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The sheet(s) containing the abstract is/are attached.

If no classification is furnished, Form P.9 should accompany this form.
The figure of the drawing to which the abstract refers is attached.

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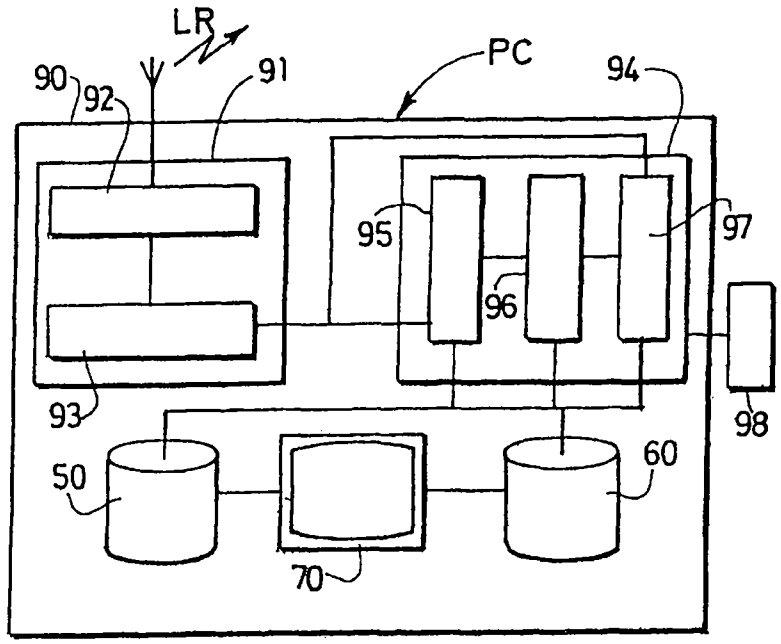
(54) Title: WORK TRAIN CIRCULATION ASSISTANCE METHOD AND SYSTEM

(54) Titre : PROCEDE ET SYSTEME D'AIDE A LA CIRCULATION DES TRAINS-TRAVAUX



(57) **Abstract:** The invention relates to an under-construction railway line comprising two adjacent two-way tracks which are controlled from a central signal box PC (90) by a central signal box operator. According to the invention, the tracks are divided into sectors Si which extend between two end signal boxes Pi (i and i+2) and on which trains can travel in block or cautious running mode. The inventive system consists of: a computer (94) comprising means for managing and processing data (95, 96, 97) and a synoptic operating display (70); means (81, 91) enabling communication between the central signal box operator and work train escort officials such that an escort official can request (M1) authorisation from the central signal box operator to travel in block mode in one direction (101) on a given sector Si; train-locating means (121, 122; 82) which are connected (81, LR, 91) to the computer; means (123) for detecting the direction of movement of a train, which are connected (81, LR, 91) to the computer; means (98) for inputting the operating status (CE) of the sectors, which are connected to the computer; and processing means (96) which process the data supplied by the detection and locating means. In this way, if no other train is travelling on the sector in question Si, no other train is travelling on the next sector Si+2 in the opposite direction and the adjacent sector Si+1 of sector Si of the adjacent track is not in use, the central signal box operator authorises the escort official of the train to travel in block mode on the sector in question Si from end i to end i+1.

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The invention primarily relates to a method of aiding the movement of works trains on a railway line under construction.

On a line in operation, a track is divided into sections of 400 to 2500 m, on each of which the trains move at a speed depending on a signal exhibited at the entrance to the section, usually the colour of a three-colour traffic light, which is green, if the section is free, orange, if the next section is occupied by a train - the light at the entrance of this next section is therefore red -, and red, if the preceding section is occupied.

For a train to be able to run on a section at the speed of the line, that is to say run "in section", it is preferred that at least the two sections that follow this section are free of any other train. It is in these conditions that the signal is green at the entrance of the section in question.

The presence of a train on a section is detected by a track circuit which controls the signalling elements that have just been evoked.

Fitting a line under construction with such a signalling system is out of the question. Its cost would be prohibitive.

Up to now, the signalling for the movement of works trains on the tracks of a railway line under construction has been provided in empirical fashion by the work-site personnel with the aid of signboards and other panels and of radio and telephone means. The major disadvantage of such an empirical solution, not to mention the requirement for significant staffing, is that it limits the speed of the trains on the tracks, the drivers being obliged to drive "in works mode",

that is to say running by sight.

The applicant is therefore proposing here a new solution, but in the restricted context of a new line under construction

- with two adjacent tracks,
- each track being two-way, that is to say that the trains can move on it in both directions.

Thus, the present application concerns primarily a method of aiding the movement of works trains on a railway line under construction with two tracks that are adjacent and two-way, managed from a central block PC by a PC chief in which

- the tracks are divided into sectors Si extending between two end blocks (i and i + 2) on which the trains can move in sections or in works mode,
- at the request for authorization, to move in sections in one direction on a given sector Si, from an escort agent of a train to the PC chief,
- a check is made as to whether another train is moving on the sector Si in question,
- a check is made as to whether another train is moving on the following sector S_{i+2} in the opposite direction,
- a check is made as to whether the adjacent sector S_{i+1} of the adjacent track is undergoing work and
- if the three checks are negative,
- the authorization is given by the PC chief to the escort agent to move his train in sections.

The technical effect of the method of the invention resides in the ability, in certain conditions, to have a works train move at the speed of the line, much greater than the speed of movement when running by sight and to gain precious time. To give an idea, the invention can be used, on 10 to 15 km sectors, to achieve a speed of 80 km/h instead of 30 km/h in work, and to move at an average speed of 45-50 km/h when it

is only 20-25 km/h with a running-by-sight movement.

Preferably, each block delimiting a sector, extending over a certain length,

- a check is made as to whether no train is moving in the opposite direction on the block i+2 terminating the sector Si in question,
- to authorize movement in sections on the sector Si in question.

Advantageously, a train leaving a set of formation sidings of a marshalling zone of a works base travels via a track junction block before moving on the line, an agent of the points-marshalling block, after agreement by the PC chief, controlling the predicted itinerary over the track junction block.

In this case, after actuating the points of the track junction block, the agent of the points-marshalling block delivers the authorization for the train to leave the set of formation sidings to move on the line.

Again preferably, a signal is given to the works train that it has reached a beginning or an end of block Pi and

- when it reaches a beginning of block Pi, the train moves until it is completely on the length of the block and the escort agent then makes a request to the PC chief to move in sections on the following sector Si and
- when it reaches an end of block Pi, it complies with an injunction to wait or with an authorization to move on the sector Si.

The invention also relates to a system of aiding the movement of works trains on a railway line under construction with two tracks that are adjacent and two-way managed from a central block PC by a PC chief, the tracks being divided into sectors Si extending between

two end blocks Pi (i and i+2) on which the trains can move in sections or in works mode, the system comprising

- a computer at the central block comprising means of management and means of processing of data and a block diagram panel for operating the line under construction, with at least its tracks, its sectors and its end blocks,
- means of communication between the PC chief and escort agents of the works trains for authorization requests, to move in sections in one direction on a given sector Si, from an escort agent of a train to the PC chief,
- means of storing messages (Mi),
- means of locating a train on the sectors of the line, connected to the computer,
- means of detecting the direction of travel of a train on the sectors of the line, connected to the computer,
- means of entering the state of work of the sectors, connected to the computer and
- processing means processing the data from the means of detection and of location so that, if
  a) no other train is moving on a sector in question Si,
  b) no other train is moving on the following sector Si+2 in the opposite direction,
  c) the adjacent sector Si+1 of the sector Si of the adjacent track is not in works mode,

  the PC chief authorizes the escort agent of a train to move in sections on the sector Si in question from the end i to the end i+2.

Preferably, a sector Si is represented on the block diagram of the central block PC as totally occupied when a works train is moving on it.

Again preferably, the means of locating trains on the sectors comprise

- signalling elements of beginning and end of blocks Pi flanking the sectors Si and identifying the blocks and the sectors,
- means of communication between the train and the central block arranged so as to exchange messages (Mi), in particular requests (M1), injunctions to wait (N2) or authorizations (M3).

Again preferably, the signalling elements are indicator panels but may also be, according to a more elaborate form of embodiment, radio beacons.

In the first case, it is the escort agent who generates the transmission of the request messages and who interprets the responses of the PC chief, whereas in the second case, this transmission may be automatic.

The invention will be better understood with the aid of the following description of the system of aiding the movement of works trains according to the invention and of the method that it uses, with reference to the appended drawing in which

- Figure 1 illustrates the general principle of works trains movement in sections according to the method of the invention;
- Figures 2, 3 and 4 show an example of signalling elements equipping the railway lines for the location of the trains on the sectors, comprising respectively one one-way track, one two-way track and two two-way tracks;
- Figure 5 is a functional block diagram of the system of aiding the movement according to the invention;
- Figure 6 is a flowchart illustrating a typical example of message interchange, conforming with the invention, between the works trains and the central block;
- Figure 7 is a flowchart of the operation of the aid system according to the method of the invention and
- Figure 8 shows an example of the display of a block

diagram panel of lines under construction and of the control of movement according to the method of the invention.

With reference to Figure 1, the tracks 100' and 100" of the line 200 of railway under construction connect at least one elementary work-site CE to its works base BT.

The works base BT is arranged so as to allow the constitution and distribution of works trains TTX A, B, etc on the line 200 with the elementary work-site CE as their destination.

Thus, a train leaving a set of formation sidings 196 of a marshalling zone 197 of a works base 198 travels via a track junction block 199 before moving on the line, an agent of the points-marshalling block 195, after agreement by the PC chief 194, controlling the predicted itinerary over the track junction block 199.

The lines are arranged as described below:

A line 200 is divided into successive adjacent sectors Si, S_{i+2}, etc on the track 100' and S_{i+1}, S_{i+3}, etc on the adjacent track 100". Blocks P_i, P_{i+2}, etc and P_{i+1}, P_{i+3}, etc respectively delimit these sectors on these tracks.

The blocks P_i, P_{i+2}, etc have a length of track 120, 140, etc of 1500 metres at least, whereas the sectors S_i, S_{i+2}, etc may have a length of track 130, 150, etc much greater (approximately 10 km) so that they can run "in sections", at a speed of 80 km/hour approximately. In comparison, the blocks are always travelled by running by sight except when they are used as parking track.

Based on this arrangement in sectors, the system 400 (Figure 5) aiding the movement of works trains comprises primarily signalling elements disposed along the tracks allowing escort agents to locate the train

TTX that they are escorting.

These signalling elements may be radio beacons with frequencies locked onto the special channels recognized by equipment on board the trains, but here, the preference is more simply for indicator panels as described below.

Furthermore, the system 400 of aiding movement comprises onboard electronic means available to the escort managers on the trains to help a PC chief situated in a central block PC to regulate and control the movement of the trains. These electronic means will be described later.

In relation to the signalling elements, with reference to Figure 2, on a one-way track 100 travelled in a single direction 101, are placed indicator signboards 121, 141, etc of the beginnings of blocks P_i, P_{i+2}, each bearing an inscription, for example DP 21 (beginning of block No. 21), etc DP 41 (beginning of block No. 41) and indicator signboards 122, 142, etc of the ends of blocks Pi, P_{i+2}, etc each bearing an inscription FP 21, FP 41, etc (end of block 21, 41, etc). These inscriptions identify each block P_i reached by the works train while locating the beginning and the end of the portion 120, 140 of the track on which it is possible to park. They are visible only from a train moving in the direction 101.

With reference to Figure 3, on a two-way track 100 allowing two opposite directions of movement 101 and 102, the lengths of track 120, 140, etc of the blocks P_i, P_{i+2} have ends which are at the same time beginnings of blocks for one direction of movement and ends of blocks for the opposite direction of movement.

That is why, on these two-way tracks, additional signboards 221, 222, 241, 242, etc have been placed on

the backs of the signboards 122, 121, 142, 141, etc which for their part are visible only from the trains moving in the direction 102.

To differentiate the directions of movement 101 and 102, additional signboards 123, 124 indicate on which radio channel LR the works train TTX must communicate with the central block PC, the channels being different on these two signboards.

The radio channels used, or the sequence of numbers of blocks and of sectors travelled, constitute data for detecting the direction of movement of the trains.

In the case of a line 200 comprising two adjacent two-way tracks 100' and 100", with reference to Figure 4, the tracks are organized into blocks Pi and sectors Si on the track 100' and into adjacent blocks P_{i+1} (220, 240) and sectors S_{i+1} (230, 250) on the adjacent track 100", and comprise indicator signboards disposed as previously (221, 222 etc - 122, 121 etc and 421, 422 etc - 322, 321 etc). Additional signboards indicate the track number V1 OR V2. Finally, points 301 and 302 are disposed to connect and allow two-way working of the two adjacent tracks, bypassing the elementary work-sites if necessary and providing for trains moving in opposite directions on one and the same track to cross.

These various signalling elements allow the escort agent to locate the train in the sectors and in the blocks, and to transmit data on the movement and/or location of the train that he is escorting to the PC chief. Each works train TTX 80 (Figure 5) comprises a radio transceiver 81 and, coupled to the latter, a man-machine interface (MMI) 82, with a keyboard and screen not shown, and allowing the escort agent to send messages to a central block 90 and to receive messages, via the channel LR of a radio link therewith.

The central block 90 for its part comprises central means 91 of communication including a radio transceiver 92 and a modem 93 for converting the signals received in baseband assimilable by a computer 94 for regulating and controlling the movement of the trains.

The computer 94 comprises essentially means of managing and means of processing data in liaison with a block diagram panel 70, here a video display screen, means 50 of storing the messages and means 60 of storing data, in particular for controlling the display of the block diagram panel in display data characteristic of the lines, the sectors, the blocks and the location of the works trains and of the elementary work-sites.

The computer 94 comprises means 95 of managing the messages received on the modem 93, means 96 of processing the detection and location data contained in the messages received, and means 97 of managing the messages to be sent via the modem 93. It is also connected to input means 98, here a man-machine interface MMI comprising at least an alphanumeric keyboard and screen in particular for entering data for controlling the block diagram panel, including the display data, and storing them in the means 60, or for making requests to display messages stored in the means 50 in the form of a log.

The module 95 dates and stores the messages received in the means 50 and the module 97 for managing the messages to be sent generates date and stores the messages sent in these same means 50. As for the module 96 for processing the detection and location data, it is arranged so as to interpret the messages received, verify the movement conditions, deduce the tenor of the messages to be sent, and where necessary update the block diagram panel.

The operation of the system 400 of aiding the movement

of the works trains in sections will now be described.

With reference to Figure 6, when the escort agent of the works train 80 has obtained the authorization to leave his works base BT, delivered by the agent of the points-marshalling block, the train 80 may, during a step 1, move and access a block Pi of the track 100' of the line 200 by running by sight on the portion of track 120 of the block, from the beginning of the block indicated by the signboard 121, to the end of the block, indicated by the signboard 122.

The escort agent, that is to say the train 80, then, in step 2, asks the PC chief, that is to say the central block 90, for authorization to move on the length of track 130 of the sector Si by sending a radio message M1 on the channel LR using his transceiver 81. The channel LR used, previously indicated by a signboard 123 (or 124) is here specific to the direction of movement 101 (or 102).

For this, the escort agent enters on the MMI 82 the data comprising the message M1, that is to say at least the identification A of the train and the number P identifying the block Pi reached, indicated on the signboard 121 for the beginning of the block (DP21).

In step 3, this message M1 is received by the transceiver 92 of the PC 90, is digitized and decoded by the modem 93, then, during the subsequent step 4, after storage in the means 50 and display on the MMI 98 by the module 95, is analysed by the processing module 96. This analysis is carried out according to certain criteria, developed later, for deciding on the mode of movement over the length of the track 130 of the sector Si or on the stopping of the train on the length of track 120 of the block Pi.

If the result of the analysis is negative, in step 5, a

wait message M2 is generated by the module 97 for managing the messages to be sent and, at the same time as being stored in the means 50, is sent by the transceiver 92 to the transceiver 81 of the train A, for example, via the same channel LR.

The receipt by the escort agent of the message M2 has the effect, in step 7, of causing the train to stop at the end of block signboard 122.

If the result of the analysis is positive, the module 97 for managing the messages to be sent, in step 6, generates a message M3 authorizing the train A to move in sections on the length of track 130 of the sector Si. This message M3 is also stored in the means 50.

During step 8, this message is transmitted to the train 1 by the transceiver 92. Subsequently, the escort agent, in step 9, sends an acknowledgement message M4 to the PC chief and, in step 10, the train A moves in sections on the sector Si.

In step 11, the acknowledgement message M4 is managed by the management module 95 and the processing module 96 updates the block diagram panel 70 while storing, in the means 60, the occupancy of the sector Si by the train A.

The method of controlling the movement described above is identically reiterated every time that the train TTX accesses a new block Pi until it arrives at the elementary work-site CE.

The log, stored as has been seen in the memory 50, may be viewed at any time on the screen and used for example at the request of the PC chief thanks to the MMI 98, in correlation with the block diagram panel 70 which provides him with any aid he requires.

More precisely, with reference to Figure 7, on receipt of a message Mi originating from the train 80 via the receiver 92 of the central block PC 90, in a step 21, the transceiver 92 transmits the message Mi to the modem 93 converting the analogue message received into a digital message that can be understood by the computer 94 in a manner known to those skilled in the art. During step 22, the module 95 for managing the messages received extracts from it the number P of the block Pi reached, the identification A of the train 80, the nature of the request, for example a request to move on the sector Si following the block Pi in the direction of travel of the train indicated by the channel LR, and supplements these detection and location data A, P, LR, during a subsequent step 23, with any additional data available in the memory 50 and entered by the PC chief using the MMI. These additional data may for example specify the composition of the train A, the specifics of the block Pi, the various radio channels used depending on the tracks and the direction of movement, the urgency of the routing of the train A, etc.

The detection and location data are transmitted to the processing module 96 which, during subsequent steps, searches in succession in the memory 60 for:

- during step 25, the train TTX immediately preceding the train A on the track 100', running in the same direction 101 and the sector Sj or the block Pj it has reached,
- during step 26, the closest train TTX coming towards the train A on the track 100' (if this track is two-way) and the sector Sk or the block Pk it has reached,
- during step 27, whether the line comprises two tracks, the location Sl of the elementary work-site CE closest to the sector Si and situated on the track 100" adjacent to the track 100' used by the train A.

Each of the steps 25, 26, 27 then computes the numbers N1, N2, N3 of sectors free of trains between the sector Si and the sectors Sj and Sk, or the location S2. These numbers N1, N2, N3 are compared with minima n1, n2, n3 that must not be exceeded, during a step 28, in order to decide according to whether the minimum concerned has or has not been exceeded, that:

- the train TTX A may move in sections on the sector Si, in which case, during a step 31, a message M is sent in response to the message M1 with a "movement in sections on the sector Si" mention,
- the train TTX A may move on the sector Si by running by sight, in which case the message M3 sent during a step 32 comprises a "movement in works mode on the sector Si" mention,
- the train TTX A must, at the end-of-block panel of the block Pi, await a subsequent authorization to move on the sector Si, in which case, during a step 33, a message M2 is sent thereto.

At the end of the process, in a step 40, the management module 95 updates the log in the storage means 50 and the block diagram panel 70 in the storage means 60.

The minima n1, n2, n3 not to be exceeded depend on the safety conditions established in advance.

In normal use of the system, the following conditions may be adopted:

$$\begin{cases} N1 = |j - i|/2 \\ n1 = 1 \quad \text{and } N1 \geq n1 \end{cases}$$

In this case, a train B may not enter a sector Si already occupied by a train A running in the same direction:

$$\begin{cases} N2 = |k - i|/2 \\ n2 = 2 \ , \ N2 \geq n2 \end{cases}$$

In this case, a train B running in one direction may not enter a sector Si if a train A running in the opposite direction on the same track is occupying the sector S_{i+2}:

$$\begin{cases} N3 = |1 - i - 1|/2 \\ n3 = 1 \qquad \text{and} \quad N3 \geq n3 \end{cases}$$

In this case, movement in works mode on the sector Si is imposed only if the adjacent sector S_{i+1} is in elementary work-site condition CE, otherwise the train may move in sections.

In accordance with the above safety levels, the block diagram panel displayed on the screen 70 may have the aspect shown in Figure 8. In this figure, three lines under construction, L1, L2, L3, have been represented, each one comprising two tracks V1 and V2, and on each track, the sectors Si, extending between the end or beginning blocks Pi depending on the direction of movement, i-2, i, i+2, etc, and the adjacent sectors S_{i+1} between the blocks P_{i+1}.

Each line L1, L2, L3 illustrates one of the three preceding cases of control exerted by the aid system 400, that is to say:

On the line L1, track V1, a works train B is occupying the sector S1(i-2) or the block P1i, occupation displayed on the panel 70, and requests to move in sections on the sector S1i. The aid system 400 ascertains that it is preceded by a works train A occupying the sector S1j also displayed, j here being equal to i+2. j-i being equal to or greater than n1,

authorization may be given, since no train is moving in the sector Si.

On the line L2, the situation of the train B is the same, but the train A is occupying the sector S1k or the block P1k, k being equal to i+4. k-1 being equal to or greater than n2, authorization may again be given, since no train is moving on the blocks or sectors Pi and Pi+2, Si and Si+2.

On the line L3, the sector S3l, where l = i+1, of the adjacent track V2 being in elementary work-site condition CE, l-i-1 being zero, only an authorization to move in work on the sector S3i may be given.

Authorization is then given only if these three verifications are made and the safety conditions respected.

CLAIMS 2003/03361

1. Method of aiding the movement of works trains (TTXA, TTXB, etc) on a railway line (200) under construction with two tracks that are adjacent (100', 100") and two-way (101, 102), managed from a central block PC by a PC chief in which
   - the tracks (100', 100") are divided into sectors Si extending (130, 150, etc) between two end blocks Pi (i and i + 2) on which the trains can move in sections or in works mode,
   - at the request (2) for authorization (M1), to move in sections in one direction (101) on a given sector Si, from an escort agent of a train (B) to the PC chief,
   - a check is made as to whether another train (A) is moving on the sector Si in question,
   - a check is made as to whether another train (A) is moving on the following sector S_{i+2} in the opposite direction (102),
   - a check is made as to whether the adjacent sector S_{i+1} of the adjacent track (100") is undergoing work (CE) and
   - if the three checks are negative,
   - the authorization (M3) is given (8) by the PC chief to the escort agent to move his train (B) in sections.

2. Method according to Claim 1 in which, each block (Pi) delimiting a sector (Si), extending over a certain length (120, 140, etc),
   - a check is made as to whether no train (A) is moving in the opposite direction on the block i+2 terminating the sector Si in question,
   - to authorize (8) the movement in sections on the sector Si in question.

3. Method according to either of Claims 1 and 2, in which a train leaving a set of formation sidings

(196) of a marshalling zone (197) of a works base (198) travels via a track junction block (199) before moving on the line, an agent of the points-marshalling block (195), after agreement by the PC chief (194), controlling the predicted itinerary over the track junction block (199).

4. Method according to Claim 3, in which, after actuating the points of the track junction block (199), the agent of the points-marshalling block delivers the authorization for the train to leave the set of formation sidings (196) to move on the line (200).

5. Method according to one of Claims 1 to 4, in which a signal is given to the works train (TTXA, TTXB) that it has reached a beginning (121, 141, 221, 241, etc) or an end (122, 142, 222, 242, etc) of block Pi and

- when it reaches a beginning of block Pi, the train moves until it is completely on the length of the block and the escort agent then makes (2) a request (M1) to the PC chief to move in sections on the following sector Si and
- when it reaches an end (122, 222, 142, 242, etc) of block Pi, it complies with an injunction (M2) to wait (7) or with an authorization (M3) to move (8) on the sector Si.

6. System (400) of aiding the movement of works trains (TTXA, TTXB) on a railway line under construction with two tracks (100', 100") that are adjacent and two-way (101, 102) managed from a central block PC (90) by a PC chief, the tracks being divided into sectors Si extending (130, 150, etc) between two end blocks Pi (i and i+2) on which the trains can move in sections or in works mode, the system comprising

- a computer (94) at the central block (90)

comprising means of management and means of processing of data (95, 96, 97) and a block diagram panel (70) for operating the line under construction, with at least its tracks, its sectors and its end blocks,

- means (81, 91) of communication between the PC chief and escort agents of the works trains for authorization requests (M1), to move in sections in one direction (101, 102) on a given sector Si, from an escort agent of a train to the PC chief,
- means (50) of storing messages (Mi),
- means (121, 122, 141, 142, etc, 221, 222, 241, 242, etc; 82) of locating a train on the sectors of the line, connected (81, LR, 91) to the computer,
- means (123, 124) of detecting the direction of travel of a train on the sectors of the line, connected (81, LR, 91) to the computer and
- means (98) of entering the state of work (CE) of the sectors, connected to the computer and
- processing means (96) processing the data from the means of detection and of location so that, if
  a) no other train is moving on a sector in question Si,
  b) no other train is moving on the following sector Si+2 in the opposite direction,
  c) the adjacent sector Si+1 of the sector Si of the adjacent track is not in works mode,

  the PC chief authorizes (8) the escort agent of a train to move in sections on the sector Si in question from the end i to the end i+2.

7. System according to Claim 6, in which a sector Si is represented on the block diagram (70) of the central block PC as totally occupied when a works train is moving on it.

8. System according to either of Claims 6 and 7, in which the means of locating trains on the sectors Si comprise
   - signalling elements (121, 122, 141, 142, etc, 221, 222, 241, 242, etc) of beginning and end of end blocks Pi delimiting the sectors Si at their ends and identifying the blocks and the sectors,
   - means (81, 82) of communication between the train and the central block (90) arranged so as to exchange messages (Mi), in particular requests (M1), injunctions to wait (N2) or authorizations (M3).

9. System according to Claim 8, in which the signalling elements comprise indicator signboards.

10. System according to Claim 8, in which the signalling elements comprise radio beacons.

11. System according to one of Claims 6 to 10, in which the signalling elements supply a number (P) of block Pi.

12. System according to one of Claims 6 to 11, in which the signalling elements supply a number of channel LR.

13. System according to Claim 12, in which the channel LR is specific to the direction of movement.

14. System according to one of Claims 6 to 13, in which the authorization requests (M1) comprise the identification (A) of the train.

15. System according to one of Claims 6 to 14, in which the processing means (96) are arranged so as to deduce, from the state of occupation of the sectors Si stored in the storage means (60, 50), and from a movement request message (M1) from a

train TTXA, the conditions of movement of that train and decide whether it may or may not move in sections.

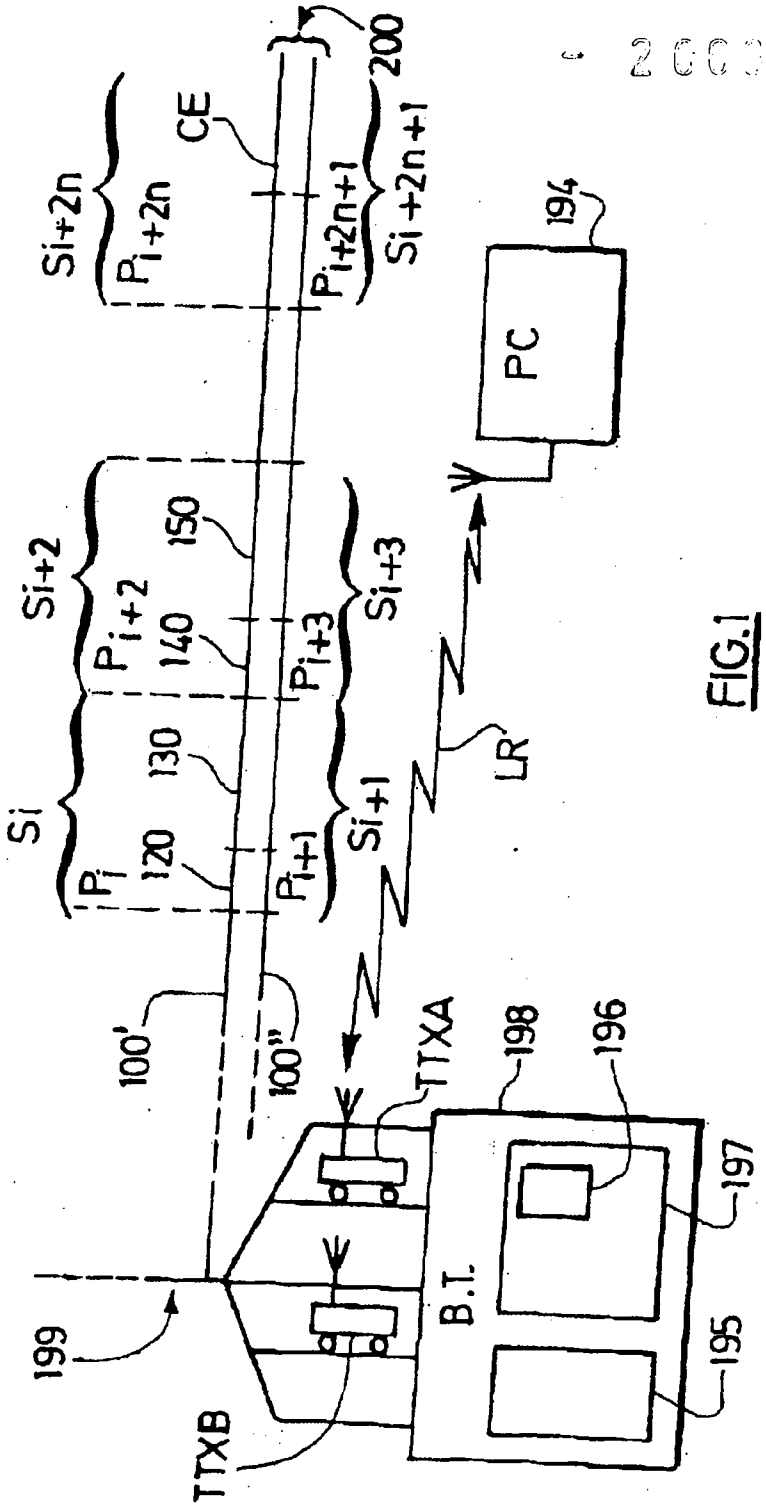

FIG.1

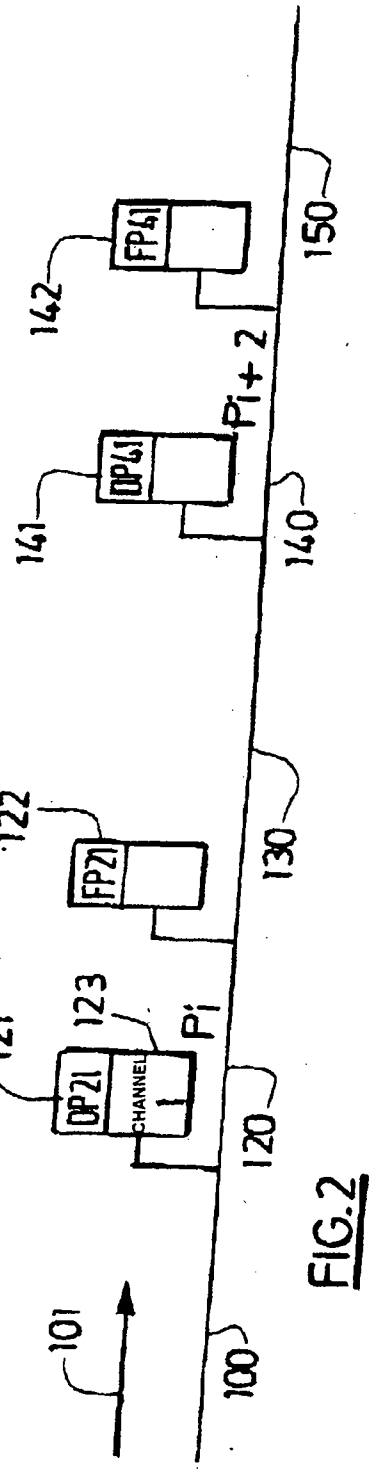
101
100
DP21
CHANNEL 1
121
123
Pi
FP21
122
130
120
DP41
Pi+2
141
140
FP41
142
150

FIG.2

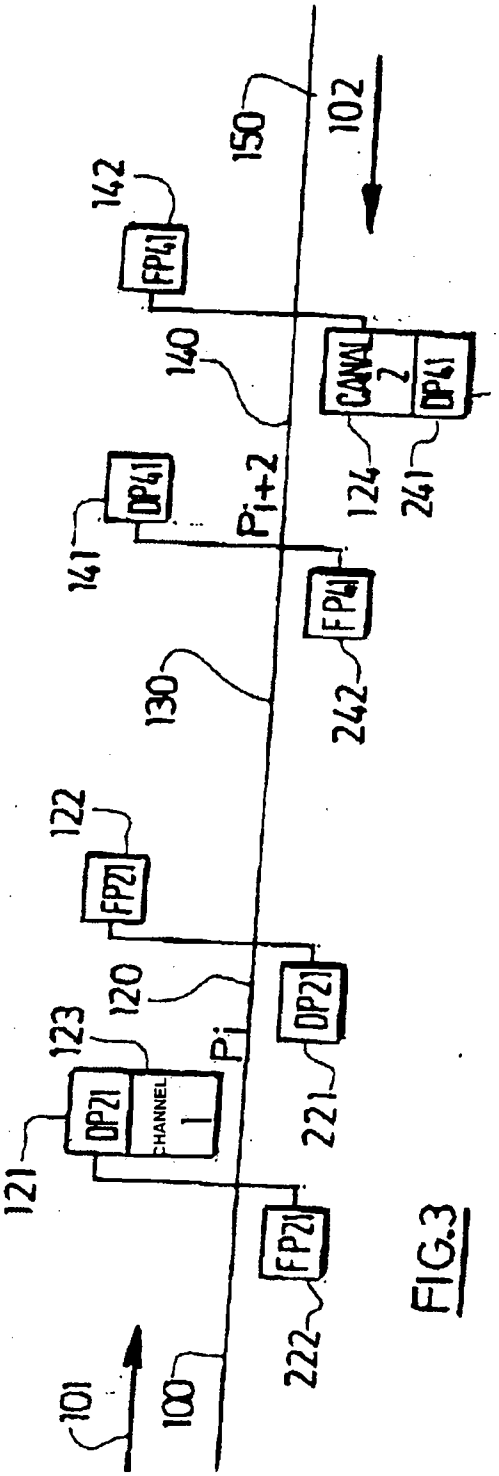
101
100
DP21
CHANNEL 1
121
123
Pi
120
FP21
122
DP21
221
FP21
222
130
DP41
Pi+2
141
FP41
242
140
CANAL 2
DP41
124
241
FP41
142
150
102

FIG.3

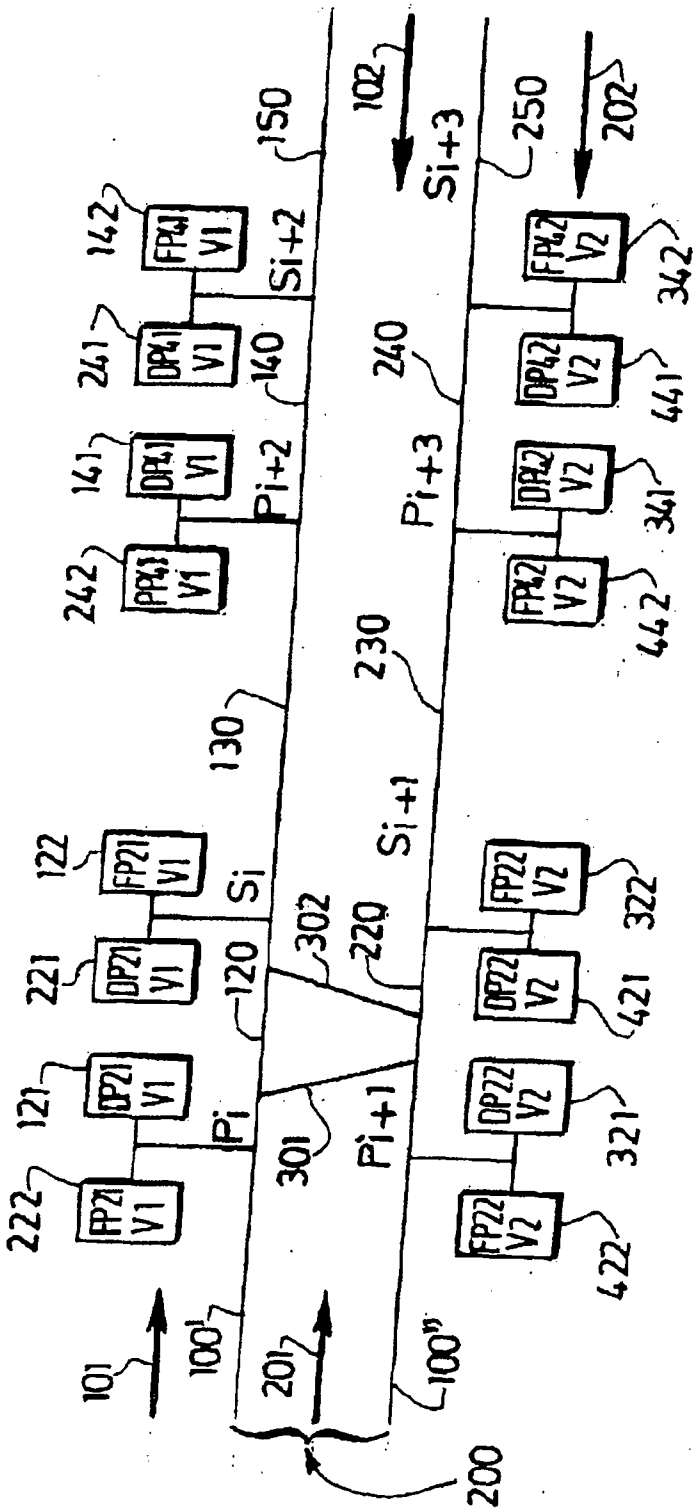
101
100'
201
100''
200
Pi
Pi+1
Pi+2
Pi+3
Si
Si+1
Si+2
Si+3
102
202
150
130
230
250
120
220
140
240
301
302
121
122
141
142
221
222
241
242
321
322
341
342
421
422
441
442
FP21 V1
DP21 V1
FP22 V2
DP22 V2
FP41 V1
DP41 V1
FP42 V2
DP42 V2

FIG.4

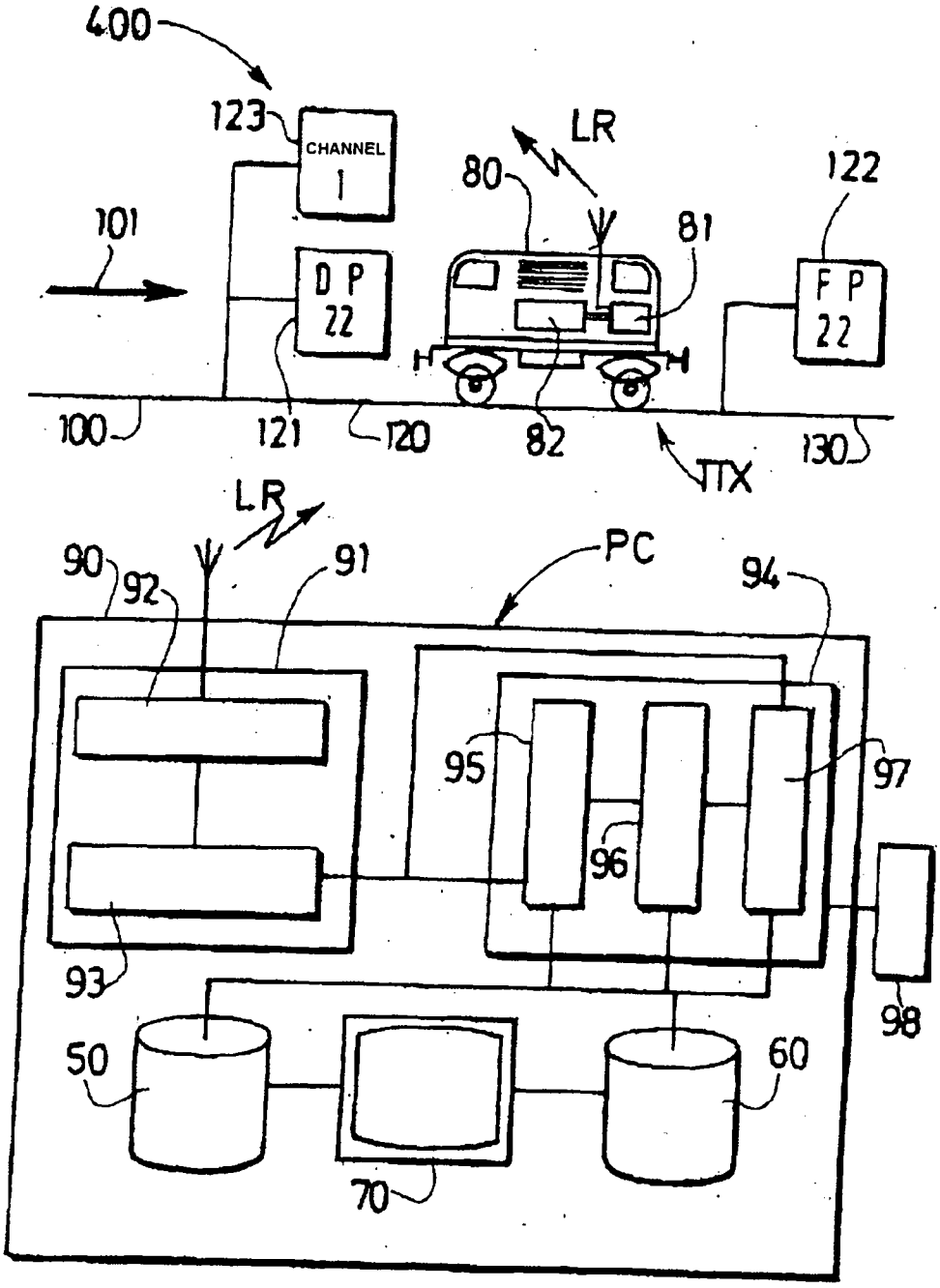
400
123
CHANNEL 1
LR
80
122
101
81
D P 22
F P 22
100
121
120
82
TTX
130
LR
90
92
91
PC
94
95
97
96
93
98
50
60
70

FIG.5

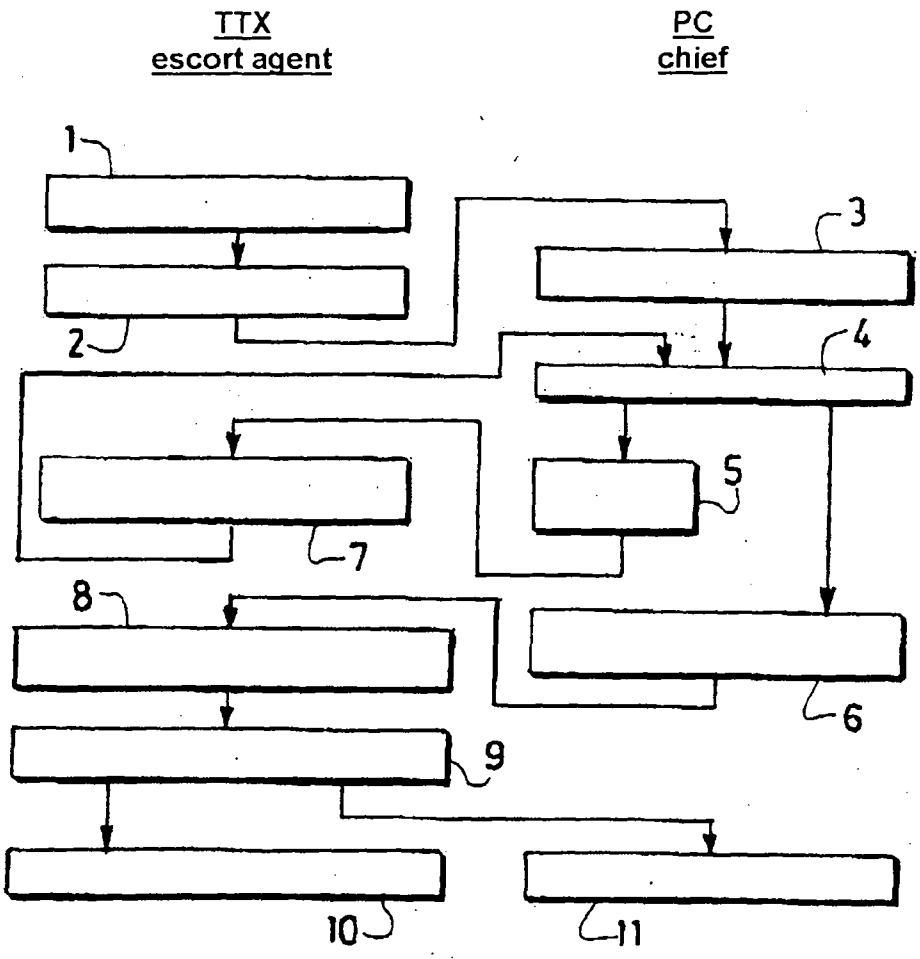

FIG.6

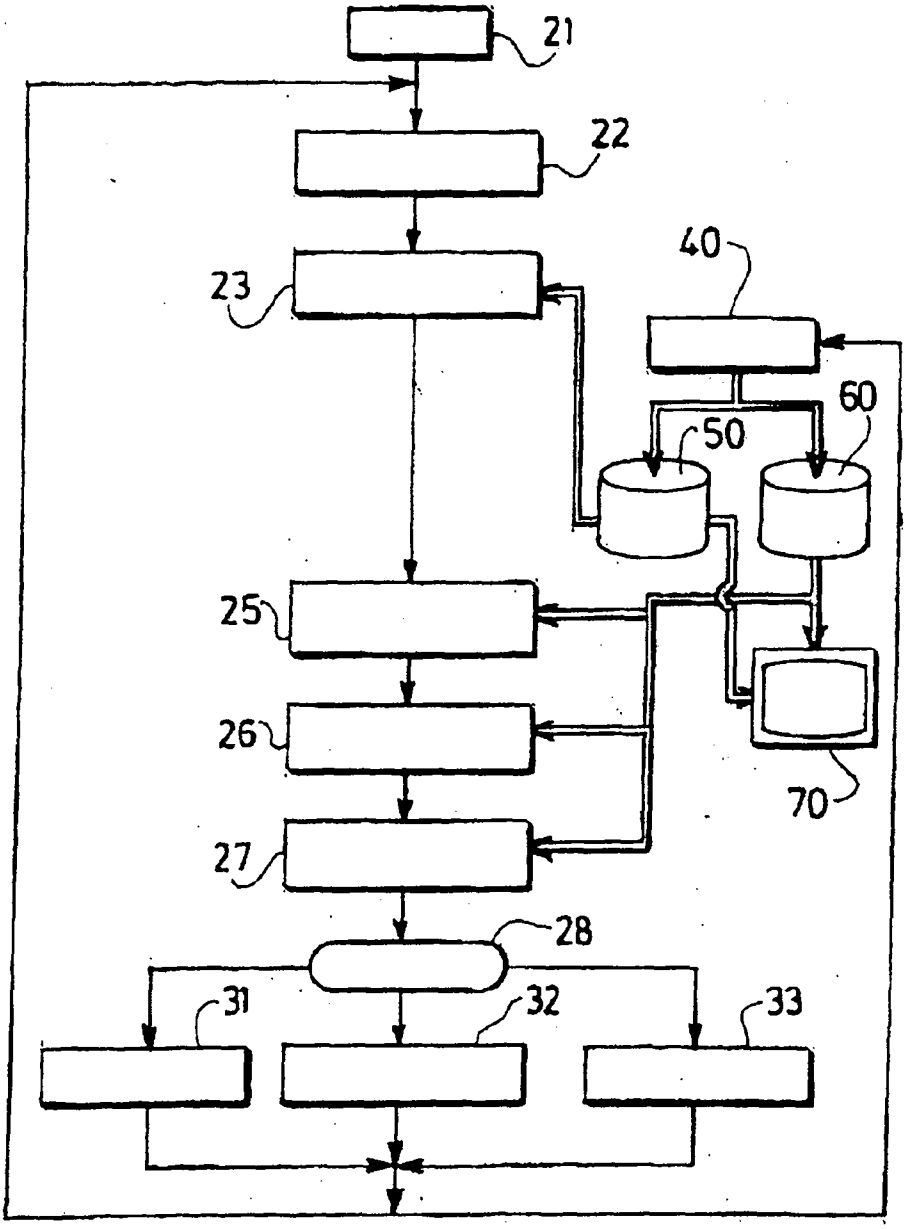

FIG.7

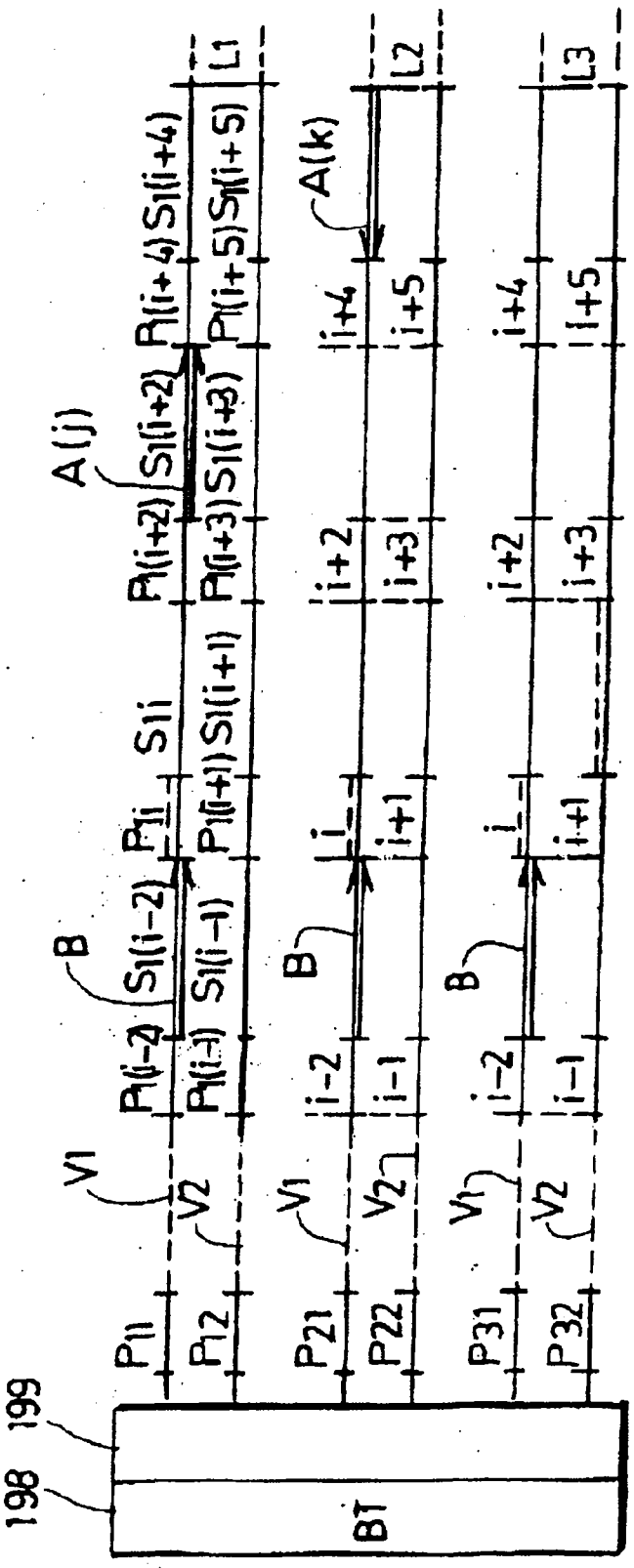
198
199
BT
P11
P12
P21
P22
P31
P32
V1
V2
B
A(j)
A(k)
Pi(i-2)
Pi(i-1)
Pi(i)
Pi(i+1)
Pi(i+2)
Pi(i+3)
Pi(i+4)
Pi(i+5)
Si(i-2)
Si(i-1)
Si i
Si(i+1)
Si(i+2)
Si(i+3)
Si(i+4)
Si(i+5)
i-2
i-1
i
i+1
i+2
i+3
i+4
i+5
L1
L2
L3
CE(I)

FIG.8