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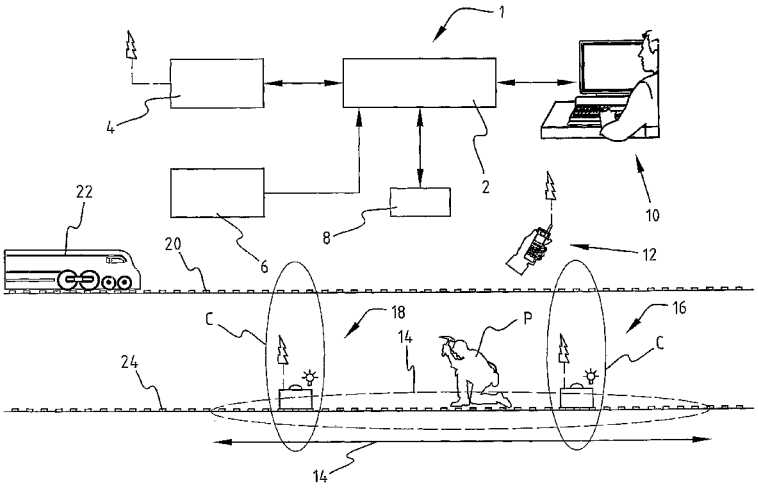

(57) Abstract: The present invention relates to a method for securing a rail system during maintenance operations on the rail system, wherein the rail system comprises a traffic control system and a rail infrastructure which is subdivided into work zones, comprising steps for: - inputting into the traffic control system work data relating to the maintenance operations in the traffic control system, wherein the work data are processed as a withdrawal of at least one work zone, wherein the responsibility for the withdrawal lies with the traffic control system, - transmitting the work data to an external workstation, situated for instance at the location of the maintenance operations, comprising a processing unit, memory and communication means for establishing a connection with the traffic control system in order to transfer the responsibility for the withdrawal of the work zone to the external workstation; - transmitting from the external workstation to the traffic control system a confirmation of the work data sent to the external workstation, wherein the responsibility is transferred to the mobile workstation.

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WABTEC EX1019

SYSTEM, METHOD AND SUBSYSTEMS FOR SECURING A RAIL SYSTEM

Rail systems require regular maintenance, for instance of sleepers, rails, points, signals, overhead wires and other subsystems. Such maintenance is hazardous, since those carrying out the maintenance must go onto the rail system so as to carry out the maintenance and rail traffic usually continues during maintenance operations. Accidents unfortunately still occur.

Many possible safety solutions have already been proposed which, however, have not been able to prevent the occurrence of accidents effectively or at a cost which is acceptable in practice.

In order to prevent the occurrence of accidents during maintenance operations, the present invention provides a method for securing a rail system during maintenance operations on the rail system, wherein the rail system comprises a traffic control system and a rail infrastructure which is subdivided into work zones, comprising steps for inputting into the traffic control system work data relating to the maintenance operations in the traffic control system, wherein the work data are processed as a withdrawal of at least one work zone, wherein the responsibility for the withdrawal lies with the traffic control system,

- transmitting the work data to an external workstation, situated for instance at the location of the maintenance operations and comprising a processing unit, memory and communication means for establishing a connection with the traffic control system in order to transfer the responsibility for the withdrawal of the work zone to the external workstation;

transmitting from the external workstation to the traffic control system a confirmation of the work data

sent to the external workstation, wherein the responsibility is transferred to the mobile workstation.

According to an embodiment of the present invention, a train service manager operating the traffic control system therefore enters a work zone where maintenance is being performed as a withdrawal into a traffic control system suitable according to the invention for this purpose. The work zone is hereby blocked for other use, such as rail traffic in particular, and such rail traffic can no longer be sent over this work zone.

A further advantage is that a part of the traffic control system is incorporated or taken over in the external workstation. A person operating the external workstation hereby knows with certainty that the traffic control system is unable to set a route over the work zone. This person, the workplace safety controller (WSC), can then allow a team of workers into the work zone.

The method preferably further comprises steps for:

- transmitting data to a work area marking unit, comprising a power supply, communication means and signalling means such as a light source, that the work zone has been transferred to the external station;
- actuating the signalling means on the basis of these data;
- marking a work area by means of the work area marking unit.

The work area marking unit marks in conspicuous manner the work area within which the work is being carried out. Such a work area can extend from an area of a few metres to areas of a number of kilometres in length. A work area can here also include a large number of work zones. It is recommended to mark the work area at the boundaries of the area. In one embodiment this

marking takes place by means of a light signal of the work area marking unit. An advantage of the present embodiment is that the signalling means can be controlled on the basis of the fact that the withdrawal of the work zone has been transferred to the external workstation, whereby a train route over the work zone cannot be entered in the traffic control system. It will in this case preferably not be possible to switch on the light signal if the responsibility for the work zone is not available in the mobile station.

A further advantage is that those performing the work can observe from the state of the signalling whether this state of withdrawal is in effect. Positioning the marking unit at the boundaries of the work area further prevents workers unintentionally leaving the work area, since they will here notice the light signal of the marking unit. In an application of the marking unit in a rail infrastructure with a plurality of tracks, the light signalling provides workers with a point of orientation as to which track of the plurality of tracks present is the one which is allocated to them and is therefore safe.

In a further embodiment, the method comprises steps for transmitting position data from the work area marking unit, which further comprises position input means or position determining means, to the external workstation or the traffic control system. It becomes possible on the basis of such data to cause a train travelling on a neighbouring track in the work area to travel at a lower speed at the position of the work area, whereby the work situation becomes safer.

The method preferably further comprises steps for transmitting position data from the work area marking unit, further comprising position input means or position determining means, to the external workstation

or the traffic control system. In order to disrupt rail traffic for the shortest possible time during the maintenance operations or for the purpose of the maintenance operations, the workplace safety controller transfers occupation of the work zone to the traffic control system by means of the external workstation. As quickly as possible after maintenance operations the traffic control system can hereby again plan routes in safe manner over the unblocked work zone.

A further aspect of the present invention relates to a system for securing a rail system during maintenance operations on the rail system, comprising:

- a traffic control system comprising a processing unit, a memory and input means for allocating travel routes over work zones of the rail system, wherein a route is processed as a withdrawal of a work zone;
- an external workstation, comprising a processing unit, a memory and communication means as well as means for processing information relating to work zones and work data;
- wherein the traffic control system further comprises input means for inputting work data and processing means for processing the work data as a withdrawal of the work zone. An advantage of this embodiment is that a work zone is designated as withdrawn in similar manner as when travel routes are set. When routes are set a series of successive work zones are allocated in known manner exclusively for the purpose of performing a train journey. As a result of this exclusive allocation, the traffic control system cannot make a double allocation to a work zone. Using the present embodiment it is not possible, after work data relating to a work zone have been inputted, to give a work zone another use until this condition has been terminated.

Such a system makes it possible to place the responsibility for unblocking the work zone in the traffic control system, after inputting the maintenance operations, in the hands of an operator of the workstation, which in practice will be a workplace safety controller. This extension of the traffic control system makes it technically impossible for the central part of the traffic control system to plan a train route on the part of the rail infrastructure transferred to the external station and comprising the work zones in the work area.

In further embodiments, the external workstation comprises a module for wireless communication. Such a module can comprise a module for connection to a telephone network. This creates freedom of location for the external workstation, whereby on the basis of personal observation the operator thereof in the vicinity of the maintenance operations can unblock the work zone as quickly as possible to the central traffic control system.

A further aspect of the present invention relates to a work area marking unit, comprising a power supply, communication means, a processing unit and signalling means for marking a work area comprising one or more work zones or parts thereof. As described in the foregoing, the safety of the workers in the work area can be increased using such a work area marking unit.

For the purpose of determining the position of the unit, this latter preferably comprises positioning means. As already stated in the foregoing, a train on a neighbouring track can for instance be slowed on the basis of the position of the work area marking unit so as to enhance safety in the work zone.

For the purpose of determining the position of the unit, this latter comprises in one embodiment means for

reading a coding arranged on a rail in the work area. In this embodiment use is made of such coding arranged in the rail infrastructure, for instance on sleepers or rails for the purpose of designating boundaries or boundaries of parts of work zones. The position determination depends in such a case on the dense nature of the arranged coding. A further advantage of this embodiment is that because such coding can be track-dependent, the positioning of the marking unit designates exactly the track in the work zone.

In an alternative embodiment, the positioning unit of the work area marking unit comprises a GPS module for determining the location of the unit by means of signals receivable from satellites. Such an embodiment has the advantage that the position determination can be performed independently of a coding system of the track. A further advantage of this embodiment is that the position of the work area can be monitored if the work area is a mobile work area. This is for instance the case in maintenance operations which extend for a period or time over one or more work zones, for instance if they are being performed from a work train. If the work area marking unit is situated on the train, the displacement of the work area can be monitored in flexible manner, whereby possible speed reduction measures on neighbouring tracks can last for the shortest possible time.

In a further embodiment, the positioning unit of the work area marking unit comprises input means with which the person can input the position within the rail system. Here it is possible to envisage input means such as a keyboard, handwriting recognition, voice recognition and the like. It is likewise possible to combine such embodiments for the position determination.

A further aspect of the present invention relates to an external workstation, comprising a processing unit, a memory and communication means, as well as means for processing information relating to work zones and work data. The external workstation is therefore able to take over a part of the functionality of the traffic control system such that the operator of the external workstation can ensure blocking of the work zone.

The external workstation preferably comprises a module for wireless communication, whereby the operator of the external workstation can take up position with a great measure of freedom close to the work area. Connection is preferably established with the traffic control system by means of a module which is suitable for connection to a telephone network, where PSTN, GSM, UMTS and the like can be envisaged. Other wireless connection techniques based on network connections, such as WiFi, are likewise possible.

Further advantages, features and details of the present invention will be further elucidated on the basis of a detailed description of embodiments, wherein reference is made to the figures, in which:

- fig. 1 is a schematic representation of an embodiment according to the present invention; and
- fig. 2 is a flow diagram of a method according to the present invention.

A security system 1 (fig. 1) as embodiment according to the present invention comprises a sub-module of a traffic control system 2. This module adds functionality to the traffic control system for the purpose of inputting into the traffic control system work data as a withdrawal of a work zone from the rail infrastructure available for train traffic. A work zone is a part of a rail infrastructure which serves as basic unit for removal from operation for the purpose of

maintenance operations. The traffic control system is connected to an input module 10 in which a so-called train service manager inputs travel routes and also, in accordance with an embodiment of the present invention, the work data as withdrawal of a work zone. For this purpose the traffic control system has at its disposal knowledge of infrastructure elements stored in a data file 8. The new traffic control system is further connected to a GSM server 4 for exchanging data with external workstations 12.

The external workstation 12 can comprise a laptop, a mobile phone or a handheld computer. This external station 12 is provided with a GSM module with which data can be exchanged with GSM server 4.

The mobile computer 12 is further provided with software means for performing the interaction with the traffic control system, including storage and processing of the work data and/or the withdrawal data of work zones. The module is also able to send back confirmations of receipt of such data, whereby the traffic control system will look upon these data as external and the work zone will be designated as withdrawn.

After receipt and confirmation of the withdrawal data of the work zone, a signal is sent to the work area signalling unit 16. On the basis of the receipt of such a signal, this unit will switch on a lamp located thereon. Instead of being provided with a lamp, the unit may also be provided with other light-emitting means comprising for instance LEDs. The signals received by the unit are preferably sent from handheld computer 12, but can likewise be sent in automatic manner from traffic control 2 by means suitable for the purpose. At least one signalling unit is present in the simple variant of a work area 14 shown in figure 1; if the work

area is of any size, a signalling unit is preferably placed on either side of the work area. If the work area were to comprise a plurality of tracks, a plurality of signalling units can of course be applied. A work area can for instance comprise a point, whereby the work area has three ends which can each be provided with a signalling unit 16, 18.

In a further embodiment the signalling unit 16 is provided, as already described in the foregoing, with position determining means such as a GPS. Such a device is able to transmit its position to for instance workstation 12 or GSM server 4. On the basis of such position data the traffic control is then able to send a message in automatic manner with means suitable for this purpose to an approaching train 22 on a neighbouring track 20 such that the train can reduce its speed in good time before reaching the work area, whereby the work situation within the work area will be safer. Noise nuisance for instance is hereby also greatly reduced for the workers. The signalling unit hereby functions as it were as an electronic security fence around the work area. The circles C around the units indicate this. Approaching trains which will enter the circles are warned and can reduce speed in good time on the basis of the warning.

Figure 2 shows a number of situations of the work zones in the traffic control system and the external station. In situation 30 the work zones are available for setting of routes. In this situation a known traffic control system for a work zone has the possibility of allocating this zone as part of a route during a route-setting process (not shown).

In the shown embodiment, data relating to maintenance operations on the rail system are inputted in step 31 into the traffic control system. A work zone

is hereby designated as withdrawn. On the one hand this takes place in a memory of the traffic control system and on the other this is indicated by means of for instance a colour coding on a display device, such as a display of the traffic control system, to the train service manager as operator of the traffic control system. In step 31 this withdrawal information of the work zone is then transmitted by the traffic control system to an external workstation which communicates with the traffic control system via communication means.

In situation 32 the authority in respect of the work zone is transferred in this manner to the external workstation. In step 33 a confirmation is sent by the external workstation to the traffic control for the purpose of accepting the transferred responsibility for the occupied work zone. This can take place in automatic manner, or commands can be entered for this purpose by security staff into the external workstation or their handheld computer in order to send this information to the traffic control system.

In step 35 the local workplace security is then initialized by for instance switching on the work area marking unit as already specified in the foregoing. As additional security a line section employee, in addition to placing a work area marking unit, can also place a per se known self-signalling short-circuit rod on the track.

In step 37 the workers who will carry out the maintenance operations on the rail system can then go onto the secured track. In situation 38 the maintenance operations are carried out in the work area secured in the above described manner. In step 39 the track is cleared of workers and equipment as well as the work area marking unit and the possible short-circuit rod, whereafter in situation 40 the rail system and the

security system are suitable for countermanding the safety precautions.

In step 41 the withdrawal of the work zone is transferred to the traffic control system from the mobile workstation, optionally by means of an instruction from security staff, which results in situation 42 in which the traffic control system has received a message with the transferred data and the external workstation has sent acknowledgement. In step 43 the traffic control system sends a confirmation of receipt of the withdrawal data and this results in situation 44 wherein the occupied work zone is once again available to the traffic control system. In step 45 the work zone is unblocked within the traffic control system so that in situation 30 it is once again available for the normal allocation of the work zone as part of the route for a train.

The train service manager operating the traffic control system sees displayed on for instance a screen, in situations 32 and 44, that the system is not available for route setting. In situations 34 and 42 and the situations therebetween the work zone in question is displayed as wholly missing, for instance by not displaying the work zone at all or doing so with greatly differing colour coding and the like.

The above described embodiments of the system and components thereof can be varied freely within the scope of the appended claims. The scope of protection is defined by the appended claims.

CLAIMS

1. Method for securing a rail system during maintenance operations on the rail system, wherein the rail system comprises a traffic control system and a rail infrastructure which is subdivided into work zones, comprising steps for:

- inputting into the traffic control system work data relating to the maintenance operations in the traffic control system, wherein the work data are processed as a withdrawal of at least one work zone, wherein the responsibility for the withdrawal lies with the traffic control system,

- transmitting the work data to an external workstation, situated for instance at the location of the maintenance operations, comprising a processing unit, memory and communication means for establishing a connection with the traffic control system in order to transfer the responsibility for the withdrawal of the work zone to the external workstation;

- transmitting from the external workstation to the traffic control system a confirmation of the work data sent to the external workstation, wherein the responsibility is transferred to the mobile workstation.

2. Method as claimed in claim 1, comprising steps for:

- transmitting data to a work area marking unit, comprising a power supply, communication means and signalling means such as a light source, that the work zone has been transferred to the external station;

- actuating signalling means on the basis of these data;

- marking a work area by means of the work area marking unit.

3. Method as claimed in claim 1 or 2, comprising steps for:

- transmitting the work data from the external workstation to the traffic control system in order to transfer the withdrawal of the work zone to the traffic control system;

- transmitting from the traffic control system to the external workstation a confirmation of the work data sent to the traffic control system, wherein the responsibility for the work zone is transferred to the traffic control system.

4. Method as claimed in one or more of the foregoing claims, comprising steps for transmitting position data from the work area marking unit, further comprising position input means or position determining means, to the external workstation or the traffic control system.

5. System for securing a rail system during maintenance operations on the rail system, comprising:

- a traffic control system comprising a processing unit, a memory and input means for allocating travel routes over parts of the rail system,

- wherein the traffic control system further comprises input means for inputting work data and processing means for processing the work data as a withdrawal of a work zone;

- an external workstation, comprising a processing unit, a memory and communication means as well as means for processing information relating to work zones and work data.

6. System as claimed in claim 5, wherein the external workstation comprises a module for wireless communication.

7. System as claimed in claim 5 or 6, wherein the workstation comprises a module for connection to a telephone network.

8. Work area marking unit, comprising a power supply, communication means, a processing unit and signalling means for marking a work area comprising one or more work zones or parts thereof.

9. Work area marking unit as claimed in claim 8, comprising positioning means for the purpose of determining the position of the unit.

10. Work area marking unit as claimed in claim 9, wherein the positioning unit comprises a reader for reading a coding arranged on a rail in the work area.

11. Work area marking unit as claimed in claim 9, wherein the positioning unit comprises a GPS module for determining the location of the unit by means of signals receivable from satellites.

12. Work area marking unit as claimed in claim 9, wherein the positioning unit comprises input means with which a person can input the position within the rail system.

13. External workstation, comprising a processing unit, a memory and communication means, as well as means for processing information relating to work zones and work data.

14. Station as claimed in claim 13, wherein the external workstation comprises a module for wireless communication.

15. Station as claimed in claim 13 or 14, wherein the workstation comprises a module for connection to a telephone network.

16. System as claimed in one or more of the claims 5-7, comprising a work area marking unit according to one or more of the claims 8-12.

17. System comprising parts as claimed in one or more of the claims 5-16 for performing a method according to one or more of the claims 1-4.

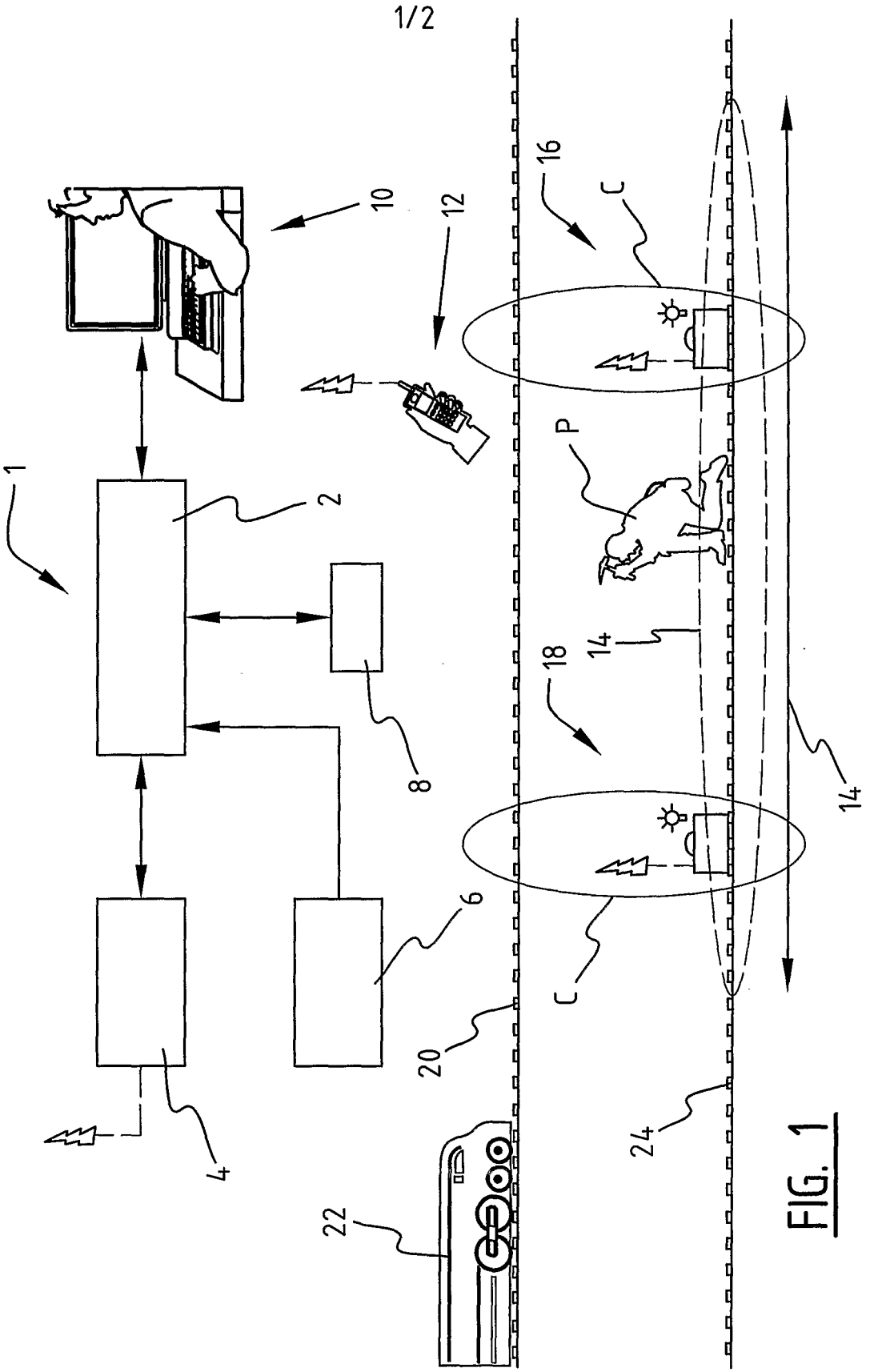

FIG. 1

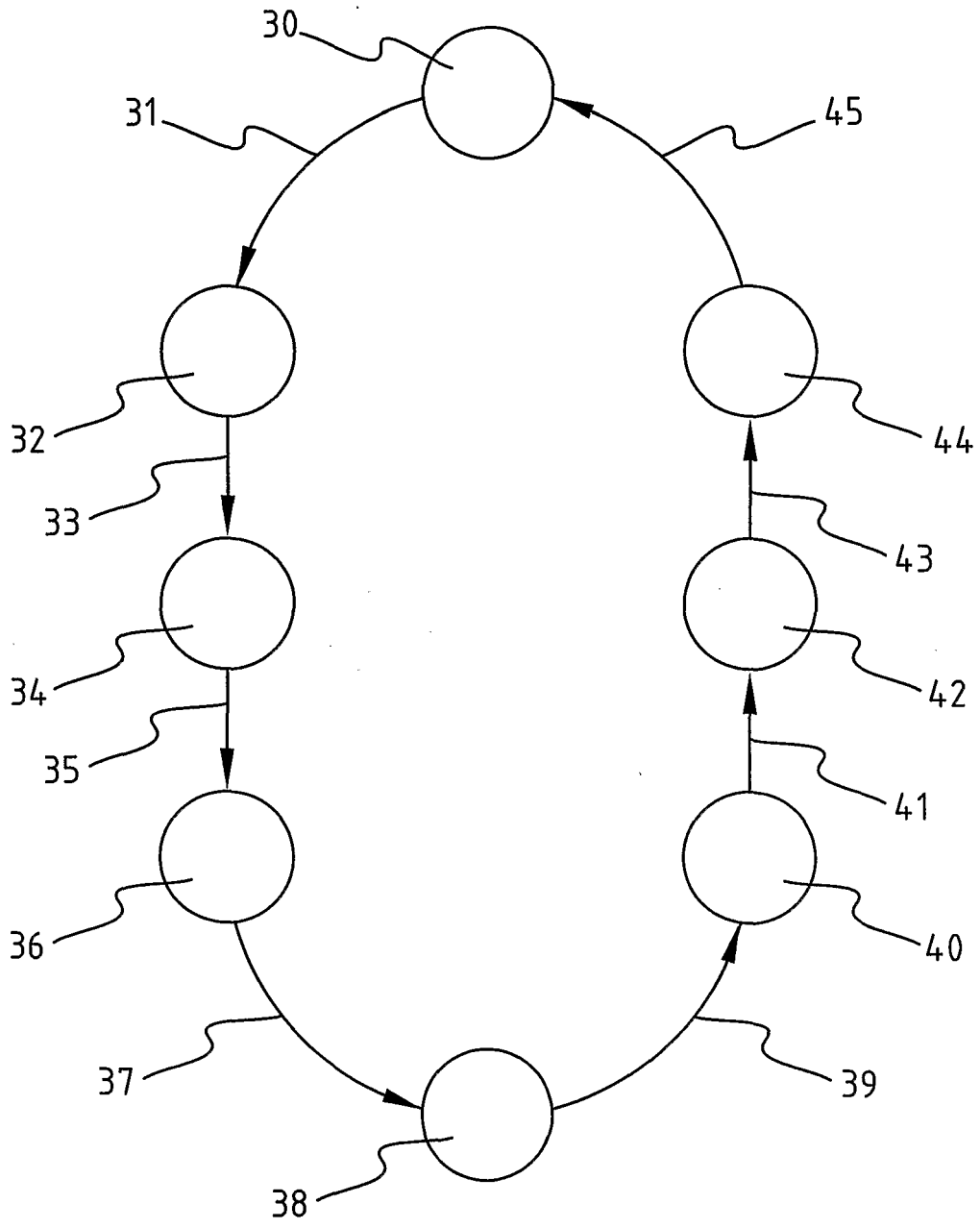

FIG. 2

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B61L23/06 B61L27/00

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 B61L

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

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 March 2005	16/03/2005

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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