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(71) Applicant (for all designated States except US): **ELPA D.O.O.** [SI/SI]; Paka 39 d, 3320 Velenje (SI).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **PAVCNIK, Bojan** [SI/SI]; Smarska 17, 3320 Velenje (SI).

(74) Agent: **MARN, Jure**; Ljubljanska ulica 9, 2000 Maribor (SI).

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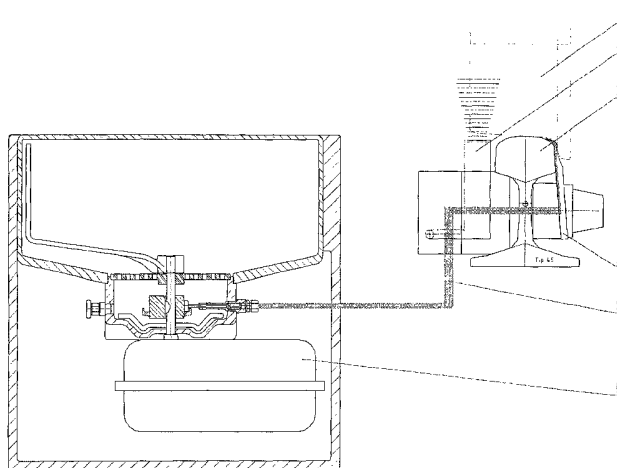
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(54) Title: METHOD AND DEVICE FOR DECREASING OF FRICTION BETWEEN WHEEL AND RAIL



(57) Abstract: The subject of this invention is Process and device for reduction of friction between a wheel (1) and a rail (2) by application of a lubricant onto the rail and/or the wheel and solves technical problem of lubricating of rail and/or wheel to reduce friction between the rail and the wheel. Advantages of the process and the device according to invention are low consumption of lubricant with high effect, metered amount of lubricant, environmentally friendly device manufactured almost entirely of Aluminum and distributing low quantities of biologically degradable medium to preset position, contact-less operation, low or negligible maintenance costs, cycles of filling with medium are prolonged up to 10 times resulting in increased economics of operation, and use of electricity from sources such as 24 V DC via rectifier from 220 V AC net, batteries, fuel cells, or combination of solar cells and batteries.

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Process and device for reduction of friction between a wheel and a rail

DESCRIPTION OF INVENTION

Technical field

Transport; lubrication; railway traffic

Description of technical problem

During transport on rails there is increased friction between wheel ring (i.e. part of wheel in physical contact with rail) and said rail while vehicle drives along a curved portion of the railway. This friction increases wear of both the rail and the wheel due to a relative slip between said rail and said wheel. For wear reduction mechanically driven greasers (for purposes of this application greaser is a device used for applying lubricant) are used. Nowadays, rails are greased with graphite grease with characteristics highly dependable on temperature. The technical problem to be solved by this invention is therefore to find such a way of lubricating which will permit use of modern and sophisticated environmentally friendly lubricants (hereinafter sophisticated lubricants), control over amount of lubrication exiting from lubrication device independent on ambient temperature, and infrequent filling of lubrication device reservoir.

State of the art

There are two large groups of existing greasers (lubricating devices), i.e. mechanical and those using gas as propelling medium.

Mechanical greasers operate by spring forcing grease toward the valves which are run over/ opened by wheel ring. Due to faster trains these greasers are subject to mechanical damage of both valves and wheel rings resulting in expensive maintenance (problems with spare parts). Of course this kind of greasers are not limited only to trains, they can be used on all kinds of vehicles using rails. In addition, regulation of exiting amount of grease is difficult, and actual amount of grease applied depending mostly on outside

temperatures. These greasers do not permit use of sophisticated lubricants and require frequent (e.g. once a month) filling of reservoirs with grease.

Greasers using gas as propelling medium work by expanding gas pushing lubricant through nozzles toward the rail. These greasers have also some disadvantages. They cause spills around the greaser, prevent application of lubricant to exact location of lubrication, do not allow for controlled dosage, and are not suitable for application of sophisticated highly effective lubricants.

Description of new invention

The subject of present invention is Process and device for reduction of friction between a wheel and a rail and presents a solution to above presented technical problem.

Process according to this invention comprises use of two consecutively connected sensors, preferably contact-less (i.e. sensor sensing approaching wheel without physically contacting said wheel). These sensors sense approaching or passing (crossing) of said wheel. Using sensors in pair also enables recognition of direction of wheel approaching as described below.

In the first case, if a train is approaching from the direction in which the lubrication of said rails is advantageous (e.g. entering a curve) then a scenario of events runs as follows (for easier understanding we shall assume that the train travels from left to right and we observe said train facing the rail essentially perpendicularly): the wheel initially activates first (left) sensor (A), this sensor comprising an element extending time during which said sensor is active (e.g. from 0.1 to 0.5 seconds, also denoted as time delay for purposes of this application). During this time delay the sensor (A) provides signal to the second (right) sensor (B) (e.g. permits or provides electrical current to reach second sensor (B)). On the other hand, the second sensor (B) is triggered and active only during short period during which said wheel is above said sensor (B). When approaching wheel triggers the sensor (B), said sensor (B) emits signal passing through still open sensor

(A) to control unit of lubricating device, i.e. both sensors (A) and (B) are simultaneously active. This control unit then activates operation of a lubricating device for predetermined duration (e.g. 5 seconds). In case of long train composition in which case train passes lubrication device longer than predetermined duration (e.g. 5 seconds) said sensor pair again triggers the lubrication device, and described cycle repeats itself as many times as necessary for the whole train to pass said lubricating device.

In the second case, if the train is approaching from the direction in which the lubrication of said rails is not advantageous (e.g. exiting a curve) then a scenario of events runs as follows: The wheel first activates sensor (B) which is triggered and active only during short period during which said wheel is above said sensor (B), i.e. momentarily. Said sensor (B) therefore ceases to be active before said wheel is within sensor (A) range. As one of both sensors is inactive (i.e. sensor (B)) the control unit does not trigger of the operation of lubrication device and therefore no lubricant is applied on said rail.

These cases occur when train drives from straight portion of the rail into the curve, and vice-versa. In former case the lubrication occurs while in latter case no lubrication occurs which means economical use of lubricant. The lubricant itself attaches to lubricated surfaces therefore it remains on said rail and said wheel and does not scatter (spill) around said rail which is frequently the case with lubricant which are currently used. In addition, rain, snow and other classical solvents do not dissolve it. In addition, sun does not liquefy said lubricant (viscosity is not significantly changed) and therefore said lubricant does not trickle from the lubricated site.

The lubrication device continues to operate following crossing of the last wheel of said train for predetermined duration (e.g. 5 seconds), and during this period prepares lubricant for next train.

This invention also enables addition of an additional sensor, or use of electronic means to enable each of the sensors to activate another sensor with time delay. This permits application of different amounts of lubricant onto said rail depending on direction of

wheel approach. For example, three sensors are used, either of outer sensors used within its own time delay (whereby both time delays may be of equal, or different duration) for activation of inner sensor, and inner sensor used for activation of lubrication device whereas dosage of lubricant differs depending on direction of wheel approach. The dosage can be used with device according to this invention or some device already known in state of the art.

The applicant concedes that lubrication site (i.e. position of lubrication) is known in state of the art and well known to those skilled in railway maintenance, and will not be further described in this patent application.

The device according to this invention can also comprise pumping element, in preferred embodiment connected to mixer, said mixer used in order to provide well stirred lubricant, and further comprises connecting elements for connection with at least one nozzle, at least one nozzle, and control mechanism. In preferred embodiment, said control mechanism comprises at least two sensors.

Sensors used in preferred embodiment are electro-mechanical and are contact-less, different types of sensors can be used, however.

The pumping element according to preferred embodiment comprises a driving motor, e.g. electrical, said driving motor running via reduction gear and driving axle a piston connected with piston rod to an eccentric mechanism, and at the same time reservoir mixer. Driving mechanisms of said mixer and the piston can be separated or different type of pumping element used instead of reciprocating mechanism provided that such different type of pumping element enables metering of lubricant. Use of the reciprocal pump enables metering (dosage) of lubricant by changing length of movement of the piston taking advantage of the eccentric mechanism. This change is achieved by changing position of connection of a piston rod and the eccentric mechanism.

Sophisticated lubricants contain solid particles dispersed in basic medium – fluid. These lubricants are prone to sedimentation of solid particles to the bottom of container therefore prompting use of mixer to prevent this. Mixing frequency is in preferred embodiment depending on frequency of wheels crossings (past lubrication site) as mixing is performed simultaneously with lubrication (i.e. spraying of said lubricant on said wheel and said rail). Mixing can be performed also independent from lubrication, e.g. with separated driving mechanism for mixer, with clutch or some other technical solution known in state of the art to achieve similar effect.

Said device can feature rail applicator (for purposes of this application known also as a smearing knife), said knife used instead of said nozzle, said smearing knife applying lubricant to said rail and/or said wheel ring. In latter case, said wheel ring applies lubricant onto said rail for significant lengths (up to several kilometers) thereby serving also as distributing element. Description of said smearing knife itself is not subject of this application.

Said device comprises also a reservoir comprising sufficient amount of lubricant for predetermined time of operation of lubrication device. In preferred embodiment the device is powered from conventional 220V electrical grid, however, other forms of power supply can be used such as solar cells, fuel cells, wind generator power, battery power, etc.

Advantages of process and device according to this invention, in inventor's opinion, are small use of lubricant with high efficiency, metering of amount of lubricant applied, environmentally friendly device manufactured mostly from Aluminum applying small amounts of biologically degradable medium on predetermined lubrication site, contactless operation, negligible cost of maintenance, extended cycles of filling of lubricant up to 10 times resulting in improved economy, use of electricity from sources such as 24 V DC via rectifier from 220 V AC net, batteries, fuel cells, or combination of solar cells and batteries.

This invention is explained in more detail below with further description of embodiments and figures whereby the figures make part of this patent application and show as follows:

Figure 1 shows a wheel of rail car with wheel ring (1), a ring (2), a smearing knife (3), a sensor (4) which can be either the first sensor (A) (401) or the second sensor (B) (402) or any other sensor according to this invention, a lubrication supply element (5), a pumping element (6).

Figure 2 shows approach of the wheel whereby lubrication is performed, as follows: in part (a) of Figure 2 the sensor (401) senses the approaching wheel (1) and activates the sensor (402); in part (b) of Figure 2 the sensor (402) after sensing the wheel (1) activates the operation of the lubrication device and lubrication process using the smearing knife (3); in part (c) of Figure 2 after crossing of the wheel (1) the lubrication device continues lubrication until termination.

Figure 3 shows approach of the wheel whereby lubrication is not performed, as follows; in part (a) of Figure 2 the sensor (402) senses the wheel (1) and does not activate the sensor (401) as the sensor (402) was not previously activated by the sensor (401); in part (b) of Figure 2 the sensor (401) senses the wheel (1) and activates the sensor (402), however the sensor (402) does not activate lubrication as it is not active itself; in part (c) of Figure 2 the lubrication device is in ready state.

Figure 4 shows the pumping element (6) comprising a reservoir for lubricant (601), upper mixing blade (602), a lubrication supply element (603), lower mixing blade (604), filter (605), pumping accessory with a check valve (606), a pushing piston (607), a pressure ring (608), an eccentric mechanism (609), a driving axle (610), a driving motor, in preferred embodiment with a reduction gear (611).

The lubrication device according to preferred embodiment operates in the following fashion: after the wheel approaches from direction in which lubrication is advantageous

(i.e. entering the curve) (Figure 2) the driving motor (611) is started, said driving motor in this embodiment comprising reduction gear, said driving gear driving the pushing piston (607) via the driving axle (610). The pushing piston (607) pushes the lubricant through the pumping accessory and through sufficiently long lubrication supply element (5) to the nozzle or, in this particular embodiment, the smearing knife (3) which applies the lubricant onto the rail (2) and/or on the wheel (1). Following that, the wheel (1) smears the lubricant onto the rail by rolling on the rail.

The pumping element (6) comprises the lower mixing blade (604) to prevent sedimentation of solid particles of the lubricant to a bottom of the pumping element (6), under the pumping accessory. If this blade is not applied, resulting sediment could eventually stop operation of the pumping element (6).

Appropriate use of the piston position relative to the eccentric mechanism enables metering of lubrication amount which is applied by nozzle onto the rail or in this particular embodiment by the smearing knife (3) onto the rail.

Control, regulation, and optimization of the process can be performed by a computer program comprising programming means for undertaking of any step according to any preceding description provided that such computer program is running on a computer. It is clear that the described solution can be undertaken in different embodiment without changing the essential elements of the invention.

PATENT CLAIMS

1. Process for reduction of friction between a wheel and a rail by application of a lubricant onto the rail and/or the wheel, characterized in that it comprises sensing of the wheel approach using at least one sensor of a sensor pair, activating the second sensor within time delay of the first sensor during which the first sensor remains active, activating a lubrication device by means of the second sensor, and applying the lubricant onto the rail and/or the wheel using the lubrication device.
2. Process according to the claim 1, characterized by the use of three sensors instead of the sensor pair whereby outer sensors are equipped with time delays of different duration for activation of the third, inner, sensor, and further whereby the inner sensor activates the lubrication device whereby the amount of the lubricant applied is different for approach of the wheel from different directions, respectively.
3. Device for reduction of friction between a wheel and a rail by application of a lubricant onto the rail and/or the wheel, characterized in that it comprises sensing means for sensing of approach of the wheel and the direction of the wheel approach, metering means, and lubrication means connected thereto.
4. Device for reduction of friction between a wheel and a rail by application of a lubricant onto the rail and/or the wheel, characterized in that it comprises at least two sensors (4), whereby one of said sensors (401) within time delay activates the second of said sensors (402) when the wheel (1) approaches, and further comprises the pumping element (6) activated by the second sensor (402), and lubricant supply element (5) which is applied onto the rail and/or the wheel.
5. Device according to the claims 3 and/or 4, characterized in that the application of the lubrication is performed by means of a nozzle.

6. Device according to the claims 3 and/or 4, characterized in that the application of the lubrication is performed by means of a smearing knife (3).
7. Device according to any preceding claim, characterized in that the pumping element (6) comprises a reservoir for the lubricant (601), said reservoir periodically stirred by upper mixing blade (602).
8. Device according to any preceding claim, characterized in that said pumping element (6) comprises reciprocal pump, said pump comprising a pushing piston (607) connected to an eccentric mechanism (609), said arrangement enabling metering of the lubricant applied by changing position of connection between a piston rod and the eccentric mechanism.
9. Device according to any preceding claim, characterized in that said pumping element (6) comprises lower mixing blade (604), said lower mixing blade (604) providing for stirring of the lubricant before entering lubrication supply element (5).
10. Device according to any preceding claim, characterized in that the driving motor can be powered by any of the following electric power sources: 220 V net, battery, fuel cells, wind generator, and solar cells, or combination thereof.
11. Device for reduction of friction between a wheel and a rail by application of a lubricant onto the rail and/or the wheel, characterized in that it performs process for reduction of friction between the wheel and the rail by application of a lubricant onto the rail and/or the wheel.

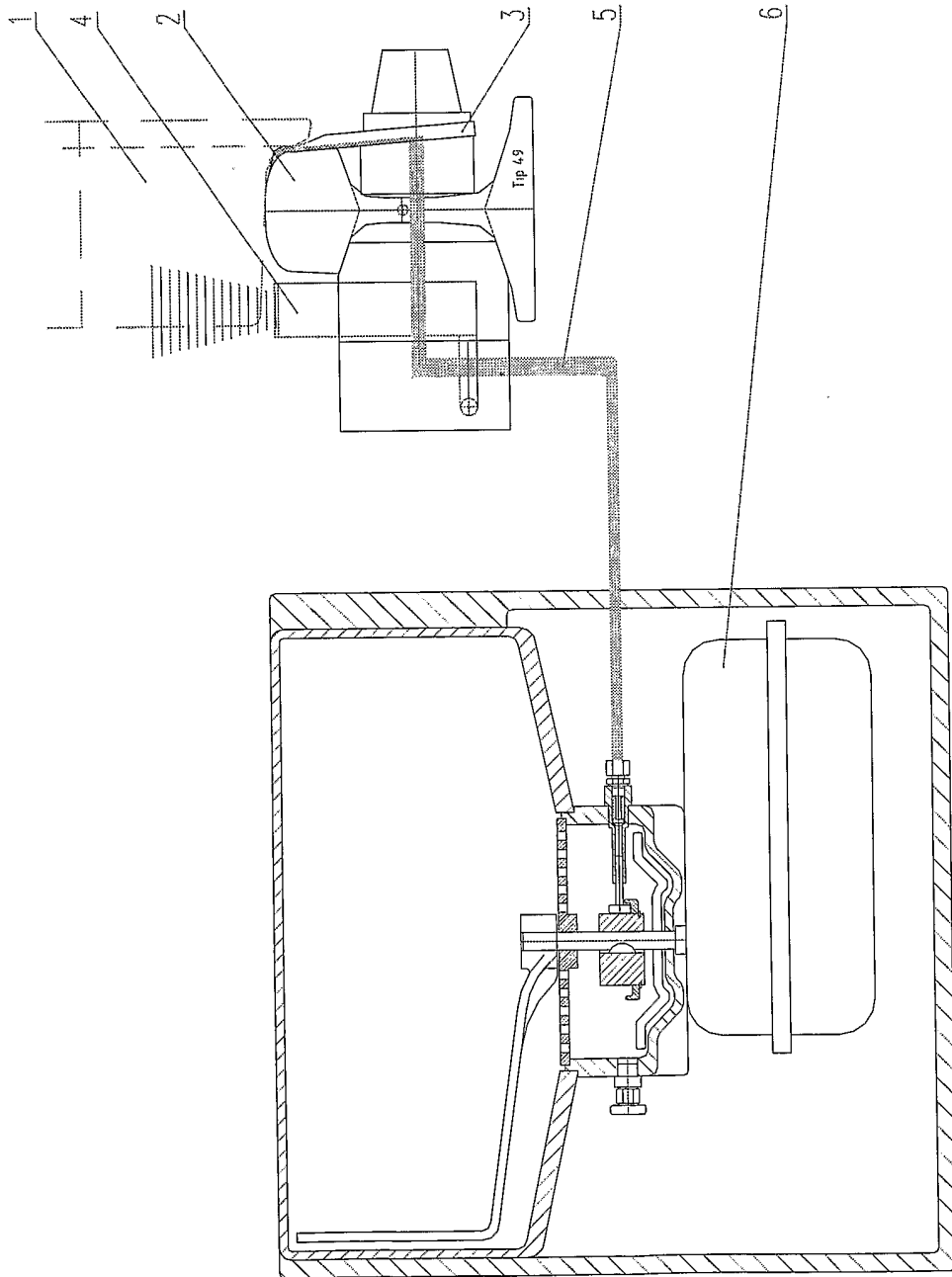


Fig. 1

Drive towards direction

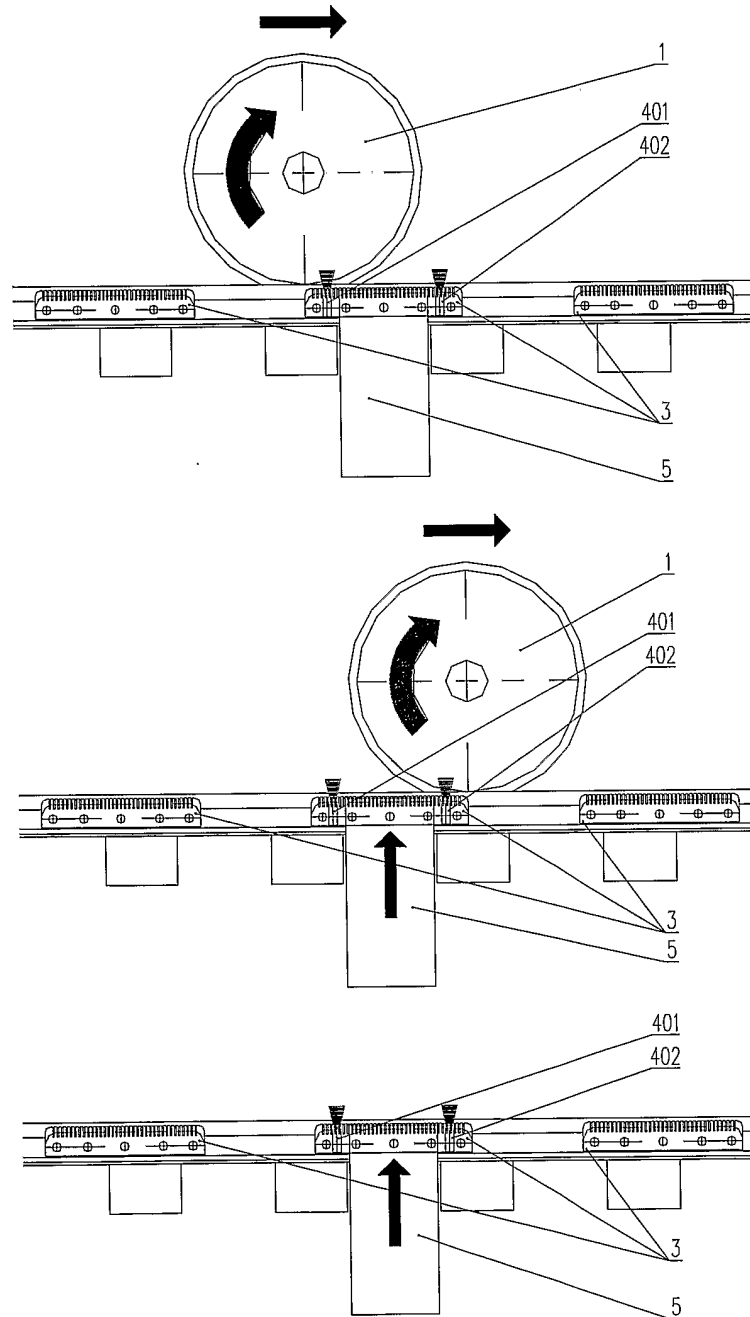


Fig. 2

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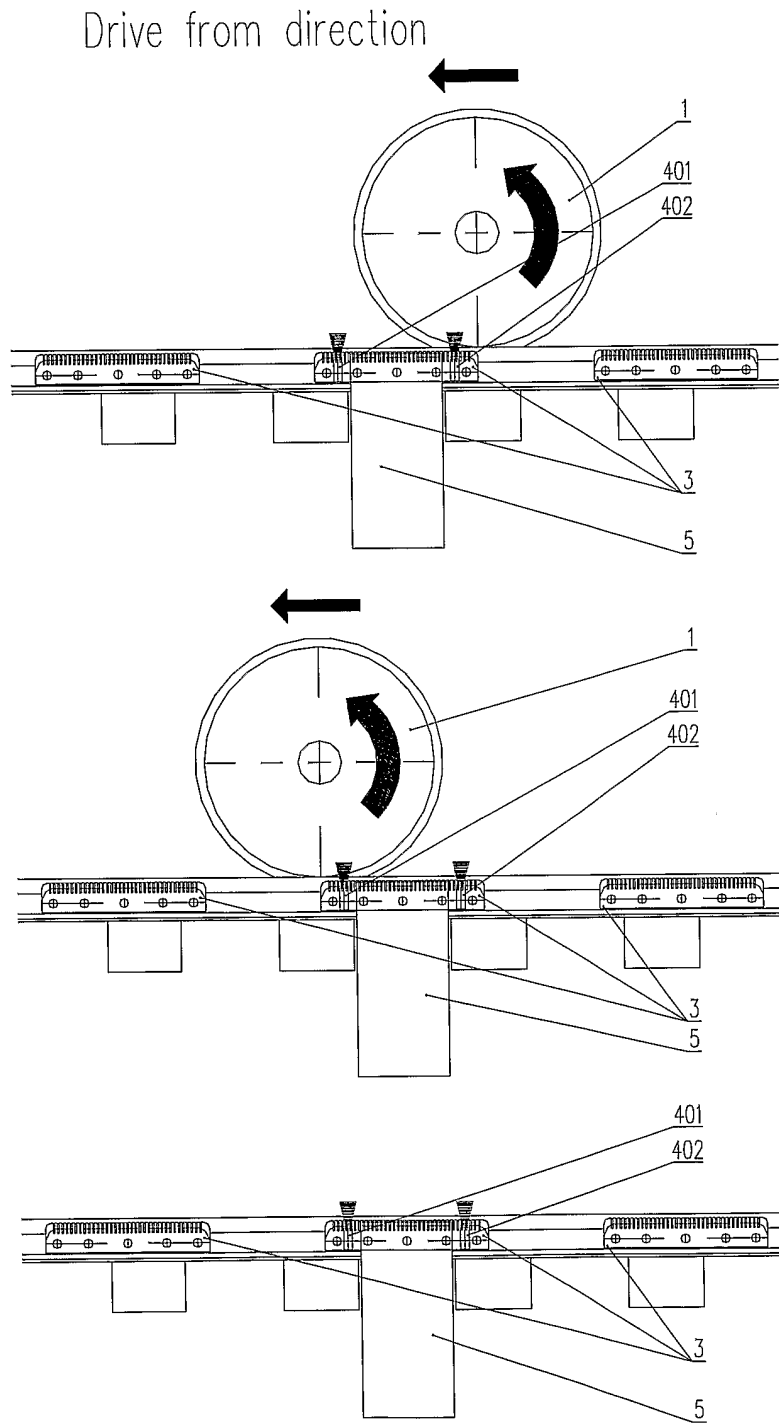


Fig. 3

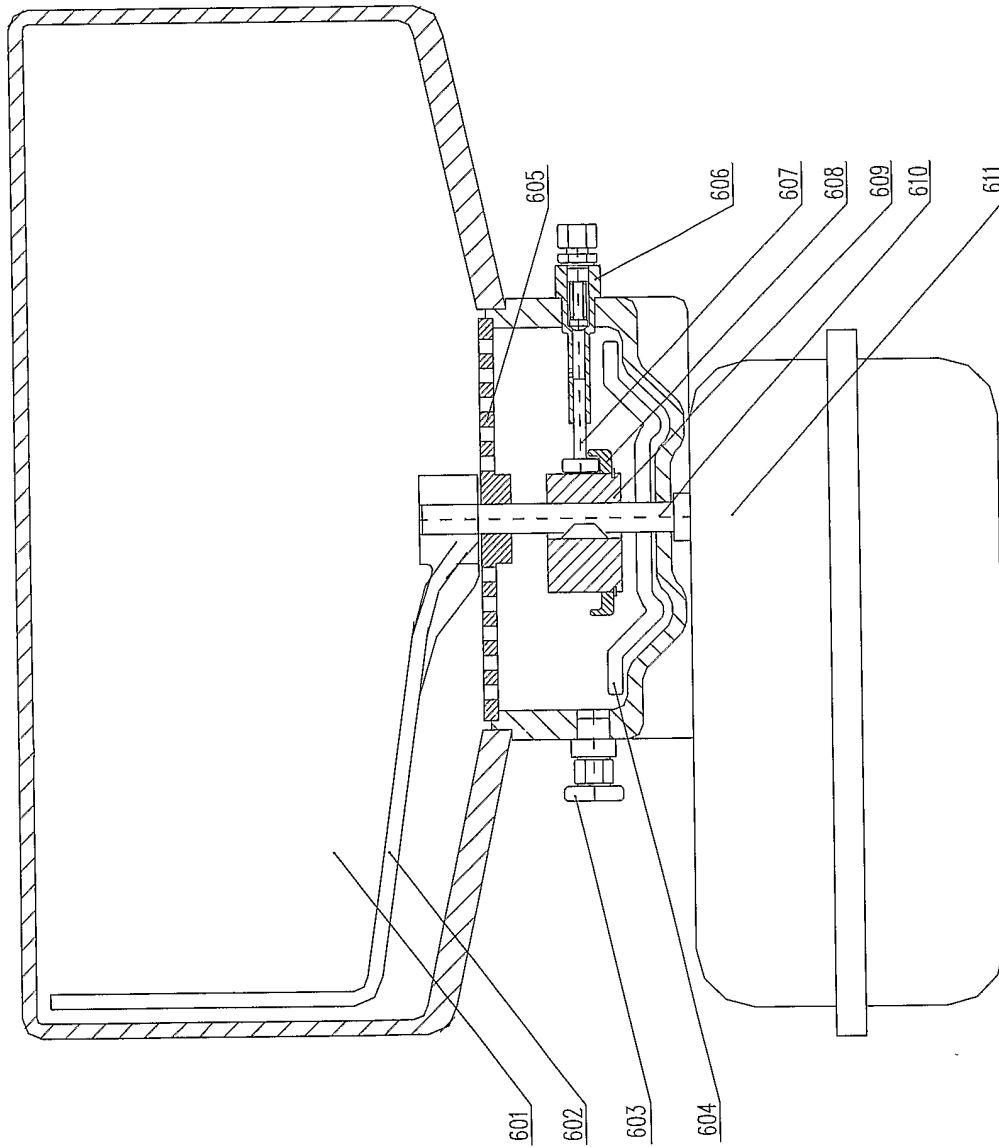


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/SI 03/00028

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B61K3/00

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 7 B61K F16N

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 214 647 A (LUTTS WILLIAM M) 29 July 1980 (1980-07-29) column 3, line 49 -column 5, line 35; figures 1,2	1,3,5,7, 11
X	---	11
A	GB 2 267 938 A (PORTEC INC) 22 December 1993 (1993-12-22) page 5, line 32 -page 7, line 7 page 8, line 18 - line 27	1,3,7,8, 10
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A	US 4 368 803 A (DOMBROSKI ROBERT M ET AL) 18 January 1983 (1983-01-18) column 3, line 19 -column 6, line 16; figures 1,2	1,3,5,7, 11
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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

° Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance	*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
E earlier document but published on or after the international filing date	*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
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)	*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.
O document referring to an oral disclosure, use, exhibition or other means	*G* document member of the same patent family
P document published prior to the international filing date but later than the priority date claimed	

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/SI 03/00028

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 641 037 A (WISE BRUCE R ET AL) 24 June 1997 (1997-06-24) column 3, line 27 -column 4, line 37 column 6, line 9 - line 37; figures 1,2,6	6-8
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