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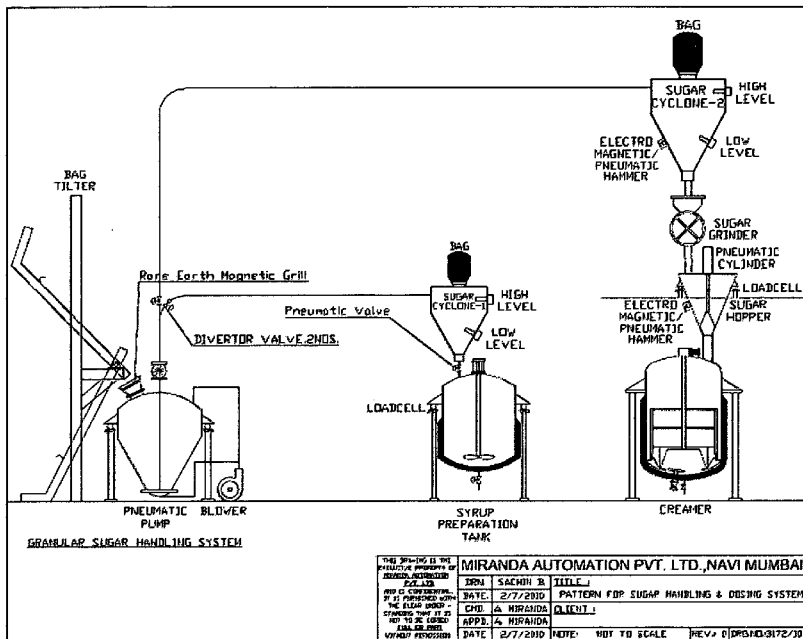
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**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(H))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Hi))

[Continued on next page]

(54) Title: PROGRAMMABLE LOGIC CONTROLLER BASED SUGAR CONVEYING, PULVERIZING AND DOSING SYSTEM



(57) Abstract: This invention is based on programmable logic controller based sugar conveying, pulverizing and dosing system. Which is more accurate, more hygienic, fully automated hence less man power consuming, auto feeding programmable logic controller (PLC) based sugar conveying, pulverizing, dosing system which comprises of bag tilter, pneumatic pump, buffer cyclone, sugar pulverizer, weighing hopper. The present invention used the pic system which is a digital computer used for automation of electromechanical processes, which is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

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**Published:**

— *with international search report (Art. 21(3))*

**TITLE OF INVENTION:** "Programmable logic controller based sugar conveying, pulverizing and dosing system."

### **FIELD OF INVENTION**

The present invention is a more accurate, more hygienic, fully automated hence less man power consuming, auto feeding programmable logic controller (PLC) based sugar conveying, pulverizing, dosing system which comprises of bag tilter, pneumatic pump, buffer cyclone, sugar pulverizer, weighing hopper. the present invention used the pic system which is a digital computer used for automation of electromechanical processes, which is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

### **BACKGROUND OF THE INVENTION**

The present invention used the PLC system for sugar conveying, pulverizing, dosing system. PLCs are well-adapted to a range of automation tasks. These are typically industrial processes in manufacturing where the cost of developing and maintaining the automation system is high relative to the total cost of the automation, and where changes to the system would be expected during its operational life. On the other hand, in the case of mass-produced goods, customized control systems are economic due to the lower cost of the components, which can be optimally chosen instead of a "generic" solution, and where the non-recurring engineering charges are spread over thousands or millions of units. In this present very accurate invention Sugar bags are unloaded in to the pneumatic pump by the bag tilter; material passes through the high capacity magnetic grills to avoid any foreign material contamination after that Sugar weighed quantity is pneumatically conveyed to the buffer cyclone from the pneumatic pump. Sugar from the buffer cyclone is fed to the sugar pulveriser . Then Quantity of the sugar is maintained in the buffer cyclone with the help of the level sensor . Regulated sugar is fed to the sugar pulveriser and the pulverized sugar is passed to the weighing hopper through the specially designed hopper attached with the proper venting arrangement. Actual quantity of the sugar Weighed in the weighing hopper is discharged in the creamer. Weighing hopper is Incorporated with the fiuidization arrangement, electropneumatic/magnetic hammer and the special design of the leak proof valve which is operated by the pneumatic cylinder.

**PRIOR ART**

In the existing system as given in US patent application US 2009/0312281 wherein the Method of preparing a non-hygroscopic pulverulent composition, includes a step for the spray drying, without an atomization support, of an aqueous solution containing at least one initially hygroscopic product, having a glass transition temperature ranging from 10° C. to 110° C , and a cryogenic fluid, especially a food-grade cryogenic fluid, or a mixture of cryogenic fluids, particularly chosen from liquid air, nitrogen and carbon dioxide, the aqueous solution being obtained by dissolving the cryogenic fluid in an initial aqueous solution containing the initially hygroscopic product.

In the existing system as given in European Patent Application EP1920656 wherein an industrial kneading and/or mixing machine for bakery products comprising a mixing bowl and a guard covering the bowl. The machine is equipped with an integrated dosing unit which doses the ingredients and pours them directly into the bowl of the kneading and/or mixing machine.

In the existing system as given in United States Patent Application 20070039981 wherein a powder dosing system for not easily flowing cohesive and adhesive powders with a feed hopper, a discharge device, a conveying device, where the discharge device has an inclined vibrating floor, and where the discharge opening from the feed hopper and the discharge opening of the discharge device are arranged relative to each other in such a manner that a reliable and relatively precise dosing of the problematic powdery materials is possible without jamming. This is accomplished by also taking into account the specific angle of repose of the material in question. With the help of a special design of various conveying devices, such as a conveying container for discontinuous dosing and a bucket wheel lock for continuous dosing, the system can be optimized.

In the existing system as given in US granted patent number 5622457 wherein A pneumatic material handling system for conveying dry, solid particulate product from one of at least two separate upstanding dry, solid particulate product supply containers to at least one desired destination. At least two identically constructed valves are connected into the conduit system intermediate the supply containers and the desired destination. Each of the two valves includes a base plate having at least first and second separate through passageways extending there through and a movable plate slidably mounted on the base plate and movable between first and second positions relative to the base plate. The movable plate has a third through passageway extending there through and being axially aligned with the first through passageway in the first position of the movable plate and with the second through passageway in the second position of the movable plate. A drive mechanism is provided for moving the movable plate between the first and second positions.

In the existing system as given in United state patent number 5485066 wherein a drive control system for a centrifugal used in, for example, a sugar refining operation, optimizes the deceleration and plow-out phases of its operation based on the torque characteristics of its particular drive motor. This is achieved by providing a centrifugal having a pulse-width modulated (PWM) frequency-modulated drive controlled by a programmable logic controller (PLC) running a ladder logic program. The ladder logic program implements a regenerative braking loop which complements the dynamic braking characteristic curve of the drive motor, thereby obtaining an optimal amount of braking torque for the motor over a wide range of motor revolutions or frequencies. Preferably, the system also implements a dynamic plow-out control for the motor when in plow-out mode to enable the centrifugal to be plowed-out in a minimal amount of time.

In the existing system as given in United state granted patent 4085850 wherein the direction to arranging a weigh hopper in a free floating manner in a rigid frame so that the hopper either rests upon a load cell or pulls on a load cell while the hopper is free to move up and down in a rigid frame only influenced by flexing aligning rods which are not rigidly secured to the weigh hopper but are secured to the rigid frame. This structure eliminates the usual multiplicity of load cells common to this art.

In the existing system as given in US patent application number 2009/025881 1 wherein a solid dishwashing agent for dishwashers that can be placed within the dishwasher once for several washing cycles and that can be automatically dosed according to the actual need. Said solid dishwashing agent in general is in one piece and comprises a carrier and therein incorporated active substances that at least comprise a builder. Said carrier is a solid, water-soluble matrix that is tight against water and humidity, and forms a dishwashing agent that is dimensionally stable at the highest temperature in the storage container during a washing cycle which indicates the importance of automatic PLC system in present invention.

### **THE OBJECT OF THE INVENTION**

The object of the present invention is to provide a more accurate, more hygienic, fully automated hence less man power consuming, auto feeding programmable logic controller (pic) based sugar conveying, pulverizing, dosing system. No prior art with all these advances introduced yet. Additionally the present invention also provides pneumatically conveying of sugar weighed quantity, Auto feeding of the pulveriser, Hygenic system, Online grinding of the sugar weighing and feeding, Accurate quantity dosing, Multilocation dosing of sugar, Dust free atmosphere, No wastage of the material. Few more added advantage of using Sugar Pulverizer - Dust free and noise free operation, fully automated with manpower saving, Accurate and hygienic charging, No human errors as weights controlled by PLC.

Moreover the PLC system which is being used makes this invention unique as PLCs are well-adapted to a range of automation tasks. These are typically industrial processes in manufacturing where the cost of developing and maintaining the automation system is high relative to the total cost of the automation, and where changes to the system would be expected during its operational life. PLCs contain input and output devices compatible with industrial pilot devices and controls; little electrical design is required, and the design problem centers on expressing the desired sequence of operations.

Industrial automation is the core strength of MAPL. Programmable Logic Controller System (PLC), Supervisory Control & Data Acquisition (SCADA), Instrumentation etc. are used for gaining complete control over process & equipment in automation brings in excellent pay back benefits. A well-automated project does not need human supervision over equipment & process operations & eliminates all possible human errors & staff training due to staff turnover. The process becomes very accurate, yielding consistent product quality & material usage. Automated systems acquire process data & parameters & record them continuously batch wise, line wise, equipment wise etc.

Given all above novel and unique advancement make this invention easily applicable in the industrial use in a large scale.

## **DETAILED DESCRIPTION OF THE INVENTION**

The present invention discloses the programmable logic controller based sugar conveying, pulverizing and dosing system.

### **Description of System**

Sugar bags are unloaded in to the pneumatic pump by the bag tilter, material passes through the high capacity magnetic grills to avoid any foreign material contamination Sugar weighed quantity is pneumatically conveyed to the buffer cyclone from the pneumatic pump sugar can be fed to the multi location buffer cyclones. Sugar from the buffer cyclone will be fed to the sugar pulveriser. Quantity of the sugar is maintained in the buffer cyclone with the help of the level sensor. Regulated sugar is fed to the sugar pulveriser and the pulverized sugar is passed to the weighing hopper through the specially designed hopper, which is attached with the proper venting arrangement.

Actual quantity of the sugar weighed in the weighing hopper is discharged in the creamer. Weighing hopper is incorporated with the fluidization arrangement, electro pneumatic/magnetic hammer and the special design of the leak proof valve which is operated by the pneumatic cylinder.

The system comprises of-

**Bag Tilter-** Pneumatically operated sugar bag tilter, which is used to unload the sugar bags in to the pneumatic pump.

**Pneumatic Pump-** Pressure vessel of 300lit capacity stainless steel construction Vessel is mounted on the load cell 3nos having capacity 500kgs each. Pneumatic pump is equipped with the 6" butterfly valve for the inlet of the material and 2 1/2' ball valve for the outlet of the material example- sugar. Accessories like pressure gauge ,pressure switch, pressure relief valve, safety rupture disc are mounted on the pneumatic pump for the safety purpose .System is hydraulically tested for the pressure of 6kg/cm<sup>2</sup>. Vibration motor of 0.25hp is mounted on the pneumatic pump ,air entry is provide from the top and bottom along with the fluidization chamber.

**Buffer Cyclone** -SS304 construction having capacity 500kgs of sugar equipped with the level sensor for maintaining the sugar quantity in the buffer cyclone along with the filter bag for the air venting

**Sugar Pulveriser** -Sugar pulveriser comprises of the heavy duty SS 304 body attached with the feed hopper ,slide valve to regulate the feed to the pulveriser .Rotor and beater are mounted in the bearing housing rotating at 4500to 6000rpm. Pulveriser is mounted on the steel structure .motor is attached to the rotor by V belts and pullies.Sugar is pulverized and pneumatically conveyed to a cyclone separator and thereafter to the assigned mixer. Alternatively it can be stored in silo in large quantity. In either of the designs, the system is totally controlled by the PLC.

Accurate dosing of the ingredients is essential to get the consistent quality of the product in food industries .sugar is one of a very essential ingredient and it needs to be dosed accurately. MAPL:s PLC based sugar conveying pulverizing, weighing and dosing system is very accurate and hygienic system, fully automated hence saving the manpower,Raw material.

**Weighing Hopper** -Weighing hopper mounted on the 3nos load cells of 500kgs capacity each supported on the frame. Pulverized sugar from the pulveriser falls in the hopper through the specially designed hopper equipped for the de-aeration of the pulveriser. Weighing hopper is incorporated with the fluidization system and the especially leak proof valve operated by the pneumatic cylinder.

**Fluidization -It** is a process similar to liquefaction whereby a granular material is converted from a static solid-like state to a dynamic fluid-like state. This process occurs when a fluid (liquid or gas) is passed up through the granular material. When a gas flow is introduced through the bottom of a bed of solid particles, it will move upwards through the bed via the empty spaces between the particles. At low gas velocities, aerodynamic drag on each particle is also low,and thus the bed remains in a fixed state.

Increasing the velocity, the aerodynamic drag forces will begin to counteract the gravitational forces, causing the bed to expand in volume as the particles move away from each other. Further increasing the velocity, it will reach a critical value at which the upward drag forces will exactly equal the downward gravitational forces, causing

The particles to become suspended within the fluid. At this critical value, the bed is said to be fluidized and will exhibit fluidic behaviour. By further increasing gas velocity, the bulk density of the bed will continue to decrease, and its fluidization becomes more violent, until the particles no longer form a bed and are "conveyed" upwards by the gas flow.

**Butterfly valve-** It is a valve which can be used for isolating or regulating flow. The closing mechanism takes the form of a disk. Operation is similar to that of a ball valve, which allows for quick shut off. Butterfly valves are generally favoured because they are lower in cost to other valve designs as well as being lighter in weight, meaning less support is required. The "butterfly" is a metal disc mounted on a rod. The valve may also be opened incrementally to throttle flow. Butterfly valves are available in small dimensions that enable to use these in limited space areas. Further, these valves are known for allowing high coefficient of flow. These valves are also known as quick opening valves, which are used as throttling valves to control flow. Our butterfly valves do not contain pockets as in ball valves, which mean fluids don't get trapped when the valve is closed.

**Features:** Leak-proof, Low maintenance, Easy operation, Consistent performance, Corrosion resistance, Crack-free finish.

#### **Procedure of working device-**

- a. The weighing hopper for pulverized sugar is mounted on the load cell.
- b. Required quantity of pulverized Sugar is set in the PLC ..
- c. On giving run command PLC takes the value of this hopper and starts the grinder motor.
- d. On attaining full speed of the grinder sugar inlet valve of grinder opens pneumatically.
- e. The pulverized sugar starts receiving in the hopper and as soon as the set quantity of sugar is received slide valve of crystalline sugar shuts and grinder runs for 10 seconds to empty the grinder completely, thus making sure that the grinder will always start in empty condition.
- f. Specially designed valve and the sealing ensure that no leakage of powdered sugar is possible. Conical dome type valve is operated by extended shaft pneumatic cylinder and spring seal at the bottom outlet.
- g. On demand from the operator this valve gets lifted by pneumatic cylinder and electromagnetic/pneumatic hammer is operated.

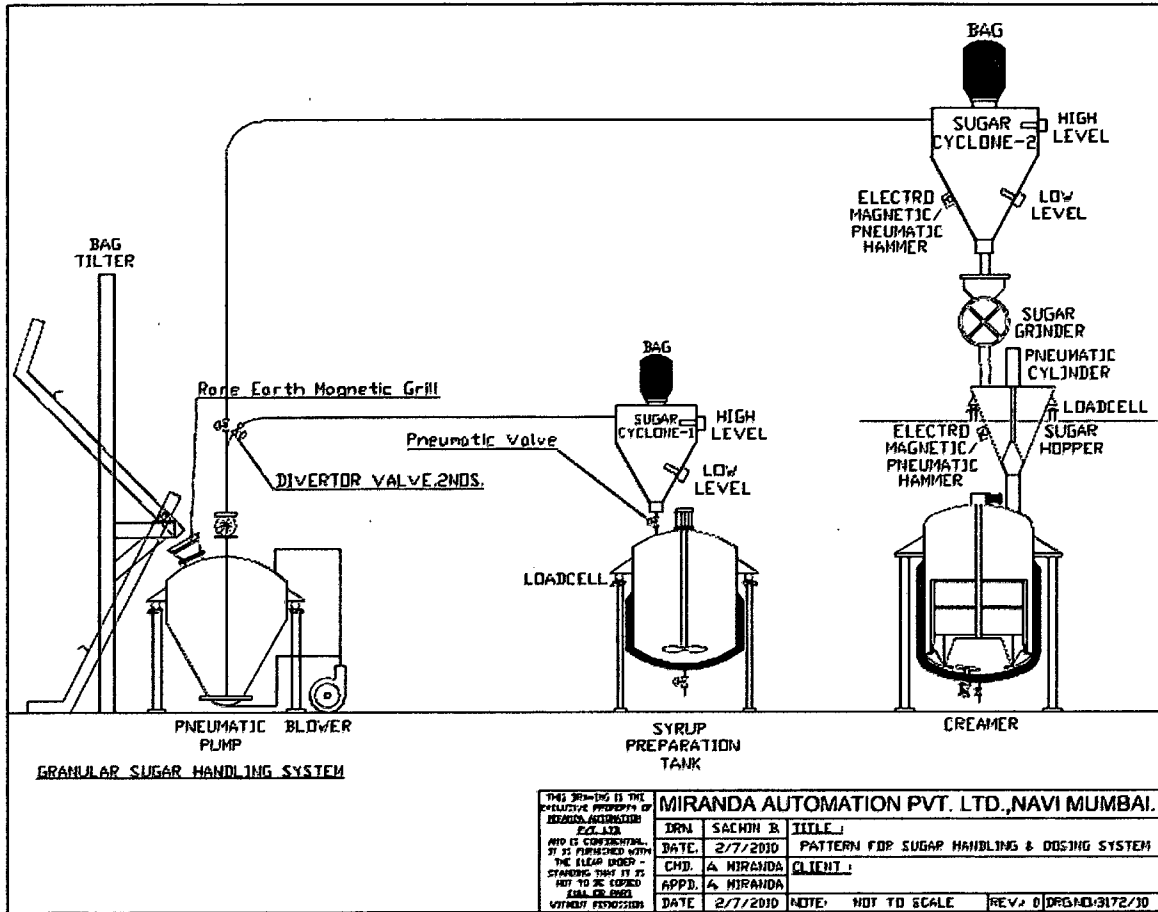
- h. There is air fluidization also carried out at the bottom of the hopper.
- i. All the above actions make the sugar powder easily flow able and help to discharge it completely in 20 sec.
- j. Fluidization of the pulverized sugar is carried out by six point air injection at the bottom of the hopper. This loosens the mass and makes it easily flow able. Hence it enhances the complete discharge of the pulverized sugar.
- k. Electromagnetic hammer helps the material to get released from the wall of the hopper. Anti friction lining inside the hopper makes the pulverized sugar not to adhere to its surface.

**CLAIMS**

1. A more accurate, more hygienic, fully automated hence less man power consuming, auto feeding programmable logic controller (PLC) based sugar conveying, pulverizing, dosing system, comprises of bag tilter, pneumatic pump, buffer cyclone, sugar pulverizer, weighing hopper, Fluidization system and butterfly valves.
2. The system in claimed 1, wherein the said bag tilter is pneumatically operated and used to upload sugar.
3. The system in claimed 1, wherein the system is hydraulically tested for the pressure of 6kg/cm<sup>2</sup>. Vibration motor of 0.25hp is mounted on the pneumatic pump.
4. The system in claimed 1, wherein the said pneumatic pump is a Pressure vessel of 300lit capacity stainless steel construction Vessel is mounted on the load cell 3nos having capacity 500kgs each.
5. The pneumatic pump in claimed 3, wherein the Pneumatic pump is equipped with the 6<sup>3</sup>/<sub>4</sub>utterfly valve for the inlet of the material and 2<sup>1</sup>/<sub>2</sub>' ball valve for the outlet of the material.
6. The pneumatic pump in claimed 3, wherein the accessories like pressure gauge ,pressure switch, pressure relief valve, safety rupture disc are mounted on the pneumatic pump for the safety purpose.
7. The system in claimed 1, wherein the said buffer cyclone SS304 construction has the capacity 500kgs of sugar equipped with the level sensor for maintaining the sugar quantity in the buffer cyclone along with the filter bag for the air venting.

8. The system in claimed 1, wherein the said Sugar pulveriser comprises of the heavy duty SS 304 body attached with the feed hopper, slide valve to regulate the feed of the pulverize .
9. The sugar pulveriser in claimed 8, wherein the Sugar pulverize has Rotor and beater is mounted in the bearing housing rotating at 4500to 6000rpm. pulveriser is mounted on the steel structure .motor is attached to the rotor by V belts and pullies.
10. The system in claimed 1, wherein the said weighing hopper mounted on the 3nos load cells of 500kgs capacity, each supported on the frame pulverized sugar from the pulveriser falls in the hopper through the specially designed hopper equipped for the de-aeration of the pulverizer.
11. The weighing hopper in claimed 10, wherein the said weighing hopper is incorporated with the fluidization system and the especially leak proof valve operated by the pneumatic cylinder.
12. The system in claimed 1, wherein the said fluidization is a process similar to liquefaction whereby a granular material is converted from a static solid-like state to a dynamic fluid-like state. This process occurs when a fluid (liquid or gas) is passed up through the granular material.
13. The steps for the construction of programmable logic controller (PLC) based sugar conveying, pulverizing, dosing system of claim 1, comprising the steps of:
  1. The weighing hopper for pulverized sugar is mounted on the load cell.
  - m. Required quantity of pulverisd Sugar is set in the PLC .
  - n. On giving run command PLC takes the value of this hopper and starts the grinder motor.

- o. On attaining full speed of the grinder sugar inlet valve of grinder opens pneumatically.
- p. The pulverized sugar starts receiving in the hopper and as soon as the set quantity of sugar is received slide valve of crystalline sugar shuts and grinder runs for 10 seconds to empty the grinder completely, thus making sure that the grinder will always start in empty condition.
- q. Specially designed valve and the sealing ensure that no leakage of powdered sugar is possible. Conical dome type valve is operated by extended shaft pneumatic cylinder and spring seal at the bottom outlet.
- r. On demand from the operator this valve gets lifted by pneumatic cylinder and electromagnetic/pneumatic hammer is operated.
- s. There is air fluidization also carried out at the bottom of the hopper.
- t. All the above actions make the sugar powder easily flowable and help to discharge it completely in 20 sec.
- u. Fluidization of the pulverized sugar is carried out by six point air injection at the bottom of the hopper. This loosens the mass and makes it easily flowable. Hence it enhances the complete discharge of the pulverized sugar.
- v. Electromagnetic/pneumatic hammer helps the material to get released from the wall of the hopper. Antifriction lining inside the hopper makes the pulverized sugar not to adhere to its surface.



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	<p>DRN. SAHIN B.</p>	<p>TITLE:</p>	<p>PATTERN FOR SUGAR HANDLING &amp; DOSING SYSTEM</p>
	<p>DATE: 2/7/2010</p>	<p>CHKD. A. MIRANDA</p>	<p>CLIENT:</p>
	<p>APPD. A. MIRANDA</p>	<p>DATE: 2/7/2010</p>	<p>NOTE: NOT TO SCALE</p>

REV: 0 | DRG-M3-3172/10

# INTERNATIONAL SEARCH REPORT

International application No PCT/IN201Q/00Q797
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. B01F15/04 B65G53/66 B65G65/23 A23L1/09 C13B50/00 C13B25/06 ADD. According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) B01F B65G A23L C13B 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) EPO-Internal , WPI Data, FSTA				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
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<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</td> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> See patent family annex.</td> </tr> </table>			<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.			
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">                     "A" document defining the general state of the art which is not considered to be of particular relevance                      "E" earlier document but published on or after the international filing date                      "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)                      "O" document 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                 </td> <td style="width: 50%; border: none;">                     "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                      "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                      "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.                      "&amp;" document member of the same patent family                 </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document 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	"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 "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 "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. "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document 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	"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 "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 "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. "&" document member of the same patent family			
Date of the actual completion of the international search		Date of mailing of the international search report		
21 June 2011		01/07/2011		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer  Tal Igrén, Antti		

# INTERNATIONAL SEARCH REPORT

International application No

PCT/IN2010/000797

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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