

620377

AUSTRALIA  
PATENTS ACT 1990

NOTICE OF ENTITLEMENT

I, Gordon David CARMICHAEL,  
of Sirotech Limited, 580 Church Street, Richmond, VICTORIA,  
on behalf of the applicant in respect of Application No.  
30442/89, entitled

"Apparatus to Measure The Bending Length and Bending Rigidity  
of Fabrics", state the following:

The person nominated for the grant of the patent has  
entitlement from the actual inventors,

Nhan Gia LY  
Frank SCAYSBROOK

by virtue of the fact that, at the time the invention was made,  
the actual inventors were officers of Commonwealth Scientific  
and Industrial Research Organisation (CSIRO) and the invention  
was made in the course of their official duties with CSIRO; the  
nominated person is therefore entitled to the grant of the  
patent by virtue of Section 54(1) of the Science and Industry  
Research Act 1949.

The person nominated for the grant of the patent is the  
applicant of the application(s) listed in the declaration under  
Article 8 of the PCT.

DATED this 25th day of October, 1991.



Gordon David CARMICHAEL  
Registered Patent Attorney

**(12) PATENT ABRIDGMENT (11) Document No. AU-B-30442/89**  
**(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 620377**

- (54) Title  
APPARATUS TO MEASURE THE BENDING LENGTH AND BENDING RIGIDITY OF FABRICS
- International Patent Classification(s)  
(51)<sup>4</sup> G01N 033/36 G01N 003/00
- (21) Application No. : 30442/89 (22) Application Date : 31.01.89
- (87) PCT Publication Number : WO89/07207
- (30) Priority Data
- |             |           |              |
|-------------|-----------|--------------|
| (31) Number | (32) Date | (33) Country |
| PI6610      | 05.02.88  | AU AUSTRALIA |
- (43) Publication Date : 25.08.89
- (44) Publication Date of Accepted Application : 20.02.92
- (71) Applicant(s)  
COMMONWEALTH SCIENTIFIC & INDUSTRIAL RESEARCH ORGANISATION
- (72) inventor(s)  
NHAN GIA LY; FRANK SCAYSBROOK
- (74) Attorney or Agent  
SPRUSON & FERGUSON, GPO Box 3898, SYDNEY NSW 2001
- (56) Prior Art Documents  
DE 2843653  
US 3933035
- (57) Claim

1. An apparatus to measure the bending length and bending rigidity of fabrics, said apparatus comprising:

a generally horizontal planar surface terminating at one end with an edge, upon which a strip of fabric is placed and along which surface it is moved, a distance transducer mounted adjacent to said surface to detect the distance moved by said strip;

a detector to determine when a leading edge of said strip passes the edge of said surface; and

an optical sensor to detect when said leading edge intersects a plane extending downwardly from said surface edge at an acute angle to the horizontal.

OPI DATE 25/08/89

APPLN. ID 30442 / 89

AOJP DATE 28/09/89

PCT NUMBER PCT/AU89/00031

**PCT**

**620377**

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> : <b>G01N 33/36, 3/00</b>	<b>A1</b>	(11) International Publication Number: <b>WO 89/07267</b> (43) International Publication Date: 10 August 1989 (10.08.89)
--	-----------	---

(21) International Application Number: PCT/AU89/00031

(74) Agent: SPRUSON & FERGUSON; G.P.O. Box 3898, Sydney, NSW 2001 (AU).

(22) International Filing Date: 31 January 1989 (31.01.89)

(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), US.

(31) Priority Application Number: PI 6610

(32) Priority Date: 5 February 1988 (05.02.88)

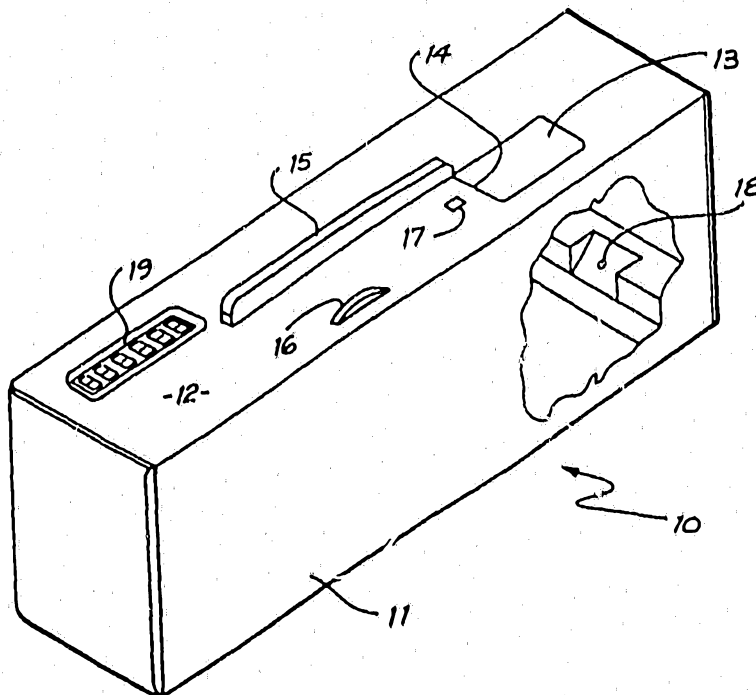
(33) Priority Country: AU

**Published**  
*With international search report.*

(71) Applicant (for all designated States except US): COMMONWEALTH SCIENTIFIC & INDUSTRIAL RESEARCH ORGANISATION [AU/AU]; Limestone Avenue, Campbell, ACT 2600 (AU).

(72) Inventors; and  
(75) Inventors/Applicants (for US only) : LY, Nhan, Gia [VN/AU]; 26 Keene Street, Baulkham Hills, NSW 2153 (AU). SCAYSBROOK, Frank [AU/AU]; 117a Essex Street, Epping, NSW 2121 (AU).

(54) Title: APPARATUS TO MEASURE THE BENDING LENGTH AND BENDING RIGIDITY OF FABRICS



(57) Abstract

An apparatus (10) to measure the bending length and bending rigidity of a piece of fabric, the apparatus includes a generally planar surface (12) upon which the piece of material is moved, the surface terminates at one end with an edge (14) over which the piece of material passes. An optical device (18) defines a plane extending downwardly from the edge (14) at approximately 41.5° and detects when that plane is intersected. The length of material which has passed over the edge (14) provides an indication of the bending length and bending rigidity of the piece of fabric.

APPARATUS TO MEASURE THE BENDING LENGTH AND BENDING RIGIDITY OF FABRICS

Background of the Invention

The present invention relates to apparatus to measure the bending length and bending rigidity of fabric.

5

Prior Art

The recent introduction to the garment manufacturing industry of sophisticated instruments for measuring fabric mechanical and physical properties has raised the awareness of the textile industry to the usefulness of objective measurement for quality control and product development. However, apart from being expensive, the currently available instruments require a skillful and devoted operator. These are the main reasons for the reluctance of most tailors to adopt fabric objective measurement for quality control.

10

Object of the Invention

It is the object of the present invention to overcome or substantially ameliorate the above disadvantages.

15

Summary of the Invention

There is disclosed herein an apparatus to measure the bending length and bending rigidity of fabrics, said apparatus comprising:

20

a generally horizontal planar surface terminating at one end with an edge, upon which a strip of fabric is placed and along which it is moved, a distance transducer mounted adjacent said surface to detect the distance moved by said strip;

25

a detector to determine when a leading edge of said strip passes the edge of said surface; and

an optical sensor to detect when said leading edge intersects a plane extending downwardly from said surface edge at an acute angle to the horizontal.

Description of the Preferred Embodiment

30

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawing, which schematically depicts in perspective view an apparatus to measure the bending length and bending rigidity of fabric.

35

In the accompanying drawing there is schematically depicted an apparatus 10 (flexometer) to measure the bending length and bending rigidity of fabrics.

-1A-

The apparatus 10 includes a body 11 having an upper horizontal surface 12 provided with an aperture 13 having a straight edge 14. Extending in a direction generally normal to the edge 14 is a guide bar 15 along which a length of fabric is moved toward the edge 14.

ALLAN  
75

RLF/0017m

Mounted adjacent the surface 12 is a displacement transducer 16 which measures the distance travelled by the fabric strip. Located adjacent the edge 14 is a reflective sensor 17 to determine when the leading edge of the strip passes thereby.

5 Mounted within the body 11 is a photodetector 18 which detects when the leading edge of the strip intersects a plane extending downwardly from the edge 14 at an acute angle of between 40° and 45°, preferably about 41.5°, to the horizontal.

10 A digital readout 19 shows the length of the fabric extending between the edge 14 and the point of intersection with the leading edge of the fabric with the abovementioned plane.

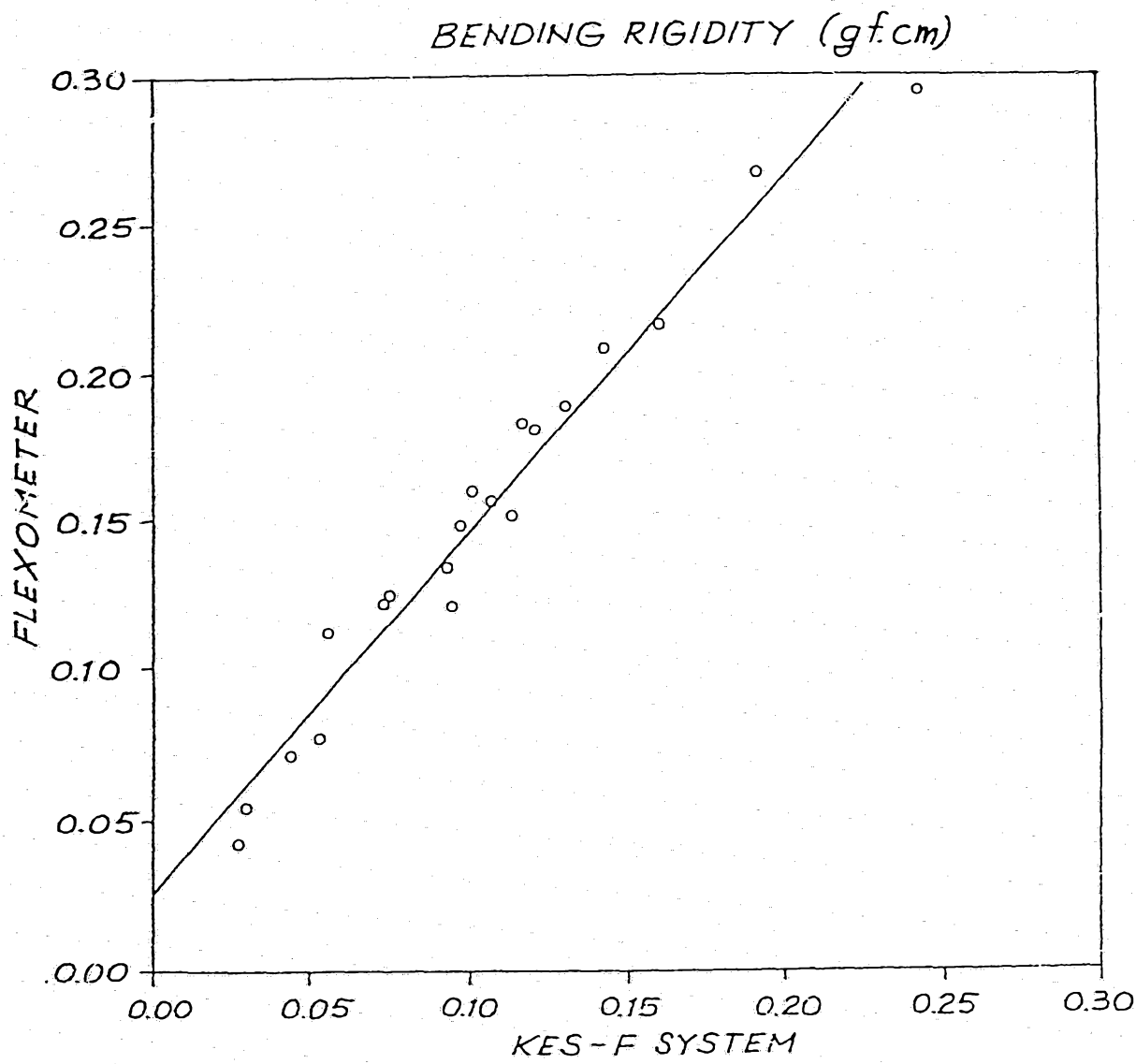
15 The above apparatus 10 measures two bending properties of a fabric, that is the fabric bending length which is related to the ability to drape a material, and the fabric bending rigidity which is related to the quality of stiffness when a fabric is handled. The bending rigidity is particularly critical in the tailoring of lightweight fabrics as a very flexible fabric (low bending rigidity) may cause seam puckering while a high bending rigidity fabric can be more manageable in sewing and produce a flat seam.

20 A photodetector 18 is used to detect the point where the overhanging part of a rectangular strip of fabric bends and reaches a plane inclined at 41.5° to the horizontal. The bending length (LB) is displayed automatically with the use of an electronic encoder, thus the error due to the operator's judgement is eliminated. This bending length is combined  
25 with the cloth mass  $M$  ( $\text{g/cm}^2$ ) to give the fabric bending rigidity (B) as shown in the following relation:

$$B = 0.10 M LB^3 \quad (\text{mg.cm})$$

30 Initial measurements with the apparatus 10 show good correlation in the bending rigidity between this instrument and the KES-F Bending Tester [2]. A correlation coefficient of 0.98 was found for 10 worsted fabrics covering a variation in fabric weight from  $113 \text{ g/m}^2$  to  $453 \text{ g/m}^2$ , both warp and weft directions were measured. This is shown in the following graph despite the high correlation, the KES-F values are significantly lower than those given by the Stiffness Meter. This is because  
35 measurements were done on the KES-F Bending Tester prior to the modification of the instrument's clamps by the manufacturer which raises the measured bending rigidities to values approximately equivalent to the apparatus 10.

**SUBSTITUTE SHEET**



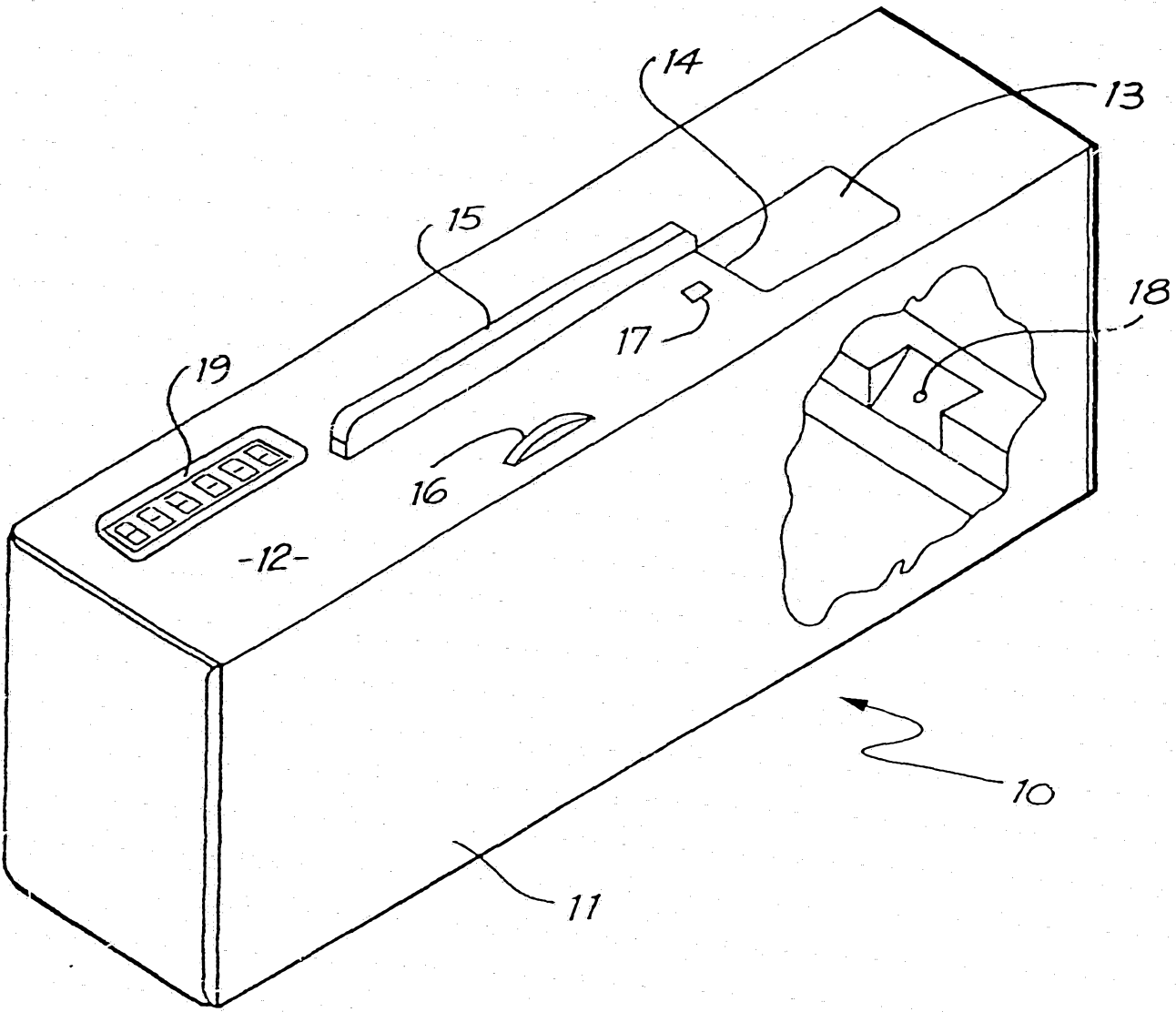
The claims defining the invention are as follows:

1. An apparatus to measure the bending length and bending rigidity of fabrics, said apparatus comprising:
  - a generally horizontal planar surface terminating at one end with an edge, upon which a strip of fabric is placed and along which surface it is moved, a distance transducer mounted adjacent to said surface to detect the distance moved by said strip;
  - a detector to determine when a leading edge of said strip passes the edge of said surface; and
  - an optical sensor to detect when said leading edge intersects a plane extending downwardly from said surface edge at an acute angle to the horizontal.
2. The apparatus of claim 1 wherein said angle is between  $40^\circ$  and  $45^\circ$ .
3. The apparatus of claim 2 wherein said angle is approximately  $41.5^\circ$ .
4. The apparatus of claim 3 further including means to define a linear path along which the fabric is moved towards said surface edge.
5. The apparatus of claim 4 further including means to measure the distance travelled by the fabric after having passed said surface edge.
6. The apparatus of claim 5 wherein said means to measure the distance of travel of said fabric is a displacement transducer.

DATED this FOURTH day of DECEMBER 1991


Commonwealth Scientific and Industrial Research Organisation

Patent Attorneys for the Applicant  
SPRUSON & FERGUSON



# INTERNATIONAL SEARCH REPORT

International Application No **PCT/AU 89/00031**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>4</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. <sup>4</sup> <b>G01N 33/36, 3/00</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC	G01N 33/36, 3/00, 19/00, G01B 5/20	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>8</sup>		
AU : IPC as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	Derwent Abstracts Accession no. 37887C/21, Class S02, SU,A, 688878 (KOSTROMA TECHN INST) 1 October 1979 (01.10.79)	
A	DE,A, 2843653 (RAU) 17 April 1980 (17.04.80)	
A	Derwent Abstracts Accession no. 21839K/09, Class S03, RO,A, 79744 (TEODORESCU H.C.) 30 July 1982 (30.07.82) (See Figure 2)	
A	US,A, 3933035 (J. BOBST & FILS S.A.) 20 January 1976 (20.01.76)	
<p><sup>10</sup> Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the International filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the International filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Z" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
28 April 1989 (28.04.89)	17 May 1989 (17.05.89)	
International Searching Authority Australian Patent Office	Signature of Authorized Officer  R. MURRAY	