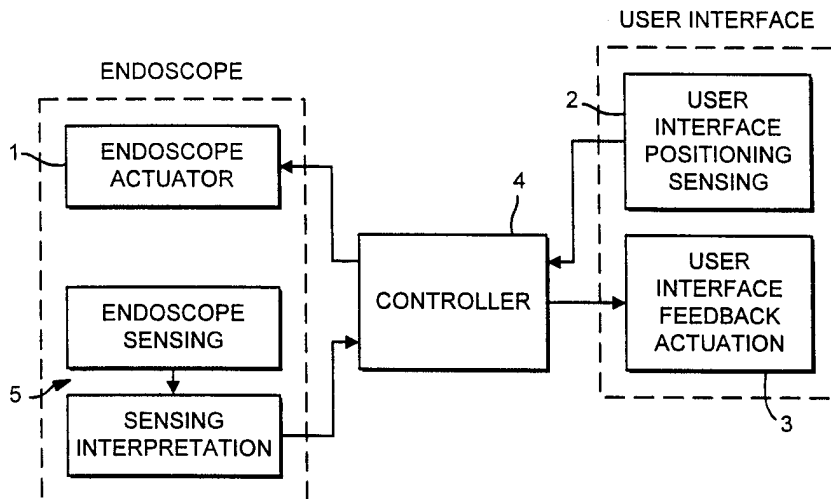




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/GB97/03166 (22) International Filing Date: 26 November 1997 (26.11.97) (30) Priority Data: 9624486.8 26 November 1996 (26.11.96) GB (71) Applicant (for all designated States except US): UNIVERSITY OF BRISTOL [GB/GB]; Senate House, Tyndale Avenue, Bristol BS1 1TH (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): GRIFFITHS, Mansel, Valmond [GB/GB]; 2 Clifton Park, Clifton, Bristol BS8 3BS (GB). BRETT, Peter, Nigel [GB/GB]; Pendragon, 3 Manor Road, Saltford, Bristol BS31 3DL (GB). TRITTO, Giuseppe [IT/FR]; 25, rue des Grands Augustins, F-75006 Paris (FR). STONE, Rhodri, Simon, Watcyn [GB/GB]; Troedrihwfer, Rhandirmwyn, Llandoverly, Dyfed SA20 0PN (GB). (74) Agent: HOGG, Jeffery, Keith; Withers &amp; Rogers, 4 Dyer's Buildings, Holborn, London EC1N 2JT (GB).</p>		<p>(81) Designated States: GB, JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). <b>Published</b> <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> (88) Date of publication of the international search report: 8 October 1998 (08.10.98)</p>

(54) Title: CONTROL MEANS



## (57) Abstract

This invention relates to control means and actuators (1) with feed-back sensors (5) suitable for use in tele-operated systems, especially surgical tools and endoscopes. A membrane (9) is provided to flex with an operator's finger, and a sensor (20) responsive to longitudinal flexing of the membrane produces an output signal dependent on the position of the finger. The membrane (9) covers the finger like a glove, and extends across the back of the hand. The sensor (20) preferably comprises an optic fibre (13). The actuator (1) is fluid-operated and comprises a corrugated tube (7) with a length-restraining member (8) along one side so that the tube curves when it is extended by internal fluid pressure. A feedback sensor (5) is responsive to the position of the tube (7) and/or lateral force experienced by the tube (7) when it engages an external object. A feedback signal from the sensor (5) operates a feedback force generator (3) in contact with the operator's finger.

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# INTERNATIONAL SEARCH REPORT

International Application No

P / GB 97/03166

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6 G06F3/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F G09B G10H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 972 074 A (WRIGHT SCOTT M) 20 November 1990	1-7, 9, 11, 12, 14, 32-36, 38, 39, 41, 42, 45
Y	see column 6, line 4 - column 8, line 11 see figures 1-5B, 8	13, 40, 43, 44
A	---	8, 10, 37, 39
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- \*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)
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- \*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
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- \*Z\* document member of the same patent family

Date of the actual completion of the international search

23 March 1998

Date of mailing of the international search report

24. 08. 98

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/03166

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 88 07659 A (VPL RESEARCH INC) 6 October 1988  see abstract see page 7, line 4 - page 10, line 19 see figures 1-16	1-9,11, 12,14, 32-36, 38,39, 41,42
A	---	10,37
X	US 4 715 235 A (FUKUI MINORU ET AL) 29 December 1987  see column 4, line 52-67 see column 34, line 54-68 see column 35, line 3 - column 36, line 17 see figure 31	1-6,32, 33,38, 39,41,42
X	STURMAN D J ET AL: "A SURVEY OF GLOVE-BASED INPUT" IEEE COMPUTER GRAPHICS AND APPLICATIONS, vol. 14, no. 1, 1 January 1994, pages 30-39, XP000511085 see page 32, line 19 - page 35, line 3 see figures 4-8	1-8,12, 14,38, 39,41,42
A	---	9-11,13, 32,33
Y	BERGAMASCO M ET AL: "ADVANCED INTERFACES FOR TELEOPERATED BIOMEDICAL ROBOTS" IMAGES OF THE TWENTY FIRST CENTURY, SEATTLE, NOV. 9 - 12, 1989, vol. PART 3, no. CONF. 11, 9 November 1989, YONGMIN KIM;SPELMAN F A, page 912/913 XP000091935 see the whole document	13,40, 43,44
A	SHIMOGA K B: "A SURVEY OF PERCEPTUAL FEEDBACK ISSUES IN DEXTEROUS TELEMANIPULATION: PART II FINGER TOUCH FEEDBACK" PROCEEDINGS OF THE VIRTUAL REALITY ANNUAL INTERNATIONAL SYMPOSIUM, SEATTLE, SEPT. 18 - 22, 1993, no. SYMP. 1, 18 September 1993, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 271-279, XP000457697 see the whole document	43,44

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB 97/03166

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-14, 32-45

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

1. Claims: 1-14, 32-45 (searched)

Apparatus and process to measure movement of a member with the provision of a membrane to move with the member and a sensor responsive to the flexing of the membrane, in which the sensor comprises two lengths of optic fibre attached to the membrane with adjacent ends spaced apart so that the spacing varies with strain in the membrane.

2. Claims: 15-24 (not searched)

Fluid operated actuator comprising a corrugated tube with a length restraining member along one side so that the tube curves toward said one side when it is extended by internal fluid pressure.

3. Claims: 25-31 (not searched)

An aid for an injured limb comprising a sensor responsive to the flexing of a patient's finger and an actuator that stimulates said injured limb or a prosthetic limb so that it flexes in accordance with said finger, in which the limb has a membrane fitted to it and a feedback sensor responsive to force experienced by the limb so as to control a feedback force generator to apply a corresponding force to the patient's hand or arm.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 97/03166

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