



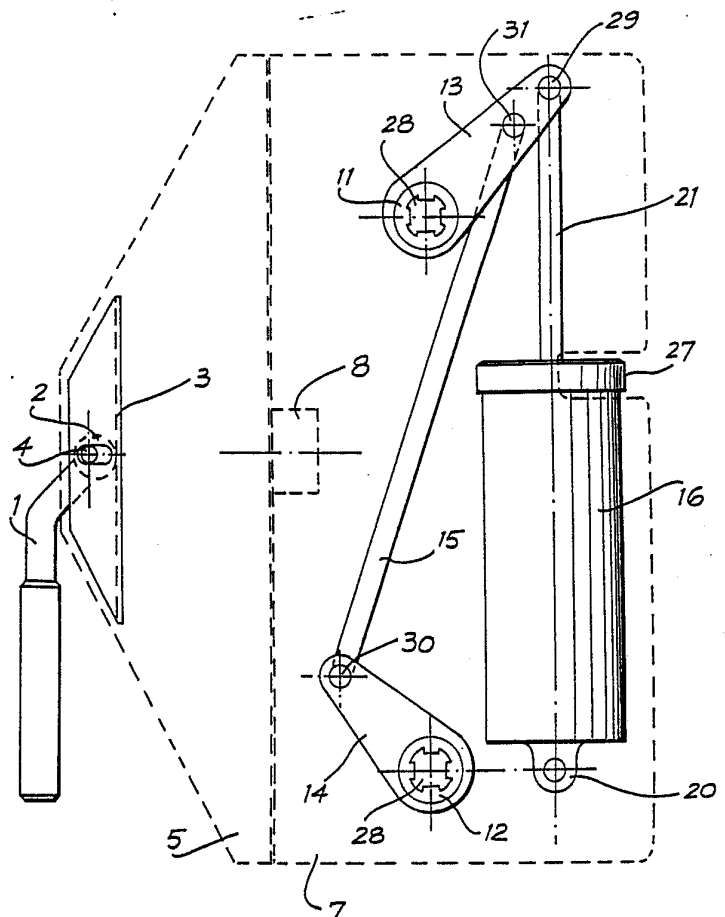
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<p>(21) International Application Number: PCT/AU87/00124 (22) International Filing Date: 30 April 1987 (30.04.87) (31) Priority Application Number: PH 5670 (32) Priority Date: 30 April 1986 (30.04.86) (33) Priority Country: AU (71) Applicant (for all designated States except US): COM-DOX NO. 70 PTY. LIMITED [AU/AU]; Roberts & Morrow, 328 Gray Street, Glen Innes, NSW 2370 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only) : TRETHERWEY, Reginald [AU/AU]; Kameruka, Deepwater, NSW 2371 (AU). (74) Agent: GRIFFITH HASSEL & FRAZER; G.P.O. Box 4164, Sydney, NSW 2001 (AU).</p>	<p>(81) Designated States: AU, DE (European patent), FR (European patent), GB (European patent), IT (European patent), US. Published With international search report.</p>	

(54) Title: ACTUATION LINKAGE FOR LINEAR MOTION RESISTANCE CELL

(57) Abstract

An actuation linkage for a linear motion resistance cell (16) particularly for use in an exercise machine wherein lever type handles having splined ends can be engaged in either side of splined sockets (28) on shafts (11) and (12). The linkage (13, 14, 15) between the shafts (11) and (12) provides a synchronous counter rotating movement between the shafts providing a rowing type movement when the levers are engaged in the sockets (28) on the same side of support frame (7) which is orientated horizontally. The support frame (7) can pivot about pin (8) to a vertical position and the lever arms be engaged in opposite sides of shaft (11) for other types of exercise.



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"ACTUATION LINKAGE FOR LINEAR MOTION RESISTANCE CELL"TECHNICAL FIELD

This invention relates to an actuation linkage for a linear motion resistance cell and has been devised particularly though not solely for use with the linear motion resistance cell described in our copending International patent application PCT/AU85/00090.

BACKGROUND ART

The linear motion resistance cell described and claimed in our above-referenced patent application was specifically developed for use with an exercise machine shown in Figures 1 and 9 of that specification. In particular Figure 9 showed a mechanical apparatus whereby a pair of lever arms could be engaged on parallel vertical shafts and moved in opposite synchronous rotation to give a rowing like action on the exercise machine. To this end it is necessary to provide two parallel shafts engageable with the lever arms and coupled together so that they will move synchronously in opposite rotation and also transmit that movement to the linear motion resistance cell, for the resistance of that particular movement.

DISCLOSURE OF INVENTION

The present invention is directed to an improved form of apparatus for containing the linear motion resistance cell and providing the actuation linkage for that form of synchronized opposed movement of a pair of lever arms.

Accordingly the invention consists in an actuation linkage for a linear motion resistance cell in the form of an hydraulic piston and cylinder assembly, said linkage comprising a pair of spaced apart parallel shafts rotatably mounted in a support frame and provided with engagement means for engagement with lever type handles, connecting means between said shafts coupling said shafts together such that the two shafts rotate in synchronism in opposite directions, and a crank-type linkage from at least one of the shafts to the actuation rod of the hydraulic piston and cylinder assembly, causing the rod to

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move linearly within the cylinder upon rotation of the shafts.

Preferably the crank-type linkage comprises a primary crank arm extending radially from one of the shafts and being connected to the actuation rod at its outer end.

Preferably the connecting means between the shafts comprises a secondary crank arm on the second shaft connected to the primary crank arm on the first shaft by way of a connecting rod.

Alternatively the connecting means between the shafts comprises a gear train connected between the shafts.

BRIEF DESCRIPTION OF DRAWINGS

Notwithstanding any other forms that may fall within its scope one preferred form of the invention will now be described by way of example only with reference to the accompanying drawings in which

Fig. 1 is a side view of an actuation linkage for a linear motion resistance cell according to the invention, showing the support frame in ghost outline for clarity.

Fig. 2 is a similar view to Fig. 1 to a reduced scale, fully showing the support frame, and

Fig. 3 is an end view of the apparatus shown in Fig. 2, showing the alternative position of the apparatus in broken outline.

MODES FOR CARRYING OUT THE INVENTION

In the preferred form of the invention a linear motion resistance cell in the form of an hydraulic piston and cylinder assembly (16) is mounted in a support frame (7) by way of a mounting pin (20). The piston and cylinder assembly is operable by an actuation rod (21) for linear movement within the cylinder (16) in the normal manner. The support frame (7) comprises a pair of side plates (22) and (23) (Fig. 3) separated by end plates (24) and (25) to form a rectangular box in which the linear motion resistance cell (16) and the actuation linkage therefor is located. The support frame may be provided with a cut away portion (26) allowing access to a control

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ring (27) on the linear motion resistance cell for control of the operation of that resistance cell.

The actuation linkage comprises a first shaft (11) rotatably mounted in bearings between the side plates (22) and (23) and a second shaft (12) similarly mounted and located vertically below the first shaft (11). The shafts may take any convenient form but are preferably provided with splined sockets (28) for engagement with similarly splined shafts on the ends of lever arms used with the exercise apparatus.

The first shaft (11) is provided with a first crank arm (13) mounted on the shaft for rotation therewith and coupled to the actuation rod (21) of the linear motion resistance cell by way of a crank pin (29). Rotation of the first shaft (11) under the operation of one or more lever arms engaged therewith causes the crank arm (13) to rotate and the actuation rod (21) to be forced into and/or out of the cylinder (16).

The second shaft (12) is also provided with a second crank arm (14) interconnected with the first crank arm (13) by way of a connecting rod (15) coupled to the crank arms by crank pins (30) and (31) respectively. The two crank arms are orientated relative to each other as shown in Figure 1 and the distance from the crank pin (31) to the axis of the shaft (11) is the same as the distance from the crank pin (30) to the axis of the shaft (12). In this manner rotation of one of the shafts (11) or (12) causes rotation of the other shaft in synchronisation in the opposite direction. To achieve even movement between the shafts (11) and (12) it is necessary for the crank arms (13) and (14) to each be orientated at the same angle to the "centreline" joining the axes of the two shafts, although spaced on opposite sides of that centreline. Both shafts are also coupled either directly or indirectly to the actuation rod (21) of the linear motion resistance cell so that engagement of the exercise machine lever arms with either of the shafts (11) or (12) can be used for

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operation of the machine.

Although the linkage between the shafts (11) and (12) has been described as a pair of crank arms linked by a connecting rod (15) it will be appreciated that other
5 forms of linkage such as a gear train could be used to transmit the synchronous counter rotating movement from one shaft to the other.

The main support frame (7) is coupled to a mounting frame (5) by way of a horizontal pivot pin (8) and the
10 orientation of the main frame (7) relative to the support frame (5) is controlled by a locking pin (10) which is engageable in two positions so that the main frame can assume either a vertical position as shown in solid outline in Figures 2 and 3 or a horizontal position as
15 shown in broken outline in Figure 3. The support frame (5) is in turn adapted to be engaged with a vertical post (not shown) on the exercise machine and to this end the support frame is provided with a rubber pad (6) arranged to fit against one side of the post, and a clamp pad (3)
20 operable by a cam (2) about a pivot pin (4) in the support frame under the influence of actuation clamping handle (1). When the clamping handle (1) is raised to a horizontal position, the pad (3) moves away from the vertical surface of the post, releasing the support frame
25 and allowing the support frame to move vertically upwards and downwards to a desired position on the post. Once that desired position has been reached the handle (1) is pivoted downwardly moving the clamp pad (3) into clamping engagement with the surface of the post and securely
30 clamping the support frame in position between the face of the clamp pad (3) and the rubber pad (6).

In use the support frame is moved to the desired vertical position on the support post as described above and the lever arms engaged with the shafts (11) and/or
35 (12) for the desired form of exercise. For example when it is desired to rotate a pair of lever arms in the same direction, the lever arms may be engaged with opposite

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ends of the shaft (11) so that the arms are aligned and can be rotated together by the user. When the user desires to perform rowing type exercises, or thrusting exercises with the arms or legs, the support frame is
5 firstly rotated to the horizontal position (32) and locked in place by the locking pin (10). The two lever arms may then be engaged with the first and second shafts (11) and (12) respectively, on the same side of the main frame (7) so that the two lever arms may be rotated in opposite
10 directions in synchronization against the resistance of the linear motion resistance cell (16).

In this manner an actuation linkage for a linear motion resistance cell is provided which enables the cell to be used in an exercise machine in a convenient manner
15 allowing the machine to be readily adapted between operation by parallel lever arms in the same direction, or in a rowing type exercise for operation by two spaced apart lever arms rotated in synchronization in opposite directions.

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CLAIMS

1. An actuation linkage for a linear motion
resistance cell in the form of an hydraulic piston and
cylinder assembly, said linkage comprising a pair of
5 spaced apart parallel shafts rotatably mounted in a
support frame and provided with engagement means for
engagement with lever type handles, connecting means
between said shafts coupling said shafts together such
that the two shafts rotate in synchronism in opposite
10 directions, and a crank-type linkage from at least one of
the shafts to the actuation rod of the hydraulic piston
and cylinder assembly, causing the rod to move linearly
within the cylinder upon rotation of the shafts.

2. An actuation linkage as claimed in claim 1,
15 wherein the crank-type linkage comprises a primary crank
arm extending radially from one of the shafts and being
connected to the actuation rod at its outer end.

3. An actuation linkage as claimed in either claim
1 or claim 2, wherein the connecting means between the
20 shafts comprises a secondary crank arm on the second shaft
connected to the primary crank arm on the first shaft by
way of a connecting rod.

4. An actuation linkage as claimed in claim 3,
wherein the primary crank arm and the secondary crank arm
25 each subtend the same angle with a line between the axes
of the two shafts but on opposite sides of that line.

5. An actuation linkage as claimed in either claim
3 or claim 4, wherein the length of the primary crank arm
between the axis of its shaft and the connecting rod is
30 the same as the length of the secondary crank arm between
the axis of its shaft and the connecting rod.

6. An actuation linkage as claimed in any one of
the preceding claims, wherein the support frame is
rotatably mounted to the frame of an exercise machine such
35 that the support frame can be rotated between a first
position wherein the two shafts are horizontally
orientated and vertically spaced from one another and a

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second position wherein the two shafts are vertically orientated and spaced apart side by side.

7. An actuation linkage as claimed in claim 6, wherein the support frame is coupled to a monitoring frame
5 by way of a horizontal pivot pin and retained in either the first position or the second position by a locking pin engageable between the support frame and the mounting
frame.

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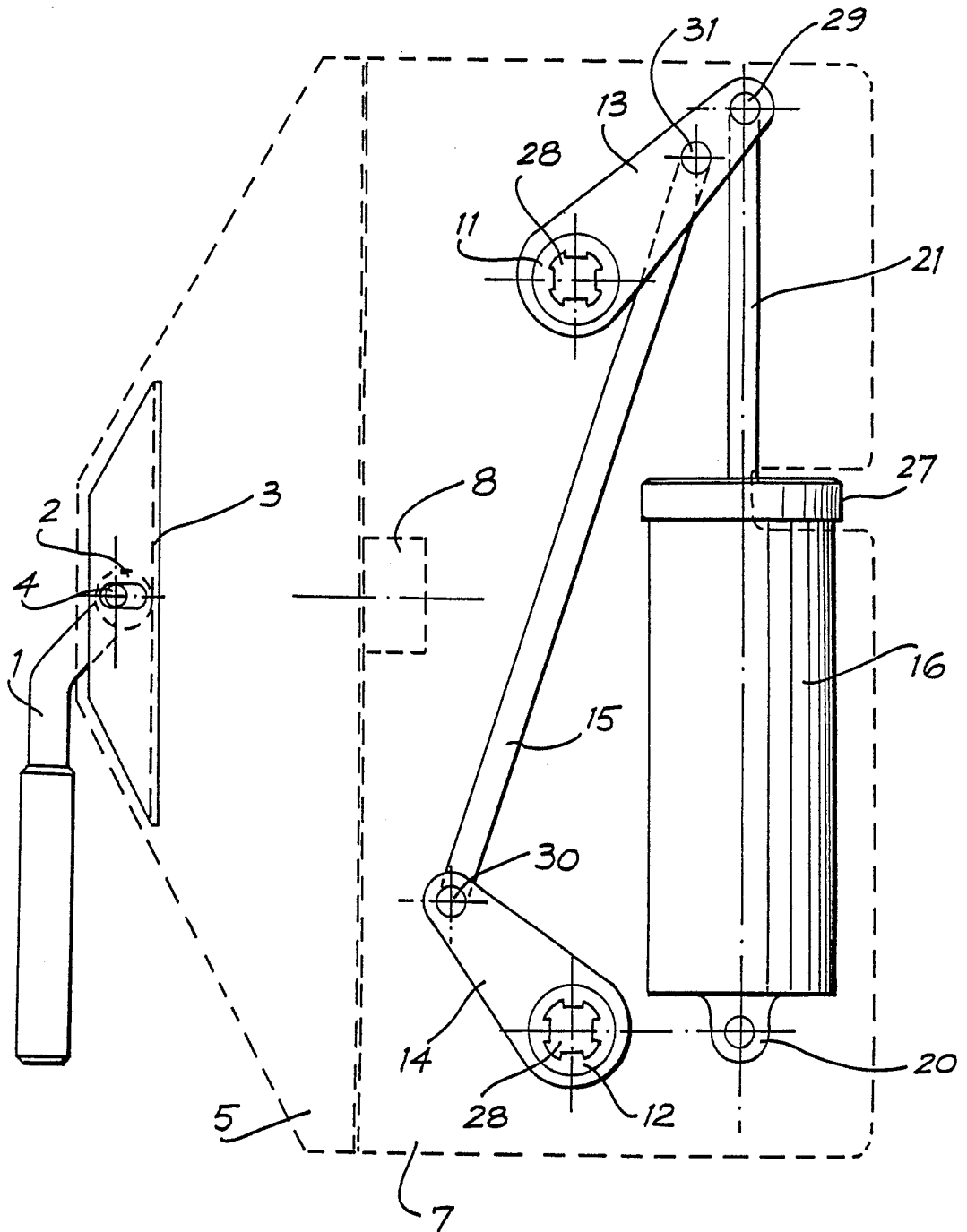


FIG. 1

SUBSTITUTE SHEET

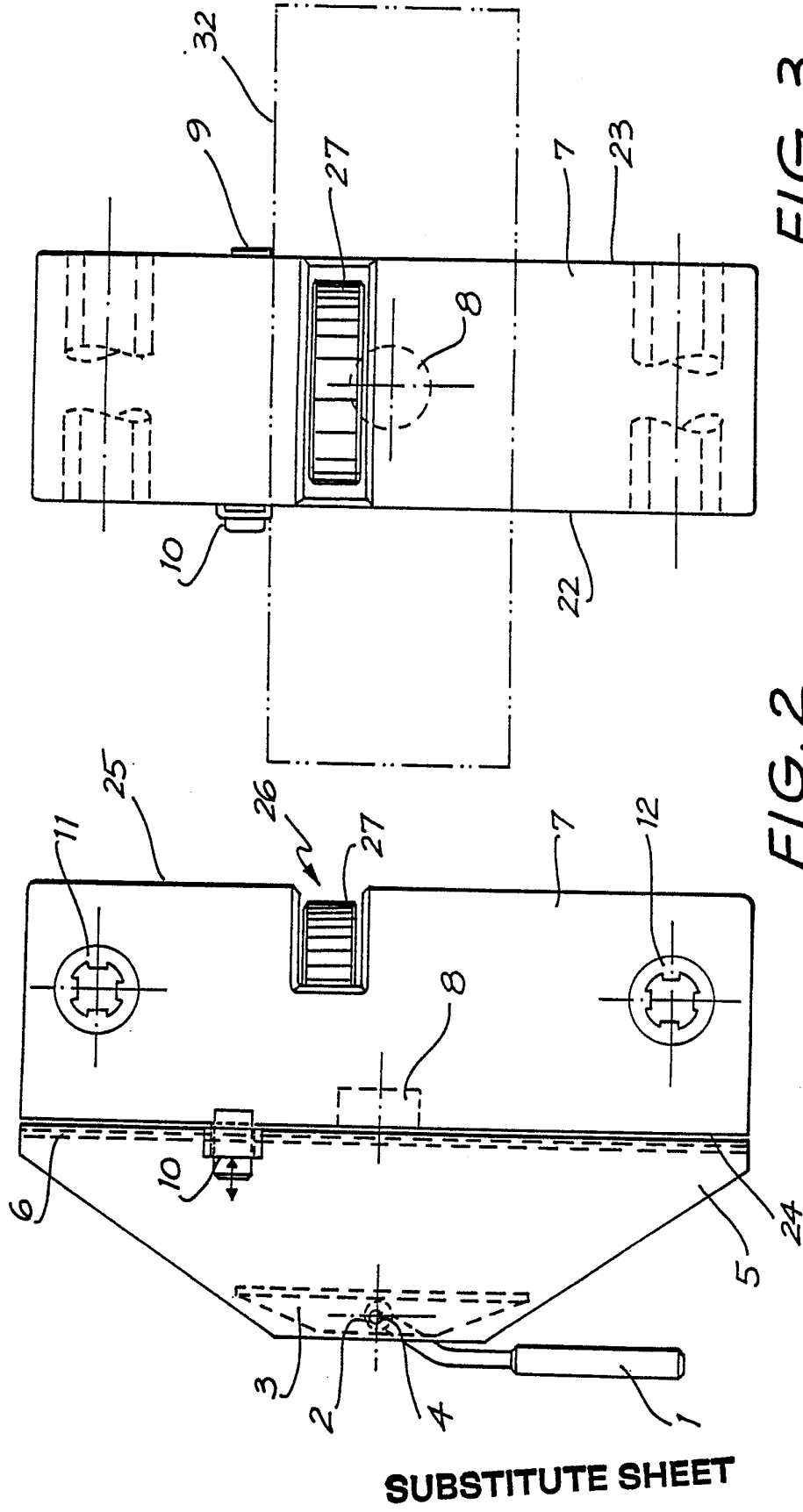


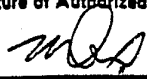
FIG. 3

FIG. 2

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 87/00124

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. ⁴ A63B 21/00, F16H 21/44		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC	A63B 21/00, F16H 21/44	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
AU : IPC as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	AU,A, 42973/85 (TRETWEY) 7 November 1985 (07.11.85)	1
X	AU,A, 35093/84 (HYDRA-GYM ATHLETICS INC) 11 April 1985 (11.04.85)	1
X	AU,A, 29986/84 (PAUL WURTH S.A.) 3 January 1985 (03.01.85)	1-7
X	US,A, 4514129 (LEGILLE et al) 30 April 1985 (30.04.85)	
A	US,A, 2032303 (ORGITANO) 25 February 1936 (25.02.36)	
<p>¹⁰ Special categories of cited documents:</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>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
30 July 1987 (30.07.87)	(30.08.87) 10 AUGUST 1987	
International Searching Authority	Signature of Authorized Officer	
Australian Patent Office.	 (G.M. COX)	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 87/00124

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian 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	Patent Family Members			
US 4514129	BR 8201964 IN 157881 SU 1251811	CA 1168442 JP 57177909	EP 62770 LU 83279	
AU 42973/85	DK 6029/85 WO 8504935	EP 179818	NO 855326	
AU 29986/84	BR 8403214 LU 84890	EP 134918 US 4570900	JP 60023685 ZA 8404379	
AU 35093/84	EP 156908	WO 8501446		

END OF ANNEX