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⑤④ **Control device with a rotary control knob.**

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**EP 0 148 561 B1**

## Description

This invention relates to a control device with at least one rotary control knob, and has particular though not exclusive application to the type of control device known as a valuator which is used for entering scalar values into an interactive graphics terminal.

US—A—1 597 067 (Diener) discloses control knobs from the technical field of radio receivers. Some of these knobs include a small-diameter control section and a large diameter control section; it is intended that the small section be used for coarse adjustment of the knob's angular position and the large section be used for fine adjustment.

DE—A—2 615 470 (Miele) discloses a control knob operable by a key inserted into two depressions in its top. It includes a concave tapering section which is included to make the knob difficult to operate without the key, for security reasons.

In the past, little attention has been given to the ergonomic aspects of valutors and these have usually consisted simply of a housing with a number of rotary control knobs mounted on one surface of the housing—see, for example, the item labelled 'control dials' in Figure 1.14 on page 25 of the textbook 'Fundamentals of Interactive Computer Graphics', Foley and Van Dam, published 1982 by the Addison-Wesley Publishing Company Inc. Such valutors have only one mode of manual operation, i.e., by turning each knob between the thumb and forefinger in conventional manner, which means that the valuator is awkward to use unless it is positioned more or less directly facing the user. This is often inconvenient since a typical graphics terminal will have a number of input and output devices, e.g., display monitor, keyboard, data tablet, competing for space on the user's working surface.

It is therefore an object of the invention to provide an improved control device whose control knob(s) have more than one mode of manual operation and are readily accessible from a variety of positions whereby the control device is not constrained to a limited range of positions or orientations relative to the user.

Accordingly, the present invention provides a control device comprising a housing with at least one externally circularly symmetrical control knob mounted on the housing such that it may rotate about its axis of symmetry, the knob having a circumferential edge and an external axial projection whose tip has a diameter substantially less than that of the circumferential edge, the tip and the edge providing two control areas at distinct first and second radii which may be contacted by an operator's finger, characterised in that the circumferential edge of the knob is substantially fully recessed into a surface of the housing, a minor part of the circumferential edge is exposed at an edge of the housing, and the external surface of the knob slopes continuously outwardly over a major part of the distance between

the tip of the axial projection and the circumferential edge to provide a third control area for contact with an operator's finger, providing a variable gear ratio between the finger and the knob.

Preferably, the sloping surface is concave and extends continuously from the tip to the circumferential edge, and the knob is recessed to substantially the full depth of the circumferential edge.

In the embodiment of the invention to be described, the control device is a valuator for an interactive graphics terminal and includes a plurality of the said knobs recessed into a common surface of the housing and disposed along each of two opposite parallel sides of the housing, a minor portion of the circumferential edge of each knob being exposed at the relevant side of the housing. Furthermore, the housing includes an arcuate buffer projection immediately on the opposite axial side of each knob to the sloping surface, the projection being concentric with and of slightly greater diameter than the circumferential edge.

The advantage of the invention is that the particular configuration of knob defined above permits several modes of manual operation. Thus the knob may be rotated in the conventional manner by grasping the tip between the thumb and forefinger to permit fine setting of the knob. The knob may also be rapidly rotated for coarse setting by flicking the exposed edge with the finger, especially if the knob is mounted with low friction, although gentle manipulation of the exposed edge will also permit fine setting. Finally, the knob may be rotated by running the length of the finger along the sloping surface, and this may be done rapidly for coarse setting or slowly for fine setting of the knob. Also, the position of the finger up or down the slope varies the effective "gear" ratio between the finger and the knob.

The recessing of the knob into the surface of the housing provides a low profile so that where a number of knobs are provided, as will usually be the case, the user can reach across to a particular knob without disturbing the settings of other knobs. It will therefore be apparent that the invention provides a construction of control device whose control knob(s) are readily accessible by the user from a variety of positions and orientations of the device.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an external perspective view of a valuator embodying the invention,

Figure 2 is a plan view of the valuator,

Figure 3 is a side view of the valuator.

Figure 4 is a cross-section of the valuator taken on the line A—A of Figure 2, and

Figure 5 is a cross-section of the valuator taken on the line B—B of Figure 2.

Referring to the drawings, the valuator comprises a generally rectangular housing 10 including a base 11 and a cover 12 fixed to the

base in any suitable manner (not shown). A plurality of control knobs 13 are set into respective circular recesses 30 in the top surface 14 of the housing cover 12, the knobs 13 being disposed four along each of the two opposite parallel sides 15, 16 of the housing. Each knob 13 is circularly symmetric, at least externally, and is mounted for rotation about its axis of symmetry on the spindles 17 of respective potentiometers 18, Figures 4 and 5. The potentiometers 18 are mounted on the underside of the cover 12 with their spindles 17 projecting through the cover 12, the potentiometers being secured in place in conventional manner by nuts 19 which engage threaded collars 20 of the potentiometers. It is to be understood that the cross-section of Figure 4 is shown in a state of partial disassembly in order to illustrate these details. The undersides of the potentiometers 18 are fixed to a printed circuit board 21, the latter providing the electrical connections from the potentiometers to an external cable (not shown). Details of the electrical circuitry are not shown nor described since these may be entirely conventional and not relevant to the present invention which is solely concerned with the physical structure.

Each knob 13 has a circumferential edge 22, and is recessed into the top surface 14 of the housing 10 substantially to the full depth of the edge 22. However, a minor part 22' of the edge 22 of each knob is exposed at the side 15 on 16 of the housing. Each knob further includes an external projection which projects axially above the surface 14, the projection terminating in a tip 23 whose diameter is substantially less than that of the circumferential edge 22. Both the tip 23 and the edge 22 are knurled as indicated in the figures. Finally, each knob 13 has an external concave surface 24 which slopes downwardly and outwardly continuously from the tip 23 to the edge 22. As mentioned above, it is the exposed edge portion 22', the tip 23 and the sloping surface 24 which permit the three different modes of manual rotation of each knob 13. In use the valuator may be placed flat on a working surface or, if desired, it may be stood on one end inclined against a stand.

In order to prevent inadvertent rotation of a knob 13 by bumping the exposed portion 22' against an adjacent object on the working surface, each exposed portion 22' is guarded by a respective arcuate buffer 25 which projects from the side 15 or 16 of the housing cover 12 immediately below the knob. The outer surface of each arcuate buffer 25 is concentric with the circumferential edge 22 of the knob 13 but has a slightly greater diameter than the edge 22; thus the buffer 25 projects slightly beyond the exposed edge portion 22' to protect the latter against knocks.

It is to be understood that the invention is not limited in its application to graphics valuator as described above, but has general

applicability to control devices having one or more rotary control knobs, for example hi-fi equipment. Furthermore, the cross-sectional shape of the sloping surface 24 may be varied from that shown; thus it may be more or less curved as desired in a particular design of knob, and it need not necessarily extend substantially the full distance from the tip 23 to the edge 22 as shown. For example, an annular part of the external surface of the knob adjacent the edge 22 could be flat so that the sloping surface 24 begins some distance in from the edge 22, or a part of the external surface of the knob adjacent the tip 23 could be cylindrical with the outwardly sloping surface 24 beginning only some distance below the tip.

### Claims

1. A control device with a rotary control knob comprising a housing (10) with at least one externally circularly symmetrical control knob (13) mounted on the housing such that it may rotate about its axis of symmetry, the knob having a circumferential edge (22) and an external axial projection whose tip (23) has a diameter substantially less than that of the circumferential edge, the tip and the edge providing two control areas at distinct first and second radii which may be contacted by an operator's finger, characterised in that:

the circumferential edge of the knob is substantially fully recessed into a surface of the housing,

a minor part of the circumferential edge is exposed at an edge of the housing,

and the external surface of the knob slopes continuously outwardly over a major part of the distance between the tip of the axial projection and the circumferential edge to provide a third control area for contact with an operator's finger, providing a variable gear ratio between the finger and the knob.

2. A control device according to Claim 1, wherein the sloping surface (24) is concave and extends substantially continuously from the tip (23) to the circumferential edge (22).

3. A control device according to Claim 2, wherein the knob (13) is recessed to substantially the full depth of the circumferential edge (22).

4. A control device according to Claim 3, wherein the circumferential edge (22) is exposed at one side of the housing (10).

5. A control device according to Claim 4, wherein the said one side of the housing (10) includes an arcuate projection (25) immediately on the opposite axial side of the knob to the sloping surface (24), the projection (25) being concentric with and of slightly greater diameter than the circumferential edge (22).

6. A control device according to Claim 5, wherein the circumferential edge (22) of the knob is knurled.

7. A control device according to Claim 6,

wherein the external axial projection of the knob is knurled at the tip (23).

8. A control device according to Claim 4 or 5, wherein the device includes a plurality of the said knobs (13) recessed into a common surface (14) of the housing (10) and disposed along the side of the housing.

9. A control device according to Claim 8, wherein the device includes a plurality of the said knobs (13) recessed into a common surface (14) of the housing (10) and disposed along each of two opposite parallel sides of the housing.

10. A control device according to Claim 9, wherein the device is a valuator for an interactive graphics terminal.

#### Patentansprüche

1. Steuervorrichtung mit einem Steuerdrehknopf, die ein Gehäuse (10) mit wenigstens einem außen kreissymmetrischen Steuerknopf (13) umfaßt, der am Gehäuse so angebracht ist, daß er sich um seine Symmetrieachse drehen kann, wobei der Knopf einen Umfangsrand (22) und einen äußeren axialen Vorsprung aufweist, dessen Spitze (23) einen Durchmesser hat, der wesentlich kleiner als der des Umfangsrandes ist, und die Spitze und der Rand zwei Steuerbereiche unter einem ersten und einem zweiten Radius liefern, die voneinander verschieden sind, welche Steuerbereiche mit dem Finger einer Bedienungsperson berührt werden können, dadurch gekennzeichnet, daß:

der Umfangsrand des Knopfes im wesentlichen vollständig in eine Außenfläche des Gehäuses versenkt ist,

ein kleinerer Teil des Umfangsrandes an einem Rand des Gehäuses freiliegt,

und die Außenfläche des Knopfes fortlaufend schräg nach außen über den größeren Teil des Abstandes zwischen der Spitze des axialen Vorsprungs und des Umfangsrandes verläuft, so daß ein dritter Steuerbereich zur Berührung mit dem Finger einer Bedienungsperson vorgesehen ist, wodurch sich ein variables Übersetzungsverhältnis zwischen dem Finger und dem Knopf ergibt.

2. Steuervorrichtung nach Anspruch 1, bei der die schräg verlaufende Fläche (24) konkav ausgebildet ist und im wesentlichen fortlaufend von der Spitze (23) bis zum Umfangsrand (22) verläuft.

3. Steuervorrichtung nach Anspruch 2, bei der der Knopf (13) im wesentlichen über die volle Tiefe des Umfangsrandes (22) versenkt ist.

4. Steuervorrichtung nach Anspruch 3, bei der der Umfangsrand (22) an einer Seite des Gehäuses (10) freiliegt.

5. Steuervorrichtung nach Anspruch 4, bei der diese eine Seite des Gehäuses (10) einen bogenförmigen Vorsprung (25) unmittelbar auf der der schräg verlaufenden Fläche (24) gegenüberliegenden axialen Seite des Knopfes aufweist, wobei der Vorsprung (25) konzentrisch zum Umfangsrand (22) ist und einen etwas größeren Durchmesser als dieser hat.

6. Steuervorrichtung nach Anspruch 5, bei der der Umfangsrand (22) des Knopfes gerändelt ist.

7. Steuervorrichtung nach Anspruch 6, bei der der äußere axiale Vorsprung des Knopfes an der Spitze (23) gerändelt ist.

8. Steuervorrichtung nach Anspruch 4 oder 5, wobei die Vorrichtung eine Vielzahl der genannten Knöpfe (13) aufweist, die in eine gemeinsame Außenfläche (14) des Gehäuses (10) versenkt und an der Seite des Gehäuses entlang angeordnet sind.

9. Steuervorrichtung nach Anspruch 8, wobei die Vorrichtung eine Vielzahl der genannten Knöpfe (13) aufweist, die in eine gemeinsame Außenfläche (14) des Gehäuses (10) versenkt und entlang jeder von zwei gegenüberliegenden parallelen Seiten des Gehäuses angeordnet sind.

10. Steuervorrichtung nach Anspruch 9, wobei die Vorrichtung ein Wertgeber für ein interaktives graphisches Terminal ist.

#### Revendications

1. Dispositif de commande ayant un bouton rotatif de réglage comprenant un boîtier (10) ayant au moins un bouton (13) de réglage ayant une symétrie circulaire extérieurement, monté sur le boîtier afin qu'il puisse tourner autour de son axe de symétrie, le bouton ayant un bord circonferentiel (22) et une saillie axiale externe dont le bout (23) a un diamètre légèrement inférieure à celui du bord circonferentiel, le bout et le bord formant deux zones de réglage ayant un premier et un second rayon distincts et au contact desquelles peut être placé de doigt d'un opérateur, caractérisé en ce que:

le bord circonferentiel du bouton est placé pratiquement totalement au-dessous d'une surface du boîtier,

une petite partie du bord circonferentiel est exposée sur le bord du boîtier, et

la surface externe du bouton est inclinée de façon continue vers l'extérieur sur la plus grande partie de la distance comprise entre le bout de la saillie axiale et le bord circonferentiel afin qu'une troisième zone de réglage destinée à être au contact du doigt d'un opérateur soit formée et donne un rapport variable de démultiplication entre le doigt et le bouton.

2. Dispositif de commande selon la revendication 1, dans lequel la surface inclinée (24) est concave et est disposée de manière pratiquement continue du bout (23) jusqu'au bord circonferentiel (22).

3. Dispositif de commande selon la revendication 2, dans lequel le bouton (13) est disposé dans une cavité pratiquement sur toute la hauteur du bord circonferentiel (22).

4. Dispositif de commande selon la revendication 3, dans lequel le bord circonferentiel (22) est exposé d'un côté du boîtier (10).

5. Dispositif de commande selon la revendication 4, dans lequel ledit côté du boîtier (10) a une saillie courbe (25) disposée du côté axial du bouton qui est opposé à celui qui coporte la

surface inclinée (24), la saillie (25) étant concentrique au bord circonférentiel (22) et ayant un diamètre légèrement supérieur à celui de ce bord.

6. Dispositif de commande selon la revendication 5, dans lequel le bord circonférentiel (22) du bouton est moleté.

7. Dispositif de commande selon la revendication 6, dans lequel la saillie axiale externe du bouton est moletée à l'extrémité (23).

8. Dispositif de commande selon la revendication 4 ou 5, dans lequel le dispositif comporte plusieurs boutons (13) disposés au-dessous d'une

surface commune (14) du boîtier (10) et placés le long du côté du boîtier.

9. Dispositif de commande selon la revendication 8, dans lequel le dispositif comporte plusieurs boutons (13) disposés au-dessous d'une surface commune (14) du boîtier (10) et placés le long de chacun de deux côtés parallèles opposés du boîtier.

10. Dispositif de commande selon la revendication 9, dans lequel le dispositif est un dispositif d'entrée de valeurs destiné à un terminal graphique interactif.

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FIG. 1

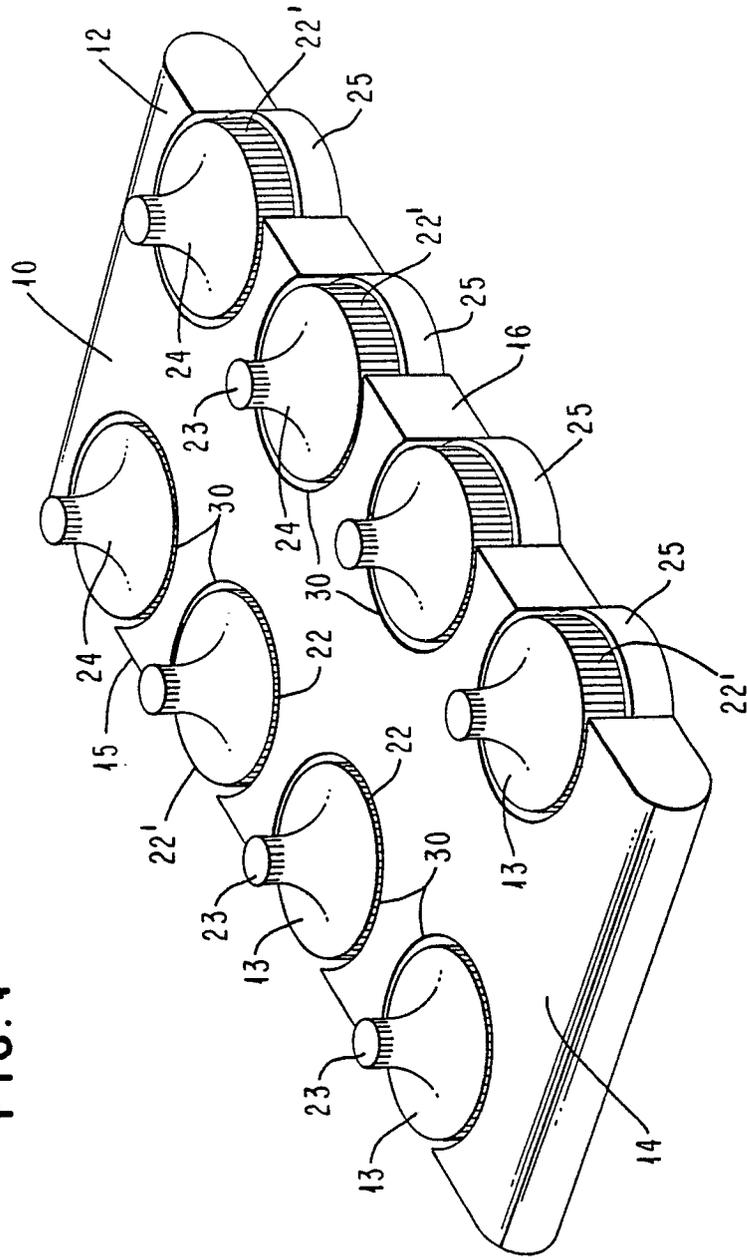
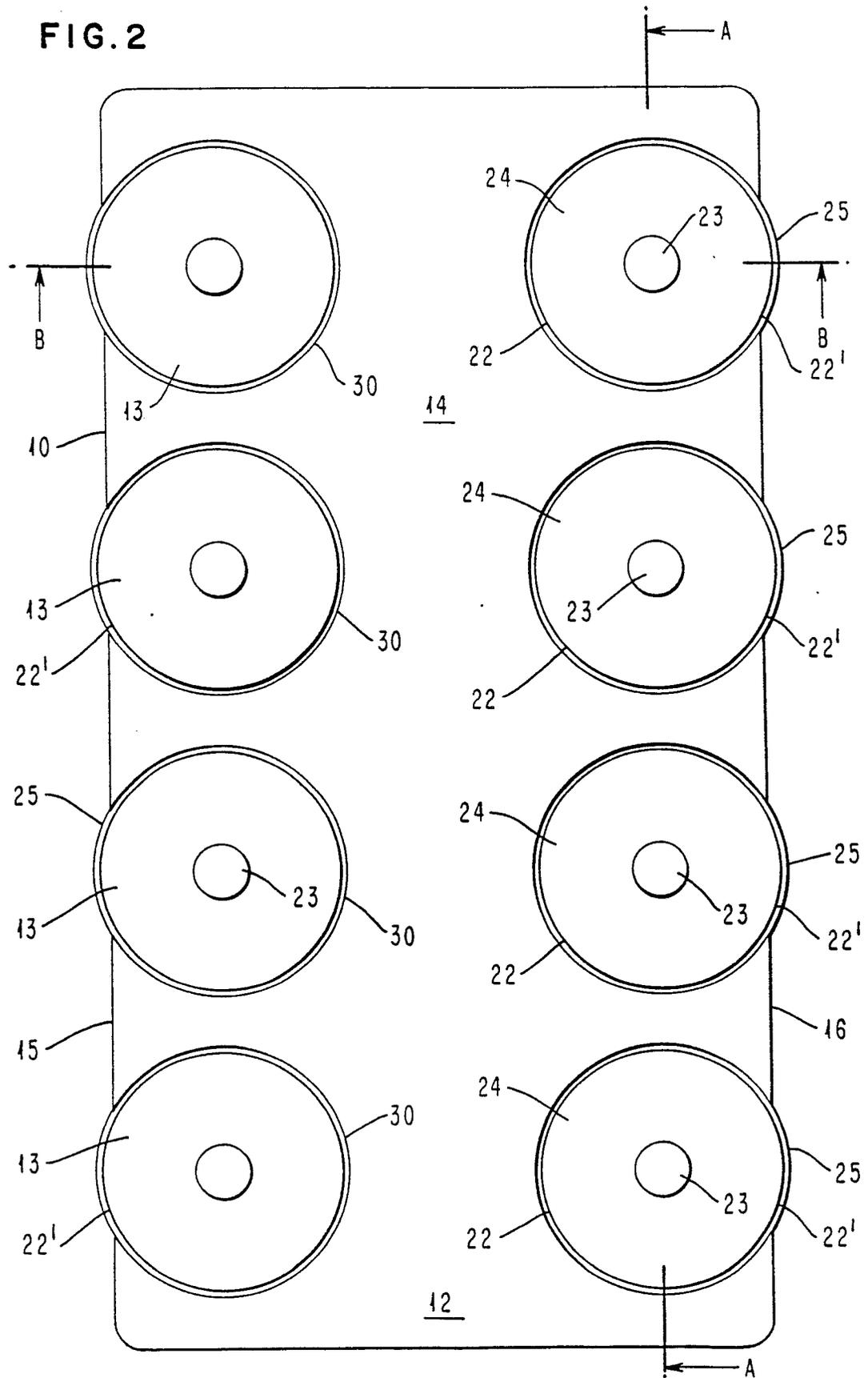


FIG. 2



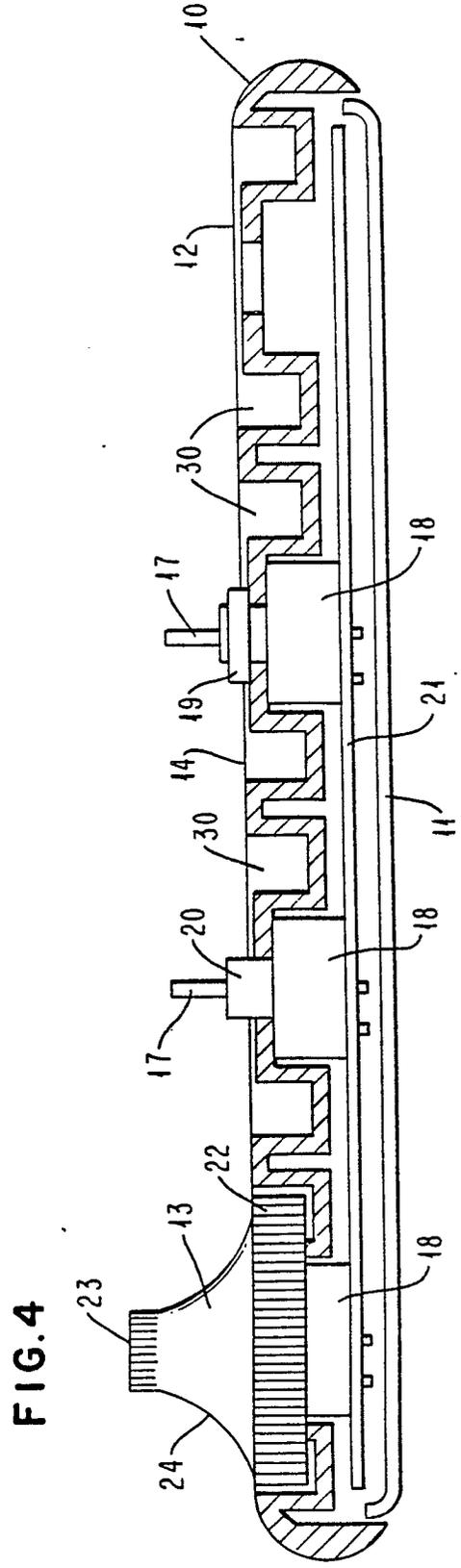
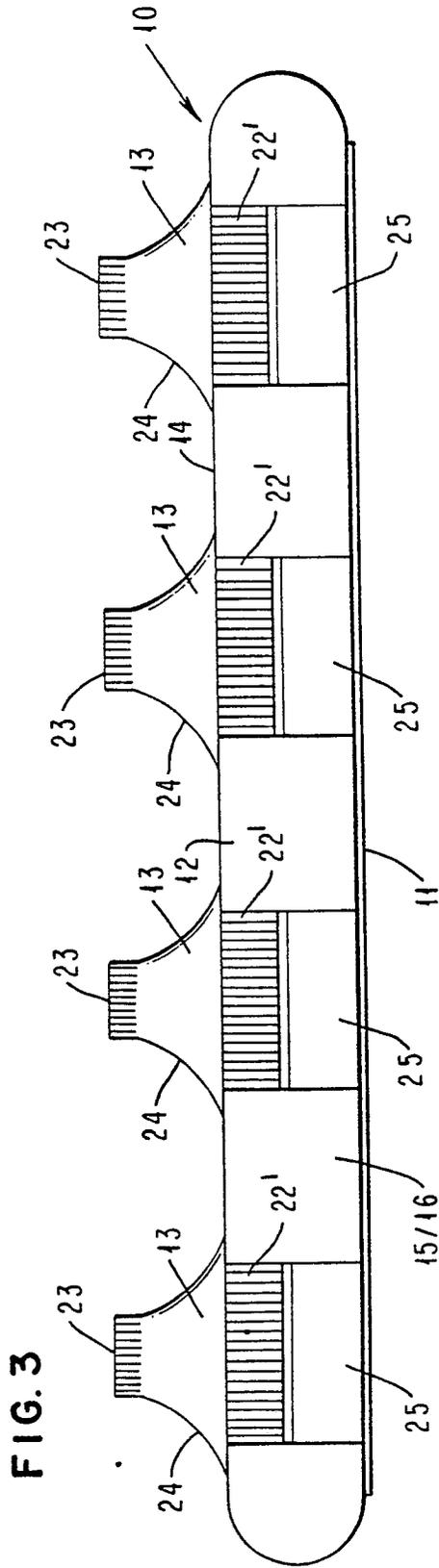


FIG. 5

