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(54) **ELECTRIC SWITCH DRIVE WITH A STEPPER MOTOR**

(57) The invention relates to an electric point machine for switching the blades of a point as a result of which a rail vehicle can change its direction of travel, comprising: motion bolts which are designed for setting the two point blades in motion between a first and a second position; a motor which is connected to the motion bolts for the propulsion thereof; a transmission which is connected between the motor and the motion bolts and is designed for adapting at least one of the power, speed

and torque of the motor to the motion bolts; a control unit which is designed for driving the motor on the basis of a received control signal, characterized in that the electric point machine further includes a wireless communication unit which is designed for wireless reception of the control signal and driving the motor by the control unit, on the basis of the control signal, for propelling the two point blades of the railway point between the first and second point positions.

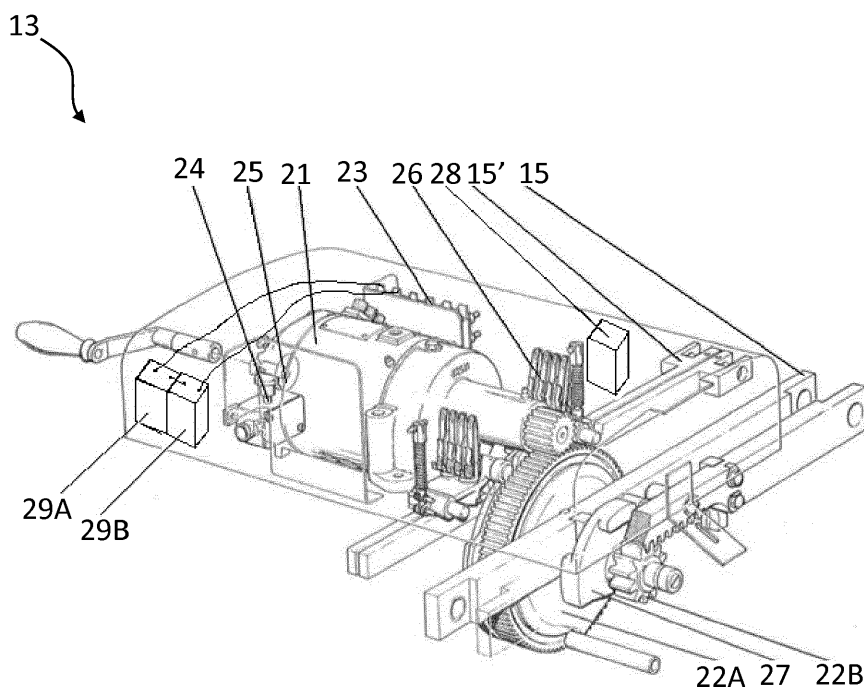


Fig. 2

Description

[0001] The invention relates to an electric point machine for changing over the blades of a point as a result of which a rail vehicle can change its direction of travel.

[0002] Point machines form the core of a point. With the point machine, the blades of a point are operated and displaced, as a result of which a rail vehicle can change its direction of travel. What is meant by this is not a forward-and-return direction but rather a change from one track to another, from a main line to a diverted line. Points may be regarded as one of the base elements of present-day rail infrastructure. Present-day rail infrastructure accordingly includes a multitude of points.

[0003] Not only in the Netherlands but also elsewhere, the density of the railway network is continually increasing. More and more towns and villages are being opened up, and alternative and new railway routes are being laid out. To an increasing extent, the existing and also the new railway routes are being travelled ever more intensively. In order to guarantee capacity for the requisite transportation of people and goods, it is, inter alia, necessary to lower the probability of malfunctions significantly. Furthermore, to an increasing extent there is also an increasing need to be able to carry out maintenance operations on the track in a short time and efficiently. Accordingly there is an overall need for an improved, operationally safer and maintenance-friendlier railway network.

[0004] The invention aims to meet the aforementioned need, and in accordance with the invention, in a first aspect, an improved electric point is provided for propelling two point blades of a railway point between a first and a second point position, comprising

- motion bolts which are designed for setting the two point blades in motion between a first and a second position;
- a motor which is connected to the motion bolts for the propulsion thereof;
- a transmission which is connected between the motor and the motion bolts and is designed for adapting at least one of the power, speed and torque of the motor to the motion bolts;
- a control unit which is designed for driving the motor on the basis of a received control signal, and also
- a communication unit which is designed for receiving the control signal and driving the motor by the control unit, on the basis of the control signal, for propelling the two point blades of the track point between the first and second point positions, characterized in that the motor is a stepper motor.

[0005] As stated, the railway network is being used ever more intensively, and the density of the railway network is increasing all the time. Single-track line sections are growing into multi-track line sections; new routes are being laid out, and new villages and towns opened up.

[0006] Line sections are lengths of track between two, mostly relatively large, stations. These line sections may consist of one track but usually comprise several tracks. When there are more tracks, also called multi-track sections, trains having contrary directions have their own track, for example when it is a question of a double track. This is in contrast to a single track, in which case trains have to make use of one and the same track in both directions.

[0007] Besides single and double tracks, there are also line sections in which three or sometimes even four tracks run parallel to one another, and at least in the Netherlands there are even some stretches with six tracks. The line sections can be divided up again into so-called blocks according to the block system. Only one rail vehicle may be present per block, and a line section often consists of various blocks coupled together, but a short line section may, in principle, also consist of a single block.

[0008] Research shows that a large proportion of the malfunctions in the line sections and yards, and also of the failure of trains, are the direct consequence of points or at least related thereto to a great extent. Point malfunctions accordingly have a great influence on the schedule.

[0009] With the increase of the traffic on the track and the continually more intensive use, the need for a robust track is ever increasing, and there is consequently a need for improved points with a lower probability of malfunctions.

[0010] The invention meets the aforementioned need for robust points by providing, in accordance with a first aspect of the invention, a point machine that displays an improved propulsion because the motor of the point according to the first aspect of the invention is a stepper motor.

[0011] The motors as used in point machines known at present are d.c. motors with two field windings: one for each direction of rotation. The motors are constructed for a nominal operating voltage of 120 volts d.c. The motor optionally includes a gearbox which acts as transmission in order to transform power, torque and speed.

[0012] However, such motors have the disadvantage that they are less efficient. They have relatively large losses, and they cannot be adjusted with great accuracy. As a result, a currently known point machine has to be provided with all kinds of means in order to guarantee good action of the point. Accordingly, currently known points include friction units in order to prevent overloading of the motor, but the motion bolts are also provided with cams and interlocks in order to bring about the correct switching of the point blades.

[0013] In an example, the electric point machine of the invention includes a brushless direct-current motor. This has the advantage that they need less maintenance, because no trailing contacts (carbon brushes) or other commutators are contained therein. This is handled electronically. That means that the wear thereof is considerably lower than in the case of d.c. motors known at present.

The efficiency is also higher: such brushless d.c. motors have fewer losses.

[0014] The brushless d.c. motor is typically a permanent-magnet motor, but may also be configured as a coupled reluctance motor or an induction motor. Such brushless d.c. motors have a high torque in relation to the weight of the motor. This makes them particularly suitable for application in a point machine, on account of the high requisite torque in order to adjust the point blades, whereas (particularly in the case of a wireless or battery-operated point machine) the weight of the motor preferably has to be as low as possible. Not only is the torque high in relation to the weight but also in relation to the power consumption. This results in a high electrical efficiency, making the motor particularly suitable for a mobile/wireless point machine that is provided with power by means of a storage battery. At the same time, such motors have a proven improved reliability, reduced noise output and longer service life. The longer service life is dictated by, among other things, the absence of the components subject to wear, such as the brushes, and development of erosion on the commutator. The electromagnetic interference of such motors is also considerably lower; this has a positive effect on the use of a motor in an application such as the point machine, in which case the electronics in the point machine should not experience any interference from the motor. The reason for this is that it would make the control and/or the (wireless) communication less reliable. For this reason, the motor and/or the control unit and/or the communication unit is/are preferably shielded from electromagnetic radiation, for example by being housed separately in a sealed metal housing. Because the rotor of the brushless d.c. motor includes no windings, these do not require active cooling by means of a current of air in/through the motor and along the rotor. In contrast to conventional motors in point machines, a brushless d.c. motor can consequently be accommodated completely inside a closed housing. At the same time, this makes them suitable to be cast in a resin or similar material, as a result of which wear - for example, as a consequence of vibrations from the track - has less influence on the motor.

[0015] In a preferred embodiment, the motor of the point machine according to one aspect of the invention is a stepper motor. A stepper motor is a very specific type of brushless d.c. motor in which one entire rotation of the rotor is divided into a discrete number of separate steps. As a result, the exact position (the angle) of the rotor not only can be controlled but can also be read out. With such a stepper motor it is possible to cause the rotor, and with it the drive shaft, to make an exact number of revolutions or an exact angular rotation. The driving of the motor can happen by means of a continuous direct current, as a consequence of which the drive shaft will rotate continuously. However, the stepper motor is preferably energized by means of a pulse train (preferably a pulse of square waves). In this case, the drive shaft will rotate by a fixed angle per pulse.

[0016] Stepper motors have various advantages over the d.c. motors that are used in point machines known at present. They can be regulated at relatively low cost, have a high torque at start-up and likewise at low speeds, making them very suitable for use in a point machine. Furthermore, they are, inter alia, simple in construction, low in maintenance, reliable, low probability of slip, precise positioning, no components subject to wear; the response at a start, stop or reversal of rotation is also very good. They are also compact in design. This means that the motor occupies little room and, seeing that the motor takes up a large part of the content of the point machine, the point machine with such a motor is considerably more compact, so compact even that the entire housing, and therefore the point machine itself, can be completely integrated into the track. The housing can be accommodated between the rails and, for example, may constitute an integrated part of a sleeper. As the number of moving parts is smaller and the durability greater, maintenance on such point machines is very limited. This means that there is also no need to place the point machine outside the track, and that it can therefore be accommodated in the track in an integrated manner. Such a design is more compact and more robust.

[0017] With the stepper motor, the rotation of the rotor shaft can be regulated in very reliable and exact manner, as a result of which stepper motors are outstandingly suitable to drive the motion bolts in a reliable and accurate manner, and thereby to accurately change the position of the point blades.

[0018] In one example, the electric point machine also includes a hydraulic pump or a combined electrohydraulic pump which is driven by the (aforementioned) brushless d.c. motor or stepper motor. Obviously, the point machine includes correspondingly hydraulic components (such as flaps and valves) which are known to a person skilled in the art, in order to drive the point blades hydraulically.

[0019] In an example, the stepper motor is a stepper motor from the group consisting of a permanent-magnet stepper motor, a hybrid synchronous stepper motor and a variable-reluctance stepper motor.

[0020] The stepper motor may be a permanent-magnet stepper motor which includes permanent magnets in the rotor. The rotor and stator of this motor may be toothed but are preferably not toothed. The rotor has a north side and a south side. Activation of a phase results in an electromagnetic force, and in the rotor aligning itself with the energized phase. In order to increase the step resolution of a permanent-magnet stepper motor, the number of poles in the stator or the number of phases can be increased. The motor preferably comprises 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 or more phases or number of poles in the stator. The motor may, however, also be a variable-reluctance motor. This variable-reluctance stepper motor preferably has a toothed, non-magnetic rotor. When a phase is energized, the rotor moves to the place having the lowest reluctance (minimum re-

luctance).

[0021] In order to increase the resolution in the case of a variable-reluctance stepper motor, the number of teeth in the rotor or the number of poles can be increased. The motor preferably comprises 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 or more teeth in the rotor, or number of poles. The motor may, however, also be a hybrid synchronous stepper motor. A hybrid stepper motor is a combination of the two preceding types. The rotor is preferably magnetic and toothed; the poles of the stator are preferably also toothed. The toothing in the stator is divided into two different zones: one zone for north poles and one for south poles. They are therefore of opposite polarity, and the south poles are situated 'between' the north poles. When a phase is energized, the rotor will shift to the position having the least room between the teeth of the rotor and the teeth of the stator.

[0022] In an example, the control unit is designed to read out the angular position of the stepper motor and to compare it with a previously set angular threshold value, and the control unit is furthermore designed to communicate fault information via the communication unit if the angular position does not exceed the angular threshold value when the motor is being driven in order to bring the point blades between the first and second positions.

[0023] One advantage of the stepper motor is that the control unit may include an angular threshold value which can be adapted beforehand (and/or adapted remotely). This angular threshold value is a variable which is dictated by the previously calculated angle that would be necessary in order to move the point blades between the first and second positions. This may be, for example, a rotation of the drive shaft of 10 times 360 degrees, but that is obviously only an example. The control unit therefore knows how many revolutions would have to be made for a successful switching of the point. In point machines known at present, use is often made of the power consumption of the motor as an indication that the point has been switched. After all, if the point has been switched, the blade cannot be displaced further, and the power consumption will greatly increase which is an indication that the motor can be switched off. However, if an obstruction (ice-formation or litter) arises within the point, the motor will also display a high power consumption while the point is not in the correct position. In the case of a stepper motor, this can be obviated, because the motor will not make the number of previously set revolutions in case of an obstruction. The angular position does not tally with the angular threshold value, and this means that the point has not been switched correctly. This is preferably communicated via the communication unit, which thus signals that the point is not working properly.

[0024] In an example, the communication unit is designed for wireless communication and wireless reception of the control signal.

[0025] In an example, the communication unit is designed for wireless communication and wireless reception of the control signal from a wireless terminal, said

wireless terminal comprising, in particular, one of a group consisting of a wireless dedicated terminal, a mobile phone, a smartphone, a tablet and a laptop.

[0026] In an example, the communication unit is designed for wireless communication and wireless reception of the control signal via a remotely situated central server.

[0027] According to one aspect of the invention, the point machine is provided with a wireless communication unit, optionally in combination with a wired (redundant) communication unit. The wireless communication unit is designed to establish at least one wireless communication link, optionally with a central server, and to receive instructions in the form of control signals via the central server or otherwise. The communication via the central server can, however, be established with a (local) terminal, such as a dedicated mobile device and/or a mobile phone, a smartphone, a tablet and/or a laptop. The control unit of the point machine receives the control signals from the communication unit, on the basis of which the motor can be energized in order to displace, via the transmission, the motion bolts and the point blades connected thereto between the first and second positions.

[0028] With such a point machine according to the invention, points can be driven in such a way that a large number of points within a respective line section, zone or block can be controlled with it.

[0029] Known point machines are linked physically, in wired manner, to a switch box close to the track. From this switch box, the point is not only provided with power but is also driven at the same time. From the switch box, many wires accordingly run in the direction of the points, but also in the direction of signals and other components of the rail infrastructure.

[0030] If a problem arises in or close to a switch box - which occurs relatively frequently in practice - this has direct effect on a large number of components of the rail infrastructure and therefore also on a number of points.

[0031] The inventor has realized that many of the problems of a point have their origin not only in the switch box but, in particular, in the cabling from and to the switch box or signal box and other components of the rail infrastructure. For instance, many of the cables have not been dug in to the correct depth. As a result, cables are damaged relatively frequently, for example as a consequence of (digging) operations, subsidence, tree-roots etc. It also appears that many cables have been dug in at a spot other than described in accordance with the (public) register, such as KLIC [Dutch Cables and Wires Information Centre]. As a consequence thereof, sometimes even cables in use are mistaken for dummy leads, and cables are affected by digging operations, because no-one had expected to come across any cables there.

[0032] In order to solve this problem, a point machine is provided that includes a wireless communication unit so that at least the driving of the point can happen in wireless manner, and at least no physical wiring is necessary for controlling the points. In this way, the point

can always be driven, irrespective of the operation and presence of a wired link from the point. At the same time, the status of the point can be read out at all times, even when it cannot be energized in order for its position to be switched. If the point cannot be adjusted to the other position, this can, for example, certainly be read out. In this way, it can be determined whether the point is already in the correct position, so that the point can nonetheless be travelled over. If the point were to be controlled in wired manner only, this is not possible. It is not possible to read out whether the point is situated in the correct or incorrect position.

[0033] By providing a point machine according to the invention with a wireless communication unit, the point machine is made suitable to be driven and inspected centrally, without an adaptation to the schedule being needed for this purpose. The point machine can, however, also be driven via the switch box close to the track, in which case the communication between the switch box and the point is configured in wireless manner.

[0034] This has various advantages over the currently known way of driving a point machine. Firstly, wiring - at least for control - is superfluous, which benefits the robustness of the points and therefore the rail infrastructure. Secondly, there are additional advantages, such as the central, remote read-out and driving of the points.

[0035] In an example, the electric point machine further includes a storage battery which is designed for supplying the wireless communication unit with power.

[0036] In an example, the electric point machine further includes a storage battery which is designed for supplying the motor of the electric point machine with power.

[0037] The electric point machine preferably has one or more built-in storage batteries. These may be, for example, storage batteries of the lithium-ion or lithium-ion-polymer type. In an example, the storage battery can be used in order to supply the communication unit with power, so that said unit is not dependent on an external power supply from the signal box or such like. This storage battery can also serve as back-up power supply in the case of a failing power supply from the signal box. Furthermore, the power supply may also be of such capacity that it is suitable to energize the motor of the point machine. This has the advantage that the point machine can be driven without power supply from the signal box or switch box being needed for it. In this way, the point has no need for cabling, and the probability of malfunction due to the cables is minimal. This benefits the robustness of the point and therefore the entire rail infrastructure. Furthermore, this makes it possible for such a point machine to be used for a mobile/temporary point. The storage battery is preferably configured in such a way that it is designed for high spot loads of short duration, possesses a high temperature resistance, and is fireproof to a high degree.

[0038] In an example, the electric point machine further includes a charging unit which is designed for charging the storage battery and is preferably designed to be

linked to an external solar panel for sunlight-based charging of the storage battery.

[0039] The storage battery can preferably be charged by means of a charging unit which is designed for transforming the voltage of the motor to a voltage suitable for charging the storage battery. Furthermore, the charging unit is preferably suitable to be linked to an external separate solar panel, or to a solar panel fastened in or to the housing of the point machine, so that the storage battery can be charged by means of sunlight. As an alternative, other forms of durable energy supplies may also be provided. For example, a windmill with dynamo, optionally in combination with solar cells, but these may also be devices that have been designed to convert other forms of energy into electrical energy; for example, in which motion in the track (vibration, motion of the rails or magnetic induction by a passing train, etc.) is converted into electrical energy which can be stored in a storage battery.

[0040] In an example, the wireless communication unit is designed for wireless mobile communication over a cellular mobile network, in particular a 2G GSM, 2.5G GPRS or EDGE, 3G UMTS, HSDPA or LTE, 4G LTE Advanced, GSM-R or FRMRS network.

[0041] The wireless communication preferably takes place over a cellular mobile network. This may be a conventional network - UMTS, LTE or LTE Advanced - but also a rail-specific network such as GSM-R or, in the future, FRMRS or similar network.

[0042] In an example, the wireless communication unit is configured to be redundant and designed for establishing at least two simultaneous wireless connections.

[0043] For the purpose of reliability and operational safety, the wireless communication unit is designed to establish a redundant connection, preferably simultaneously over different networks, preferably over two separate commercial telecommunications networks. This guarantees that control signals are received correctly and instructions for driving the point are executed at all times.

[0044] In an example, the point machine is designed for retrofitting and is configured in such a way that this point machine can simply replace a point machine of an existing point. This has the advantage that existing points can be upgraded to new technologies in a very simple manner, with communication happening in wireless manner and the power supply preferably being provided internally by means of a battery. Malfunctions in cables can then be rectified quickly and simply, because the existing point machine merely has to be replaced by one according to the invention, after which the point can be put into operation again. The interruption or duration of a malfunction is consequently short, and after the new point machine has been put into operation the cabling can, if required, be repaired at another time.

[0045] The invention will be explained in more detail on the basis of figures, in which:

Figure 1 shows an electric point machine for use in a rail infrastructure;

Figure 2 shows an electric point machine for use in a rail infrastructure with a wireless communication unit according to one aspect of the invention.

[0046] For a better understanding of the invention, the matching components will be indicated by identical reference numerals in the following description of the figures.

[0047] In figure 1 a point 10 is shown. A point 10 is a means to allow trains to change track. In addition to the regular single point, other variants also exist. The regular point includes a pair of track parts that differ in direction and, via the point, come together to form a single track part. For this purpose, the point includes a pair of so-called point blades 11A, 11 B which are located against or close to one of the rails 12A, 12B of the collective part of the track. One of the point blades, the left blade 11 A, viewed from the front side of the point 10, being the collective part, creates the motion of the left blade together with the left stop rail. The other point blade, the right blade 11 B, bears against the other rail 12A and together with it creates the motion of the right blade. When a blade bears against the stop rail, this blade is called the adjacent blade, and the other blade is called the distal blade.

[0048] For the purpose of displacing the blades from the first to the second position - that is to say, from the first to the second point position - the point is provided with a sliding stool. On the sliding stool, the points can simply change position and are preferably configured as flat steel plates. These can be lubricated and can be made free from ice in the winter for the purpose of simplifying the changing of position of the point blades.

[0049] Points may be configured in various ratios. These ratios define the angular ratio, which angle is formed by the centre lines of the two tracks between which the point changes. Examples of the angular ratios of the points are 1:9, 1:12, 1:15, 1:20, a different maximum speed being permitted for each of the angular ratios, for example 40, 60, 80, 110 km/h, respectively.

[0050] There are so-called left and right points, which are situated leading to the left or to the right. Viewed from the front side of a point - the front side being defined by the part of the track where both track parts come together - a point from which the track leading away branches off to the right is a right-handed point. In this case, the blades 11A, 11 B of such a right-handed point may be in different positions, for example wherein the blades lead to the righthand track, this being a right-handed point leading to the right, and vice versa.

[0051] For a long time, points were mostly operated by hand. In the course of time, these have been replaced by mechanically or electrically operated points. In the case of mechanically operated points, the blades are switched by a point machine 13. The point machine 13 adjusts the blades 11A, 11 B via pull-wires which are connected to a point lever in a signal box. Consequently, the signal box includes one or more appliances in order to operate one or more point machines 13 via the pull-

wires. The pull-wires ensure that the pull-rods 14A, 14B or motion bolts 15 of the point machine 13 displace the point blades 11A, 11 B between the first and second positions. In the course of time, the majority of the mechanical point machines have been replaced by electric point machines.

[0052] Currently known electric point machines are driven centrally from a signal box or similar local body. For example, the point blades on the motion bolts can be moved electrically from a train safeguarding system (NX) between a first and a second position using one or, mostly, several electric points.

[0053] With a point machine according to one aspect of the invention, it is possible to establish a direct wireless connection between a central local - or preferably remotely situated - server and the point machine 13 by means of the wireless communication unit which is present therein.

[0054] In figure 2 the various components of a point machine are clearly visible. The electric point machine 13 shown in figure 2 includes, among other things, a motor 21, motion bolts 15, an optional transmission 22A, 22B and a control unit 23 with connecting terminals. The point machine 13 shown here furthermore includes a crank contact 24 and crank opening 25, in order to allow manual operation with the lever, a contact bridge 26, motion bolts 15 and inspection bolts 15', a friction unit 22A, in order to prevent overloading and enable open running, and a locking piece 27, in order to lock the motion bolts.

[0055] Currently known motors 21 of the electric point machines 13 are d.c. motors. These d.c. motors are mostly fed by a d.c. power supply of about 120 V. The motors known at present include a transmission, in order to transform the speed, the torque and the power of the d.c. motor to the desired value for setting the motion bolts in motion. Known transmissions mostly ensure a speed reduction in the order of 1:13. The power supply of the currently known d.c. motors is provided from an external signal box or the like. By virtue of the fact that many of the d.c. motors known at present are provided with two coils - electrical energizing of one of the coils resulting in rotation of the rotor shaft of the motor in the one direction, and energizing of the other coil resulting in rotation in the other direction - the control of the motor is largely regulated by the energizing of one of the two coils and consequently of the one set of connecting terminals of the motor, or the other.

[0056] In this way, the driving of the points known at present is provided from the signal boxes. Inspection of whether the points are in the correct position and the changing action has been executed correctly is also assessed via the signal box.

[0057] With a point machine 13 according to the invention, the control of the point becomes possible via received instructions from the wireless communication unit 28. For this purpose, the wireless communication unit 28 is connected to the control unit 23. The feed of the wireless communication unit is preferably delivered by an in-

ternal power supply, such as in the form of a storage battery 29A, 29B. In practice, this will often be a number of storage batteries in order to provide the required capacity and the required security in the event of the failure of one of the storage batteries. The storage batteries are preferably lithium-ion or lithium-ion-polymer storage batteries, on account of the favourable weight/capacity ratio and the property that they are able to deliver a high peak current.

[0058] The storage battery 29 of the point machine 13 is preferably of such a capacity that the motor can also be driven by it in order to change the position of the point blades. In this example, the motor of the point machine is a brushless d.c. motor, preferably a stepper motor. Using this, it is possible to make this driving possible with a limited storage-battery capacity. At the same time, it is possible to determine very accurately whether the point blades have been switched correctly. This is also possible if the point machine is electrohydraulic and the point blades are therefore adjusted hydraulically by means of a hydraulic pump driven by an electric motor. For this purpose, the storage batteries should then preferably be charged continuously or at any rate monitored continuously, in order to be charged in the form of a trickle charger, if necessary. This charging may be carried out by means of the power supply from the signal box or via a solar panel which is not shown.

[0059] This may be a detachable solar panel which is linked to a charging unit, not shown, in the point machine. This solar panel, however, is preferably an integral component of the point machine, reducing the probability of theft and damage.

[0060] The communication unit 28 preferably communicates over a wireless cellular mobile network such as a 2G GSM, 2.5G GPRS or EDGE, 3G UMTS, HSDPA or LTE, 4G LTE Advanced, GSM-R or FRMRS network. Several simultaneous connections to the central server are preferably established, preferably via different networks. This makes the connection particularly robust.

Claims

1. Electric point machine for propelling two point blades of a railway point between a first and a second point position, comprising

- motion bolts which are designed for setting the two point blades in motion between a first and a second position;
- a motor which is connected to the motion bolts for the propulsion thereof;
- a transmission which is connected between the motor and the motion bolts and is designed for adapting at least one of the power, speed and torque of the motor to the motion bolts;
- a control unit which is designed for driving the motor on the basis of a received control signal,

and also

- a communication unit which is designed for receiving the control signal and driving the motor by the control unit, on the basis of the control signal, for propelling the two point blades of the railway point between the first and second point positions, **characterized in that** the motor is a stepper motor.

2. Electric point machine according to Claim 1, wherein the stepper motor is a stepper motor from the group consisting of a permanent-magnet stepper motor, a hybrid synchronous stepper motor and a variable-reluctance stepper motor.
3. Electric point machine according to Claim 1 or 2, wherein the control unit is designed to read out the angular position of the stepper motor and to compare it with a previously set angular threshold value, and wherein the control unit is furthermore designed to communicate fault information via the communication unit if the angular position does not exceed the angular threshold value when the motor is being driven in order to bring the point blades between the first and second positions.
4. Electric point machine according to Claim 1, 2 or 3, wherein the communication unit is designed for wireless communication and wireless reception of the control signal.
5. Electric point machine according to Claim 4, wherein the communication unit is designed for wireless communication and wireless reception of the control signal from a wireless terminal, said wireless terminal comprising, in particular, one of a group consisting of a wireless dedicated terminal, a mobile phone, a smartphone, a tablet and a laptop.
6. Electric point machine according to Claim 4 or 5, wherein the communication unit is designed for wireless communication and wireless reception of the control signal via a remotely situated central server.
7. Electric point machine according to one of the preceding claims, further including:
 - a storage battery which is designed for supplying the wireless communication unit with power.
8. Electric point machine according to one of the preceding claims, further including:
 - a storage battery which is designed for supplying the motor of the electric point machine with power.
9. Electric point machine according to one of the pre-

ceding claims, further including:

- a hydraulic pump driven by the motor, which is designed to set the motion bolts in motion hydraulically.

5

10. Electric point machine according to one of the preceding Claims 7-9, further including:

- a charging unit which is designed for charging the storage battery and is preferably designed to be linked to an external solar panel for sunlight-based charging of the storage battery.

10

11. Electric point machine according to Claim 10, wherein the point machine further includes an integrated solar panel which is linked to the charging unit.

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12. Electric point machine according to one of the preceding claims, wherein the wireless communication unit is designed for wireless mobile communication over a cellular mobile network, in particular a 2G GSM, 2.5G GPRS or EDGE, 3G UMTS, HSDPA or LTE, 4G LTE Advanced, GSM-R or FRMRS network.

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13. Electric point machine according to one of the preceding claims, wherein the wireless communication unit is configured to be redundant and is designed for establishing at least two simultaneous wireless connections.

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14. Electric point machine according to Claim 13, wherein the at least two simultaneous wireless connections are established over different cellular mobile networks.

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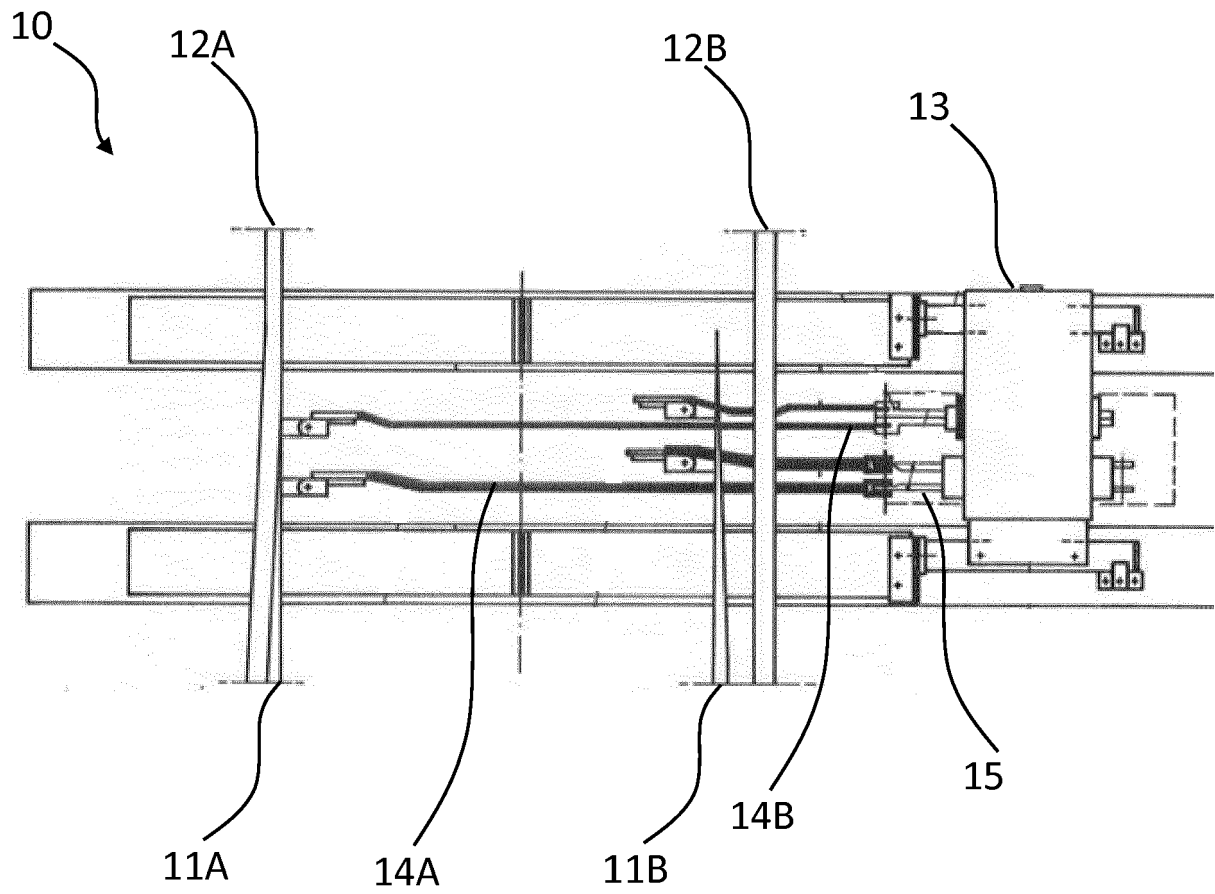


Fig. 1

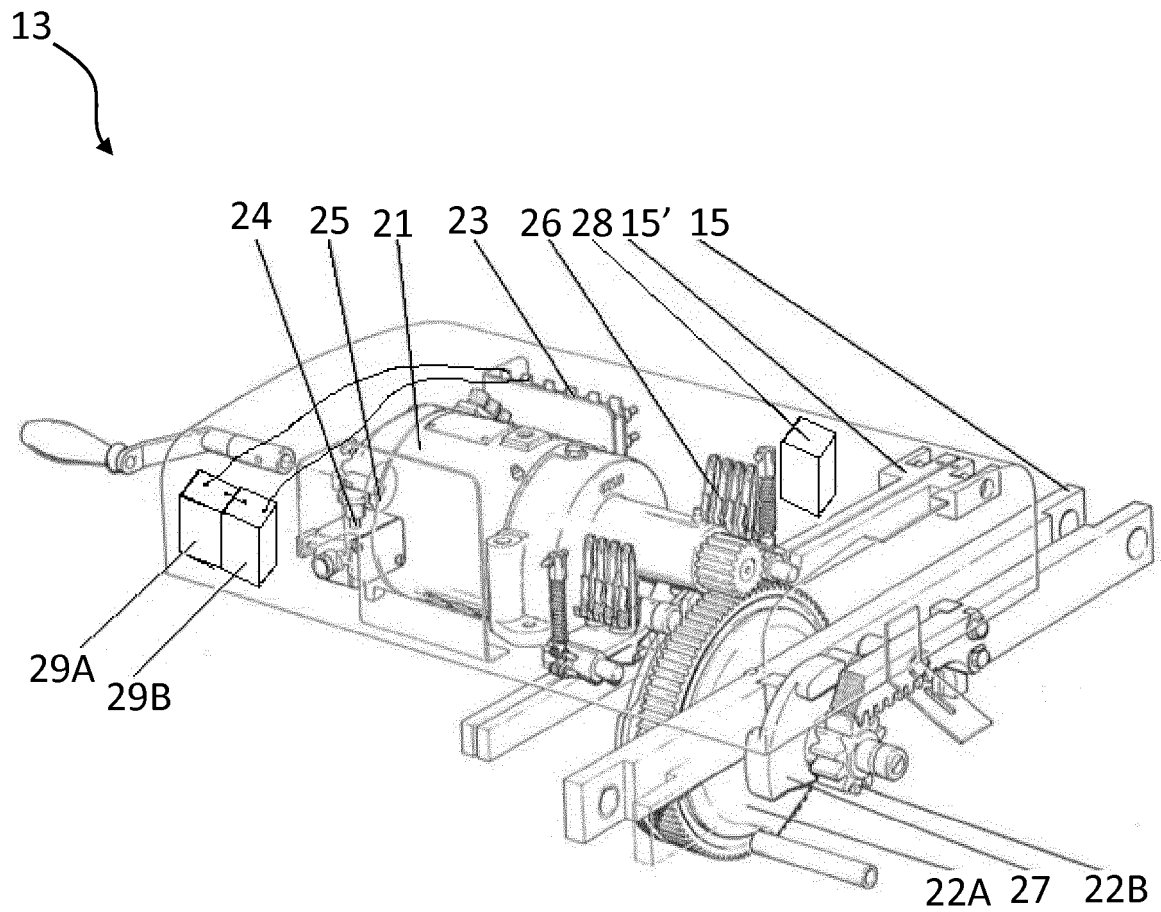


Fig. 2



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 18 2109

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Y	* paragraph [0001] *	4-8,	
A	* paragraph [0011] - paragraph [0015] *	10-14	
	* paragraph [0044] - paragraph [0049] *	3	
	* paragraph [0069] - paragraph [0076] *		
	* paragraph [0125] - paragraph [0133] *		
	* figures 1,6,7 *		
X	----- CN 102 632 909 A (NANJING INST RAILWAY TECHNOLOGY) 15 August 2012 (2012-08-15) * page 1; claim 1 *	1,2,9	
Y	----- US 7 416 159 B2 (BEAMAN DONALD C [US] ET AL) 26 August 2008 (2008-08-26) * column 5, line 20 - column 6, line 24 *	4-8,	
	* figures 1,6,7 *	10-14	

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			B61L
Place of search		Date of completion of the search	Examiner
Munich		13 November 2017	Janssen, Axel
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82