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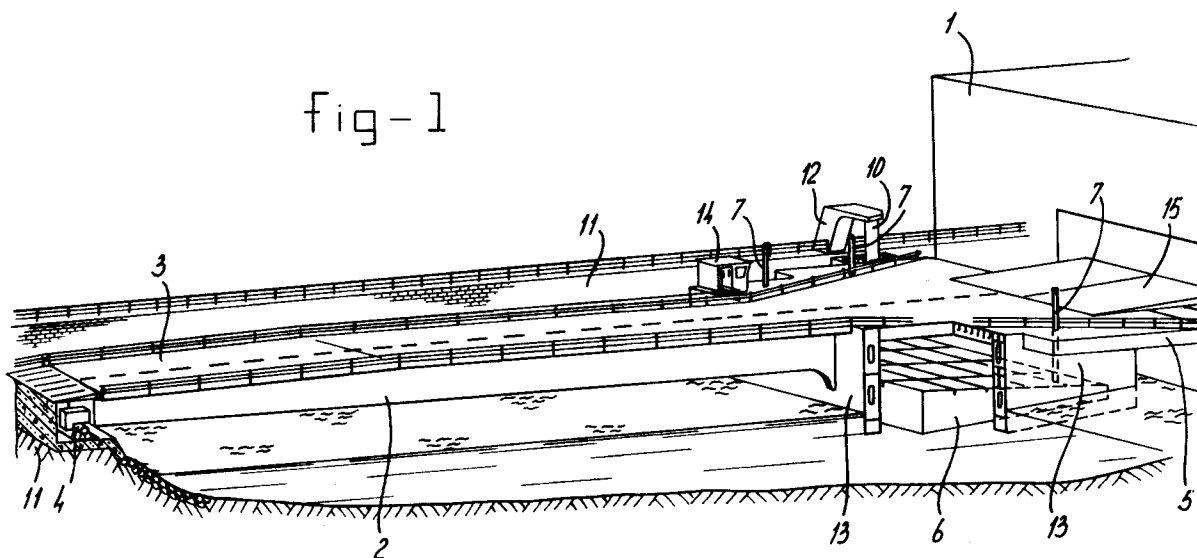
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NL-2502 LS Den Haag (NL)(54) **Loading and unloading terminal for Ro-Ro ships.**

(57) A loading and unloading terminal for Ro-Ro ships comprises a movable bridge (2) which at its one end (3) is hingeably supported on the quay and at its other end (5) is supported by a float (6) of fixed buoyancy. Displacement means (7) are arranged between the float and the other end (5) of the bridge in

order to be able to move said end section in an essentially vertical direction relative to the float (6). Said displacement means comprise a hydraulic system which has hydraulic cylinders, pumps, lines, valves and control means.

fig-1

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The invention relates to a loading and unloading terminal for Ro-Ro ships, comprising a movable bridge which at its first end section is hingeably supported on the quay and at its second end is supported by a float in such a way that the edge of the roadway of the second end section can be brought essentially to the height of the traffic deck of the loading and unloading area of a moored ship.

In a known loading and unloading terminal of this type, a pontoon is chosen as the float, which pontoon has water pumps by means of which the buoyancy of the float can be varied. One drawback is that a relatively expensive pumping installation is needed in order to be able to pump a relatively large amount of water within a relatively short time. A lower pump capacity could suffice, but the time needed to pump a specific amount of water can then be too long. One solution to this problem could be to connect the moored ship to the free end of the bridge via one or more cables and to be able to vary the buoyancy of the float located underwater by pumping air in and out. The drawback of this possible solution is that the ship is often unable to take up the weight of bridge and float transferred by the cable without being damaged. This applies in particular in the case of ships with an aluminium superstructure.

The present invention provides a practical solution to the problem of bringing the said second end section of the bridge approximately to the height of the traffic deck of the loading and unloading area of the moored ship under all conditions (high and low water, large or small distance between the water level and the Plimsoll line of the moored ship).

According to the invention, to this end the terminal is characterised in that the float has a fixed buoyancy and displacement means are arranged between the float and said second end section of the bridge in order to be able to move said end section essentially in the vertical direction relative to the float.

The said displacement means could, inter alia, consist of gear racks and pinions engaging therein, but preference is given to a hydraulic system with hydraulic piston-cylinder units, one or more pumps, lines, valves, a tank for hydraulic fluid and control means, each hydraulic piston-cylinder unit being connected to both the base of the float and the bridge, one connection being made by the cylinder and the other by the piston rod.

By connecting the underside of the said second end section to vertical pontoon walls, extra buoyancy can be provided for that end section, whilst said pontoon walls can also be used to stabilise the position of the said float.

In order to guide the vertical displacement of the said second end section, use can be made of

fixed guide rods extending through said second end section.

The tank for hydraulic oil can be accommodated in the float.

In order to determine the height of the traffic deck of the loading and unloading area of a moored ship and to be able to adjust the hydraulic system using said height determination, sensors can be arranged to measure the height of the roadway of the bridge at the location of said second end section with respect to the height of the traffic deck of the loading and unloading area of the moored ship.

A sensor could also be used to determine the distance between the Plimsoll line and the water level.

The invention will now be explained in more detail with reference to the figures.

Figure 1 shows a perspective view of the loading and unloading terminal according to the invention.

Figure 2 shows a side view of the terminal, with part of the end of the bridge shown in cross-section.

Figures 3 and 4 show the end section of the bridge in cross-section in two different positions.

The terminal shown for loading and unloading a Ro-Ro ship, which is shown diagrammatically, comprises a bridge 2 which at one end section 3 is hingeably supported on a tube 4 and at the other end section 5 is supported by a float 6 of fixed buoyancy. The width of the end section 5 is matched to the width of the stern of the Ro-Ro ships to be moored. The remainder of the bridge 2 is narrower than the end section 5.

In Figure 1 a corner of the end section 5 has been left out of the drawing in order to render the float 6 visible.

Four hydraulic piston-cylinder units 7 are arranged between the float 6 and the end section 5 in order to be able to bring the edge of the section 5 approximately to the height of the traffic deck of the loading and unloading area of the moored ship 1 in various states of loading thereof and to maintain the height position of the edge when the load on the bridge 2 is increased or reduced. The piston rod of said units 7 is connected to the double-skinned bottom of the float 6 and the top of the cylinder of each unit 7 is connected to the top of a sleeve 8, the bottom of which is fixed to the platform of end section 5. The lowermost section of each hydraulic unit 7 runs in a sleeve 9 within the float 6.

In order to guide the end section 5 during its movement, use is made of a number of tubes 10 which extend through said end section 5. One such tube 10 can be seen in Figure 1 and is fixed to a suspension console 12 provided on the quay 11.

The underside of the end section 5 is provided with four vertical pontoon walls 13 which provide the bridge 2 with additional buoyancy and enclose the float 6 between them and stabilise the position thereof.

Preferably, a hydraulic oil tank, one or more pumps, pipes, hoses, filters, valves and the like are arranged inside the float 6 in order to be able to slide the hydraulic piston-cylinder units in and out. These are not shown.

The system can be operated from the cabin 14.

As soon as a Ro-Ro ship has moored, the hydraulic system will, depending on the water level and the distance between the water level and the Plimsoll line of the moored ship, be operated in such a way that the edge of the end section 5 comes to lie essentially at the height of the traffic deck of the loading and unloading area of the ship. The ramp 15 of the ship is then hinged onto the bridge 2, so that, after any necessary adjustments of the position of the bridge with the aid of the hydraulic system, the ship can be unloaded and/or loaded.

The ship rises during unloading and settles lower during loading and, by measuring the height of the edge of the end section 5 with respect to a fixed point on the ship by means of a sensor 16 and using the measurement result to control the hydraulic system in such a way that the end section 5 follows the vertical movement of the ship, loading and unloading can take place without interruption and continuously. It is also possible, via a pipe which extends through the float, to determine the height of the water level by means of a sensor arranged on the top section of the pipe. The measured height is a measure for the distance between the Plimsoll line and the water level.

Diverse variants and modifications are possible within the scope of the invention. The essential feature is that the bridge 2 can be hinged upwards and downwards with respect to the float 6 by means of displacement means 7.

Claims

1. Loading and unloading terminal for Ro-Ro ships, comprising a movable bridge (2) which at its first end section (3) is hingeably supported on the quay (11) and at its second end (5) is supported by a float (6) in such a way that the edge of the roadway of the second end section (5) can be brought essentially to the height of the traffic deck of the loading and unloading area of a moored ship, characterised in that the float (6) has a fixed buoyancy and displacement means (7) are arranged between the float (6) and said second end section (5) of

the bridge in order to be able to move said end section (5) essentially in the vertical direction relative to the float (6).

- 5 2. Loading and unloading terminal according to Claim 1, characterised in that said displacement means consist of a hydraulic system with hydraulic piston-cylinder units (7), one or more pumps, lines, valves, a tank for hydraulic fluid and control means, each hydraulic piston-cylinder unit (7) being connected to both the base of the float (6) and the bridge (2), one connection being made by the cylinder and the other by the piston rod.
- 10 3. Loading and unloading terminal according to Claim 1 or 2, characterised in that the underside of said second end section (5) is connected to vertical pontoon walls (13) which provide said end section with extra buoyancy and stabilise the position of the float (6).
- 15 4. Loading and unloading terminal according to one of the preceding claims, characterised in that, in order to guide the vertical displacement of said second end section (5), a number of fixed guide rods (10) extend through said second end section.
- 20 5. Loading and unloading terminal according to one of the preceding claims, characterised in that the tank for hydraulic oil is accommodated in the float (6).
- 25 6. Loading and unloading terminal according to one of the preceding claims, characterised by sensors (16) to determine the height of the roadway of the bridge (2) at the location of said second end section (5) relative to the height of the traffic deck of the loading and unloading area of a moored ship.
- 30 7. Loading and unloading terminal according to one of Claims 1 to 6, characterised by a sensor to determine the distance between the Plimsoll line and the water line.
- 35 40 45 50 55

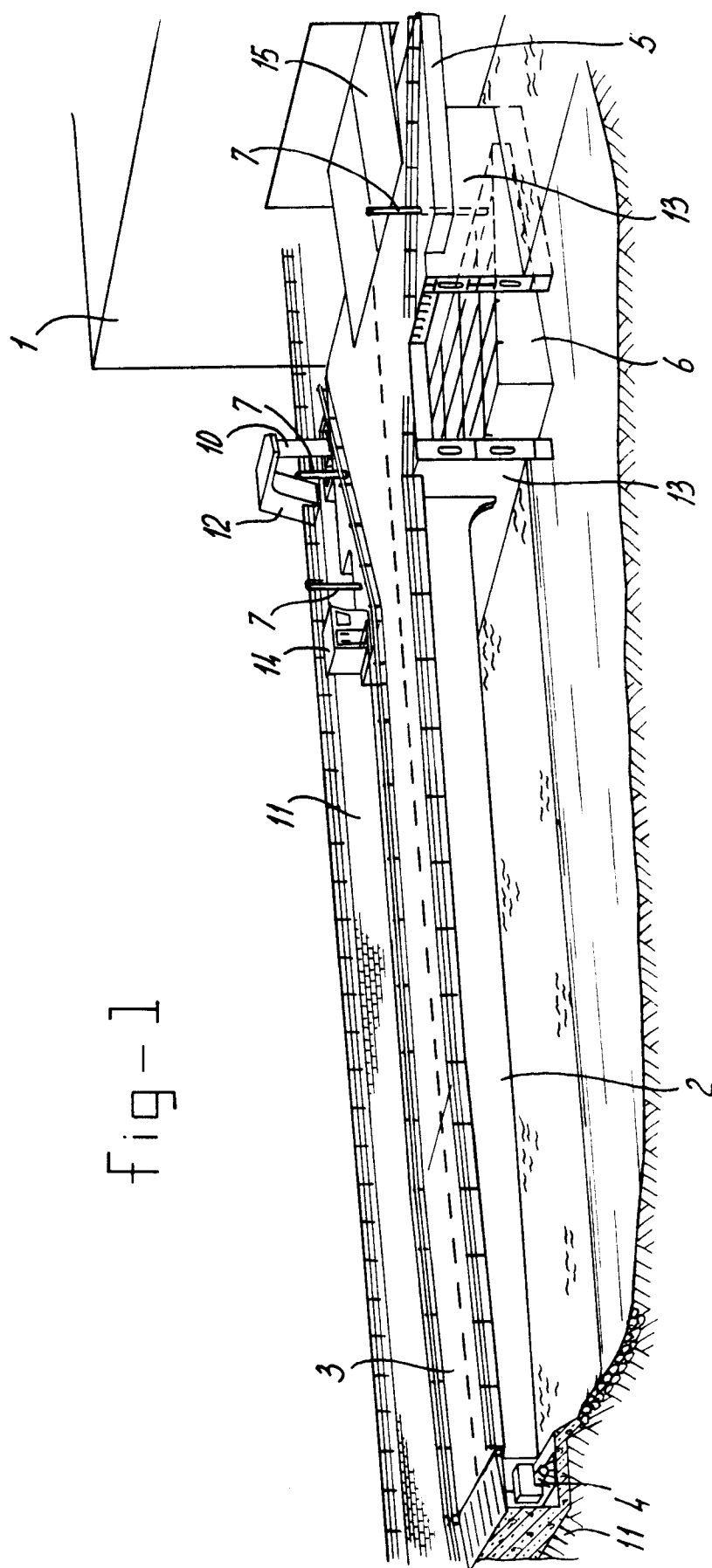


fig-1

fig-2

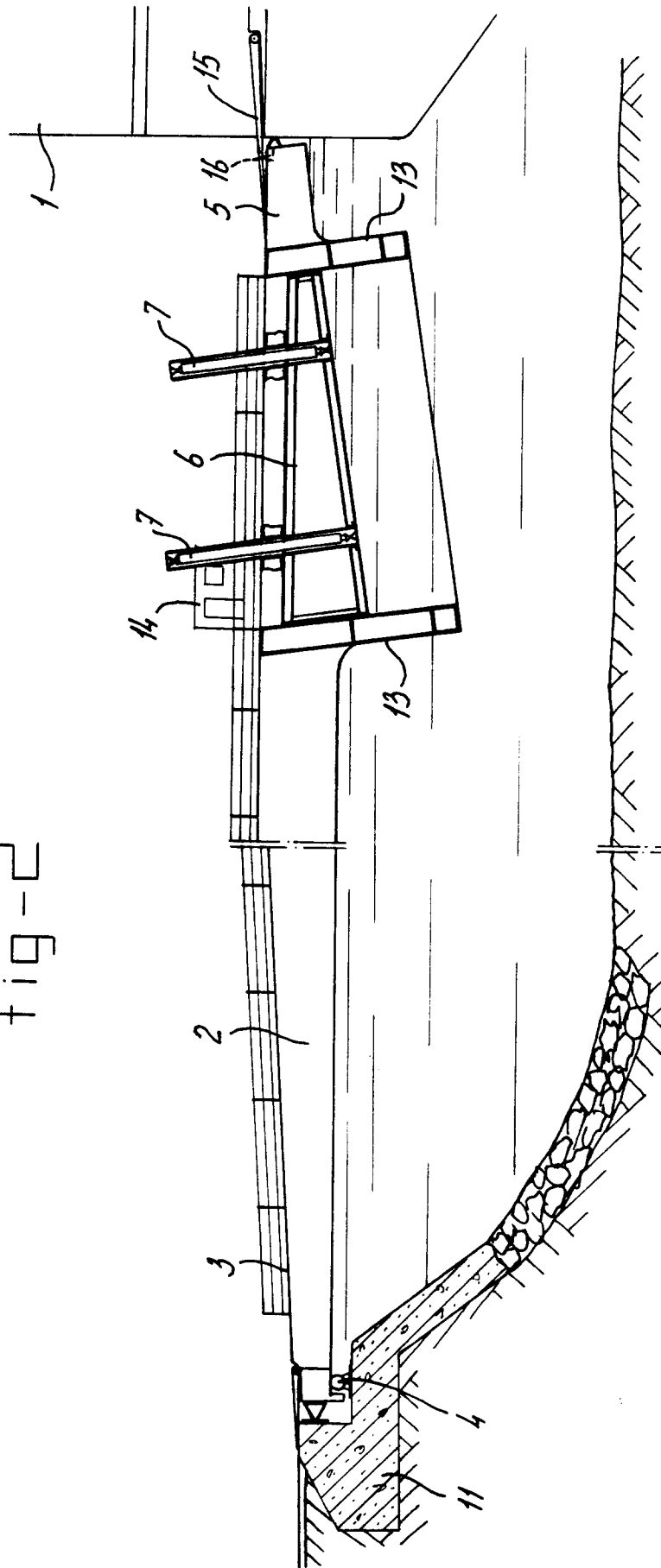


fig-3

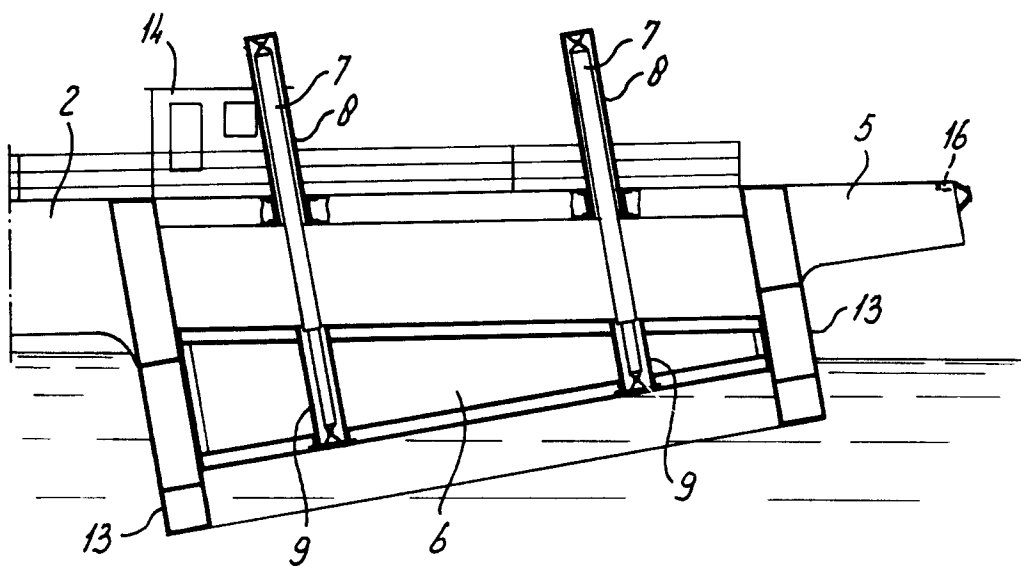
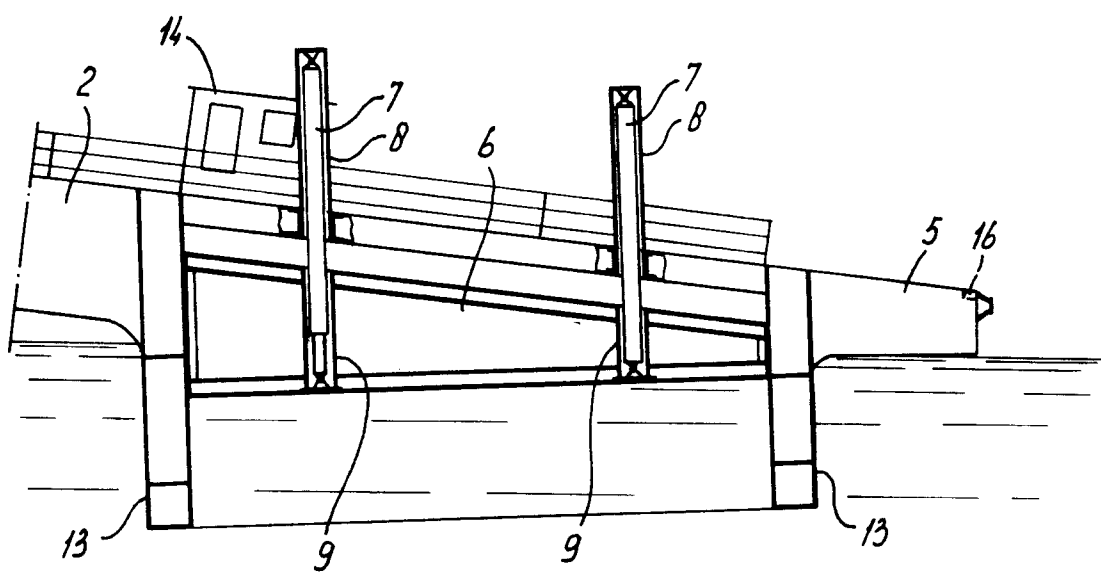


fig-4





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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 1457

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	WO-A-88 07605 (T.IVARSSON) 6 October 1988 * page 2, line 28 - page 3, line 23; figure 1 * ---	1,2,4 6,7	E01D15/24 B65G69/28 B63B27/14
Y	GB-A-2 053 100 (CARGOSPEED EQUIPMENT LTD.) 4 February 1981	6,7	
A	* page 1, line 55 - line 75; figure 1 * ---	1	
X	FR-A-2 467 159 (FIVES-CAIL BABCOCK) 17 April 1981 * page 4, line 5 - line 38; figures 1,2 * ---	1,2,4	
X	EP-A-0 245 227 (MACGREGOR-NAVIRE INTERNATIONAL AB) 11 November 1987 * figures * ---	1,2	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B63B E01D B65G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 1 September 1995	Examiner Stierman, E
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	