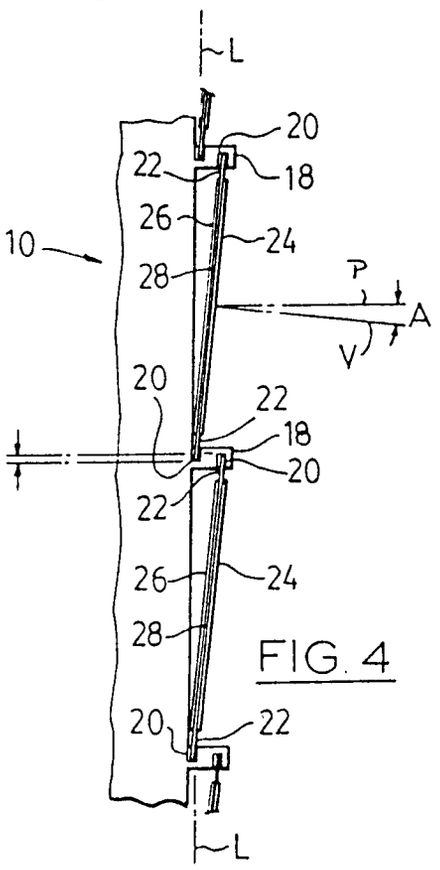


FIG. 4

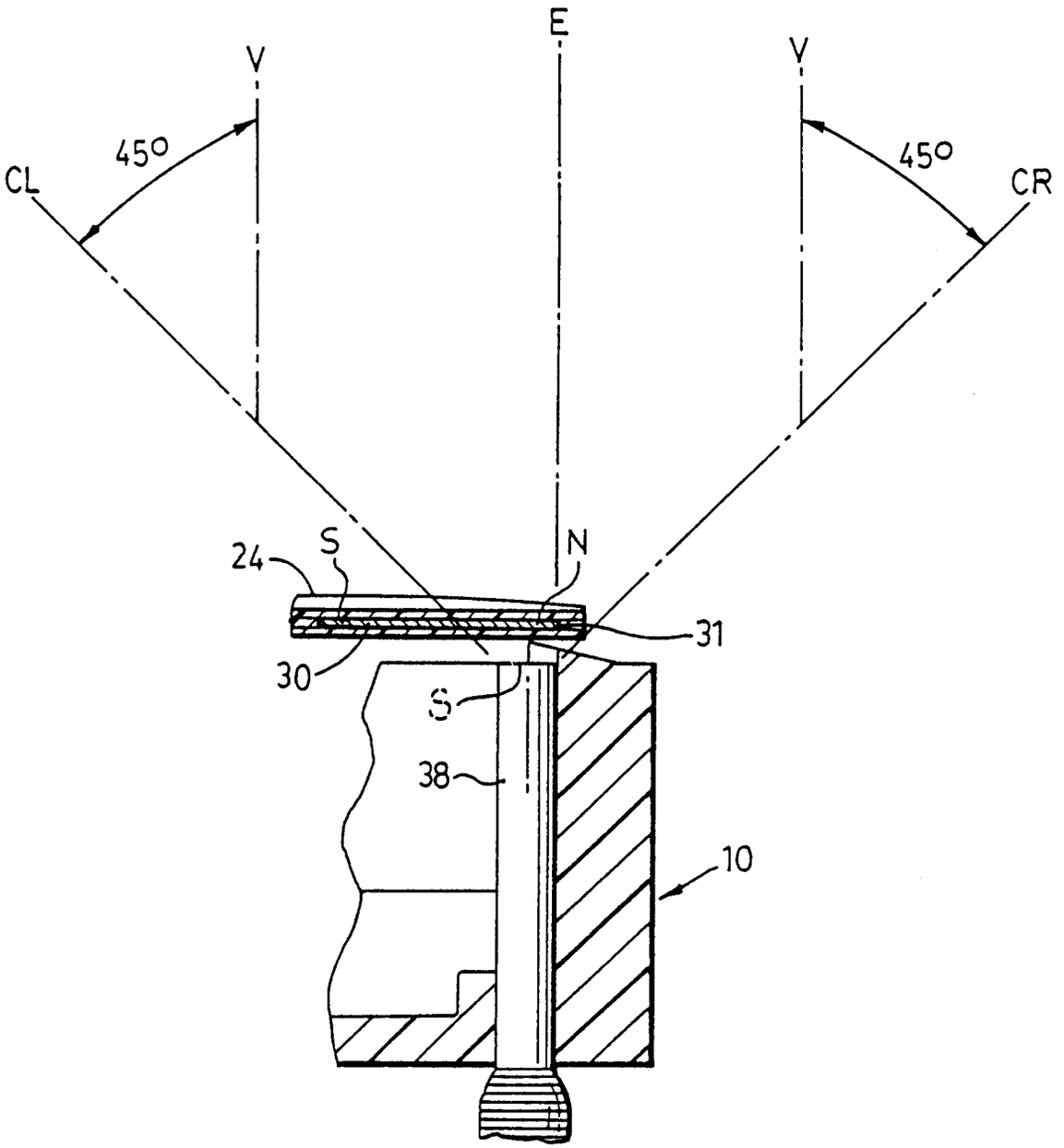


FIG. 5

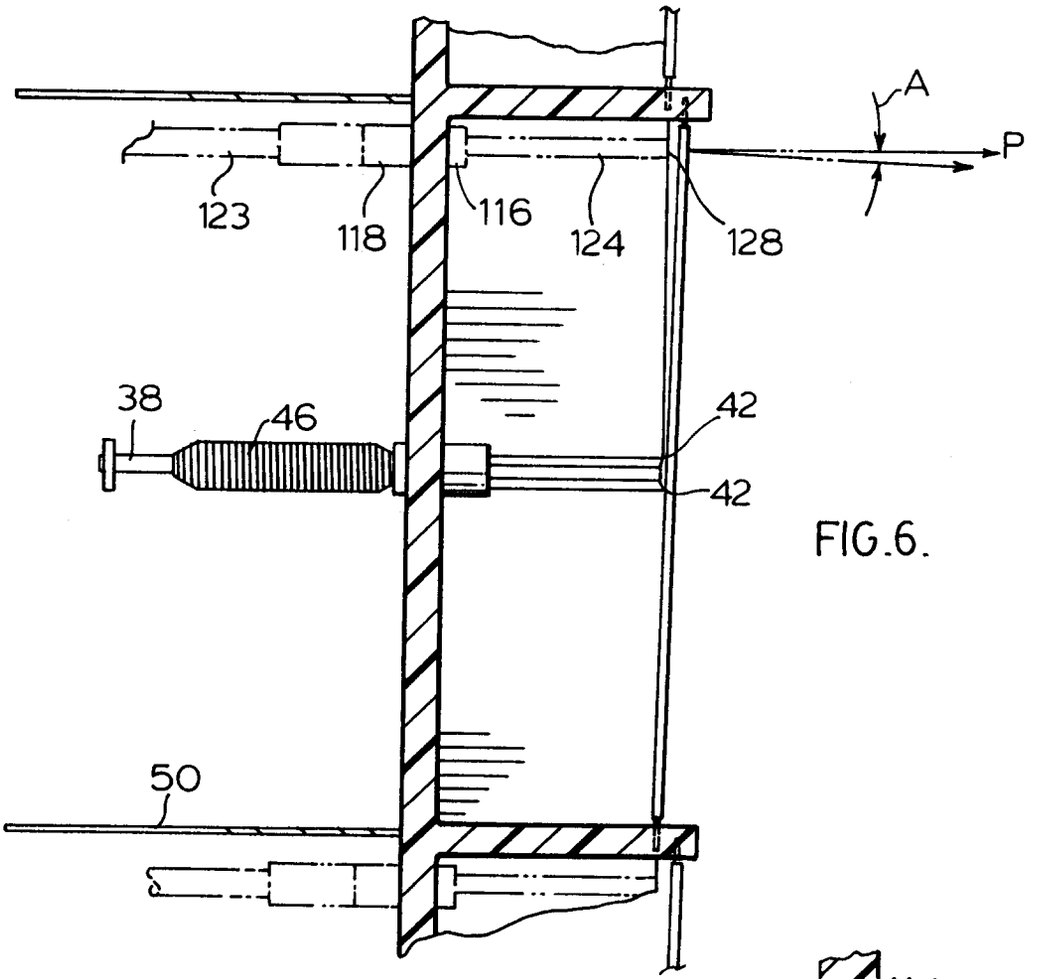


FIG.6.

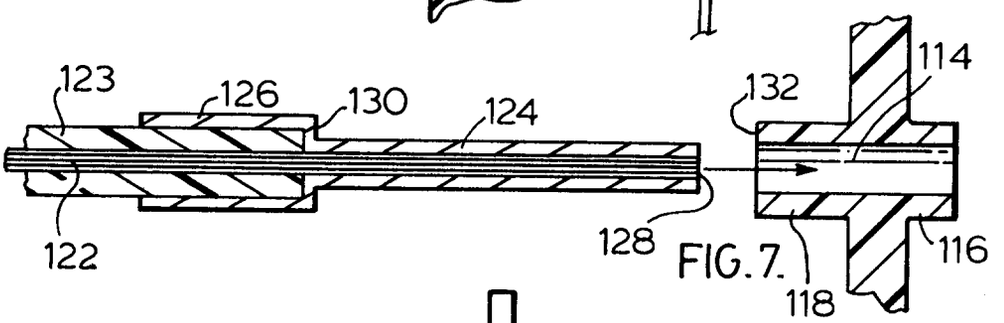


FIG.7.

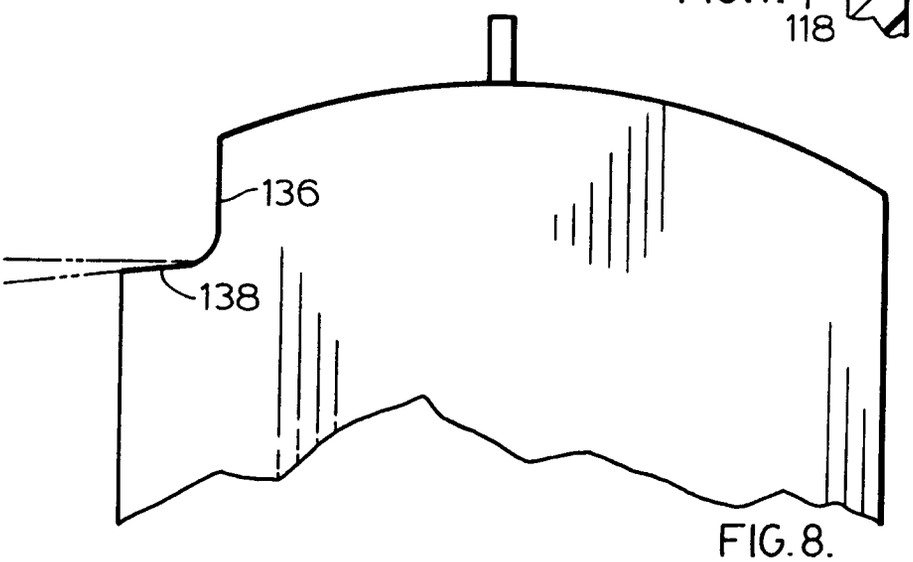


FIG.8.

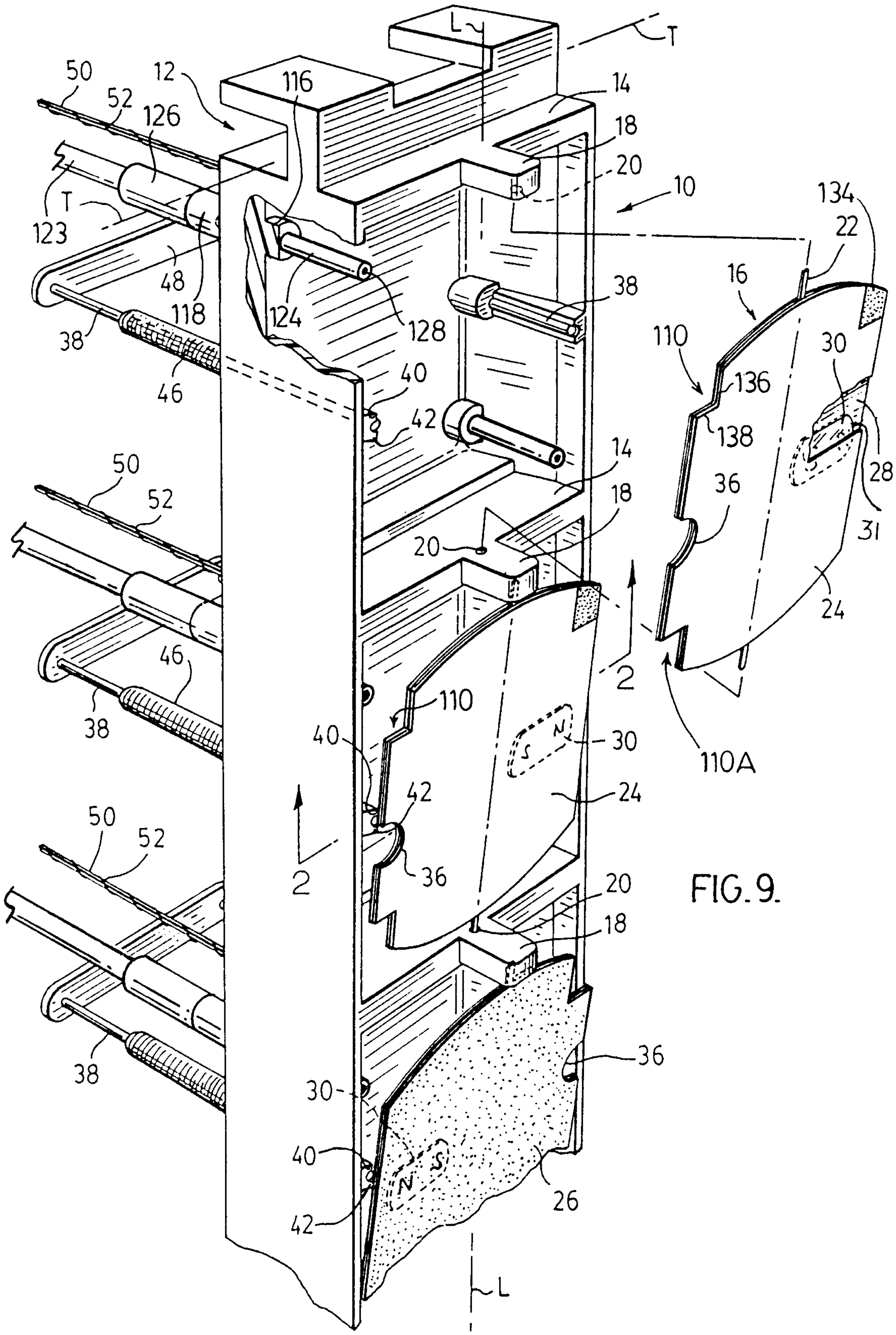

L
T
50
12
116
14
52
126
18
20
10
134
22
T
123
48
118
38
124
128
38
16
110
30
38
46
40
42
136
138
28
36
31
14
50
52
18
20
24
46
110
2
38
40
30
42
24
110A
36
2
20
50
52
18
36
38
30
40
42
26
L

FIG. 9.

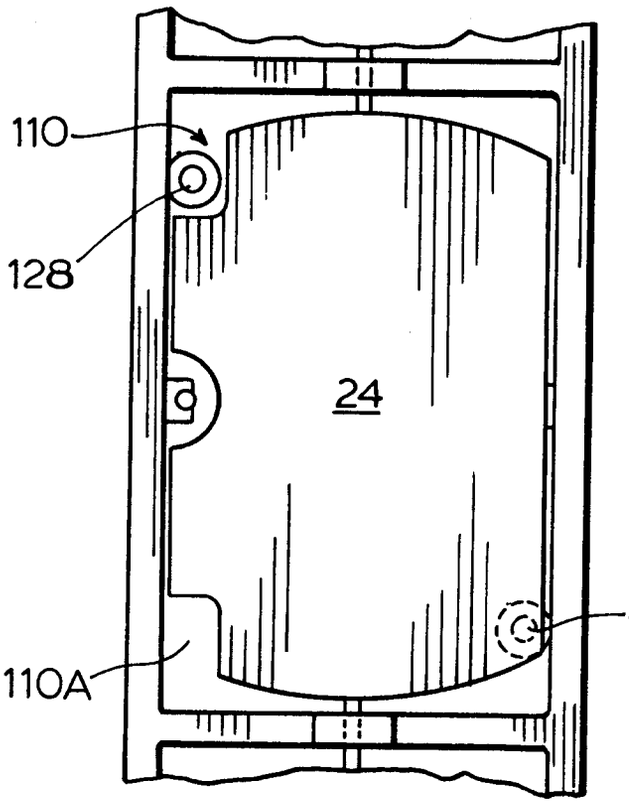


FIG. 10.

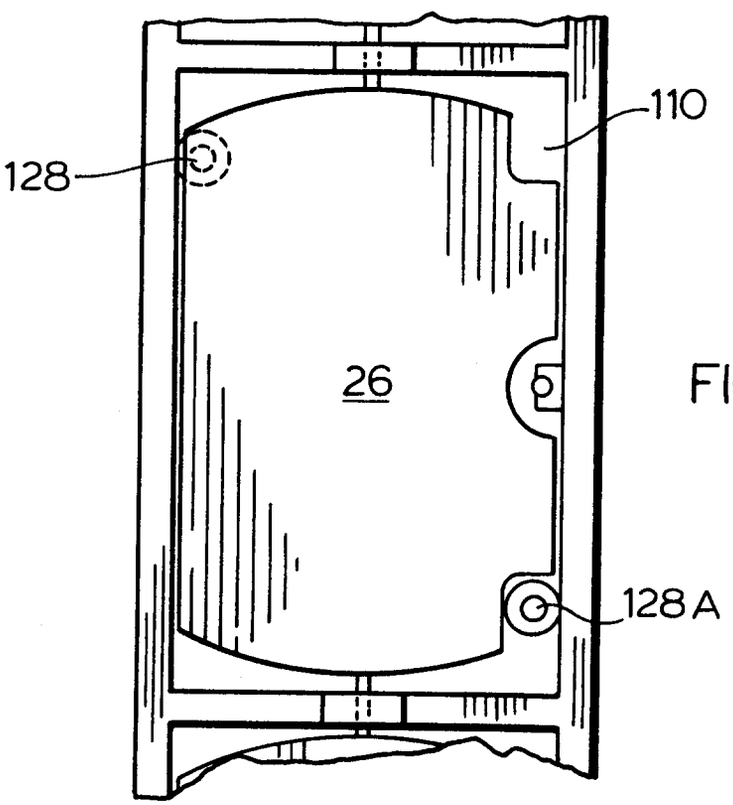


FIG. 11.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 30 0420

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	EP-A-0 401 980 (DAYCO PRODUCTS CANADA) * abstract; figure 1 * & US-A-5 055 832	1	G09F9/37 G09F9/30
D,A	GB-A-2 158 983 (NEI CANADA) & US-A-4 577 427 * abstract; figure 1 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G09F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05 APRIL 1993	GALLO G.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)