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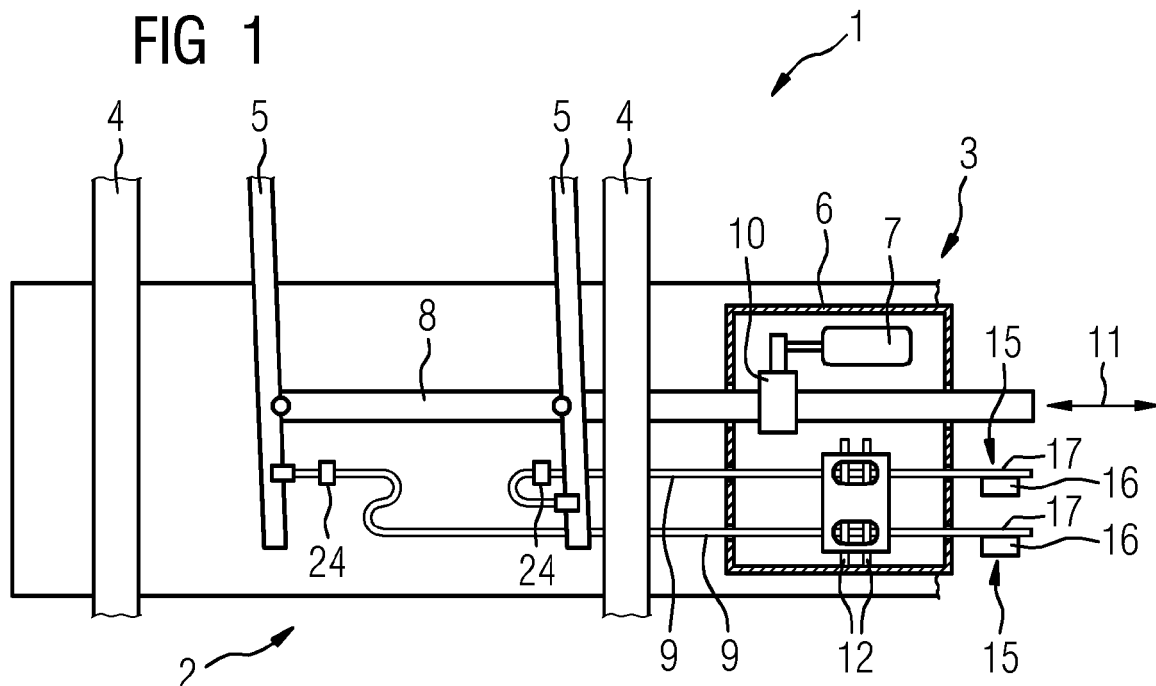
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**(54) POINT MACHINE AND METHOD FOR OPERATING A POINT MACHINE**

(57) The invention relates to a point machine (3) for moving a railway point (2), comprising at least one main rod (8) that moves the railway point (2), at least one detector rod (9) that is connected to the railway point (2) and follows the movement of the railway point (2), and at least one locking device (12) that can lock the movement of the detector rod (9) in at least one predetermined locking position of the railway point (2). To reduce the

failures of the point machine (3), it comprises at least one first sensor device (15) which is designed to measure the position of the at least one detector rod (9) in a longitudinal direction (11) in the locking position.

Further, the invention relates to a method for operating a point machine (3) and a computer program product.

**FIG 1****EP 4 279 353 A1**

## Description

**[0001]** The invention relates to a point machine for moving a railway point, comprising at least one main rod that moves the railway point, at least one detector rod that is connected to the railway point and follows the movement of the railway point, and at least one locking device that can lock the movement of the detector rod in at least one predetermined locking position of the railway point.

**[0002]** Further, the invention relates to a method for operating a point machine, comprising at least one main rod that moves the railway point, at least one detector rod that is connected to the railway point and follows the movement of the railway point, and at least one locking device that can lock the movement of the detector rod in predetermined end positions of the railway point, the method comprises the following step: moving the railway point via the main rod.

**[0003]** Such devices and methods are known from prior art and are used to move a railway point to its different positions. The point machine moves a switch blade of the railway point to its different end positions. The main rod is connected to the switch blade and moved by a driving motor of the point machine. The detector rod allows point machines to confirm that they are in their end position. The locking device locks the movement of the detector rod in the end positions. Therefore, the end positions are also called locking positions. There are gaps in the detector rod where the locking device fits in and locks the movement of the detector rod mechanically. Although the gaps in the detector rod are wider than the locking device, sometimes the position of the gap of the detector rod and the locking device does not fit and therefore the point machine cannot be locked. The reason for this can be different and is not completely known. In this case, the point machine reports a failure as it is not secured that its end position has been reached. Such failures stop the train traffic until maintenance has been done to the point machine and the locking device works properly.

**[0004]** Therefore, it is the purpose of the present invention to provide a point machine and the method of the above-mentioned type in order to reduce the number of failures in operation.

**[0005]** The problem is solved by the subject matter of the independent patent claims.

**[0006]** The invented solution has the advantage that it is very simple to install and therefore is not very cost effective. By measuring the position of the detector rod in the longitudinal direction, it is possible to detect a displacement of the detector rod relative to a reference position i.e., to the locking device. The reference position can for example be determined in an installation phase of the point machine and represents the position where the locking device fits in the gap in the detector rod and where the operation of the locking device is guaranteed. By implementing the sensor device, it is possible to detect

very early if a displacement relative to the reference position is happening. A small displacement does not mean a failure of the point immediately, because usually there is a small clearance. The clearance is made by design and is for example 2.5 mm. If the displacement above a predetermined amount is detected, further additional action can be done. For example, a maintenance technician can be sent to the point machine and readjust the setting of the detector rod. During this maintenance work, the adjustment can be done more easily with the invention because the actual positioning of the detector rod can be seen permanently by the help of the first sensor device. Thus, an easy maintenance is possible.

**[0007]** The invention can be extended by the following advantageous embodiments.

**[0008]** In one embodiment, the first sensor device may comprise at least one linear encoder. This has the advantage that the position of the detector rod is available immediately also after restart of the sensor device and/or the point machine. Therefore, it is possible to switch off the point machine and the sensor device while it is not in use.

**[0009]** In another embodiment, the at least one detector rod comprises at least one adjustment device, which allows an adjustment of the length of the detector rod in the longitudinal direction. This has the advantage that a displacement of the detector rod can be maintained very quickly and easily. The adjustment device can for example be designed very simple as a clutch with an adjuster nut and lock nut, so that the distance of the clutch parts can be regulated by the adjuster nut.

**[0010]** Further, in order to transfer the measured data to a separate device or database, the point machine comprises at least one communication device, which can communicate data with an external device.

**[0011]** In another advantageous embodiment, the point machine comprises at least one second sensor device, which measures an ambient temperature. This has the advantage that also the temperature is monitored. The temperature can influence the material of the detector rod and, therefore, its length. So it is useful to take this into account.

**[0012]** In another embodiment, the point machine comprises at least one evaluation device, which is connected to the first sensor device and is designed to evaluate the measured position of the detector rod relative to a reference position. This has the advantage that findings out of the measurements can be evaluated automatically. For example, the evaluation device is designed to evaluate a maintenance plan using the measured position, wherein the maintenance plan for example includes work instructions for adjusting the length of the detector rod. This has the advantage that a much faster maintenance is possible. Maintenance work on railway points has very often a lot of time pressure. Therefore, faster maintenance is very useful. The maintenance plan can for example include instruction how many rotations of an adjuster nut in which direction are needed. Therefore, the

maintenance worker can work faster and more accurate.

**[0013]** In an embodiment of the inventive method, an ambient temperature of the point machine can be measured by a second sensor device. This has the already further above-mentioned advantage that the temperature can be considered as the temperature can have an influence.

**[0014]** In another embodiment, evaluating a maintenance plan using the measured position, wherein the maintenance plan includes work instructions for adjusting the length of the detector rod. This has the already above-mentioned advantage that the maintenance work can be accelerated.

**[0015]** Finally, the invention further relates to a computer program product, comprising instructions for performing the method of the above-mentioned embodiments.

**[0016]** In the following, the invention will be further described related to the exemplary embodiment in the attached drawings.

**[0017]** It shows:

Fig. 1 schematic drawing of an exemplary embodiment of a point machine according to the invention;

Fig. 2 schematic detailed drawing of the point machine of fig. 1;

Fig. 3 a schematic drawing of the point machine of fig. 2 with additional details;

Fig. 4 a side view of fig. 3.

**[0018]** In the following, the invention is described related to the exemplary embodiment in fig. 1 to fig. 4.

**[0019]** A railway facility 1 comprises railway tracks with railway points 2, one of these railway points 2 is shown in fig. 1. This railway point 2 comprises a point machine 3, stock rails 4, and point blades 5, wherein the point machine 3 moves the point blades 5 between the stock rails 4.

**[0020]** The point machine 3 comprises a housing 6, a drive motor 7, a main rod 8, and 2 detector rods 9. The main rod 8 is connected to the point blades 5 and driven by the drive motor 7 via a gear box 10. So, the main rod 8 is driven in a longitudinal direction 11 by the drive motor 7 to move the point blades 5 between its end positions. In each of the two end positions, one of the two point blades 5 is adjacent to one of the stock rails 4 in a well-known manner. Therefore, in the end positions a safe movement of the trains over the point is possible.

**[0021]** The detector rods 9 are respectively connected to one of the point blades 5 and follow their movement. Therefore, by the detector rods 9 the position of the point blades 5 can be detected. Within the housing 6 of the point machine 3 there are two locking devices 12. The locking devices 12 respectively fit into gaps 13 in the

detector rods 9. If the point blades 5 are in one of their end positions, the gap 13 is aligned with the locking device 12, and the locking device 12 is moved in a direction rectangular to the longitudinal direction 11 so that the detector rod 9 is mechanically locked.

**[0022]** The point machine 3 according to the invention further comprises first sensor devices 15. Each first sensor device 15 comprises at least one absolute linear encoder 16 that is fixed to the housing 6 and one magnetic slider 17 that is connected to the detector rod 9. By the sensor device 15 each movement of the detector rod 9 can be measured. To integrate the magnetic slider 17 it could be useful to extend the detector rods 9 and do some milling at the end to place the magnetic slider 17. It is also possible to place the first sensor devices 15 on different locations at the different detector rods 9. This can be advantageous if the space in the housing 6 is limited.

**[0023]** The point machine 3 according to the invention further comprises a second sensor device 18. The second sensor device 18 comprises at least one temperature sensor 19 that measures an ambient temperature. In the exemplary embodiment in the figures the second sensor device 18 is outside the housing 6, but it can alternatively also be in the housing 6.

**[0024]** The point machine 3 further comprises an evaluation device 20 that is connected to the first sensor device 15 and the second sensor device 18. Advantageously, the connection can be done wirelessly. The evaluation device 20 is designed to evaluate the measured position of the detector rod relative to a reference position. This has the advantage that findings out of the measurements can be evaluated automatically. In the exemplary embodiment of the figures the evaluation device is designed to evaluate a maintenance plan using the measured position. The maintenance plan includes work instructions for adjusting the length of the detector rod. This has the advantage that a much faster maintenance is possible. Maintenance work on railway points has very often a lot of time pressure. Therefore, faster maintenance is very advantageous.

**[0025]** Further, every detector rod in the exemplary embodiment of the figures comprises one adjustment device 24. Each adjustment device 24 allows an adjustment of the length of the detector rod 9 in the longitudinal direction 11. This has the advantage that the position of the gap 13 can be changed very quick and easy. The adjustment is done by rotating an adjuster nut (not shown). A locking nut (not shown) for example locks the adjustment device 24 after the adjustment. By that it is guaranteed the no unintentional length change is done.

**[0026]** The maintenance plan can for example include instructions how many rotations of the adjuster nut in which direction are needed. Therefore, the maintenance worker can change the length of the detector rod 9 very quickly. In a future embodiment an automatic adjustment device could be included or a tool that automatically adjusts the adjustment device 24 according to the working

plan of the evaluation device 20.

**[0027]** The point machine 3 further comprises a communication device 21 by which data generated by the evaluation device 20 can be communicated externally. This communication can for example be to a cloud storage 22. The cloud storage 22 enables a long-term monitoring of the detector rods 9 generating useful insights on several railway points 2. For example, it generates a global view on the condition of several point machines 3 that are equipped with the invention. The data generated by the evaluation device 20 can be used for predictive maintenance of the point machine 3 and/or the whole railway facility 1. Further, via the temperature data gathered with the displacement information, it will be possible to predict the detector rods 9 displacement based on weather forecast. Finally, with all these information it could be possible to generate a planning for each technician to send them onsite and thus avoid as much as possible disruptions on the railway facility 1 while optimizing the schedule of every technician currently devoted to this task.

**[0028]** Additionally or alternatively, the point machine 3 may further comprise a local visualization device 23, by which data or maintenance advice can be shown locally, for example to a service technician that works on the railway point 2.

**[0029]** Figure 4 shows a side view of the detector rod 9 with its gap 13 and the locking device 12 that moves in the gap 13. In the exemplary embodiment of the figures the gap 13 has a width B in the longitudinal direction 11 of 21 mm. The locking device 12 has a width A in the longitudinal direction of 16 mm. thus, there is a designed clearance of 2.5 mm on each side of the locking device 12 in theory. However, as already mentioned during service of the railway point 2 the clearance can change. Due to the invention these changes do not lead to problems and down time of the railway point 2.

## Claims

1. Point machine (3) for moving a railway point (2), comprising

at least one main rod (8) that moves the railway point (2), at least one detector rod (9) that is connected to the railway point (2) and follows the movement of the railway point (2), and at least one locking device (12) that can lock the movement of the detector rod (9) in at least one predetermined locking position of the railway point (2),

### characterised in that

the point machine (3) comprises at least one first sensor device (15) which is designed to measure the position of the at least one detector rod (9) in a longitudinal direction (11) in the locking position.

2. Point machine (3) according to claim 1, **characterised in that** the first sensor device (15) comprises at least one absolute linear encoder (16).

3. Point machine (3) according to claim 1 or 2, **characterised in that** the at least one detector rod (9) comprises at least one adjustment device (24), which allows an adjustment of the length of the detector rod (9) in the longitudinal direction (11).

4. Point machine (3) according to one of the preceding claims, **characterised in that** the point machine (3) comprises at least one second sensor device (18), which measures an ambient temperature.

5. Point machine (3) according to one of the preceding claims, **characterised in that** the point machine (3) comprises at least one communication device (21), which can communicate data with an external device.

6. Point machine (3) according to one of the preceding claims, **characterised in that** the point machine (3) comprises at least one evaluation device (20), which is connected to the first sensor device (15) and is designed to evaluate the measured position of the detector rod (9) relative to a reference position.

7. Point machine (3) according to claim 6, **characterised in that** the evaluation device (20) is designed to evaluate a maintenance plan using the measured position, wherein the maintenance plan includes work instructions for adjusting the length of the detector rod (9).

8. Method for operating a point machine (3) comprising at least one main rod (8) that moves the railway point (2), at least one detector rod (9) that is connected to the railway point (2) and follows the movement of the railway point (2), and

at least one locking device (12) that can lock the movement of the detector rod (9) in predetermined end positions of the railway point (2), the method comprises the following steps:

- moving the railway point (2) via the main rod (8),

### characterised in that

- measuring the position of the at least one detector rod (9) in a longitudinal direction (11) in the locking position of the railway point (2) by a first sensor device (15).

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9. Method according to claim 8,

**characterised in that**

measuring an ambient temperature of the point machine (3) by a second sensor device (18).

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10. Method according to claim 8 or 9,

**characterised in that**

evaluating a maintenance plan using the measured position, wherein the maintenance plan includes work instructions for adjusting the length of the detector rod (9).

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11. Computer program product comprising instructions for performing the method according to claims 8 to 10.

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FIG 1

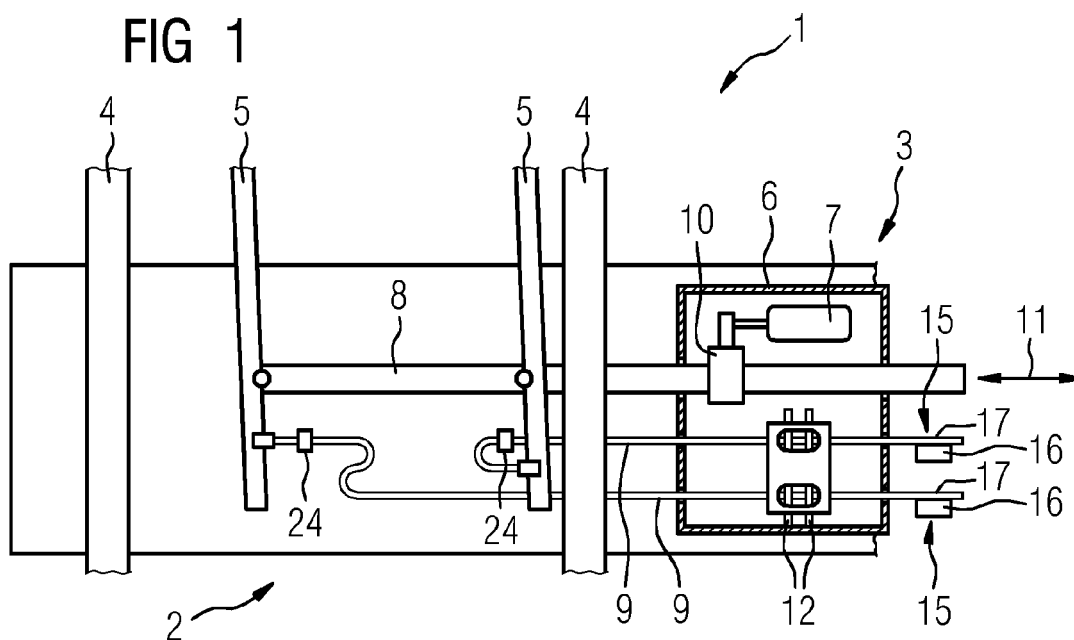


FIG 2

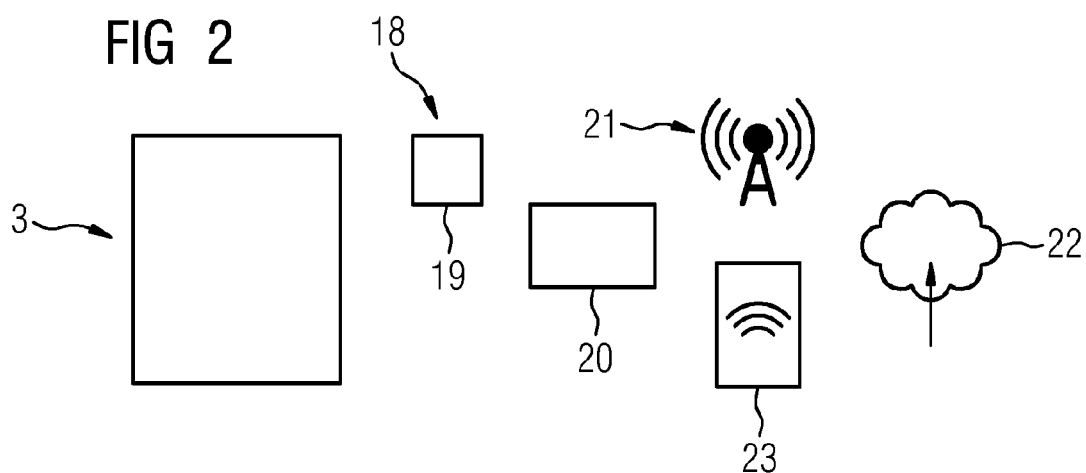


FIG 3

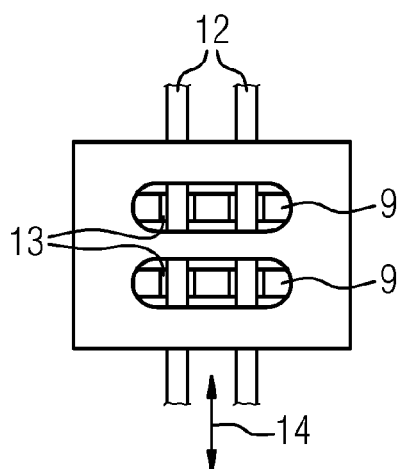
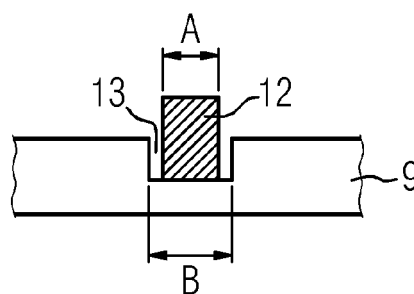


FIG 4





## EUROPEAN SEARCH REPORT

Application Number

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| The present search report has been drawn up for all claims |                                                                                                                                                                   |                   |                                         |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------|
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Date of completion of the search | Examiner            |
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| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                  |                     |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 22 17 4265

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