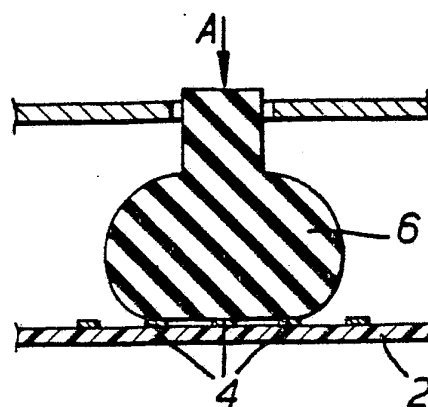
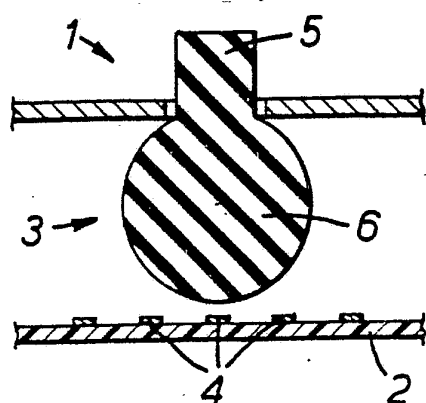


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ³ : H01H 13/64, 1/02		A1	(11) International Publication Number: WO 84/ 03172 (43) International Publication Date: 16 August 1984 (16.08.84)
(21) International Application Number: PCT/GB84/00036 (22) International Filing Date: 10 February 1984 (10.02.84) (31) Priority Application Number: 8303679 (32) Priority Date: 10 February 1983 (10.02.83) (33) Priority Country: GB		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(71) Applicant (for all designated States except US): GOULD INSTRUMENTS LIMITED [GB/GB]; Roebuck Road, Hainault, Ilford, Essex IG6 3UE (GB). (72) Inventor; and (75) Inventor/Applicant (for US only) : LECKLIDER, Thomas, H. [US/GB]; 27 Farm Adine, Saffron Walden, Essex CB11 3HR (GB). (74) Agent: A. A. THORNTON & CO.; Northumberland House, 303-306 High Holborn, London WC1V 7LE (GB).			

(54) Title: VARIABLE CONTROL DEVICE



(57) Abstract

A variable control device comprises a manually operable member (5) arranged to be moved in a first direction (A) by an operator, a substrate (2) provided with a plurality of contacts (4) spaced apart in a plane transverse to said first direction, and a further member (6) disposed between the manually operable portion (5) and substrate (2) one of the further member (6) and the substrate (2) being deformable and said further member being provided with a conductive surface facing the substrate which upon movement of the manually operable member (5) in said first direction (A) causes a progressively greater number of contacts (4) to be bridged by the conductive surface provided on the further member (6) due to relative deformation between the further member and the substrate.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	KR	Republic of Korea
AU	Australia	LI	Liechtenstein
BE	Belgium	LK	Sri Lanka
BG	Bulgaria	LU	Luxembourg
BR	Brazil	MC	Monaco
CF	Central African Republic	MG	Madagascar
CG	Congo	MR	Mauritania
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SD	Sudan
FR	France	SE	Sweden
GA	Gabon	SN	Senegal
GB	United Kingdom	SU	Soviet Union
HU	Hungary	TD	Chad
JP	Japan	TG	Togo
KP	Democratic People's Republic of Korea	US	United States of America

- 1 -

VARIABLE CONTROL DEVICE

The present invention relates to a manually operable variable control device.

It is known that control devices capable of varying the range of shift of a parameter are usually in the form of a rotary switch or potentiometer. These devices are physically large and in some cases the design of the devices only permits two or three selectable positions.

The present invention provides a variable control device comprising a manually operable member arranged to be moved in a first direction by an operator, a substrate provided with a plurality of contacts spaced apart in a plane transverse to said first direction, and a further member disposed between the manually operable portion and substrate, one of the further member and substrate being deformable and said further member being provided with a conductive surface facing the substrate whereby upon movement of the manually operable member in said first direction a progressively greater number of contacts are bridged by the conductive surface provided on the further member due to relative deformation between the further member and the substrate.

The present invention comprises a variable control device which resembles a push-button. There is a functional relationship between the output of the device and the degree to which the device is pressed.



- 2 -

Features and advantages of the present invention will become apparent from the following description of embodiments thereof when taken in conjunction with the accompanying drawings, in which:-

5 Figure 1 shows a first embodiment of the present invention with Figure 1a showing the neutral position and Figure 1b the depressed position;

Figure 2 shows a second embodiment of a control device according to the present invention in which
10 Figure 2a shows the neutral position and Figure 2b shows the depressed position; and

Figure 3 shows a further embodiment of a control device according to the present invention in which
Figure 3a shows the neutral position and Figure 3b shows
15 the depressed position.

According to the embodiments of the present invention, there is provided a plurality of switch contacts which close in a successive sequence in response to increased pressure on a deformable member. The
20 relationship between the pressure required to close a switch is not necessarily linearly related to the position of a switch in the sequence. It may require much more pressure to close a particular switch in the sequence of switches than it did to close the
25 immediately previous switch.

As shown in Figure 1, a control device generally indicated by the reference numeral 1 comprises a resilient member 3 and a number of spaced and electrically separate conductors 4 located opposite
30 the member 3 on a circuit board 2 or other rigid insulating member. The conductors are in the forms of spaced parallel tracks which for convenience are printed on the substrate and extend in a plane transverse to the direction of movement of the key portion 5. The
35 resilient member 3 in this embodiment is shaped



- 3 -

to provide a manually operable key portion 5 and a bulbous contact-making portion 6. At least the portion 6 is made of or has its surface provided with a conductive elastomeric material which can be deformed by pressure such as can be applied by one finger.

One of the conductors 4, preferably the centre conductor, is used as a common conductor and is in contact with the member 3 when in the neutral position as shown in Figure 1a. In use, an operator applies pressure to the key portion 5 in the direction of the arrow A which causes the portion 6 to deform and flatten as shown in Figure 1b in directions at right angles to the direction of pressure so as to increase the number of conductors 4 contacted by the portion 6.

When the control device 1 is in use in a micro-processor controlled apparatus, for example, the individual conductors 4 can be scanned by the micro-processor in the same way as it would scan a conventional keyboard. Alternatively, in the case of a plurality of control devices 1 each having a common centre conductor the corresponding individual conductors 4 may be bussed together but not the common centre conductors and the micro-processor can then scan the bus tracks and the common conductors.

According to another embodiment of the present invention, the member 3 is one piece member made of a non-conductive elastomer and the device includes a layer of conductive material which in this case is a layer of elastomeric material 8 stretched between supports 7 on the inner surface of a housing of the device between the portion 6 and the conductors 4 such that on progressively depressing the key portion 5 the increase in pressure causes the layer 8 to progressively spread over the

35



- 4 -

conductors 4 as shown in Figure 2b and in a similar manner to the bulbous portion 6 in Figure 1b.

Alternatively, as shown in Figure 3, instead of using a one-part member 3, the parts 5 and 6 can be made of different materials and in this case the portion 6 consists of a metal spring capable of being flattened in a similar way to the elastomeric portion 6 of the previous two embodiments when the key portion 5 is depressed. The key portion 5 may be a conventional plastics key or any other suitable form of key. In this instance, the portion 6 is a strip of metal formed into the appropriate shape by having its ends located in the key portion 5 to form a resiliently deformable cylindrical portion intermediate its ends.

The above embodiments may be used on any one of a number of instruments and for any one of a number of functions, for example on a micro-processor control oscilloscope, where pressing the control device causes an on-screen cursor to move faster or to make items in a roll-round list change more quickly. The control device is thus capable of varying the speed where the degree of speed is proportional to the amount the control device is pressed, giving the user good "feel" when using the instrument.

Although the term 'bulbous' has been used in relation to the portion 6 in Figures 1 and 2 in order to describe a substantially spherical member, it will be understood that a substantially cylindrical member could be used such as the spring member shown in Figure 3.

Further, although it is convenient to use a rigid substrate 2 and a deformable portion 6 on the key portion 5 it is also possible to achieve the same result by having a rigid portion 6 and a deformable substrate 2 or a combination of the two.



- 5 -

Although in Figure 1 the bulbous portion 6 of the member 3 contacts one of the conductors 4 when in the neutral position, this is not in fact essential. The portion 6 may, in all embodiments, be spaced from all the conductors 4 when in the neutral position. Further, there is no need for the conductors to be bridged in any particular order; the electric circuitry connected to the device can evaluate which contacts are bridged and take appropriate action.



CLAIMS:

1. A variable control device comprising a manually operable member movable in a first direction by an operator, a substrate provided with a plurality of contacts spaced apart in a plane transverse to said first direction, and a further member disposed between the manually operable member and the substrate, one of the further member and the substrate being resiliently deformable and said further member being provided with a conductive surface facing the substrate whereby upon movement of the manually operable member in said first direction a progressively greater number of contacts are bridged by the conductive surface provided on the further member due to relative deformation between the further member and the substrate.
2. A device according to claim 1, wherein the further member is made of an elastomeric material at least whose surface is conductive.
3. A device according to claim 1, wherein the further member is a composite member comprising a first portion of an elastomeric material and a second portion in the form of a strip of a conductive elastomeric material whose ends are anchored and which is arranged to contact the contacts on the substrate.
4. A device according to claim 1, wherein the further member is formed by a strip of resilient metal whose ends are received by the manually operable member and which has a resiliently deformable portion intermediate its ends which is arranged to contact the contacts on the substrate.



5. A device according to any one of the preceding claims, wherein the further member is cylindrical in cross-section when viewed in a direction transverse to said first direction.
- 5 6. A device according to any one of claims 1 to 3, wherein said further member is generally spherical in shape.



1/1

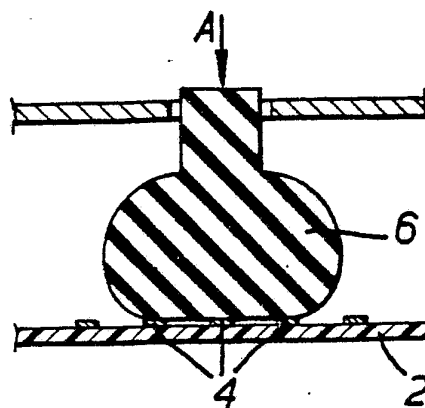
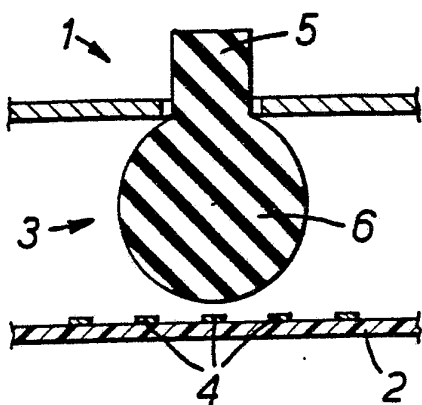


FIG. 1.

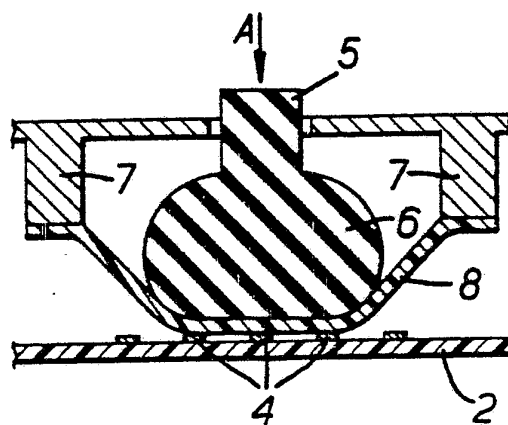
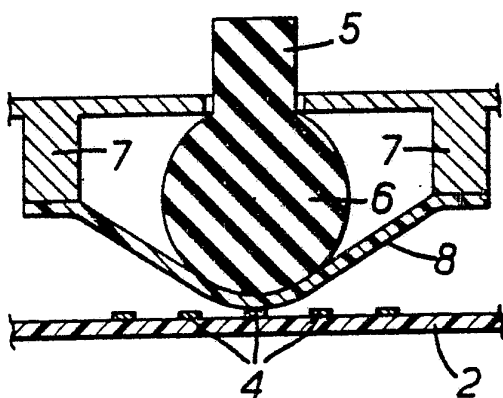


FIG. 2.

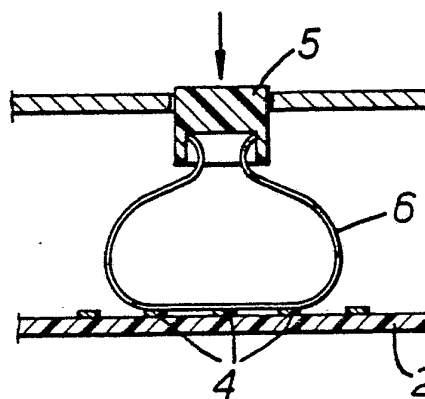
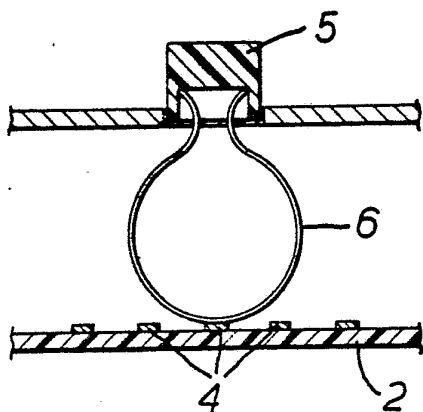
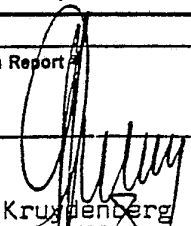


FIG. 3.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 84/00036

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ³ : H 01 H 13/64; H 01 H 1/02		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC ³	H 01 H 1/00; H 01 H 13/00; H 01 C 10/00	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category [*]	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	FR, A, 2189848 (PHILIPS) 25 January 1974 see pages 3,4; last paragraph; figure 3	1
A	FR, A, 2196515 (MATSUSHITA) 15 March 1974 see claim 1	2,3,6

[*] Special categories of cited documents: ¹⁵ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²	
8th May 1984	07 JUIN 1984	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
EUROPEAN PATENT OFFICE	 G.L.M. Kruxenberg	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 84/00036 (SA 6587)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 30/05/84

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 2189848	25/01/74	NL-A- 7308412	27/12/73
		DE-A- 2230479	10/01/74
FR-A- 2196515	15/03/74	DE-A, C 2341521	28/02/74
		US-A- 3898421	05/08/75
		CA-A- 998413	12/10/76
		NL-A- 7311342	20/02/74
		GB-A- 1441765	07/07/76
		JP-A- 49066405	27/06/74
		JP-A- 49066406	27/06/74
		JP-A- 49079656	01/08/74