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[Continued on next page]

(54) Title: MOTORIZED LINEAR PISTON SYSTEM

(57) Abstract: The invention relates to a motorized linear piston system comprising a motor (1), piston housing (2), action shaft (3), joint with movable head (4), fixed joint (5), gear transmission reducer mechanism (6), belt and pulley mechanism (7), driveline slot (8), cover (9), driver (10), sensor no. 2 (11), sensor no. 1 (12), DC power supply input (13), sensor no. 3 (14), 12 V DC Power supply (15), and cable (16) elements, characterized in that said system can be integrated to the machinery industry, especially the agricultural machinery, robotics and various industrial practices as well as machinery and devices, which has robotics mechanism or require mechanical motion.

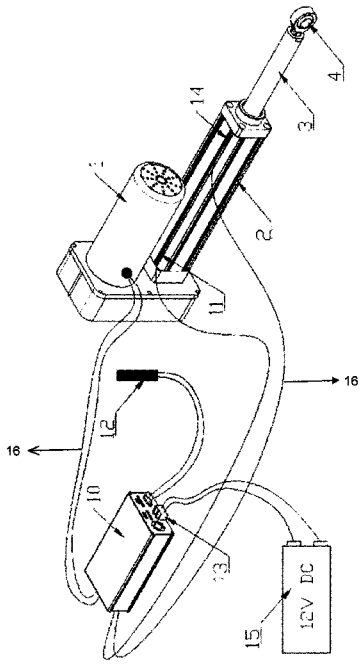

fig.- 1

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MOTORIZED LINEAR PISTON SYSTEM

Technical Field

The invention is a motorized linear piston system that can be integrated to the machinery industry, especially the agricultural machinery, robotics and various industrial practices as well as machinery and devices, which has robotics mechanism or require mechanical motion, as a system that operates when the compact driver, motor and piston assembly is driven once by the electrical power supplied by a DC power supply.

Prior Art

Hydraulic pistons are the circuit elements that convert the hydraulic energy of the fluid within the hydraulic circuit into mechanical energy, thus obtaining linear motion and force. In the end, almost all hydraulic systems drive a hydraulic cylinder.

In current practices available in the art, the system includes a hydraulic piston for reciprocating motion and an oil pump that generates the oil pressure in the system for moving said piston; a reducer capable of transferring desired revolutions per minute to said oil pump; valve groups that direct the hydraulic piston accordingly, and multiple hydraulic pipes. That is to say, the system is a complicated and complex system comprising of multiple parts.

Examination of the operating conditions reveals that the parts in reciprocating motion operate at a single connection axis. Therefore, all parts forming the cylinder are positioned on the same axis.

Hydraulic fluid, on the other hand, is an essential element for system operation. A hydraulic cylinder must contain the pressurized oil therein in order to fulfill its function.

Objects of the Invention

At hydraulic systems available in the prior art, in case pressure loss is experienced within the cylinder due to internal or external leaks that might occur during operation and if such loss reaches to a critical value, the cylinder might become non-functional due to such pressure losses. Sealing components are used at various areas in order to prevent probable leaks at the hydraulic cylinder. The sealing components manufactured from a large variety of materials in various types are selected depending on the construct of the hydraulic cylinder and the operating conditions.

It is desirable that the hydraulic pistons used in almost all of the industrial hydraulic systems in order to enjoy the attraction of hydraulic energy maintain its efficiency until their technological service life expires.

The labor, time and production losses that shall arise in case the expensive circuit components in the hydraulic system of complex nature breakdowns or malfunctions have a negative impact on the costs.

It is a known fact that significant oil leaks are experienced at the hydraulic piston in time and hydraulic fluid overheat is experienced depending on use at the circuit where the hydraulic piston system is in use according to the industrial practice. Another overheat factor is that, when the hydraulic systems that run outdoors become subject to ambient temperature or direct sunlight, the hydraulic fluid within the system is easily overheated, reducing the performance.

The hydraulic fluid within the oil tank, oil pump, valve and hose group, which form the hydraulic system, is in continuous circulation. Therefore, the oil heats up after a certain period of operation and degrades, which in turn reduces operation performance of the system.

The most prominent problems due to aforementioned conditions are poor performance and experiencing losses.

Besides, the fertile agricultural lands are contaminated as the oil leaks experienced at the hydraulic systems used at industrial practices aiming agriculture directly mix into soil.

Furthermore, complicated nature of the systems in the prior art leads to excessive material replacement costs due to wear as a result of use, material costs and naturally high service and maintenance costs.

The fuel consumption at the system where this type of system is implemented is higher at the rate of approximately 5%.

Brief Description of the Invention

A motorized linear piston system is created by supplying power from a DC power supply, that is to say from an accumulator or an alternate source which enable implementation of the system, taking into consideration the disadvantages of the hydraulic system employed in current practices.

The invention enables reduction of the material costs by eliminating the mess at the hydraulic systems of the prior art through compact positioning of the driver, motor and linear piston group.

The service life of the machinery is extended and the efficiency thereof is improved as power distribution is more balanced at the system where the

invention is implemented. That is to say, as the oil pressure transmitted to the piston at the hydraulic piston systems of the prior art is powerful, it causes an instant thrust at the piston, thus jolting the machine group. At the system of the invention, on the other hand, the torque that the electric motor exerts on the piston is more stable and the power distribution on the machine is more balanced and vibration-free by virtue of the limiting sensors on the piston.

What differs from the hydraulic systems of the prior art is that, by virtue of the limiting sensors installed in the present invention, more accurate positioning is established as stop at forward-backward position is electrical by means of the limiting sensors available on the piston housing at the linear piston system. This enables shortening and extending the positioning distance of the piston shaft through position changes at the limiting sensors, because it is not possible to ensure positioning at the hydraulic systems of the prior art, which is suitable for this system.

On the other hand, as the system of the invention doesn't contain any oil or oil circuit, oil leaks are prevented, thus eliminating the possibility of chemical contamination at the fertile agricultural land due to industrial practices intended for agriculture.

5% fuel economy is also achieved at the industrial practices intended for agriculture.

The motorized linear piston system of the invention can be integrated to machinery and devices, which has robotics mechanism, or which require mechanical motion.

Description of the Figures

The motorized linear piston system realized for achieving the objectives of the invention is illustrated in the figures attached hereto.

Figure 1 illustrates the perspective view of the motorized linear piston system of the invention together with the system components.

Figure 2 illustrates the perspective view of the motorized linear piston system of the invention from a different angle.

Figure 3 illustrates the perspective view of the gear transmission, that is to say the reducer mechanism of the motorized linear piston system of the invention.

Figure 4 illustrates the perspective view of the belt and pulley mechanism chamber of the motorized linear piston system of the invention.

Description of the References in the Figures

1. Motor
2. Piston housing
3. Action shaft
4. Joint with movable head
5. Fixed joint
6. Gear transmission reducer mechanism
7. Belt and pulley mechanism
8. Driveline slot
9. Cover
10. Driver
11. Sensor no. 2
12. Sensor no. 1
13. Dc power supply input
14. Sensor no. 3
15. 12 V DC Power supply

16.Cable

Detailed Description of the Invention

The invention relates to a motorized linear piston system comprising a motor (1), piston housing (2), action shaft (3), joint with movable head (4), fixed joint (5), gear transmission reducer mechanism (6), belt and pulley mechanism (7), driveline slot (8), cover (9), driver (10), sensor no. 2 (11), sensor no. 1 (12), DC power supply input (13), sensor no. 3 (14), 12 V DC Power supply (15), and cable (16) elements, characterized in that said system can be integrated to the machinery industry, especially the agricultural machinery, robotics and various industrial practices as well as machinery and devices, which has robotics mechanism or require mechanical motion.

The motor (1) is the part that generates power for the piston housing (2) wherein for motor (1) is suitable for using any of the DC, step or servo motor options

The piston housing (2) is the aluminum exterior housing forming the piston and where Sensor no. 2 (11) and Sensor no. 3 (14) are installed.

The action shaft (3) is chromium plated action shaft.

The joint with movable head (4) is the joint with movable head that enable fixation of the piston at a point.

The fixed joint (5) is the joint that enable fixation of the piston at a point.

The gear transmission reducer mechanism (6) is the driveline mechanism between the motor (1) and the piston housing (2) and comprises of two gears.

The belt and pulley mechanism (7) is the driveline mechanism between the motor (1) and the piston housing (2).

The driveline slot (8) is the chamber that contains the belt and pulley mechanism (7) where the piston housing (2) and the motor (1) is securely fixed.

The cover (9) is the cover of the driveline slot (8) and incorporates the fixed joint (5) thereon.

The driver (10) is the electronic control board that commands the system.

Sensor 2 (11) is the sensor positioned on the piston housing and limits the piston in backward direction.

Sensor no. 1 (12) is the movable sensor that drives the system to perform reciprocating motion through the signal send externally to the motorized linear piston system.

DC power supply input (13) is the element where the 12V' power required for system operation is supplied to the Driver (10).

Sensor no. 3 (14) is the sensor positioned on the piston housing and limits the piston in forward direction.

12V DC Power supply (15) is the 12V power supply required for starting the system and accumulator is preferable especially for implementing the system to agricultural machinery. However, it is also possible to use another alternate power source, which is capable of supplying 12V power, instead of accumulator for robotics or industrial practices.

According to the operating principle of the motorized linear piston system of the invention; the Driver (10) receives the supply voltage from 12V DC power supply (15). The supply voltage and signal transmission is conducted via cables (16) throughout the entire system.

The driver (10) drives the motor (1) in backwards direction by closing its circuit via the signal received from the movable sensor no. 1 (12) positioned at a suitable spot on the machinery or the system where the system of the invention is applied. When the motion reaches to Sensor no. 2 (11), the sensor limits the motion and stops the motor (1). Sensor no. 1 (12) sends duplex signal to the driver. Then the driver (10) closes its circuit in accordance with the signal received from Sensor no. 1 (12) and drives the motor (1) in forward direction. Sensor no. 3 (14) establishes the limit in forward direction. In case of any excessive (extraordinary) stress on the motor (1), then the driver (10) engages protective measures for 3 seconds in order to protect itself and the system and de-energizes. After 3 seconds, the driver (10) re-energizes the system. If such stress is eliminated, then the piston system of the invention automatically resumes normal operation.

The Driver (10) operates on 12V voltage. In case min. 10V is not supplied to the driver (10) input then the system deactivates due to voltage drop and the system becomes non-functional. The motor (1) installed in the system can be suitable for using of DC, STEP or SERVO motor. The connection between the motor (1) and the linear piston housing (2) and then the action shaft (3) is established through belt and pulley mechanism (7) and gear transmission reducer mechanism (6).

The Sensor no. 1 (12) signaling the Driver (10) externally can be any of the ultrasonic sensor, programmable switch, object reflection sensor, IR sensor, mechanical switch or RF module sensors according to the field of

use, taking into consideration the type of the industrial practice to which the motorized linear piston system will be integrated.

The invention is a motorized linear piston system characterized in comprising motor (1), piston housing (2), action shaft (3), joint with movable head (4), fixed joint (5), gear transmission reducer mechanism (6), belt and pulley mechanism (7), driveline slot (8), cover (9), driver (10), sensor no. 2 (11), sensor no. 1 (12), DC power supply input (13), sensor no. 3 (14), 12V DC power supply (15), and cable (16) elements.

CLAIMS

Claim 1. A motorized linear piston system characterized in comprising motor (1), piston housing (2), action shaft (3), joint with movable head (4), fixed joint (5), gear transmission reducer mechanism (6), belt and pulley mechanism (7), driveline slot (8), cover (9), driver (10), sensor no. 2 (11), sensor no. 1 (12), DC power supply input (13), sensor no. 3 (14), 12V DC power supply (15), and cable (16) elements.

Claim 2. A motorized linear piston system according to Claim 1, characterized in that it is compact with driveline slot (8) in which the gear transmission reducer mechanism (6) and belt and pulley mechanism (7) are positioned, a cover (9) covering the driveline slot and a fixed joint (5) adjacent to the cover (9) surface.

Claim 3. A motorized linear piston system according to Claim 1, characterized in that a motor (1) and the piston housing (2) are fixed to the driveline slot (8) with a 90 degree angle and that the motor (1) and the piston housing (2) are parallel to each other.

Claim 4. A motorized linear piston system according to Claim 1, characterized in that the joint with movable head (4) attached to the action shaft (3) is positioned on the piston housing (2) in such manner suitable for its movement capabilities.

Claim 5. A motorized linear piston system according to Claim 1, characterized in that a sensor no 2 (11) enabling reverse motion and sensor no 3 (14) enabling forward motion are positioned on the piston housing (2).

Claim 6. A motorized linear piston system according to Claim 1, characterized in that the driver (10) has at least one DC power supply

input (13) and contain sensor 2 (14) element that sends external signals to the driver (10).

Claim 7. A motorized linear piston system according to Claim 1, characterized in comprises belt and pulley mechanism (7) and gear transmission reducer mechanism (6) that supply power to motor (1), the piston housing (2) and the action shaft (3).

Claim 8. A motorized linear piston system according to Claim 1, characterized in that the Sensor no. 1 (12) installed on the Driver (10) can be any of the ultrasonic sensor, programmable switch, object reflection sensor, IR sensor, mechanical switch or RF module sensors depending on the field of use.

Claim 9. A motorized linear piston system according to Claim 1, characterized in that the motor (1) element can be any of the DC, step or servo motor options.

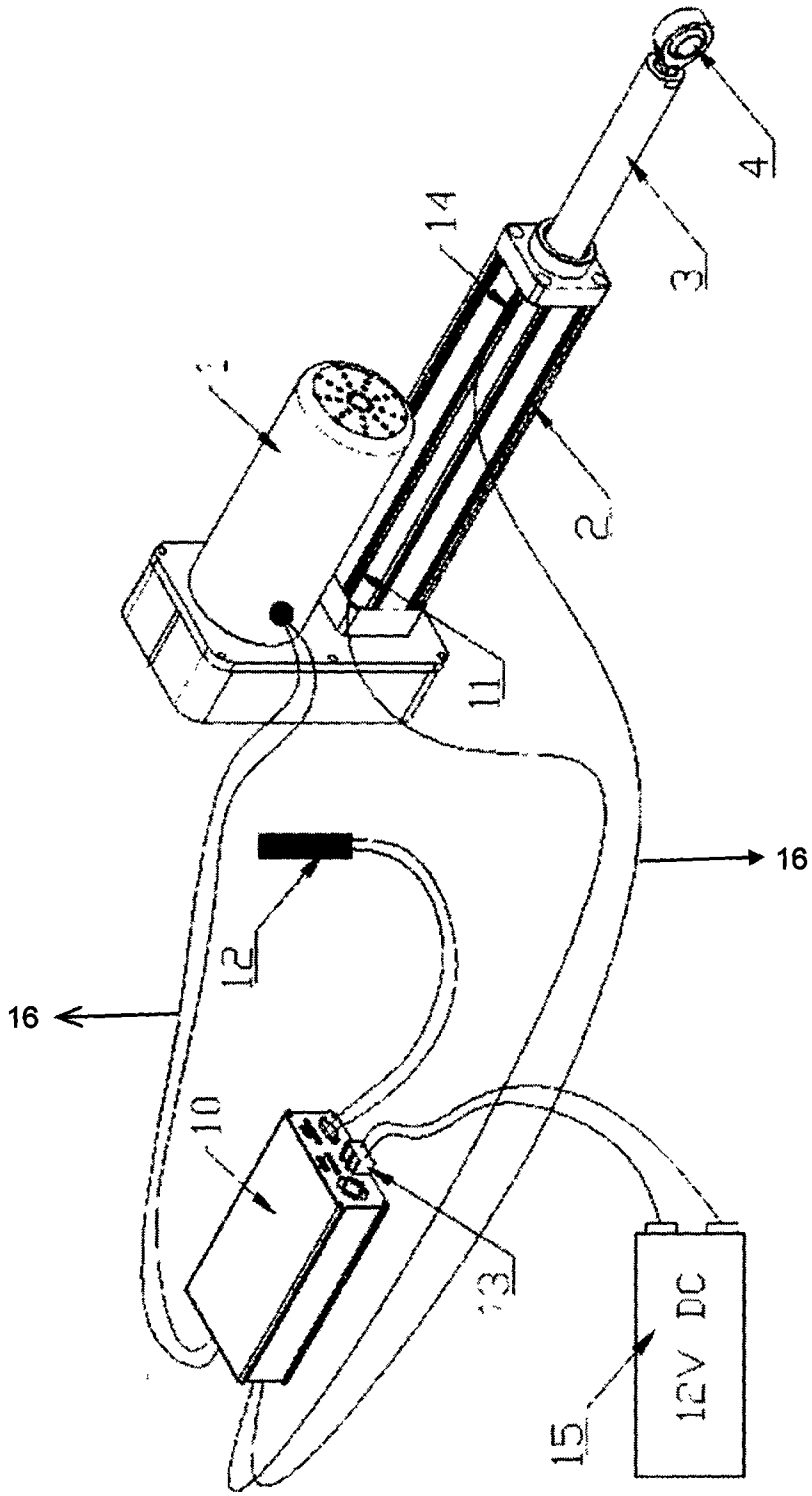

fig.- 1

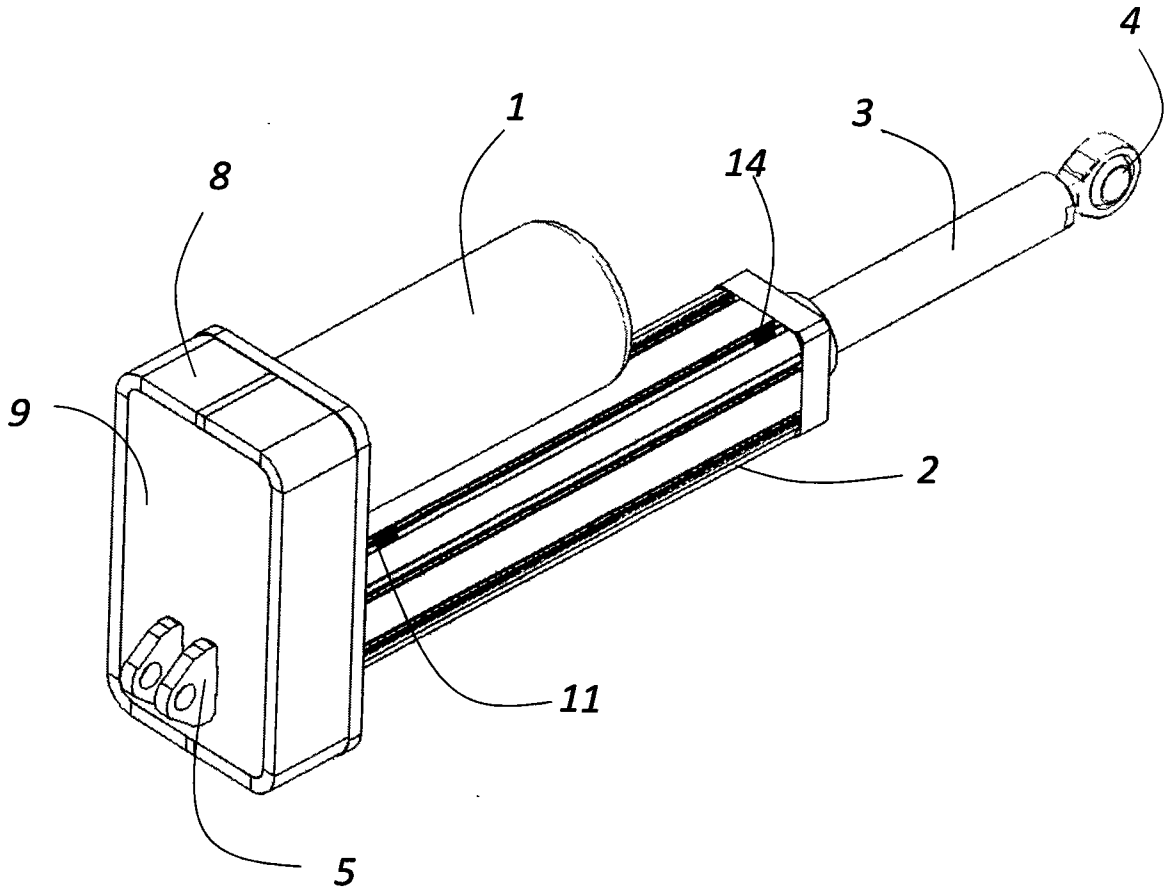

fig.- 2

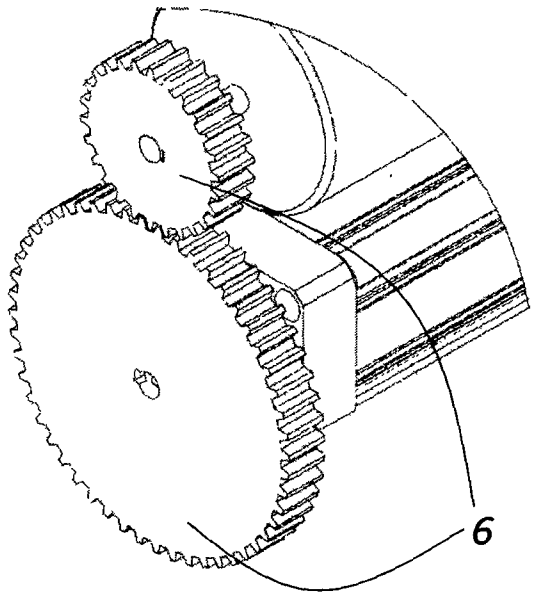

fig.- 3

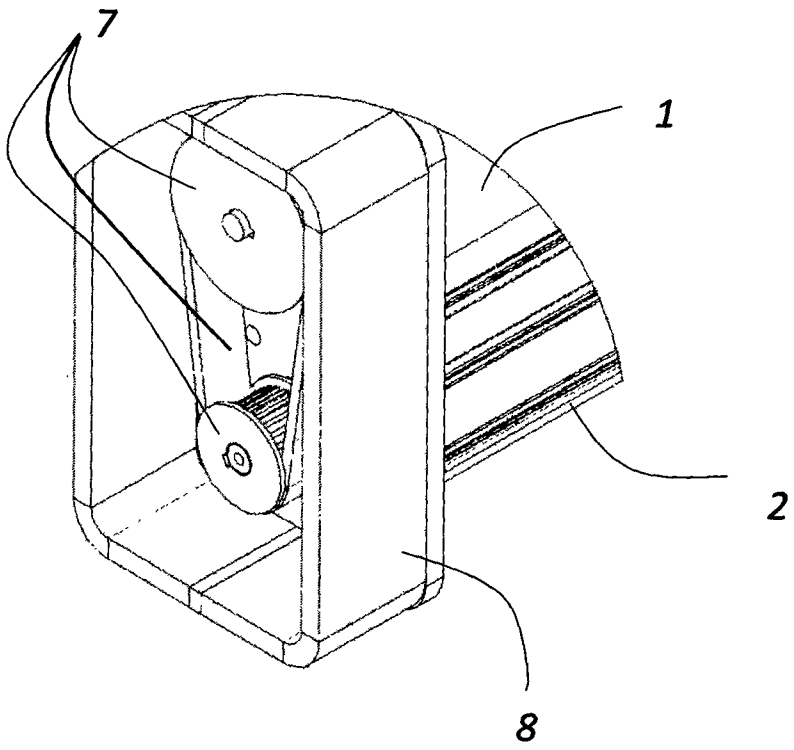

fig. - 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2015/000347

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16H25/20
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)
F16H

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.
X	EP 0 551 197 A1 (LINK MILES LTD [GB]) 14 July 1993 (1993-07-14) the whole document	1-9
X	US 4 137 784 A (GRIFFIN JAMES A) 6 February 1979 (1979-02-06) the whole document	1-9
X	US 2011/298323 A1 (BRIESCHKE TODD M [US]) 8 December 2011 (2011-12-08) the whole document	1-9
A	EP 1 980 770 A2 (GOODRICH ACTUATION SYSTEMS LTD [GB]) 15 October 2008 (2008-10-15) the whole document	1,2,7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"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

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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

International application No
PCT/TR2015/000347

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0551197 A1	14-07-1993	CA 2084618 A1	10-07-1993
		DE 69305367 D1	21-11-1996
		DE 69305367 T2	20-02-1997
		EP 0551197 A1	14-07-1993
		GB 2263465 A	28-07-1993
		US 5346045 A	13-09-1994
US 4137784 A	06-02-1979	NONE	
US 2011298323 A1	08-12-2011	NONE	
EP 1980770 A2	15-10-2008	EP 1980770 A2	15-10-2008
		US 2008250771 A1	16-10-2008