A safety monitoring apparatus (2) for monitoring the safe operation of a crane (4, 8, 10) or other lifting device. The safety monitoring apparatus includes a number of sensors (16, 18) for measuring input parameters (36, 38, 40) such as the load (14) supported by the lifting device and the angle of heel of the base of the lifting device caused by the lifting operation, in conjunction with a processor (20) for comparing the input parameters with pre-ordained maximum safe values and a number of devices for providing output signals (42, 44, 60) to an operator of the lifting device, for indicating the safe operation of the lifting device to the operator.
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"Safety Monitoring Apparatus"

This invention relates to a safety monitoring apparatus. In particular, this invention relates to the safe use of cranes or other lifting equipment such as access platforms, scissor lifts or winches by ensuring that in operation they do not exceed safe working parameters, including load or moment and/or a defined safe working angle from a horizontal datum and/or a maximum permitted lateral boom loading. Certain embodiments of the invention are particularly concerned with cranes mounted on marine vessels, particularly relatively small workboats such as those commonly used in fish farming.

It is known for indicators to be fitted to load carrying devices for the purpose of measuring and displaying the load carried by the machine, while having regard to stability and safety. Such devices may have mechanical, electro-mechanical or electronic components. The fitting of such devices is particularly beneficial in cases where the crane, access platform, winch or other lifting device is operating wholly or in part in the form of a cantilever structure. In such conditions of operation, the
lifting device is in a state of metastable equilibrium, and excessive loading or accentuated extension of the cantilever would increase the load moment on the structure, causing catastrophic instability to occur.

When load indicators are fitted to lifting devices in order to indicate the load carried, these indicators may receive signals from the machine which will take account in a dynamic manner of such factors as load carried, length of boom or jib, angles of boom or jib sections, and radius from the machine centre at which the load is carried.

Such indicators, however, assume that the machine is lifting on a firm and totally level base which will not change in form or state during the lifting operation, either with regard to its angle of inclination to the horizontal, or with regard to its stability as a load carrying support once it has been loaded by the machine in the course of the lifting operation.

Any signals regarding stability which are input to such conventional indicators on lifting devices are set manually by the operator after consideration of the machine set-up or condition, and before lifting commences. For example, the operator of a crane may choose to input to a load indicator the range of duties applicable when the outriggers of the crane have been lowered on to the ground, and the machine has been declared to be level by visual inspection of an inclinometer. In the case of machines lifting loads while mounted on rails, a load range may be selected by the operator to take account of the maximum cant on the railway track to be experienced during operations.

These indicators, however, are unable to take account
of changing conditions affecting the foundation of the lifting device and affecting the stability of the machine when these factors are themselves changed adversely by the machine commencing lifting operations.

Furthermore, these indicators have the disadvantage of being separate devices which require constant monitoring by the operator, particularly when working on unstable foundations, when working close to the safe working load or moment of the lifting equipment, or when working in windy conditions.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig 1 is a perspective view showing a crane lifting a load, the crane being mounted upon a waterborne vessel and having an operating station including a safety monitoring device according to the present invention;

Fig 2 is a side view of a knuckle boom crane;

Fig 3 is a side view of a telescoping boom crane;

Fig 4 is a side view of a stiff boom crane;

Fig 5 is partial cross-sectional view of a joystick assembly type inclinometer;

Fig 6 is a schematic of the processor of the safety monitoring device; and

Fig 7 is a perspective view of the safety monitoring device according to the present
invention.

The present invention is designed to protect a crane, access platform, winch, or other item of lifting equipment, and to guarantee its safe operation, by giving advance warning to the operator of the onset of an unstable condition arising from, for example, an excessive working load or moment being applied, the working angle from a horizontal datum exceeding an acceptable limit, or an excessive lateral load being applied on the boom, hook, or platform.

With reference to the drawings and in particular to Fig 1, in a preferred embodiment of the present invention, there is provided a safety monitoring apparatus 2 for a crane 4, wherein the crane 4 is adapted to be mounted upon a waterborne vessel 6. In such circumstances, the situation often arises wherein a crane 4 of a specific maximum load moment (usually measured in tonne-metres) is mounted upon a waterborne vessel 6 of a size not capable of stably supporting a load 14 carried by the crane 4 which is within the maximum load moment of the crane 4. This can cause a catastrophic failure such as capsize of the vessel 6.

In the preferred embodiment, the present invention is adapted to monitor the operation of, for example, a knuckle boom crane 4, telescoping boom crane 8 or stiff boom crane 10 of a known type, mounted upon a relatively small waterborne fish-farming workboat, tug, fishing trawler or similar vessel 6. In such vessel/crane combinations, the crane 4, which in Fig 1 is a knuckle boom crane 4 of Fig 2, is typically mounted either on the port or starboard side of the vessel 6, close to the edge of the deck 12 and mid-way between the bow and the stern of the vessel 6. In
these circumstances, a compromise between vessel
stability and the operation of the crane 4 is
necessary. It will be appreciated that the crane 4 may
be located at any suitable part of the vessel deck 12
having consideration for the deck space and cargo to be
carried. Typical examples of cranes 4, 8, 10 of the
type employed are shown at Figs 2 to 4.

For such a crane/waterborne vessel combination, the
critical safety aspects are the load 14 carried by the
crane 4 and the relative pitch and/or roll of the
vessel 6 which occurs when the load is being carried by
the crane 4. It will be appreciated by those skilled
in the art that a potentially unstable situation may be
approached under circumstances where, for example, an
operator of the crane 4 attempts to lift a load 14 from
the vessel 6 to a point outside the vessel 6 at an
extension therefrom causing the vessel 6 to roll to an
unstable, unsafe angle from the horizontal. Similarly,
attending to lift a load 14 from a point outside the
vessel 6 at an extension therefrom liable to cause the
vessel 6 to roll to an unstable angle would be equally
unsafe. Furthermore, such an unstable situation could
result in the operator attempting to lift a load 14
beyond the maximum load moment of the crane 4, giving
rise to an unsafe situation wherein both the crane 4
and the vessel 6 were in an unstable state.

Guidelines produced by the Marine Safety Agency in the
United Kingdom provide that in a vessel 6 fitted with
such a deck crane 4, which the crane 4 is operating,
the angle of heel (or roll) generally should not exceed
7° or that angle of heel which results in a freeboard
on the low side of 250 mm, whichever is the lesser
angle. Accordingly, it will be appreciated that
unstable, unsafe conditions referred to herein
generally refer to operations exceeding such operating
guidelines.

The present invention is provided with sensor means 16,
18 for measuring a number of input parameters which in
the preferred embodiment comprise at least the load 14
applied on the crane 4 and the angle of heel (and,
optionally but preferably, the angle of pitch) of the
vessel 6. There is also provided a means 20 for
analysing the input parameters and providing one or
more output signals which indicate the approach of an
unstable and/or unsafe condition of crane 4 and/or
vessel 6 to an operator of the crane 4.

The sensor means 16, 18 for measuring loading
parameters may comprise any one of a number of types of
sensing device, but preferably comprises a pressure
transducer 18 incorporated into the hydraulic pipework
(not shown) of a hydraulic derrick ram 22 of the crane
4, 8, 10, in a way that will be appreciated by a person
skilled in the art. The pressure transducer is a known
device suitable for measuring the pressure in the
hydraulic derrick ram 22, this being the ram which
applies a force to the boom 24 of, for example, a
knuckle boom or stiff boom crane 4, 10, to enable the
raising or lowering of the boom 24. When a load 14 is
supported by the crane 4, the hydraulic pressure in the
ram 22 is increased and thus, by means of the pressure
transducer 18, the load 14 supported by the crane 4 may
be monitored.

The sensor means 16 for measuring the heel and pitch
may comprise any one of a number of types of
inclinometer or other angle sensing devices. In the
preferred embodiment, a suitable inclinometer 16 is
provided by the use of an inverted joystick assembly
16. Joysticks are well known control devices, in which manipulation of the joystick generates output signals representing the deviation of the joystick from a rest position (usually vertical), relative to the base of the joystick assembly, in two orthogonal axes. In the present case, a conventional joystick assembly 16 is oriented upside down and the joystick 26 of the assembly 16 is weighted such that the joystick 26 maintains a substantially vertical orientation as the vessel 6 rolls and pitches, so that the output signals from the assembly 16 provide a measurement of the angle of the base portion 28 of the joystick assembly 16 relative to the horizontal.

The joystick assembly 16 preferably comprises an analogue joystick device 16 of a known type, which serves to measure both the angle of heel and the angle of pitch of the vessel 6. The joystick assembly 16 is mounted upside-down with the joystick 26 protruding into a damping pot 30, mounted below the body of the joystick assembly 16. The damping pot 30 contains a viscous fluid 32 such as an oil 32, which serves to damp motions of the joystick 26 in response to "normal" pitching and rolling of the vessel 6, e.g. due to wave motion. The viscosity of the oil 32 is selected to provide the most suitable damping properties in relation to such wave loading. This enables the device 16 to discriminate between "long term" changes in angle occurring as a result of the operation of the crane 4 and "short term" changes due to wave motion and the like. Alternatively, some other physical damping mechanism could be employed, or the required discrimination could be performed during processing of the output signals from the joystick assembly 16 to screen out short term motions.
Preferably, the joystick assembly 16 is an analogue joystick 16 without any electro-mechanical contacts, this serving to reduce wear of the components. Most preferably, the joystick device 16 is an inductance-type, contactless device of known type.

The joystick 26 of the joystick assembly 16 is able to swing in any direction through an angle of up to 45° (i.e. up to 22.5° deviation from the vertical) in response to the pitch and heel of the vessel 6. This is more than sufficient to embrace the range of angular motion within which a vessel 6 is required to operate. A joystick assembly 16 of suitable type is shown at Fig 5. Such joystick devices are well known in the art.

The means 20 for analysing the input parameters and providing one or more output signals includes a signal processor 20 which, in the preferred embodiment is an embedded processor of a known type, suitably a PIC16C74A microcontroller or similar.

The processor 20 receives analogue signals from the joystick assembly 16 and the pressure transducer 18. The joystick assembly 16 typically provides analogue signals in a voltage range of 0 to 0.5V which are amplified using a suitable known amplifier 34 to provide a signal in a voltage range of 0 to 5V to suit the processor 20. The amplified analogue signals provide two inputs 36, 38 to the processor 20, one representing the angle of heel of the vessel 6 and the other representing the angle of pitch.

The signal from the pressure transducer 18 is also an analogue signal, most suitably in a voltage range of 0 to 5V. Alternatively, the signal may be in a lower or higher voltage range, being amplified or attenuated to
suit the processor 20 in a similar manner to the signal 
from the joystick assembly 16. This provides a further 
input 40 to the processor 20 representing the load 14 
supported by the crane 4.

The processor 20 converts the analogue input signals 
into digital signals using integral analogue to digital 
converter means (not shown). The resulting digital 
values are analyzed by the processor 20, which 
generates output signals 42, 44 dependent on the values 
of the input signals 36, 38, 40. In the preferred 
embodiment of the invention, the processor 20 includes 
a stored look-up table which specifies appropriate 
output signals 42, 44 in response to different values 
of the input signals 36, 38, 40 or different 
combinations of values of input signals 36, 38, 40.

In the simplest case, the processor 20 may generate an 
output signal 42, 44 which activates alarm devices 
shown generally at 46 when any one of the input signals 
36, 38, 40 exceeds a predetermined value. Preferably, 
the processor 20 generates different output signals 42, 
44 as the input signals 36, 38, 40 approach 
predetermined maximum safe values, as shall be 
described in greater detail below.

In the present example there are three input signals 
36, 38, 40 representing heel, pitch and load 14. The 
processor 20 continuously compares the input signals 
36, 38, 40 with the look-up table. Output signals 42, 
44 are generated on the basis of this comparison which 
activate a variety of visual and audible alarm devices 
46 depending on how closely the input signals 36, 38, 
40 approach predetermined maximum safe values.

In this embodiment, the alarm devices 46 include a
series of light emitting diodes (LED) 48, 50, 52
comprising of a series of green LED’s 48, a series of
yellow LED’s 50 and at least one red LED 52. The first
of the series of green LED’s 48 is provided to indicate
to the user that the device 2 is energised. The
following series of green LED’s 48 (which may consist
of a further three LED’s 48) provides an indication of
the approach of an unstable situation directly related
to the input signals 36, 38, 40. Thus if the angle of
heel of the vessel 6 increases during a lifting
operation, the green LED’s 48 will become progressively
energised. If this situation worsens, a first yellow
LED 50 will become energised and the processor 20 will
also activate an audible warning device 66. An
electronic alarm 66 of a suitable known type is
employed for this purpose and this preferably emits a
first type of audible signal such as a "warbling sound"
when the first yellow LED 50 is energised. Further
yellow LED’s 50 will be provided to indicate a
worsening situation. When the final yellow LED 50
becomes energised, this will indicate to the operator
that the maximum pre-determined value of at least one
of the input parameters has been reached. If the
operator continues beyond this point, at least one red
LED 52 becomes energised, indicating that the
pre-determined maximum value for at least one of the
inputs has been exceeded and that the vessel/crane is
in an unstable/unsafe state. The electronic alarm 66
preferably emits a second type of audible signal, such
as a continuous tone, to further emphasise this
situation to the operator.

In the preferred embodiment, the processor 20, the
inclinometer joystick assembly 16 and the output means
46 are located in a waterproof housing 54, the output
means 46 of the LED’s 48, 50, 52 and the audible
electronic alarm 66 being provided upon an outer
surface 56 of the housing 54 so as to be clearly
visible to the crane operator. The processor 20 and
the inclinometer joystick assembly 16 are enclosed
within the housing 54. The housing 54 itself is most
suitably located adjacent to the crane 4. However, it
will be appreciated that the inclinometer joystick
assembly 16 need not be located within the housing 54,
but may alternatively be located at any convenient
location upon the vessel 6. As mentioned above, the
pressure transducer 18 is located in the hydraulic
pipework (not shown) of the hydraulic derrick ram 22.
The transducer 18 is connected to an input 40 of the
processor 20 via suitable cabling (not shown), as will
be appreciated by persons skilled in the art.

The apparatus 2 may be provided with a standard
interface (not shown) for connection to a laptop
computer or other suitable means (not shown) for
carrying out testing, calibration and monitoring of the
apparatus 2. The apparatus 2 may also be provided with
a means (not shown) for interfacing with the control
unit 58 of the crane 4. In cases where the
vessel/crane has been put into an unstable/unsafe
state, this would enable the safety monitoring
apparatus 2 to override manual control of the crane 4
to, for example, return the crane 4 to a stable
situation. This may occur in cases where an operator
exceeds the maximum heel of the vessel 6 by
transporting a load 14 to a position outwith the vessel
6 which causes the vessel 6 to heel, putting it in an
unstable state. The means for interfacing with the
control unit 58 may, in such a situation, inhibit or
reverse the operation which has caused the unstable
state to an extent necessary to ensure the safety of
the vessel/crane. Such means may take the form of a
suitable, known relay device (not shown).

In more general embodiments of the present invention, the safety monitoring apparatus 2 may be applied to cranes 4, 8, 10 mounted on mobile vehicles (not shown) such as vehicle flat beds or trains or mobile crane vehicles. In such cases, it will be appreciated that the stability of the vehicle to which the crane 4, 8, 10 is mounted is of equal importance as it is required that the surface to which the crane 4, 8, 10 is mounted be level to ensure a safe lifting operation. In the case of a vehicle mounted crane 4, 8, 10, this requires the vehicle flat bed (not shown) to be set level by the use of outriggers or the like (not shown). Any change in the angle of the flat bed during lifting is likely to result in an unstable/unsafe state for the vehicle/crane combination.

The apparatus has further applications in fixed or mobile structure cranes (not shown) such as tower cranes where factors such as wind loading on the crane may be of particular importance.

Accordingly, in more general embodiments of the present invention, there may be provided additional and/or alternative sensors (not shown) for monitoring a number of input parameters and providing an input to the processor 20 of the apparatus 2. Such input parameters measured may include the angle of inclination of the lifting device and its base (not shown), the engagement/disengagement of stabilising apparatus such as outriggers and counterweights (not shown), fluctuating wind or other lateral loading on the structure and the varying sector of the slewing circle of the crane 4, 8, 10 or other device in which a lifting operation is being carried out.
The sensors employed for analysing such input parameters may be selected from a range of suitable, known devices such as inclinometers, level switches, potentiometers, variable inductance position indicators, light sensitive devices, limit switches, proximity switches, cable reeling drums, rotary encoders, load cells, pressure transducers, dynamometers, strain gauges and anemometers.

Furthermore, the processor 20 may be adapted to provide output signals 42, 44, 60 to operate remote alarms (not shown). Such output signals 42, 44, 60 may initiate a signal to such remote alarms via land-based communication links, radio or satellite links or any other suitable means of communication (not shown). Such remote alarms would be of particular importance in relation to a safety monitoring apparatus 2 for a crane 4, 8, 10 or other lifting device (not shown) mounted upon a waterborne vessel 6, wherein the onset of an unstable state is potentially catastrophic. For example, the processor 20 might be adapted to activate distress signals or the like.

The safety monitoring apparatus 2 may also be adapted to monitor the operation of a winch (not shown), such as a marine winch of the type found in vessels such as trawlers and workboats (not shown). Such winches are often used to tow loads submerged below the surface of water-level, such as trawler nets (not shown). The weight and drag force exerted upon the vessel by the submerged load often causes the vessel to pitch to an unsafe angle. Accordingly, the safety monitoring apparatus 2 may be employed to monitor the safe operation of the winch by analysing the load supported by the winch in conjunction with the angle of pitch of the vessel. It will be readily appreciated that the
operation of the safety monitoring apparatus 2 under such circumstances is similar to that described above, with the angle of pitch of the vessel measured using a suitable sensor such as the inclinometer joystick assembly 16 described above. The load supported by the winch would typically be measured utilising a dynamometer or other suitable known devices (not shown).

To summarise, the input parameters provided to the apparatus 2 may suitably include the weight of the load 14 lifted; the radius at which it is lifted around the base of the unit; the height from the ground to which the load 14 is lifted; the length of any lifting boom or jib 24, 62, 64, and/or its angle relative to a horizontal datum; the angle at which the base of the lifting device is inclined relative to a horizontal datum, whether variable with regard to time or not; and the wind or other lateral loading.

The output signals 42, 44, 60 from the apparatus 2 may serve to provide alarm signals for the operator and/or control signals for over-riding manual control of the crane 4, 8, 10 or the like which is being monitored. Alarm signals may include visual warning lamps and gauges and/or audible warning bells or buzzers. Control signals may operate to inhibit the further operation of the lifting equipment in such a manner as would lead to an increased risk of failure or instability, and/or to reverse the operation of the lifting equipment in such a manner as would lead to a decreased risk of failure or instability.

In conditions where a constantly fluctuating foundation for the lifting device is found in normal operation, such as in waterborne vessels, the apparatus may
include damping or delay mechanisms as necessary.

The advantages of the invention and the ways in which
the disadvantages of previously known arrangements are
overcome include the following:

1) Where a load indicator 18 only would be fitted to
lifting equipment, the invention described also
includes a stability or level measurement input 16
as an integral part of the same apparatus.

2) The invention includes other inputs (not shown) to
indicate unstable conditions such as wind loading.

3) The invention provides dynamic indication of the
approach to unstable conditions.

4) The invention provides dynamic warning of the
approach to unstable conditions.

5) The invention can be calibrated in each and every
application to suit the recommendations of the
manufacturer of the lifting device, the unit or
foundation to which it is mounted, and to comply
with legal requirements and regulations.

Improvements and modifications may be incorporated
without departing from the scope of the invention as
defined in the Claims appended hereto.
Claims

1. Apparatus for monitoring the safety of cranes or other lifting equipment, the apparatus including sensor means for generating data signals representing a plurality of parameters relating to the operation of said equipment and signal processing means provided with input means and output means, said input means being adapted to receive said data signals, and said output means being adapted to generate output signals in response to said data signals in accordance with predetermined criteria.

2. Apparatus as claimed in Claim 1, further including at least one warning and/or control device responsive to said output signals.

3. Apparatus as claimed in Claim 2, wherein said at least one warning and/or control device comprises at least one of the following:
   (a) a visual indicator;
   (b) a machine control input;
   (c) an audible warning device;
   (d) a telemetry signal;
   (e) a data logger;
   (f) means for reversing the motion of the crane or other lifting equipment.

4. Apparatus as claimed in any one of Claims 1 to 3, wherein said sensor means comprises at least one of the following:
   (a) a load monitor;
   (b) a moment monitor;
   (c) a lateral load monitor;
   (d) a base angle monitor; and
   (e) an external loading monitor.
5. Apparatus as claimed in any preceding Claim, wherein said sensor means comprises first sensor means for monitoring the load on said crane or other lifting equipment and second sensor means for monitoring the angle of a base portion of the crane or other lifting equipment relative to the horizontal in at least one vertical plane.

6. Apparatus as claimed in Claim 5, wherein said first sensor means comprises a pressure transducer adapted to measure hydraulic pressure in a hydraulic derrick ram of a crane and to generate a first data signal representative of said hydraulic pressure.

7. Apparatus as claimed in Claim 5 or Claim 6, wherein said second sensor means comprises an inclinometer.

8. Apparatus as claimed in Claim 7, wherein movement of said inclinometer is damped and/or data signals output from said inclinometer are processed so as to discriminate between relatively short term and relatively long term motions of said inclinometer.

9. Apparatus as claimed in Claim 7 or Claim 8, wherein said inclinometer comprises an inverted joystick assembly comprising a joystick and a joystick base and adapted to generate second and third data signals representing the angle of the joystick relative to the joystick base in two vertical planes.

10. Apparatus as claimed in Claim 9, wherein said joystick is weighted such that the joystick maintains a substantially vertical orientation during rolling and pitching motions of said joystick base.
11. Apparatus as claimed in Claim 9 or Claim 10, wherein said joystick projects into a container of viscous fluid so as to damp motions of the joystick whereby the apparatus may discriminate between relatively short term and relatively long term motions of the joystick base.

12. Apparatus as claimed in any one of Claims 9 to 11, wherein said joystick device comprises an inductance-type, contactless joystick device.

13. Apparatus as claimed in any preceding Claim, wherein said signal processing means is adapted to compare said data signals with stored values of said parameters and to generate output signals selected on the basis of said comparison.

14. Apparatus as claimed in Claim 13, wherein said output signals vary as said data signals approach predetermined values.

15. Apparatus as claimed in Claim 14, further including visual and/or audible alarm devices whose output varies with said output signals.

16. A marine vessel equipped with a crane or other lifting device together with apparatus as claimed in any one of Claims 1 to 15.

17. A crane or other lifting device equipped with apparatus as claimed in any one of Claims 1 to 15.

18. A method of monitoring the safety of cranes or other lifting equipment comprising the steps of:
(a) measuring a plurality of parameters relating to the operation of cranes or other lifting equipment
in which the input parameters include one or more
load related parameters of the crane or other
lifting equipment;
(b) comparing the input parameters to pre-determined
levels set for the safe operation of the crane or
other lifting equipment; and
(c) generating one or more output signals in which the
output signals provide an input to one or more
warning and/or control devices.

19. A method as claimed in Claim 18, wherein said
parameters also include at least one of the following:
(a) moment parameters;
(b) lateral loading parameters; or
(c) base angle parameters.

20. A method as claimed in Claim 18 or Claim 19,
wherein said output signals are used to control the
operation of at least one of the following:
(a) a visual indicator;
(b) a machine control unit;
(c) an audible warning device;
(d) a telemetry unit;
(e) a data logger;
(f) means for reversing the motion of the crane or
other lifting equipment.

21. A method as claimed in Claim 20, wherein said
means for reversing the motion of the crane operates to
ensure the safety of the crane or other lifting
equipment according to pre-determined safety levels,
and functions to ensure the safety of the crane or
other lifting equipment by returning the crane from a
situation in which its safety is in jeopardy.
Fig. 5
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6 B66C23/90 B66F17/00

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 B66C B66F

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**

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Further documents are listed in the continuation of box C. Paten family members are listed in annex.

* Special categories of cited documents:
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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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  - "S" document member of the same patent family

Date of the actual completion of the international search: 28 September 1998

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Fax: (+31-70) 340-3016

Authorized officer: Guthmuller, J

From PCT/ISA210 (second sheet) (July 1992)
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