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(54) Lubricator device for grooved railway and tram rails

(57) A line for grooved railway and tram rails (2) comprises grease dispensing means (8) and grease spraying means (9) which can be connected to at least one through hole (10) made through a part of a rail (2) delimiting the groove (7) and leading into the groove (7), the dispensing means and the spraying means being designed in practice to respectively dispense the grease on a surface of the rail (2) groove (7) which is close to the through hole (10) and on a surface of the rail (2) groove (7) opposite the through hole (10). First feed means (14) feed the grease to the dispensing means (8) and to the spraying means (9), whilst second feed means (20) feed a pressurised thrust fluid to the spraying means (9) for activating them. A control unit (27) is operatively connected at least to the first feed means (14) and to the second feed means (20), and is programmed for, in practice, feeding the grease to the dispensing means (8) and to the spraying means (9), and for causing the grease to be dispensed and sprayed respectively by the dispensing means (8) and the spraying means (9).

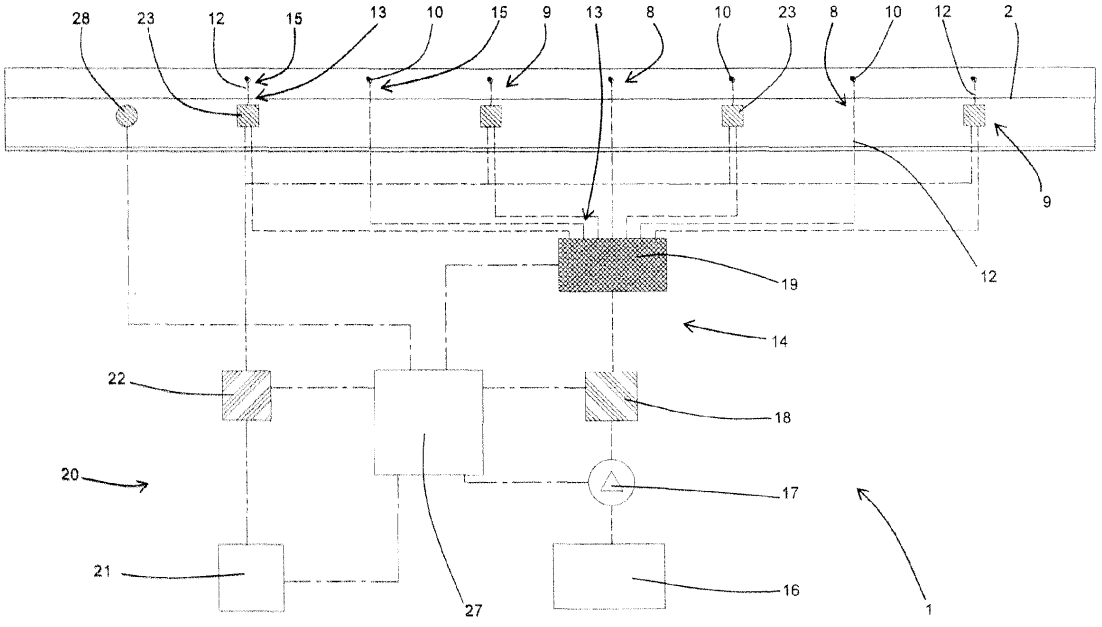

FIG. 1

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Description

[0001] This invention relates to a lubricator device for grooved railway and tram rails, that is to say, rails in which the in wheel of the train runs inside an upper longitudinal channel (the cross-section of a typical grooved rail is visible in Figures 3 and 4). Such rails are usually used for tram lines.

[0002] In particular, this invention relates to a device able to apply grease in the groove.

[0003] A problem particularly felt in the railway sector is that of wear on the rails following the passage of vehicles on them (whether they are trains, trams or other vehicles). That problem manifests itself in particular at curved stretches where the lateral thrust of the wheel on the rail is particularly high and, therefore, where friction between the two is at its maximum.

[0004] To overcome the problem over the years many devices have been developed which can apply lubricant on the rail at the most critical stretches. However, all such devices were developed relative to conventional railway - tram rails in which the wheel is directly in contact with the lateral face of the rail, not with a groove made in it.

[0005] In particular, the first automatic lubricating devices were devices able to apply lubricating oil. In most cases they were mounted close to the rail, at a distance allowing the train wheel to pass, and applied the oil by spraying it onto the rail. The main disadvantage of that type of device is that it cannot guarantee an adequate lubricating effect because the oil, having a low viscosity, tends to run down the side of the rail and is wasted.

[0006] Therefore, to overcome that disadvantage solutions were developed which were able to automatically apply lubricating grease to the rail. In particular, initially solutions were developed in which the grease, like the oil, was dispensed by spraying, such as that described in patents EP 787 638 and EP 1674 369. However, subsequently, to guarantee improved application of the grease, this Applicant provided a device able to apply a strip of lubricating grease to the rail, described in patent EP 1 999 000. Said device comprises a mobile nozzle which on one hand can be moved close to the rail when it must dispense the grease and distanced from the rail when a train must pass, and on the other hand is able to move along a predetermined stretch of rail.

[0007] However, at present, none of the prior art devices is able to lubricate the inside of the groove of grooved rails. Indeed, all of the prior art devices are designed to be mounted at the side of and at the same level as the surface to be lubricated, and to only lubricate a surface facing towards them.

[0008] Tests performed have also demonstrated that even for grooved rails suitable lubrication can only be achieved by using lubricating grease rather than oil.

[0009] Finally, there is also a prior art device designed specifically for greasing grooved rails. Said device is described in patent DE 1 455 331. According to that solution, each wall of the groove is lubricated by a device which feeds grease to through holes made through the rail and which lead to each wall of the groove. Said through holes are made both through the head of the raid and through the check rail. However, the installation of such a device is not without disadvantages both because it requires the ability to access both sides of the rail, and because it always requires drilling of holes in the head and the web of the rail, something which, in some cases, may have a negative impact on the mechanical performance of the rail.

[0010] Consequently, at present lubrication of the critical points of grooved rails either is not carried out, or is done exclusively manually.

[0011] In this situation the technical purpose which forms the basis of this invention is to provide a lubricator device for grooved railway and tram rails which overcomes the above-mentioned disadvantages.

[0012] In particular, the technical purpose of this invention is to provide a lubricator device for grooved railway and tram rails which allows the application of grease on both sides of the groove.

[0013] The technical purpose specified and the aims indicated are substantially achieved by a lubricator device for grooved railway and tram rails as described in the appended claims.

[0014] Further features and the advantages of this invention are more apparent in the detailed description of a preferred, non-limiting embodiment of a lubricator device for grooved railway and tram rails illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic view of the various parts of a device made according to this invention and a side of a grooved rail to which it is applied;
- Figure 2 illustrates the rail of Figure 1 with some of the parts of which the device of Figure 1 is composed arranged in the preferred installation position relative to the rail;
- Figure 3 is a view partly in cross-section according to a plane perpendicular to the axis of the rail, of a grooved rail to which spraying means which are part of the device of Figure 1 have been applied; and
- Figure 4 is a view partly in cross-section according to a plane perpendicular to the axis of the rail, of a grooved rail to which dispensing means which are part of the device of Figure 1 have been applied.

[0015] With reference to the accompanying drawings, the numeral 1 denotes in its entirety a lubricator device for grooved railway and tram rails 2 in accordance with this invention.

[0016] As already indicated, in Figure 1 the device 1 is deliberately illustrated schematically with the various parts arranged in such a way as to allow an improved understanding of the drawing. However, that layout, as well as the size of the various parts relative to each other, does not correspond to the actual layout, as will also become more apparent from the description which follows.

In contrast, in turn, although not reflecting the actual dimensions of the various parts, Figure 2 shows how in practice some of the various parts of the device 1 made according to the preferred method may be arranged relative to each other as well as relative to the grooved rail 2.

[0017] Moreover, in the accompanying drawings, reference is made to the most typical shape of grooved rails 2, that is to say, a rail 2 in which (with reference to its cross-section) the flange 3 and the web 4 are similar to those of a conventional rail 2 and in which the upper head 5 has one side (on the right in the accompanying drawings) similar to that of conventional rails 2, and the other modified and coupled with an outer wing 6 which is curved upwards in such a way as to form with it the groove 7 in which the wheel will run. Moreover, in the accompanying drawings the groove 7 has a substantially symmetrical cross-section and is delimited by two substantially flat portions of the surface of the rail 2, which converge slightly downwards.

[0018] According to this invention, in its most general embodiment the lubricator device 1 comprises first, means 8 for dispensing grease and means 9 for spraying grease, both of which can be connected to respective through holes 10 made through a part of the rail 2 which delimits the groove 7 and which extend from the outside of the rail 2 and lead into the groove 7, as illustrated in Figures 3 and 4. The dispensing means 8 (visible in Figure 4) are designed to dispense, during operation, the grease on a part of the surface of the groove 7 of the rail 2 which is close to the through hole 10 and generally mainly positioned just below the through hole 10, where the grease clings thanks to its adhesive properties. In contrast, the spraying means 9 (visible in Figure 3) are designed to spray, during operation, the grease onto the surface of the groove 7 of the rail 2 opposite the through hole 10. In other words, the dispensing means 8 are designed to make the grease come out in a fluid fashion without sudden variations in the thrust pressure (so that, in a certain sense, the grease is poured into the groove 7), whilst the spraying means 9 are designed to make the grease come out after a sudden increase in its upstream pressure. In Figures 3 and 4 the grease applied in the groove is represented by the two irregular black shapes 11.

[0019] In the embodiment illustrated all of the through holes 10 are illustrated as being made in the part of the rail 2 formed by the curved wing 6, that is to say, in the check rail. However, in other embodiments, all or only some of the holes may even be made through the head 5 of the rail 2.

[0020] Moreover, in the embodiment illustrated, there are seven through holes 10. However, according to requirements, there may be any number of through holes starting with one (as is described in more detail below, both the dispensing means 8 and the spraying means 9 may be connected to the same through hole 10 during operation). However, with reference to Figure1 , of the seven through holes 10 illustrated, three are used by the dispensing means 8, four by the spraying means 9. Those use by the dispensing means 8 are alternated with the others.

[0021] In the preferred embodiments, the dispensing means 8 and the spraying means 9 comprise respectively at least one pipe 12 for the grease having a first end 13 directly or indirectly connected to first grease feed means 14, and a second end 15 connectable to the respective through hole 10 during operation. It should be noticed that for the purposes of this invention the expression connected/connectable to the through holes 10 refers both to the case in which each pipe 12, as in Figures 3 and 4, is connected to the through hole 10 in such a way that the hole is a continuation of the pipe, and the case in which the pipe 12 is simply inserted in the through hole 10 so that it gives onto the groove 7 directly.

[0022] The first feed means 14 feed grease both to the dispensing means 8 and to the spraying means 9, and advantageously may comprise at least one tank 16 for the grease, a pump 17 for moving the grease which has a suction connection to the tank 16 and, if necessary, a first on-off solenoid valve 18 on the pump 17 delivery side. Feeding of the grease to the dispensing means 8 and to the spraying means 9 may be controlled by opening and closing the first on-off solenoid valve 18 and by controlling activation of the pump 17 for example (in a way which is known in grease lubrication plants) by means of a pressure switch mounted on the pump 17 delivery side upstream or downstream of the solenoid valve. In the preferred embodiment, the first feed means 14 also comprise at least one element 19 for distributing the grease amongst the various pipes, whose operation may be active or passive. In the former case it is possible to use, for example, a progressive distributor, that is to say, a piston-operated doser with one or more outlets able to guarantee the dispensing of the same quantity of grease with each cycle in each outlet, whilst in the latter case a simple manifold may be used.

[0023] The device 1 also comprises second feed means 20 for feeding a pressurised thrust fluid to the spraying means 9, to cause activation of the spraying means and the consequent spraying of grease from the through holes 10 towards the groove 7. Preferably, the pressurised fluid is air and the second feed means 20 comprise at least one compressor 21 and at least a second on-off solenoid valve 22 (preferably one for each through hole 10 to which the spraying means 9 are connected). Depending on requirements, the compressor 21 may also be used for feeding pressurised fluid to the pump 17 of the first feed means 14 if it is a pneumatic feed pump 17.

[0024] In more detail, the second feed means 20 feed the pressurised fluid to at least one grease spraying device 23, which is part of the spraying means 9 and is connected between the first feed means 14 and the first end 13 of the respective pipe 12.

[0025] Advantageously, for that purpose normal commercial pneumatic valves may be used. In fact, as is

schematically illustrated in Figure 3, the spraying device 23 on one side has an inlet 24 and an outlet 25 for the grease, and on the other side it has at least one entry opening 26 for the pressurised thrust fluid. The interaction between the air and the grease may be either direct or by means of a mobile element such as a piston or a membrane/diaphragm. However, in both cases, when the second solenoid valve 22 is opened the variation in the pressure of the thrust fluid propagates as far as the spraying device 23 where it is transferred to the grease present in the respective pipe 12 and through hole 10. Depending on requirements, it is possible to use spraying devices 23 which are controlled (which allow spraying only after a command has been received), or, preferably, passive, allowing spraying as soon as the pressurised fluid arrives. Also visible in Figure 3, in the background, is the progressive distributor which feeds the grease to the spraying device 23. In contrast, Figure 4 shows a pipe 12 directly connected to the progressive distributor, and which is part of the dispensing means 8.

[0026] Advantageously, according to this invention, management of operation of the entire device 1 is guaranteed by at least one control unit 27 which is operatively connected at least to the first feed means 14 and to the second feed means 20. The control unit may be a simple PLC or even more complex electronic devices. The control unit 27 is programmed to carry out, during operation, a set of functions which guarantee correct operation of the device 1.

[0027] First, in general it is programmed to activate the first feed means 14 both for feeding grease to the dispensing means 8 and to the spraying means 9 until the through holes 10 are full, and for causing the grease to be dispensed through the dispensing means 8.

[0028] Indeed, once the through holes 10 have been filled, subsequent feeding of grease to the dispensing means 8 causes a quantity of grease substantially equal to that fed to come out of the through holes 10.

[0029] However, at the same time, the control unit 27 is also programmed in such a way that it activates the second feed means 20, for causing the grease to be sprayed by the spraying means once the grease has been fed to the spraying means 9.

[0030] In more detail, in the embodiment illustrated, the control unit 27 is programmed first to operate the first feed means 14 until all of the through holes 10 are full of grease. Then it activates the second feed means 20, for causing the grease to be sprayed by the spraying means 9. Once the spraying has ended, it reactivates the first feed means 14 so that at the same time the grease previously sprayed by the spraying means 9 is replaced and a new dose of grease is dispensed by the dispensing means 8.

[0031] In some embodiments the spraying means 9 may also form the dispensing means 8. In other words, the same means may be used both as the spraying means 9 and as the dispensing means 8. In the former case the grease comes out by using the spraying device 23, whilst in the latter case it comes out thanks to the action of the first feed means 14. In this case programming of the control unit 27 also varies. Once the grease has been sprayed by the spraying means 9, the control unit inhibits operation of the second feed means 20, whilst it activates only the first feed means 14 for longer, so that, first, the grease just sprayed is replaced, and then it causes the dispensing of a predetermined quantity of grease by the spraying means 9 which act as the dispensing means 8.

[0032] Depending on requirements, the control unit 27 may be programmed to repeat the various dispending and spraying steps if different circumstances arise. In the simplest embodiment, it may be programmed to repeat the various steps after a predetermined time interval. In contrast, in the preferred embodiment, it may be programmed to repeat the various steps before and/or after and/or during the transit of a vehicle on the rail 2. Advantageously, in the case of activation during transit, the various steps may be repeated several times so as to take advantage of the passage of the various wheels to distribute a greater quantity of grease along a longer stretch of rail 2.

[0033] In these latter cases, in order to be able to detect vehicle transit, the device 1 comprises a suitable detector sensor 28 connected to the control unit 27, which can therefore be programmed to activate grease dispensing and spraying depending on the sensor reading (in any case, if necessary there may be an additional timed dispensing action). Depending on requirements the sensor may be a sensor 28 for detecting the vibrations induced by the vehicle on the rail 2, an electromagnetic sensor, an optical sensor or another type.

[0034] With regard to device 1 installation, in the preferred embodiments this is carried out by dividing the device 1 into two operating units, a first operating unit which, during operation, can be positioned close to a railway line but at a predetermined distance from the rail 2, and a second operating unit which, during operation, can be mounted at the side of the rail 2 to be greased. Preferably, the first operating unit comprises at least part of the first feed means and the second feed means 20, and more particularly the tank 16, the pump 17 and the compressor 21, as well as the control unit 27, whilst the second operating unit comprises all of the other elements, and in particular at least the dispensing means 8 and the spraying means.

[0035] Advantageously, as shown in Figures 2 to 4, the second operating unit may be inserted at least partly in the empty space along the web 4 of the rail 2 above the flange 3 and it may be covered by a specific covering guard 29 (just as the first operating unit may comprise its own containment box, not illustrated). In this way, extending between the first operating unit and the second operating unit there are only one or more tubes for the grease, one or more tubes for the pressurised fluid and the electrical connections.

[0036] The various connections between the various

parts are illustrated in Figure 1 where the dashed lines with dashes of uniform size represent the path of the grease, the dashed lines with alternating long and short dashes represent the electrical connections, and the dashed lines alternating one long and two short dashes represent the path of the pressurised fluid. In contrast, it should be noticed that in Figure 2 the connections between the various parts are not represented for reasons of clarity.

[0037] Obviously, finally, this invention also relates to a railway line with grooved rails 2, in which at least one of the grooved rails 2 is equipped with one or more through holes 10 made through a part of the rail 2 delimiting the groove 7 and leading into the groove 7, and is equipped with at least one lubricator device 1 of the type described above whose dispensing means 8 and spraying means are connected to said one or more through holes 10.

[0038] Operation of the device 1 according to this invention has already been described with reference to the structural description above.

[0039] This invention brings important advantages.

[0040] In fact, thanks to this invention it was possible to provide a lubricator device able to automatically apply lubricating grease on both of the surfaces of the groove of a grooved rail.

[0041] Finally, it should be noticed that this invention is relatively easy to produce and that even the cost linked to implementing the invention is not very high.

Claims

1. A railway line with grooved rails (2) in which at least one of the grooved rails (2) is provided with one or more through holes (10) which are made through a part of the rail (2) delimiting the groove (7) and which lead into the groove (7), the line comprising at least one lubricator device (1) in turn comprising:

   grease dispensing means (8) which are connected to at least one through hole (10), the dispensing means (8) being designed to dispense, during operation, the grease on a surface of the rail (2) groove (7) which is close to the through hole (10); and
   first feed means (14) for feeding grease to the dispensing means (8); **characterised in that** the lubricator device (1) also comprises:
   grease spraying means (9) connected to at least one through hole (10), the spraying means (9) being designed to spray, during operation, the grease on a surface of the rail (2) groove (7) which is opposite the through hole (10); the first feed means (14) also feeding the grease to the spraying means (9);
   second feed means (20) for feeding a pressurised thrust fluid to the spraying means (9) for activating them; and
   at least one control unit (27) operatively connected at least to the first feed means (14) and the second feed means (20), and programmed for, during operation:

      activating the first feed means (14) for feeding grease to the dispensing means (8) and to the spraying means (9) and for causing the grease to be dispensed through the dispensing means (8); and
      once the grease has been fed to the spraying means (9), activating the second feed means (20) for causing the grease to be sprayed by the spraying means (9).

2. The line according to claim 1, **characterised in that** the dispensing means (8) and the spraying means (9) respectively comprise at least one pipe (12) for the grease comprising a first end (13) which is directly or indirectly connected to the first feed means (14), and a second end (15) connected to the through hole (10).

3. The line according to claim 2, **characterised in that** the spraying means (9) comprise at least one grease spraying device (23) connected between the first feed means (14) and the first end (13) of the respective at least one pipe (12), and also comprising at least one entry opening (26) for the pressurised thrust fluid.

4. The line according to any of the foregoing claims, **characterised in that** the first feed means (14) comprise at least one tank (16) for the grease, a pump (17) for moving the grease and if necessary a first on-off solenoid valve (18).

5. The line according to claims 2 and 4, **characterised in that** the first feed means (14) also comprise at least one element (19) for distributing the grease between the various pipes, operation of said element being active or passive.

6. The line according to claim 5, **characterised in that** the distribution element (19) is a progressive distributor.

7. The line according to any of the foregoing claims, **characterised in that** the second feed means (20) comprise at least one compressor (21) and at least a second on-off solenoid valve (22).

8. The line according to any of the foregoing claims, **characterised in that** it also comprises a sensor (28) for detecting vehicle transit on the rail (2), the sensor being connected to the control unit (27), and also being **characterised in that** the control unit (27)

is programmed to activate grease dispensing and spraying at least according to the what the sensor detects.

9. The line according to any of the foregoing claims, **characterised in that** the control unit (27) is programmed to activate grease dispensing and spraying in a timed fashion according to predetermined intervals which, in case, may be programmable.

10. The line according to any of the foregoing claims, **characterised in that** the spraying means (9) also form the dispensing means (8), and also being **characterised in that** the control unit (27) is programmed to activate only the first feed means (14) so as to make the spraying means (9) operate as dispensing means (8), and to also activate the second feed means (20) so as to make the spraying means (9) operate as spraying means.

11. The line according to any of the foregoing claims, **characterised in that** it comprises two operating units, a first operating unit comprising at least part of the first feed means and the second feed means (20) and the control unit (27), and which, during operation, is positioned close to a railway line, and a second operating unit comprising at least the dispensing means (8) and the spraying means which, is mounted at the side of the rail (2) to be greased.

12. The line according to any of the foregoing claims, **characterised in that** the through holes (10) are only made in the check rail.

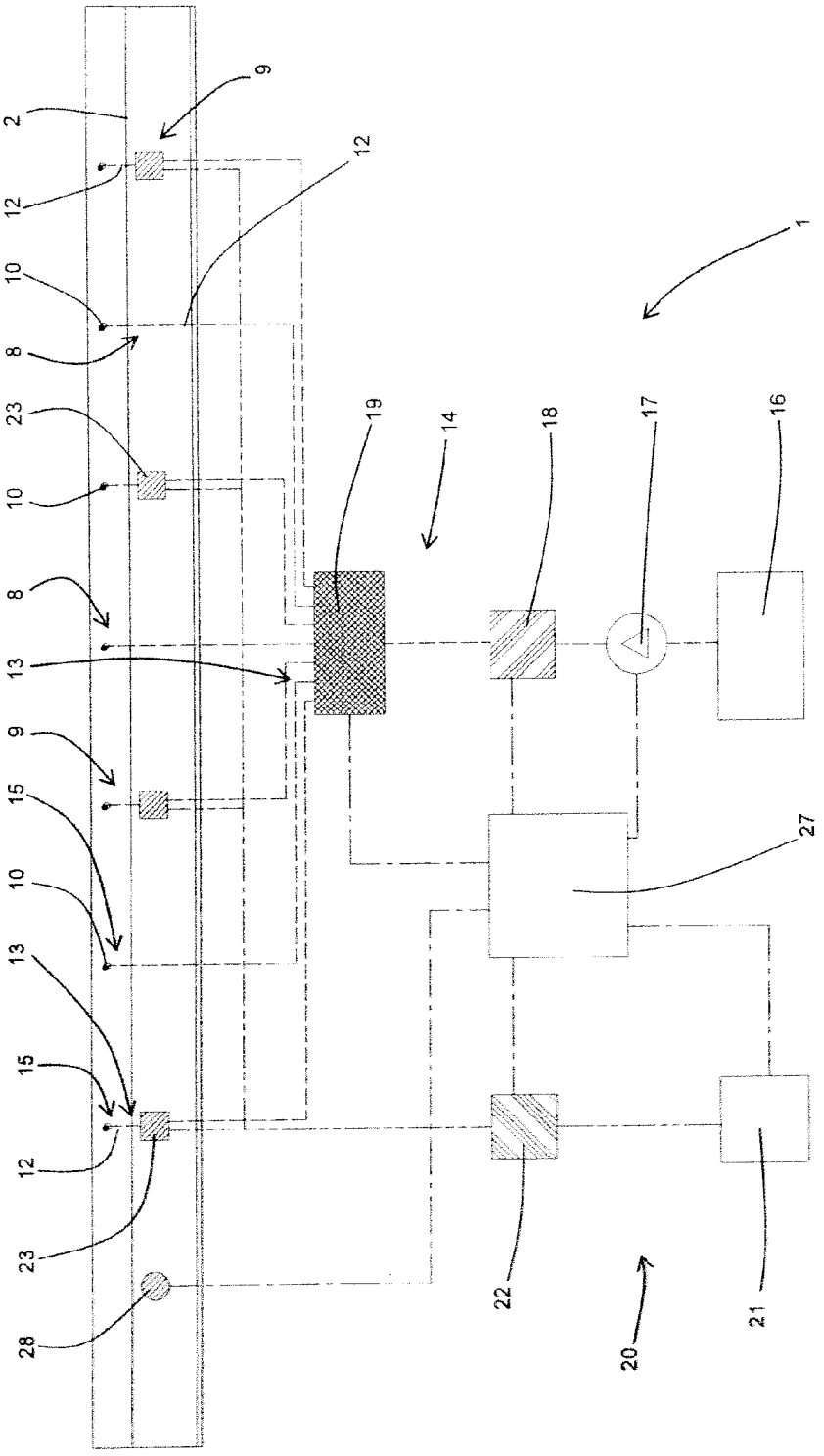

FIG. 1

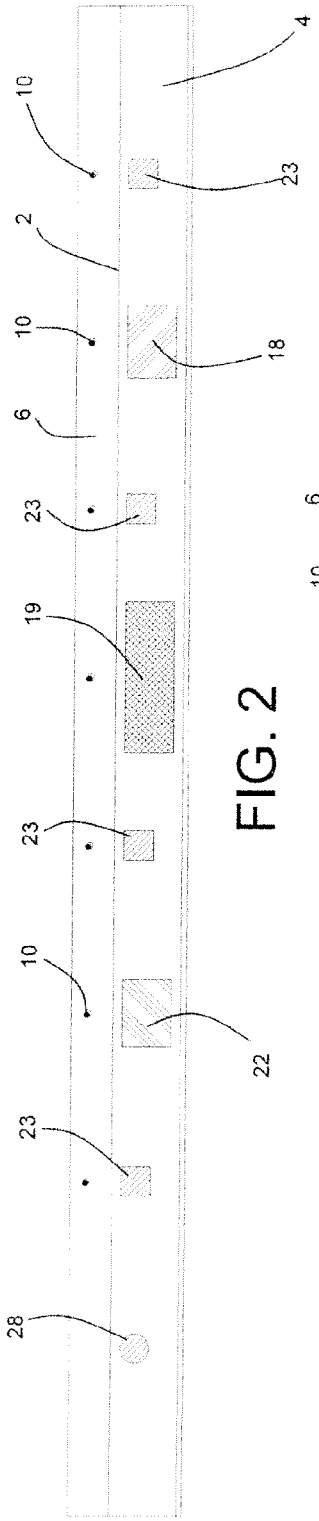

FIG. 2

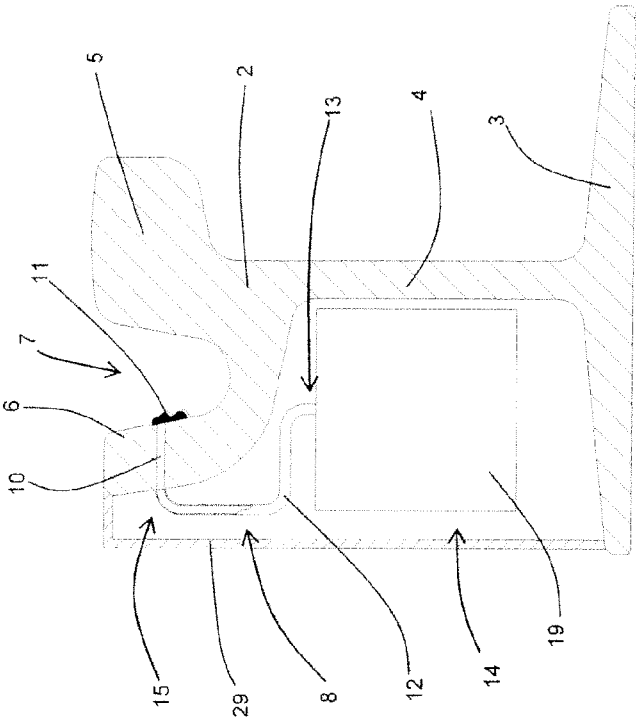

FIG. 4

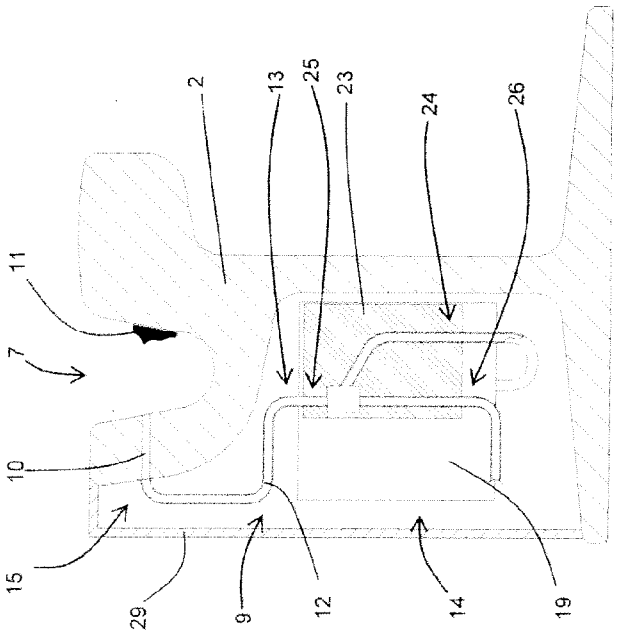

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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