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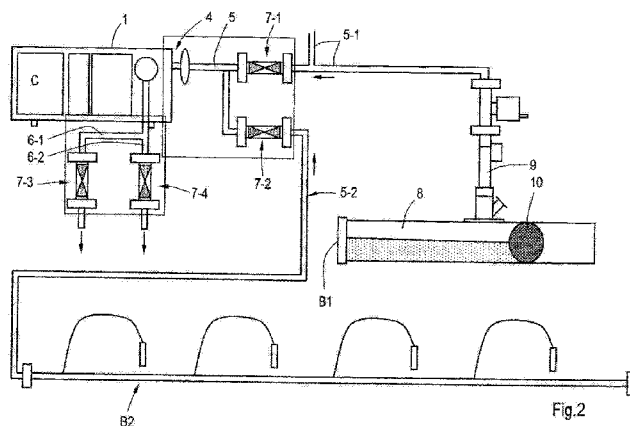
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(54) Title: PUMP SYSTEM



(57) Abstract: Beschreven wordt een pompsysteem (1) voor vloeibare media omvattende ten minste één pomp (2) met een zuigzijde en een perszijde, een op de ten minste ene pomp (2) aangesloten stuur eenheid (C), en ten minste twee aan hun ene klepkant op de zuigzijde aangesloten stuurbare kleppen (7-1,7-2), zodanig door de daarop aangesloten stuur eenheid (C) bestuurd dat elke klep (7-1,7-2) uitsluitend medium uit een, op hun respectieve andere klepkanten aansluitbare eerste bron of tweede bron doorlaat. Het pompsysteem bevat verder tenminste één met de stuur eenheid (C) verbonden niveausensor die althans bij die bron is geplaatst waar, bij overschrijding van een kritisch niveau, medium dient te worden weggepompt.



PUMP SYSTEM

The present invention relates to a pump system for liquid media.

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The present invention also relates to a method which can suitably be used, inter alia, in such a pump system, and to the use of a level sensor, in particular a capacitive level sensor.

10

Such a system comprising valves is generally known. Hitherto, clean water from, for example, well-point dewatering was drained off using a certain pump system, while, additionally, in the case of waste water use was made of a different pump system. Due to different requirements to be imposed thereon, inter alia, to meet the required capacity and/or availability, or in connection with the degree of pollution of the water to be pumped, both systems including the respective associated fittings, such as usually diesel-electric pump drives, housings, tubes, hoses and couplings, were installed and maintained in operation independently of each other.

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It is an object of the present invention to provide a single universal pump system by means of which different types of water, in particular water with different degrees of pollution and contaminations can be pumped.

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To achieve this object, the system according to the invention has the characteristics of claim 1.

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An advantage of the pump system according to the invention resides in that by virtue of a correct timing, tuned to the supply of both waste water and clean water, of the operation of the control unit of, in particular, the two or more (first) valves connected to the suction side, this supply can be supplied, if necessary, by the same pump

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or the same combination of pumps for further processing. As a result, individual fittings for pumping different kinds of water are superfluous. In respect of the above-mentioned timing, in practice, the urgency of said supply plays an important role. For example, in the case of a large amount of sewage water to be drained off because the sewage pipes are filled to capacity and will otherwise cause problems or overflow, the valve admitting sewage water is opened and the other one dealing with, for example, clean water from well-point dewatering is closed. And if the sewage pipes are sufficiently empty, the relevant valve is closed and, subsequently, the valve for the supply of clean water can be opened again.

When pumping waste water, whether or not in combination with clean water, it is desirable for the automatic operation of the pump system that it comprises a reliable waste water level detector. This detector preferably is, for example, a capacitive level detector which is to be mounted in a proper way.

A preferred embodiment of the system according to the invention is characterized in that the waste water source at least comprises a drain pipe and a substantially vertical pipe provided in a sealing manner on an opening in the drain pipe, in which or at which vertical pipe, sewage water can collect, and which vertical pipe has an inside surface and an outside surface, wherein one electrode of the level sensor, being a capacitive inductive level sensor and/or a resistance-measuring sensor, is arranged on the inside surface and the other electrode is arranged on the outside surface of said pipe to detect exceedance of the critical level.

An advantage of this embodiment of the system according to the invention is that, in spite of the

sometimes high degree of pollution of the water, the indication of the level of waste water is reliable for a level sensor constructed as described hereinabove. This can be attributed to the fact that if waste water collects
5 between the vertical distance of the electrodes on the inside and outside surface, the sensor usually electrically informs the control unit that an exceedance occurs, which control unit, in short, closes the clean water valve and opens the sewage water valve, after which the pump starts
10 pumping sewage water. A level sensor, in particular a capacitive level sensor, which is arranged and used in said way, is substantially insensitive to the degree of pollution of the supply of waste water, because it continues to correctly detect the supply of waste water in
15 the substantially vertical pipe.

A further preferred embodiment, which enables separate processing, i.e., input and output of one kind of water supplied, is characterized in that the pump system
20 comprises at least two controllable valves connected on one valve side to the delivery side, which are controlled in such a manner by the control unit connected thereto that each valve only allows passage of medium from the first source and/or the second source.

25

Further detailed, possible embodiments explained in the other claims are mentioned, together with the associated advantages, in the following description.

30 Next, the pump system and the method according to the present invention will be elucidated by means of the figures given below, in which corresponding parts are provided with the same reference numerals. In the figures:

Figure 1 schematically shows a pump system which is
35 known per se;

Figure 2 shows a combination of possible embodiments

of the pump system according to the invention; and

Figure 3 schematically shows a detail of the way in which a riser pipe, which is preferably provided with a capacitive level sensor, is connected to a sewage pipe which is bored on the upper side.

Figure 1 schematically shows a part of a pump system 1 which is known per se, which is built up around a not self-starting medium pump 2 incorporated in the system 1, which medium pump will be of the grinder-type, if used in sewer applications. Such a pump 2 requires a sufficient amount of a medium, usually a fluid, hereinafter referred to as water, around its so-termed eye 3 in order to ensure that it starts well and operates satisfactorily. Examples thereof include a turbo pump, a vortex pump, a centrifugal pump or a vane-cell pump. After starting the pump, the water is drained off from the pump head 4 via drain pipes 6, said pump head including the part 5 of the supply pipe, which is directly connected thereto. Said part 5 is also indicated here as suction side and pipe 6 as delivery side of the pump system 1.

In case the part 5 of the supply pipe, and hence the eye 3, contains insufficient water, so that the pump 2 does not start by itself, the pump system 1 comprises a pipe portion 12 which is connected via a feature 11 to the part 5, to which pipe portion an air suction pump 13 is connected. Said suction pump 13 draws air from the pipe portion 12, thereby ensuring that the pipe 5 is filled with water to such a degree that the eye 3 sees enough water to at least enable the pump to start and operate whereby there is an under pressure in the pipe part 5. The feature 11, which acts as an air separator, is critically switched to the water/air position, making sure that only air, no water, (see upward-pointing arrow) can reach the suction pump 13, because this would give rise to the air-displacing effect of the air suction pump 13 being disturbed.

Figure 2 shows the pump system 1, in which, inter alia, the medium pump 2 can be used in an overall pump system for waste water and clean water. The pump system 1 shown comprises separate medium supply pipes 5-1, 5-2
5 originating from different sources, which are jointly connected, via first, controllable valves 7-1, 7-2 to the pump head 4 of the pump system 1 via the pipe part 5. By virtue of this possibility, the system is very versatile, for example, because waste water can be processed by the
10 same system 1 as clean water.

For example, it is possible to install, temporarily, a waste water system on the already present clean water system, or vice versa. By suitably, successively and individually controlling the controllable valves 7-1, 7-2,
15 it is possible to switch to one or the other of the clean water/waste water systems. Said switching may be time-based or requirement-based and takes place in a controlled manner by means of liquid-level sensors. For controlling the opening and closing of the valves 7-1, 7-2, and/or the
20 on/off switching of the pump 2, pump 13 and feature 11, use is made of a central, usually computer-controlled control unit C, to which also the controllable valves to be elucidated hereinafter and one or more level sensors are connected in a manner not shown here.

Supply pipe 5-1 is connected to a first source represented as waste water source B1, such as a sewage water source or a temporarily or not temporarily operating waste water source, sewage water source or pressure sewer water source. The source B1 at least comprises a drain pipe
30 8 and a substantially vertical riser pipe 9 provided in a sealing manner on an opening in the drain pipe, said opening being drilled at the top of the drain pipe 8, in which riser pipe or along the edge of which waste water can collect. On the left side in fig. 2, the drain pipe 8
35 extends toward the source B1, that is to say, locations where sewage water is emitted, such as private houses,

while on the right-hand side in the pipe 8 an internal shut-off 10 is located behind which there is a downstream part of the sewer, which may or may not be open, or on which work, such as repairs or extensions, can take place without trouble. In such cases, good drainage of sewage water or, in general, waste water from the emission points must be guaranteed. If the water rises to a specific critical level, up to the riser pipe 9 or even into the riser pipe, it must necessarily be pumped away.

The riser pipe 9 comprises, as shown in figure 3, an inside wall 14 and an outside wall 15, wherein, for example, one electrode 16-1 of the capacitive level sensor 16 may be provided on the inside wall 14 and the other electrode 16-2 may be provided on the outside wall 15 of the tube 9 in order to be able to detect when the critical level of waste water or sewage water in the sewer pipe 8 and/or riser pipe 9 is exceeded. Each one of the electrodes, which are preferably mounted in general at different heights, may alternatively be provided on the inner wall 14 or outer wall 15 or may be integrated therein. The pipe 9 then forms, or is provided with, a kind of dip stick reaching into the drain pipe or sewage drain pipe 8. Air has a different permittivity or relative dielectric constant ϵ_r than water or waste water, and the presence or absence thereof is detected, in this case, capacitively in a manner which is known per se by means of the level sensor 16 connected to control unit C.

The operation of the system as described hereinabove is as follows. Based on the priority which is usually given to the drainage of sewage water, to prevent too much pollution of the environment as well as odour nuisance, the sensor 16, which detects sewage water in the drain pipe 8, will give instructions to close the valve 7-2, after which the valve 7-1 opens and the pump system 1, if not activated already, will be activated, causing the sewage water in pipe part 5 to be pumped away via the drain pipe 6 due to

the under pressure. Said action as well as the next one are controlled by control unit C. If the sensor 16 subsequently sends a signal to the control unit C that the level in pipe 8 has decreased to below the minimum level, valve 7-1 will close, after which valve 7-2 is opened to pump clean water out of source B2, which in this case is a well-point dewatering system. Independent of whether medium originates from source B1 or B2, the controlled combination of pumps 2 and 13 jointly with feature 11 makes sure that air is removed from pipe 5, so that eye 3 is under water and pump 2 can operate independently.

In particular to drain pipe 6 of the system, a branch comprising pipes 6-1 and 6-2 can be added, in which respective controllable valves 7-3 and 7-4 connected to the control unit C can be incorporated. If separate drainage of waste water and clean water is desirable, this can be achieved by the timed opening and closing of the valves 7-1, 7-2, 7-3, 7-4 in the proper manner and sequence. As a result, the media originating from the separate sources B1 and B2, after being pumped by the single medium pump 2, are advantageously separately pumped via the separate drain pipes 6-1, 6-2. A certain hysteresis or time delay in the switching action of the said valves may be built in the programmable control unit C for the purpose of keeping clean water and waste water separate.

If necessary, the control unit C can have an Internet connection, so that not only the correct operation can be checked from a remote location but, if necessary, it is also possible to intervene in the pumping process from a remote location.

As a possible alternative to the above-mentioned capacitive sensor, use could be made of a resistance sensor and/or an inductive sensor.

CLAIMS

1. A pump system for liquid media, comprising:

- at least one pump having a suction side and a delivery
5 side,

- a control unit connected to the at least one pump,

- at least two controllable valves connected on one side
thereof to the suction side, which valves are controlled by
the control unit connected thereto, such that each valve
10 only allows passage of medium from a first source or second
source connectable to their respective other valve sides,
and

- at least one level sensor connected to the control unit,
which level sensor is positioned at least near that source
15 where, in the case of a critical level being exceeded,
medium must be pumped away.

2. The pump system according to claim 1, characterized
in that the first source is a waste water source, such as a
20 sewage water source or a temporarily or not temporarily
operating waste water source, sewage water source or
pressure sewer water source.

3. The pump system according to claim 1 or 2,
25 characterized in that the second source is a clean water
source, such as a well-point dewatering source, soil
dewatering source or drainage dewatering source.

4. The pump system according to any one of claims 1 to
30 3, characterized in that the at least one level sensor is a
capacitive, inductive level sensor and/or a resistance-
measuring sensor.

5. The pump system according to any one of claims 1 to
35 4, characterized in that a/the level sensor is positioned
at least near the source operating as a waste water source.

6. The pump system according to claim 2 or 5,
characterized in that the waste water source at least
comprises a drain pipe and a substantially vertical pipe
5 provided in a sealing manner on an opening in the drain
pipe, in which vertical pipe waste water can collect, and
which vertical pipe has an inside surface and an outside
surface, wherein one electrode of the capacitive level
sensor is arranged on the inside surface and the other
10 electrode is arranged on the outside surface of said pipe
to detect exceedance of the critical level.

7. The pump system according to any one of claims 1 to
6, characterized in that the at least one pump is a self-
15 starting pump.

8. The pump system according to claim 7, characterized
in that the self-starting pump comprises a, if necessary,
self-starting co-operating combination of a medium pump and
20 an air pump.

9. The pump system according to any one of claims 1 to
8, characterized in that the at least one pump comprises a
medium pump, a turbo pump, a vortex pump, a centrifugal
25 pump and/or a vane-cell pump.

10. The pump system according to any one of claims 9 to
10, characterized in that the air pump is a vacuum pump.

30 11. The pump system according to any one of claims 1 to
10, characterized in that the pump system comprises at
least two controllable valves connected on one valve side
to the delivery side, which are controlled in such a manner
by the control unit connected thereto that each valve only
35 allows passage of medium from the first source and/or the
second source.

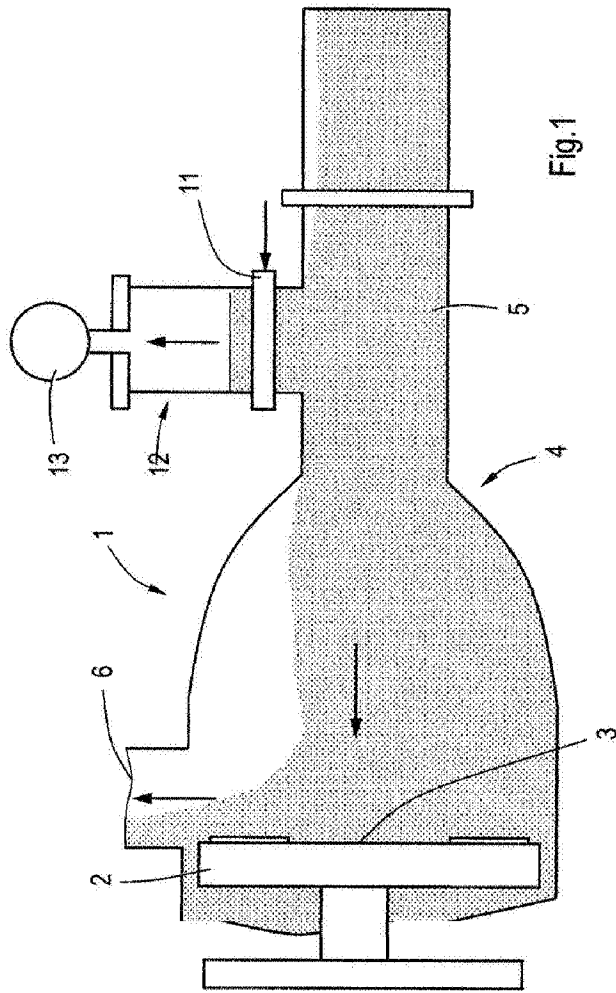
12. A method wherein liquid media are pumped by a pump system from the suction side thereof to the delivery side thereof via first and or second valves which are
5 controllably via a control unit and which are connected to, respectively, the suction and/or delivery side, wherein the control unit is arranged to make sure, in combination with at least one level sensor positioned near the first and/or second source and connected to the control unit, that at
10 least each one of the first valves only allows passage of medium from a first or second source connected thereto.

13. The method according to claim 12, characterized in that if the source is a waste water source, the level
15 sensor is a capacitively operating level sensor to detect exceedance of a critical level of waste water.

14. The method according to claim 13, characterized in that the waste water source at least comprises a
20 substantially vertical pipe where medium to be drained can collect, and which vertical pipe has an inside surface and an outside surface, wherein one electrode of the capacitive level sensor is arranged on the inside surface and the other electrode thereof is arranged on the outside surface
25 of said vertical pipe.

15. The use of a level sensor, in particular a capacitive level sensor, for measuring the level of a medium, which may or may not be polluted, in or at the edge of a
30 substantially vertical pipe which has an inside surface and an outside surface, wherein one electrode of the level sensor is arranged on the inside surface and the other electrode thereof is arranged on the outside surface of said vertical pipe.

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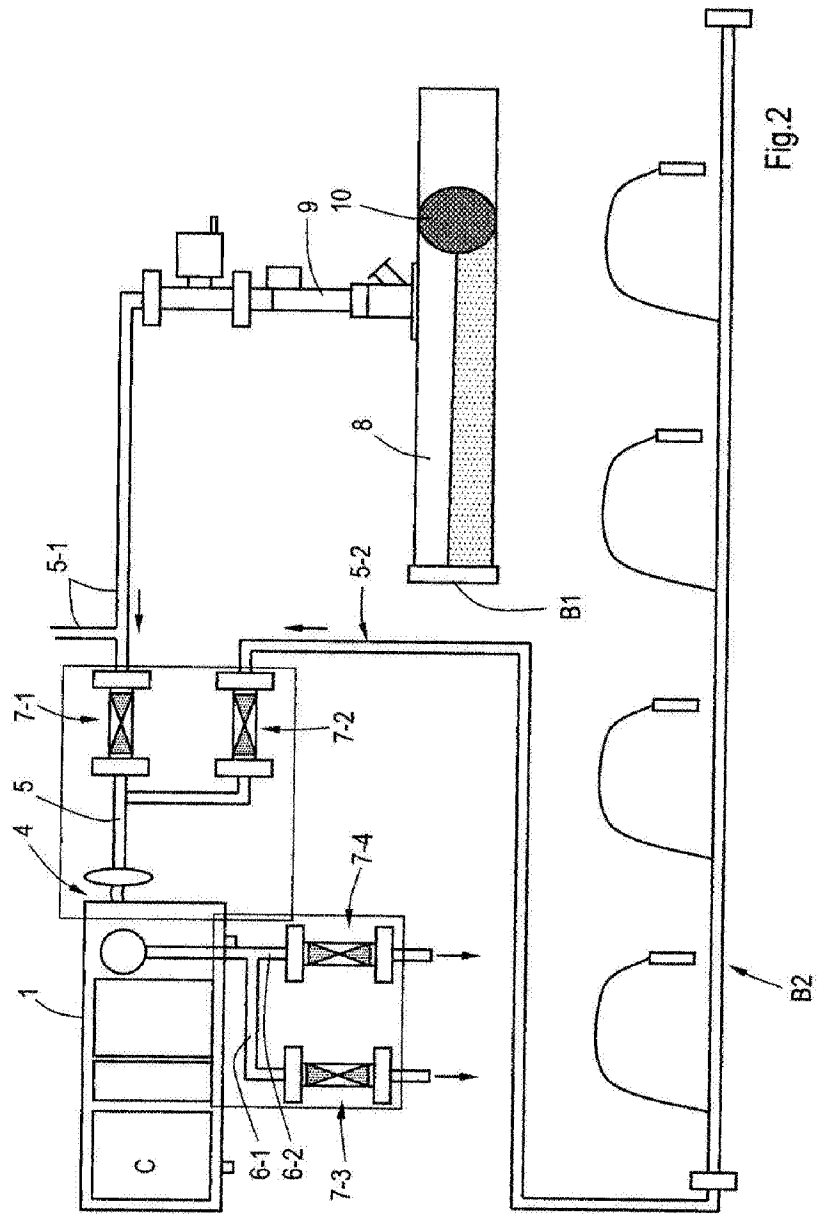


Fig.2

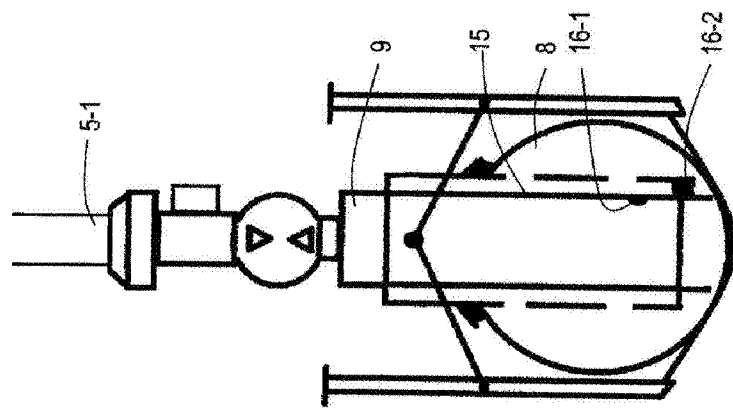


Fig.3

INTERNATIONAL SEARCH REPORT

International application No PCT/NL2016/050091

A. CLASSIFICATION OF SUBJECT MATTER INV. F04B49/22 E03F5/22 E03B5/02 ADD.		
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) F04B E03F E03B		
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) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 964 423 A1 (PELTIER THIERRY [FR]; MANON GERARD [FR]) 9 March 2012 (2012-03-09) the whole document -----	1,9,11, 12
A	US 2010/158716 A1 (LAESSLE JACK [US] ET AL) 24 June 2010 (2010-06-24) paragraph [0066] figures 1,3,8 -----	1,9,11, 12
A	US 5 701 873 A (SCHNEIDER WOLFGANG [CH]) 30 December 1997 (1997-12-30) column 10, line 35 - column 11, line 37 figures 3,16 -----	1,9,11, 12
A	DE 26 51 885 A1 (KAERCHER FA ALFRED) 18 May 1978 (1978-05-18) page 7, paragraph 3 - page 9, paragraph 1 figure 1 -----	1,9,11, 12
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search	Date of mailing of the international search report	
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2964423	A1	09-03-2012	NONE
US 2010158716	A1	24-06-2010	US 2010158716 A1 24-06-2010
			US 2013129529 A1 23-05-2013
			US 2013309105 A1 21-11-2013
			US 2015322938 A1 12-11-2015
			WO 2011088232 A1 21-07-2011
US 5701873	A	30-12-1997	AT 169720 T 15-08-1998
			CA 2151518 A1 08-12-1996
			CN 1116441 A 07-02-1996
			DE 59406680 D1 17-09-1998
			EP 0678166 A1 25-10-1995
			ES 2120076 T3 16-10-1998
			JP 3747061 B2 22-02-2006
			JP H08505680 A 18-06-1996
			US 5701873 A 30-12-1997
			WO 9513474 A1 18-05-1995
DE 2651885	A1	18-05-1978	NONE