



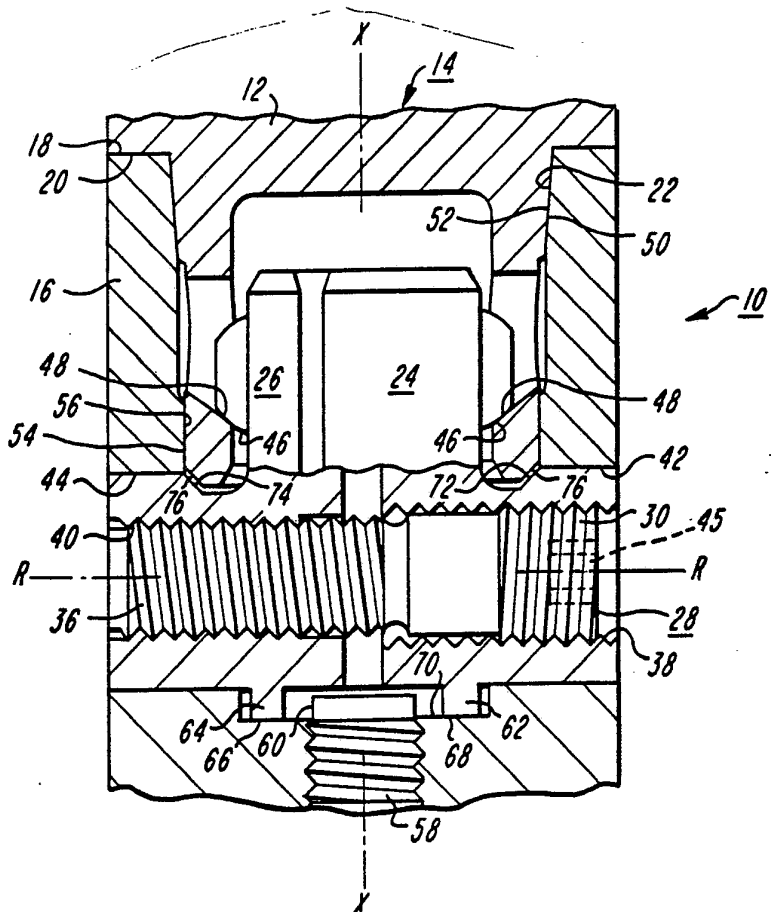
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>4</sup> : <b>B23B 29/04, 29/34</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 88/ 05358</b> (43) International Publication Date: 28 July 1988 (28.07.88)</p>
<p>(21) International Application Number: PCT/US87/02976 (22) International Filing Date: 13 November 1987 (13.11.87) (31) Priority Application Number: 007,310 (32) Priority Date: 27 January 1987 (27.01.87) (33) Priority Country: US  (71) Applicants: KENNAMETAL INC. [US/US]; P.O. Box 231, Latrobe, PA 15650 (US). KRUPP WIDIA GMBH [DE/DE]; Postfach 102161, D-4300 Essen 1 (DE). (72) Inventor: ERICKSON, Robert, A. ; 1005 Pebblebrook Drive, Raleigh, NC 27609 (US). (74) Agents: PRIZZI, John, J. et al.; Kennametal Inc., P.O. Box 231, Latrobe, PA 15650 (US).</p>	<p>(81) Designated States: AT (European patent), AU, BB, BE (European patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK, FI, FR (European patent), GA (OAPI patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent).</p> <p><b>Published</b> <i>With international search report.</i></p>	

(54) Title: CLAMPING APPARATUS FOR HOLDING A TOOLHOLDER SHANK

(57) Abstract

An apparatus (10) for holding a tubular shank (12) of a toolholder (14) is provided with a tool support member bore (22) for receiving the shank (12) and first and second radially reciprocally movable clamping jaws (24, 26) for holding the shank (12) in the bore (22). The movement of the clamping jaws (24, 26) is radially activated by rotation of a radially aligned differentially threaded member (28) engaging both clamping jaws (24, 26).



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## CLAMPING APPARATUS FOR HOLDING A TOOLHOLDER SHANK

BACKGROUND OF THE INVENTION

5           The present invention relates to mechanisms  
for releasably holding a first member and a second  
member together along a longitudinal axis. It is  
especially concerned with mechanisms for releasably  
holding a toolholder shank in a support member bore  
10 when the mechanism actuating member is transversely  
aligned with respect to the longitudinal axis of the  
toolholder shank and support member bore. Such  
mechanisms and articles are used in the cutting and  
shaping of workpieces where it is not expedient to use  
15 the tool support member in connection with a base  
member having a bore containing an axially aligned  
power driven means for axially actuating the locking  
mechanism in the tool support member.

20           Examples of toolholders and support members  
utilizing releasable locking mechanisms having radial  
activation are shown in United States Patent Nos.  
4,573,824; 4,575,293 and 4,135,418.

25           There is, however, always a need for improved  
mechanisms in this field. The ideal mechanism should  
hold the toolholder securely in place and not detract  
from the basic stiffness of the toolholder. It should  
be relatively simple in design so as to be manufactured  
at a relatively low cost.

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SUMMARY OF THE INVENTION

It is believed that the following design meets the foregoing needs. In accordance with the present invention, an apparatus is provided for 5 releasably holding the tubular shank of a toolholder. The apparatus includes a tool support member having a forwardly facing surface and a bore extending rearwardly therefrom for receiving a tubular shank. 10 Mounted in the tool support member are first and second clamping jaws which extend at least partially into the tool support member bore. An actuating member is provided for reciprocating the jaws radially inwardly so that they be at least partially received with a 15 tubular shank and then radially outwardly for releasably clamping the tubular shank to the tool support member.

The actuating member for reciprocating the clamping jaws is preferably a threaded member radially 20 extending into the clamping jaws. More preferably, the threaded member is threadedly engaged in both clamping jaws. Most preferably, the threaded member includes a first threaded diameter threaded in a first direction at a first pitch threadedly engaged in the first 25 clamping jaw, and a second different threaded diameter threaded in the first direction but at a second pitch threadedly engaged in the second clamping jaw.

It is also preferred that at least one, and more preferably both clamping jaws, have a surface 30 thereon for abutting against the toolholder shank, when they are reciprocated radially inwardly to unclamp the toolholder, to push the toolholder shank forwardly in the tool support member bore. In this manner, when a self-sticking taper is provided on the toolholder shank 35 and tool support member bore, removal of the shank from the bore is facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other aspects of the present invention will become more apparent upon review of the following detailed description of the invention in conjunction with the drawings which are briefly described below:

Fig. 1 shows a side view of an embodiment of a clamping apparatus in accordance with the present invention in partial cross section holding a tubular shank of a toolholder.

Fig. 2 shows a cross cross sectional view of the embodiments of the first and second clamping jaws in accordance with the present invention shown in Fig. 1 taken along the plane defined by orthogonal axes X-X and R-R.

Fig. 3 shows a plan view of the embodiment of the first and second clamping jaws shown in Fig. 1 as viewed looking rearwardly from the forward end of the apparatus shown in Fig. 1 along axis X-X.

Fig. 4 shows a plan view of the embodiment of the second clamping jaw shown in Fig. 1 as seen looking radially inwardly along axis R-R.

Fig. 5 shows a plan view of the embodiments of the clamping jaws shown in Fig. 1 as viewed looking forwardly from the rear end of the apparatus shown in Fig. 1 along axis X-X.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the present invention, Fig. 1 shows an embodiment of an apparatus 10 for releasably holding the tubular shank 12 of a toolholder 14. The apparatus 10 includes a tool support member 16 having a forwardly facing surface 18 which may be used for abutting against a rearwardly facing face 20 of the toolholder 14. Intersecting the forwardly facing

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surface 18 is a bore 22 which extends rearwardly therefrom about a longitudinal axis of symmetry X-X.

Located within the tool support member 16 are first 24 and second 26 clamping jaws which are also shown in Figs. 2 through 5.

The first and second clamping jaws, 24 and 26, are reciprocally movable along radial axis R-R due to their threaded engagement with threaded member 28 which extends along axis R-R. The threaded member 28 includes a first threaded portion 30 having a first threaded diameter threaded in a first direction at a first pitch and a second threaded portion 36 having a second threaded diameter also threaded in the first direction but at a second pitch. The first threaded portion 30 is threadedly engaged in a threaded radial bore 38 in the first clamping element 24 while the second threaded portion 36 is threadedly engaged in the threaded radial bore 40 of the second clamping jaw 26. The diameter of the second threaded portion 36 is smaller than the diameter of first threaded portion 30 in an amount sufficient to allow it to readily pass through the threaded bore 38 of the first clamping jaw 24 without engaging those threads. By way of example, it has been preferred to have the first threaded portion 30 have a 3/8 inch diameter 24 threads/inch left handed thread while the second threaded portion has a 5/16 inch diameter 18 threads/inch left handed thread.

Alternatively, the threaded member may have first and second threaded portions which are threaded in the opposite direction to each other for reciprocating the clamping jaws (not shown). This embodiment, while resulting in a workable apparatus, is not as preferred as the embodiment shown utilizing threaded member 28 for the reasons that threaded member 28 provides a higher mechanical advantage and results in easier assembly of the jaws. The embodiment shown in

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Fig. 1 is readily assembled by first inserting one clamping jaw in through the forward end of the bore and then holding it radially outwardly in one of the cylindrical radial openings 44 or 42 of the tool support member while the other clamping jaw is slipped in through the forward end of the bore and into the other cylindrical radial opening. The threaded member is thus threadedly engaged into the two aligned clamping jaws 24 and 26.

10 It can now clearly be seen that by rotating the threaded member, such as with an Allen Key wrench engaged in the hexagonal cross section recess in the first threaded portion, in a first direction the clamping jaws which are slidably engaged in radial cylindrical apertures 42 and 44 in the support member travel  
15 radially outwardly to clamp the tubular shank 12 into the bore of the support member, as shown. Here each clamping jaw is provided with a convex spherical abutment surface 46 for abutment with a concave cylindrical abutment face 48 that inclines forwardly as it extends  
20 radially outwardly in the shank which has a radius of curvature equal to but no more than 0.004, and preferably 0.002, inches greater than the radius of curvature of the convex spherical abutment surfaces. The spherical abutment surfaces are located on abutment members  
25 which are press fit into cylindrical depressions in the clamping jaws.

In the foregoing manner: (1) the conically tapered forward surface 50 of the shank is pushed rearwardly into an interference fit with a complementary tapered surface 52 on the bore 22; while (2) rearwardly facing abutment face 20 on the toolholder is brought into abutment with the forwardly facing surface 18 on the tool support member; and (3) rear convex cylindrical surface 54 on the shank is expanded into abutment  
30 with a complementary concave cylindrical surface 56 in the bore.  
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By rotating the threaded member 28 in a second direction, clamping jaws 24 and 26 converge inwardly toward one another to release the tubular shank. A set screw 58 centrally mounted along axis X-X in the bottom of the bore rearwardly of the clamping jaws provides an annular abutment surface 60 for abutment with either flange 62 and/or 64 on the first and second clamping jaws, respectively, to assure that when the clamping jaws are moved radially inwardly they are sufficiently centered in the bore to avoid interference with the removal of the shank and the entry of a new shank. Flanges 62 and 64 have flat bottom surfaces 66 and 68 which engage and slide across an annular flat forward facing surface 70 in the bore to thereby hold the clamping jaws nonrotatable.

As the clamping jaws are moved radially inwardly, a forwardly facing arcuate surface 72 and 74, which inclines radially outwardly as it extends forwardly, on at least one, and preferably both, of the clamping jaws engages a rearwardly tapering surface 76 on the rear of the shank 12 to force the shank forwardly in the bore. This feature is especially valuable where the shank and bore have conical mating surfaces which provide a self-sticking taper.

A preferred toolholder design for use with the present invention is disclosed in concurrently filed copending Erickson et al United States patent application Serial No. 007,070. This application is hereby incorporated by reference in its entirety.

Changes and modifications in the specifically described embodiments can be carried out without departing from the scope of the invention which is intended to be limited only by the scope of the appended claims.

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WHAT IS CLAIMED IS:

1. An apparatus for releasably holding the tubular shank of a toolholder, said apparatus  
5 comprising:

a tool support member having a forwardly facing surface and bore intersecting said forwardly facing surface and extending rearwardly therefrom for  
10 receiving said shank;

a first clamping jaw and a second clamping jaw mounted in said tool support member and extending at least partially into said bore;

a means for reciprocating said first and  
15 said second clamping jaws radially inwardly for being receivable at least partially within said tubular shank and radially outwardly for clamping said tubular shank to said tool support member;

said means for reciprocating including a  
20 threaded member radially extending into said first and said second clamping jaws for reciprocating said first and second clamping jaws;

and said threaded member including a first threaded diameter threaded in a first direction  
25 at a first pitch and threadedly engaged in said first clamping jaw, and a second threaded diameter threaded in said first direction at a second pitch and threadedly engaged in said second clamping jaw.

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2. An apparatus for releasably holding the tubular shank of a toolholder, said apparatus comprising:

5 a tool support member having a forwardly facing surface and bore intersecting said forwardly facing surface and extending rearwardly therefrom for receiving said shank;

10 a first clamping jaw and a second clamping jaw mounted in said tool support member and extending at least partially into said bore;

15 a means for reciprocating said first and said second clamping jaws radially inwardly for being receivable at least partially within said tubular shank and radially outwardly for clamping said tubular shank to said tool support member;

said means for reciprocating including a threaded member radially extending into said first and said second clamping jaws for reciprocating said first and second clamping jaws;

20 and a means for pushing said tubular toolholder shank forwardly in said bore on at least one of said first and said second clamping jaws when said first and second clamping jaws are reciprocated radially inwardly to unclamp said tubular shank.

25

3. The apparatus according to Claim 1 further comprising a means for pushing said tubular toolholder shank forwardly in said bore on at least one of said first and said second clamping jaws when said first and second clamping jaws are reciprocated radially inwardly to unclamp said tubular shank.

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4. The apparatus according to Claim 1 further comprising a first and a second spherical abutment surface on said first and second clamping jaws, respectively, for releasable abutment with said

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tubular shank when said first and second clamping jaws are reciprocated radially outwardly.

5           5.    The apparatus according to Claim 2 further comprising a first and a second spherical abutment surface on said first and second clamping jaws, respectively, for releasable abutment with said tubular shank when said first and second clamping jaws are reciprocated radially outwardly.

10           6.    The apparatus according to Claim 3 further comprising a first and a second spherical abutment surface on said first and second clamping jaws, respectively, for releasable abutment with said  
15   tubular shank when said first and second clamping jaws are reciprocated radially outwardly.

            7.    The apparatus according to Claim 2 wherein said threaded member is threadedly engaged in  
20   said first and said second clamping jaws.

            8.    The apparatus according to Claim 5 wherein said threaded member is threadedly engaged in  
25   said first and said second clamping jaws.

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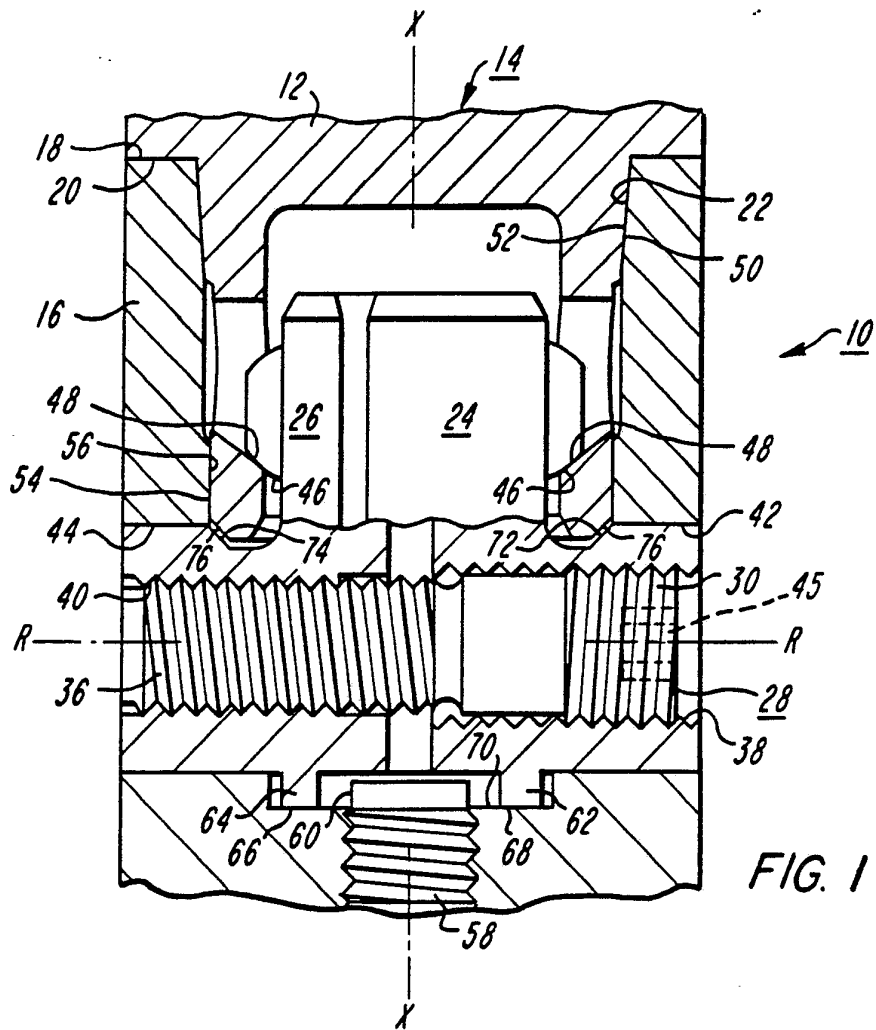


FIG. 1

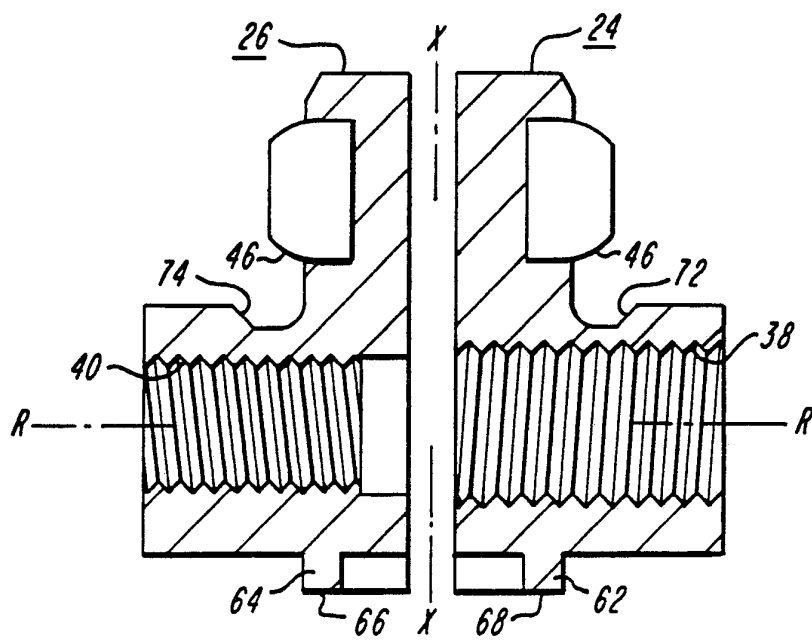
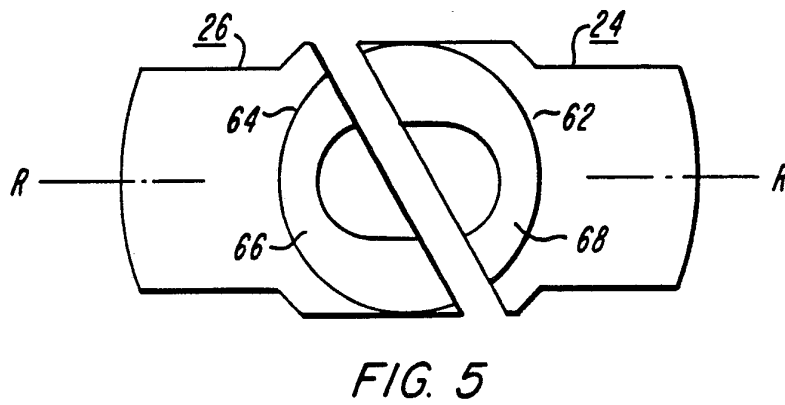
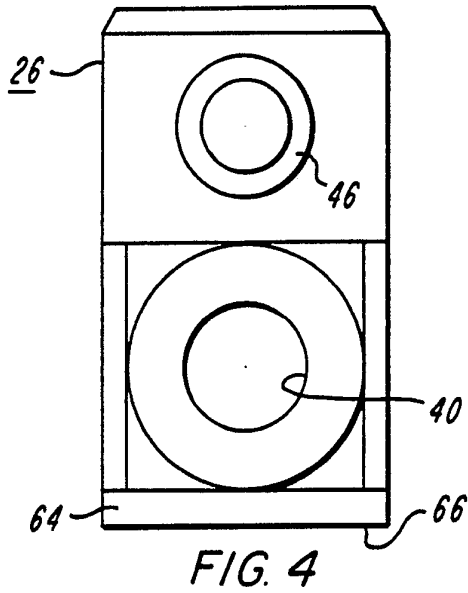
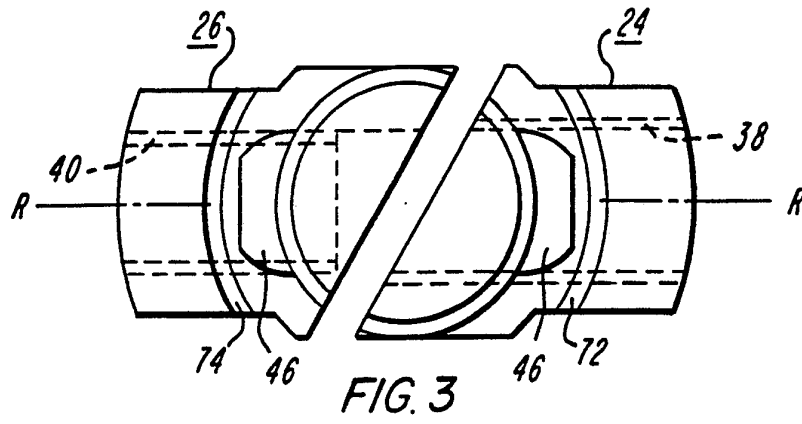


FIG. 2

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# INTERNATIONAL SEARCH REPORT

International Application No **PCT/US87/02976**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC <b>U.S. CL. 82/36B, 403/322, 403/374, 409/234</b> <b>IPC: B23B, 29/04, B23B 29/34</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
<b>U.S.</b>	<b>82/36R, 36A, 36B, 279/1B, 67, 403/322, 324, 374 408/238, 239R, 239A, 409/232-234, 407/46, 101</b>	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>14</sup>
A	US, A, 4,099,899 (VIG) 11 July 1978.	1-8
A	US, A, 4,573,824 (EHLE) 04 March 1986.	1-8
A	US, A, 4,575,293 (BERTI) 11 March 1986.	1-8
A	US, A, 4,615,244 (REITER et al) 07 October 1986.	1-8
A	US, A, 4,629,374 (BERNER) 16 December 1986.	1-8
E	US, A, 4,714,390 (ECKLE et al) 22 December 1987.	1-8
<p><sup>6</sup> Special categories of cited documents: <sup>15</sup></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>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>2</sup>		Date of Mailing of this International Search Report <sup>3</sup>
26 January 1988		<b>12 FEB 1988</b>
International Searching Authority <sup>1</sup>		Signature of Authorized Officer <sup>20</sup>
ISA/US		<i>Steven C. Bishop</i> Examiner Steven C. Bishop