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(54) Title
METHOD OF AND DEVICE FOR MECHANICAL TENSIONING OF BOLTS, STUDS AND THE LIKE

International Patent Classification(s)

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(56) Prior Art Documents
US 5152649
US 3565472

(57) Claim

1. A method of elongating and relaxing a stud having an axis and arranged in an object, the method comprising the steps of connecting a stud with a first part which is moveably only in an axial direction so as to pull the stud in the axial direction to elongate the stud and thereby to tension it in the object or to relax the stud; and moving the first part only in the axial direction by connecting the first part with a second part which is movable in a transverse direction, cooperating a friction element with at least one of the parts so as to change friction between the parts so that the first part has more surfaces cooperating with other elements and subjectable to friction during movement than the second part and so that the second part is not connected with the friction element but instead is freely turnable relative to the friction element while freely abutting against the latter; and applying a holding force to the first part via first connecting means and simultaneously applying an opposite active force to the second part via second connecting means whereby the second part is moved in the transverse

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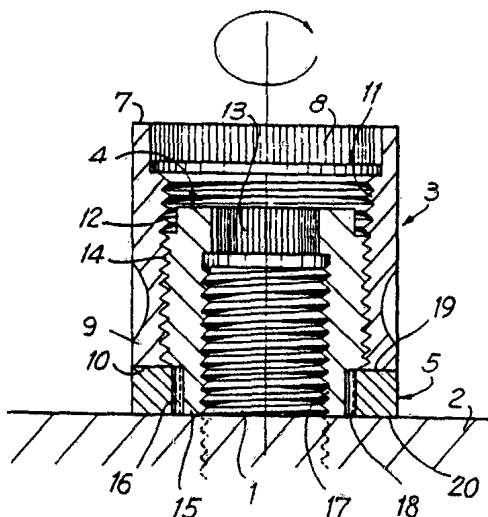
direction and the first part is moved in the axial direction to move the stud in the axial direction so as to elongate the stud and apply to the object a clamping force so that the two parts, the stud and the friction element cannot move transversely or axially relative to an object surface and vice versa, and a unitary structure is produced with all components which are immovably clamped with one another.



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<p>(21) International Application Number: PCT/US93/04465 (22) International Filing Date: 5 May 1993 (05.05.93) (30) Priority data: 07/879,342 7 May 1992 (07.05.92) US 08/051,478 22 April 1993 (22.04.93) US (71)(72) Applicant and Inventor: JUNKERS, John, K. [US/US]; 7 Arrowhead Lane, Saddle River, NJ 07540 (US). (74) Agent: STRIKER, Michael, J.; 360 Lexington Avenue, New York, NY 10017 (US). (81) Designated States: AU, BR, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p>		<p>Published <i>With international search report.</i></p> <p>657227</p>

(54) Title: METHOD OF AND DEVICE FOR MECHANICAL TENSIONING OF BOLTS, STUDS AND THE LIKE



(57) Abstract

For elongating and relaxing a bolt, a stud and the like (1) having an axis and arranged in an object (2), the stud (1) is connected with a first part (4) which is movable only in an axial direction so as to pull the stud (1) in the axial direction to elongate the stud (1) and thereby to tension it in the object (2) or to relax the stud (1), the first part (4) is moved only in the axial direction by connecting the first part (4) with a second part (3) which is movable in a transverse direction, a friction element (5) cooperates with at least one of the parts (3, 4) so as to change friction between the parts (3, 4) so that one of the parts (3, 4) has a higher friction than another of the parts (3, 4).

DescriptionMethod of and Device for Mechanical Tensioning of
Bolts, Studs and the LikeTechnical field

5 The present invention relates to a method of mechanical tensioning of bolts, studs and the like and also to a device for mechanical tensioning the same. More particularly, it relates to a method of and a device for mechanical tensioning of bolts, studs and the like, which are arranged in an object, such as for example a flange and the like.

10 Background Art

Methods and devices for tensioning of the above mentioned general type are known in the art. For example, a mechanical nut is utilized, which has two elements movable relative to one another in opposite axial directions to elongate or relax a bolt, a stud and the like. There are however many applications where no gaskets are used to seal the two flange portions or where the stud is oversized relative to the required clamping force. Therefore with a steel-to-steel flange connection there is no compression
15 feasible, and with an oversized stud there is no stud elongation feasible, and thus the axial movement of one of the parts of the thusly formed nut becomes possible.

Disclosure of Invention

~~Accordingly, it is an object of the present invention to~~
25 provide a method of and a device for mechanical tensioning of bolts, studs and the like, which avoids the disadvantages of the prior art.

Keeping with these objects and with others which will
~~become apparent hereinafter, one feature of the present~~



In one broad form the present invention provides a method of elongating and relaxing a stud having an axis and arranged in an object, the method comprising the steps of connecting a stud with a first part which is movably
5 only in an axial direction so as to pull the stud in the axial direction to elongate the stud and thereby to tension it in the object or to relax the stud; and moving the first part only in the axial direction by connecting the first part with a second part which is movable in a
10 transverse direction, cooperating a friction element with at least one of the parts so as to change friction between the parts so that the first part has more surfaces cooperating with other elements and subjectable to friction during movement than the second part and so that
15 the second part is not connected with the friction element but instead is freely turnable relative to the friction element while freely abutting against the latter; and applying a holding force to the first part via first connecting means and simultaneously applying an opposite
20 active force to the second part via second connecting means whereby the second part is moved in the transverse direction and the first part is moved in the axial direction to move the stud in the axial direction so as to elongate the stud and apply to the object a clamping force
25 so that the two parts, the stud and the friction element cannot move transversely or axially relative to an object surface and vice versa, and a unitary structure is produced with all components which are immovably clamped with one another.

30 In accordance with another feature of the present invention a mechanical tensioner for elongating and relaxing a bolt, a stud and the like having an axis and arranged in an object is proposed, which comprises a first part connectable with said stud to pull said stud and
35 movable only in an axial direction so as to pull said stud



in the axial direction so as to elongate said stud and thereby to tension it in said object, or to relax said stud; and means for moving said first part in the axial direction and including a second part connected with said
5 first part and movable in a transverse direction, and a friction element which cooperates with the first part so as to change friction between said parts so that the first part has more surfaces cooperating with other elements and subjectable to friction during movement than the second
10 part, said second part being not connected with said friction element but being freely turnable relative to said friction element while freely abutting against the latter, so that when a holding force is applied to the first part via first connecting means and simultaneously
15 applying an opposite active force to the second part via second connecting means said second part moves in said transverse direction and said first part moves only in said axial direction to move said stud in said axial direction so as to elongate said stud and apply to the
20 object a clamping force so that the two parts, the stud and the friction element cannot move transversely and axially relative to the object and vice versa, and a unitary structure is produced with all components which are immovably clamped with one another.

25 When the method is performed and the device is designed in accordance with the present invention, the desired elongation of the bolt, stud and the like is obtained in a reliable manner, the required clamping force is applied to the object such as a flange or the like, and
30 all parts of the device form a unitary structure in which the components cannot move relative to one another and a reliable clamping of all parts with one another is provided.

35 The novel features which are considered as characteristic for the invention are set forth in



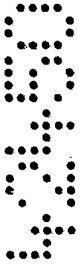
particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

5

Brief Description of the Drawings

The single Figure of the drawings is a view showing a cross-section of a device for mechanical tensioning of a bolt,

10



1 a stud and the like in accordance with the present invention
which implements a new method of mechanical tensioning in
accordance with the present invention.

Best Mode of Carrying Out the Invention

5 A method of and a device for mechanical tensioning in
accordance with the present invention is used for elongating
and relaxing a stud 1 which is arranged in an outside object
such as a flange 2 and the like. In accordance with the
invention, the stud 1 is engaged by an inner part which is
10 identified as a whole with reference numeral 4 and is
movably only in an axial direction to pull the stud in the
axial direction so as to elongate it and thereby to tension
it in the object, or to relax the stud as will be explained
hereinbelow. The inner part 4 is moved only in the axial
15 direction by means of an outer part 3 which is connected
with the inner part 4 and is movable in a transverse
direction, and by means of a friction element 5 which
cooperates with at least one of the parts 3 and 4 so as to
change friction between the parts 3 and 4 as will be
20 explained hereinbelow.

The outer part 3 has an end portion 7 facing away of the
flange 2 and provided with engaging formations, for example
splines 8, to be engaged by a tool. The outer part 3 also
has a portion 9 which faces toward the flange 2 and has a
25 surface 10 arranged to abut against the friction element 5.
Finally, the outer part 3 has an inner thread 11. The outer
part 3 can be formed as a tubular member provided with the
above specified formations.

The inner part 4 has an end portion 12 which faces away
30 of the flange 2 and is provided with a plurality of engaging
formations, for example splines 13, to be engaged by a tool.
It also has an outer surface provided with a thread 14 which
engages with the thread 11 of the inner surface of the outer
part 3. The inner part 4 has a portion 15 which is located

1 inside the cooperating part 4 and has an outer surface
provided with engaging formations, for example splines 16.
Finally, the inner part 4 has an inner surface provided with
engaging formations formed for example as an inner thread
5 17, for engaging with the stud 1. The inner part 4 is also
formed as a tubular member.

The friction element is disc-shaped. It is to be
located between the end portion 9 of the outer part 3 and
the flange 2 on the one hand, and surrounds the portion 15
10 of the inner part 4 on the other hand. The friction element
5 has an inner surface 18 provided with a plurality of
engaging formations, for example splines 18, which engage
with the splines 16 of the portion 15 of the inner part 4.
The friction element 5 has a surface 19 against which the
15 surface 10 of the outer part 3 abuts, and also an opposite
surface 20 which abuts against the outer surface of the
flange 2.

The thread 11 of the outer part 3 and the thread 14 of
the inner part 4 have one direction, while the thread 17 of
20 the inner part 4 can have another direction. For example,
the thread 17 can be a right-hand thread, while the threads
11 and 14 can be left-hand threads.

The connecting means 11, 14 connecting the inner part 4
with the outer part 3 is thread means, while the connecting
25 means 16, 18 for connecting the inner part 4 with the
friction element 5 can be spline means. These connecting
means 11, 14 and 16, 18 are axially spaced from one another.

It can be said that the inner part 4 has four surfaces
cooperating with other parts and subjectable to friction.
30 In particular, it has the surface of the inner thread 17,
the surface of the outer thread 14, the end surface abutting
against the friction element 5, and the end surface abutting
against the flange 2. In contrast, the outer part 3 has
only two surfaces which are subjectable to friction, namely
35 the surface of the inner thread 11, and the surface 19

1 abutting against the friction element 5.

In order to elongate or relax the stud in accordance with the present invention, a tool is applied so that it engages the splines 8 of the outer part 3 to move the latter
5 and also engages the splines 13 of the inner part so as to at least hold the part 4. When the outer part 3 is moved in a direction which is transverse to an axis of the tensioner and the stud, or more particularly is turned about this axis, its surface 10 abuts against the surface 19 of the
10 friction element 5 and therefore the outer part 3 cannot move further onto the friction element 5 in the axial direction. Under the action of turning of the outer part 3 and due to the cooperation between the threads 11, 14, the inner part 4 is displaced in the axial direction, upwardly
15 in the drawings, and at the same time does not displace in the transverse direction or in other words does not turn around the axis. During these movements the friction element 5 is neither displaced in the transverse direction (turned around the axis) nor in the axial direction. It is
20 immovable relative to the flange 2. The axial upward displacement of the inner part 4 without the transverse displacement (turning around the axis) causes pulling of the stud 1 upwardly and therefore it is elongating.

Thus due to inventive cooperation of the parts 3 and 4
25 and the friction element 5 which imparts a higher friction to the inner part 4 than the outer part 3, when a force is applied to one of the parts 3, 4 in a transverse direction to the axis (by applying a force to one part, by holding one part and turning another part, by applying a turning force
30 to both parts in opposite directions with equal forces), after elimination of the gaps in the assembly the outer part 3 moves in the transverse direction to the axis (rotates) while the inner part 4 moves only in the axial direction to pull the stud 1 upwardly in the axial direction. When the
35 bolt, stud and the like 1 is elongated, a substantial

1 clamping force is applied to the flange 2, so that the parts
3, 4, the friction element 5 and the stud 1 cannot move
transversely or axially relative to the flange 2 and vice
versa, so that a unitary structure is produced with all
5 components which are immovably clamped with one another.

While the invention has been illustrated and described
as embodied in a method of and a device for mechanical
tensioning of bolts, studs and the like, it is not intended
to be limited to the details shown, since various
10 modifications and structural changes may be made without
departing in any way from the spirit of the present
invention.

CLAIMS:-

1. A method of elongating and relaxing a stud having an axis and arranged in an object, the method comprising the steps of connecting a stud with a first part which is
5 moveably only in an axial direction so as to pull the stud in the axial direction to elongate the stud and thereby to tension it in the object or to relax the stud; and moving the first part only in the axial direction by connecting the first part with a second part which is movable in a
10 transverse direction, cooperating a friction element with at least one of the parts so as to change friction between the parts so that the first part has more surfaces cooperating with other elements and subjectable to friction during movement than the second part and so that
15 the second part is not connected with the friction element but instead is freely turnable relative to the friction element while freely abutting against the latter; and applying a holding force to the first part via first connecting means and simultaneously applying an opposite
20 active force to the second part via second connecting means whereby the second part is moved in the transverse direction and the first part is moved in the axial direction to move the stud in the axial direction so as to elongate the stud and apply to the object a clamping force
25 so that the two parts, the stud and the friction element cannot move transversely or axially relative to an object surface and vice versa, and a unitary structure is produced with all components which are immovably clamped with one another.
- 30 2. A method as defined in claim 1, wherein the connecting of the first part with the stud is performed by first thread means and the connecting of the second part with the first part is performed by second thread means.



- 1 3. A method as defined in claim 1; and further comprising
the step of arranging the friction element between the
object and an end portion of the second part which
faces the object so that the friction element surrounds
5 an end portion of the first part which faces the
object.
4. A method as defined in claim 1, wherein said step of
applying a force includes engaging the second part by a
tool and moving the second part by a tool in the
10 transverse direction.
5. A method as defined in claim 1, wherein said applying
force includes engaging the first part by a tool and
holding the first part immovably in the transverse
direction.
- 15 6. A method as defined in claim 1; and further comprising
the step of providing first connecting means for
connecting the first part with the second part so that
the second part moves in the transverse direction,
and second connecting means axially spaced from the
20 first connecting means and connecting the first part
with the friction element so that the first part moves
only in the axial direction.

7. A mechanical tensioner for elongating and relaxing a bolt, a stud and the like having an axis and arranged in an object is proposed, which comprises a first part connectable with said stud to pull said stud and movable
5 only in an axial direction so as to pull said stud in the axial direction so as to elongate said stud and thereby to tension it in said object, or to relax said stud; and means for moving said first part in the axial direction and including a second part connected with said first part
10 and movable in a transverse direction, and a friction element which cooperates with the first part so as to change friction between said parts so that the first part has more surfaces, said second part being not connected with said friction element but being freely turnable
15 relative to said friction element while freely abutting against the latter, so that when a holding force is applied to the first part via first connecting means and simultaneously applying an opposite active force to the second part via second connecting means, said second part
20 moves in said transverse direction and said first part moves only in said axial direction to move said stud in said axial direction so as to elongate said stud and apply to the object a clamping force so that the two parts, the stud and the friction element cannot move transversely or
25 axially relative to an object surface and vice versa, and a unitary structure is produced with all components which are immovably clamped with one another.

8. A mechanical tensioner as defined in claim 7; and further comprising first connecting means which connect
30 said first part with the stud and second connecting means which connect said second part with said first part, said connecting means being formed as threads having opposite directions.



- 1 9. A mechanical tensioner as defined in claim 7, wherein
said friction element has a first means formed so that
said first part moves in said axial direction relative
to said friction element and does not move in said
5 transverse direction relative to said friction element,
and second means formed so that said second part moves
in said transverse direction relative to said friction
element and stops movement of said second part onto
said friction element in said axial direction.
- 10 10. A mechanical tensioner as defined in claim 9, wherein
said first means of said friction element includes a
plurality of splines extending in an axial direction.
11. A mechanical tensioner as defined in claim 9, wherein
said second means of said friction element includes
15 an abutment surface facing toward said second part so
that said second part abuts against said abutment
surface when it is moved in said axial direction onto
said friction element.
12. A mechanical tensioner as defined in claim 7, wherein
20 each of said parts has an end portion arranged to face
the object, said friction element being located between
said end portion of said second part and the object and
surrounds said end portion of said first part.
13. A mechanical tensioner as defined in claim 7, wherein
25 said second part has means for engaging by a tool for
moving said second part in said transverse direction.
14. A mechanical tensioner as defined in claim 7, wherein
said first part has means for engaging by a tool so as
to at least hold said first part immovably in said
30 transverse direction.

- 1 15. A mechanical tensioner as defined in claim 7, wherein
said second part having a threaded inner surface, said
friction element having a polygonal inner surface, said
first part having an outer surface with two axially
5 spaced portions including a first cylindrical axial
portion which is threaded and engages with said
threaded inner surface of said second part and a second
axial portion which is polygonal and engages with said
polygonal inner surface of said friction element.
- 10 16. A mechanical tensioner as defined in claim 7; and
further comprising first connecting means for
connecting said first part with said second part so
that said second part moves in said transverse
direction; and second connecting means axially spaced
15 from said first connecting means and connecting said
first part with said friction element so that said
first part moves only in said axial direction.

17. A mechanical tensioner as defined in claim 7, wherein said first part has first means for engaging by a tool and said second part has second means for engaging by a tool, so that when at least one of said parts is engaged and
5 held by a tool, the other of said parts is engaged and turned by a tool.

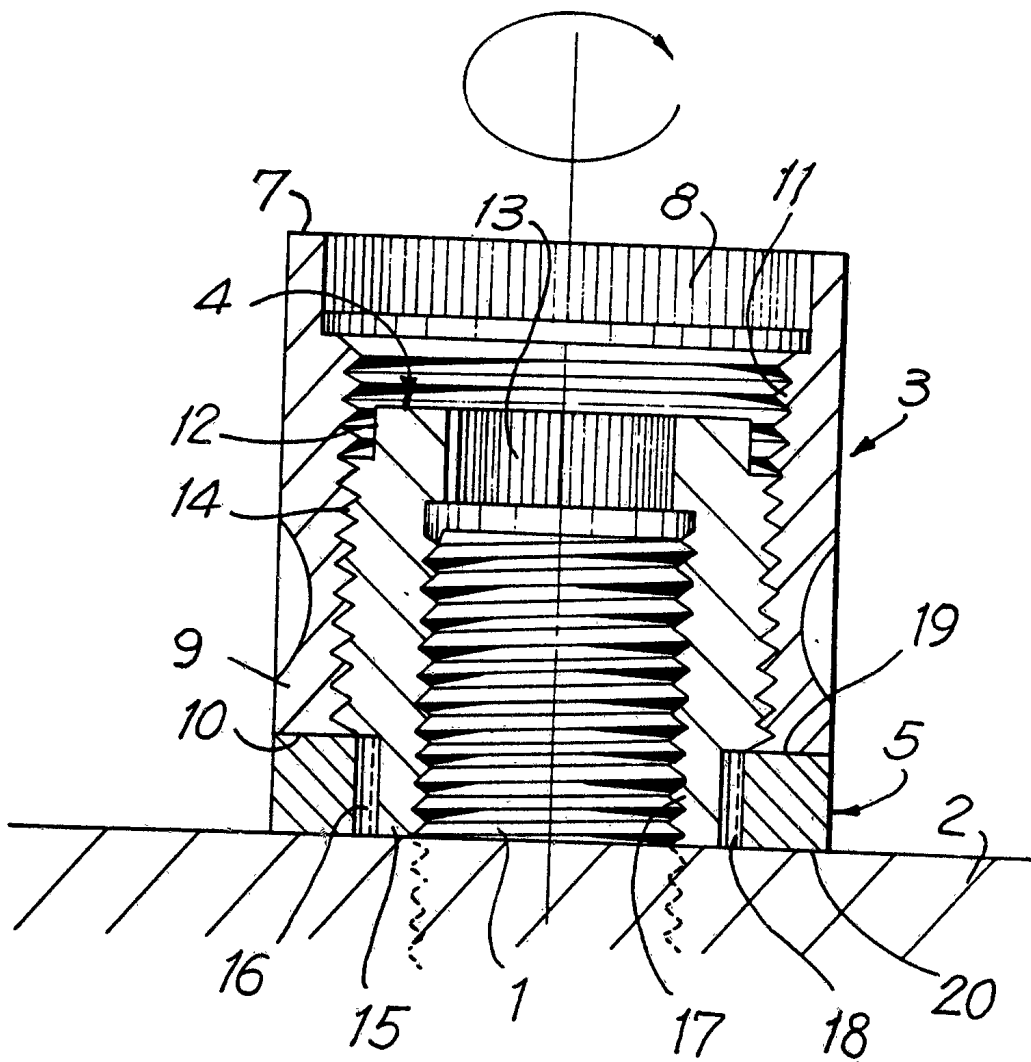
18. A method of elongating and relaxing a stud as hereinbefore described with reference to the accompanying drawings.

10 19. A mechanical tensioner as hereinbefore described with reference to the accompanying drawings.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/04465

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : F16B 37/08; B23P 11/02
US CL : 411/432; 29/25.1

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)

U.S. : Please See Extra Sheet.

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 practicable, 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,P	US, A, 5,152,649 (Popp) 06 October 1992, col. 3.	1-5,7,9,11-14
X	US, A, 3,565,472 (Sjoholm) 23 February 1971, Figure 4a.	1-7,9-14,16
Y	US, A, 443,117 (Sharaf) 23 December 1890, Figures 2,4.	15
Y	GB, A, 120,642 (Rogers) 21 November 1918.	8
A	GB, A, 2692 (Hastie) 01 July 1880.	1-16
A	US, A, 794,781 (Clausen) 18 July 1905.	1-16
A	US, A, 3,383,973 (Gazal) 21 May 1968.	1-16

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" Inter 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
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"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
"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Z" document member of the same patent family
"O" documents 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	

Date of the actual completion of the international search

21 July 1993

Date of mailing of the international search report

27 AUG 1993

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/04465

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, <u>3,435,777</u> (Schaaf) 01 April 1969.	1-16
A,P	US, A, 5,137,408 (Junkers) 11 August 1992.	1-16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/04465

B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

411/432, 433, 429, ~~434~~, 222, 226, 223, 190, 349, 237, 243, 244, 272, 292, 371, 368, 533, 534, 917, 263, 932, 264, 990; 29/525.1; 470/19; 403/22, 320; 73/761