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(54) **Integrated device for obstacle detection and travel indication for a motorised gate or the like**

Integrierte Vorrichtung zur Hindernisdetektion und Fahrtanzeige für ein motorisiertes Tor oder dergleichen

Dispositif intégré pour la détection des obstacles et l'indication de mouvement pour système motorisée de portail ou similaire

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Description

[0001] The present finding concerns an integrated device for obstacle detection and travel indication for a motorised gate or the like, with particular reference to sliding and swinging gates, barriers, automatic doors and the like.

[0002] The application of the recent directives of the European Union for the field of automated doors and gates, in particular the machinery directive and its application standard EN 13241-1, forces the manufacturer of motorised doors to install accessories having the purpose of preventing or reducing the effects of bumping into or squashing people, animals or things present in the manoeuvring radius of the moving member. The same standard forces at least one optical device for detecting obstacles to be installed, in many installation conditions. Typically, the detection of obstacles is carried out by applying an electromagnetic beam in the infrared field, between a transmitting unit and a receiving unit, arranged at opposite sides of the opening, the access of which, is controlled by a barrier or by a gate. When the infrared beam intercepts an object, the receiver sends a signal to the control unit, which is translated into a command to stop or reverse the motion of the motorisation unit. In common use, many pairs of photocells are applied installed in various positions on the pillars of the access opening of the gate or door, on their inner or outer side and at variable heights according to the use of the gate.

[0003] Just as common, even if not explicitly required by the European standards, is the installation of indicator light devices, which, synchronised with the movement of the door, warn the user that the opening or closing has begun, with the purpose of visually warning whoever is in the movement area of the gate. In general, such devices consist of yellow-orange semi transparent dome lamps, illuminated with synchronised flashing lights, with variable frequency, in general of the order of one flash per second. The light source consists of a common incandescent bulb or in some cases of LED lights, with a supply and control unit for synchronising the flashing, connected to the control station of the gear motor.

[0004] The documents US2008/094229A1 and US 186168A1 can be cited as belonging to the state of the art. In particular US2008/094229A1 discloses all the features of the preamble of claim 1.

[0005] The purpose of the present finding is combining the obstacle detection function with the indicator function, such that the indicator function is also used for diagnosing the anomalous operation of the detecting device. In particular, the light beam of which is suitably concentrated and directed by an optical deflector towards the area adjacent to the manoeuvring area of the gate. One or more LED lights are used also with a function of diagnosing the anomalous operation of the detecting device, consisting of one or more pairs of infrared photocells. For example, in the case in which the light beam is engaged by an object, the LEDs of the transmitter could be

switched on, whereas the LEDs of the receiver could be switched off, this condition being sufficient to identify the condition of the interruption of the light beam by an obstacle. In a system with many pairs of photocells, applied to the same access opening, it is possible to identify, through the LED indicators, which pair is engaged by an obstacle, or which pair of photocells has an anomalous or faulty operation condition. For example, if there are disturbances with the signal or if there is a misalignment between the transmitter and the receiver, when the gate receives the manoeuvre command, there is no actuation. The asymmetric operation of the LEDs between the receiver and the transmitter, which is essential for this invention, allows the installer and the user to immediately identify which pair of photocells is misaligned, or engaged. In a completely analogous manner, it is also possible to ensure diagnosing operations for a possible fault of the photocell. The indicator LEDs, for example, by varying the indication frequency, can help the installer carry out the correct centring of the pair of photocells during the first installation.

[0006] The present finding shall now be illustrated and described in detail, with reference to a particular embodiment, given as an example and not for limiting purposes, with the help of the attached drawing tables, in which:

- fig. 1 (table I) illustrates a general view of a motorisation system with pairs of photocells arranged in various positions;
- fig. 2 (table II) represents a three dimensional exploded view of one of the two elements of the pair, consisting of the transmitter and the receiver;
- fig.3 (table III) represents a graph of the infrared pulses over time, with synchronised flashing according to the frequency;
- fig. 4 (table IV) represents a graph of the infrared pulses, with synchronisation of the flashing according to the duration of the signal.

[0007] As can be seen in fig. 1, the access opening 1 is closed by a mobile barrier (or gate 2) actuated by the motor 6, through the rack 8, along the tracks 9 between the mechanical end stops 10. The transmitter 3 and receiver 4 elements of the pairs of photocells which, through the infrared signal 5, intercept possible obstacles during the actuation, sending a suitable signal to the control unit of the motor 6, being also supplied by it, are fixed to the side pillars 11 of the access opening and to the columns 7. As can be seen in fig. 1, indicator lights are not represented, since they are integrated in the transmitter and receiver elements 3 or 4 of the photocells, the detail of which is illustrated in fig.2. Fig.2 represents a three dimensional exploded view of one of the elements 3 or 4. The base 21 is fixed to a pillar 11 or to the column 7 with some screws passing through the holes 23 and acts as a support for the printed circuit 18, which rests on the support element 22 and is connected to the control unit of the motor 6 through a cable passing through the

hole 23. The printed circuit 18, represented in a simplified manner, has a photodiode 19 for the detection function, a terminal box 20 for the connection and a group 15 comprising at least one power LED for the flashing indication function. The printed circuit 18 is closed by a lid 14, which has the function of directing the indicator light beam of the LEDs 15 passing in the holes 16 through the deflector 17 and of protecting the photodiode 19 from interferences through the cone 13. The device is also closed by an outer lid 3 fixed by screws passing through the holes 12 and 25 on the tabs 24 of the base 21. All of this is closed in a semi-transparent outer half-shell 26, which allows the infrared beam to pass towards the deviator cone and simultaneously makes the indicator LEDs visible.

[0008] The integration of the indicator system with the device for detecting obstacles provides the user and the installer with the possibility of highlighting possible anomalies and faults of the device through the indicator device. For example, the activation of the flashing indicator device in the receiver 4 is enabled only if it is during the reception of an infrared signal 5. Therefore, if for some reason the activation of the door were to be carried out with the device for detecting obstacles not active, it would be highlighted to the user by the absence of flashing of the receiver, with however the flashing of the transmitter. This logic is particularly useful in the case in which it is wished to connect many pairs of photocells in series, with the purpose of completely checking the manoeuvre area of the door, at different heights so that, in some cases these pairs of detection devices are also applied. In this case the failed operation of a pair of photocells should be verified for each pair of devices, connecting them individually to the control unit. In this way, on the other hand, it is possible to visually identify the operation capability of each single pair, without accessing the device and without disconnecting any cable, but by simply verifying the flashing of the single devices.

[0009] Hereafter we shall illustrate the synchronisation method of the indicator device 15, represented in fig. 3. The graph a) represents the signal 5, obtained by the emission of infrared pulses of the transmitter 3, whereas the graph b) represents the emission of light pulses of the indicator light 15 of the transmitter 3 and of the receiver 4 (indicated respectively with reference numerals 27 and 28). Normally the signal 5 is emitted by the transmitter 3 towards the receiver 4 of the pair of photocells with a fixed frequency (for example, an infrared pulse of the duration of $t = 1\mu\text{s}$, with a periodicity of $\Delta t_0 = 1\text{ms}$). The transmitter 3, at the flashing of its indicator light 15, emits a packet of pulses P with a higher frequency (for example five pulse in 1s, with a period $\Delta t_1 = 20\mu\text{s}$), the receiver 4 once identified the packet of pulses, commands the flashing of its indicator light. The flashing of the transmitter 3 and of the receiver 4 are synchronised with a frequency of $1/\Delta t$, the delay between the first and the second flash being practically negligible.

[0010] A variant of the previous solution, represented in fig. 4, implies the sending of a packet of pulses with a

greater duration of the single pulse, keeping the frequency unvaried: for example, a group of pulses is sent, the single duration of which passes from the value of $t = 10\mu\text{s}$, to $t' = 20\mu\text{s}$. The sending of the packet P occurs with a periodicity indicated in the figure as ΔT (generally of the order of 1 s).

[0011] Each pair of photocells can be associated with a characteristic transmission frequency of the infrared signal, set during installation, by associating, for example, each pair of transmitters 3 and receivers 4 with an address and allowing the receiver 4 to recognise the signal of the transmitter 3 associated with it. In this way, overlapping between the signal of different pairs of photocells, in the case in which installations are carried out on the same detection plane, is avoided.

[0012] List of the reference numerals used:

1. Access opening.
2. Gate or barrier.
3. Transmitter.
4. Receiver.
5. Infrared signal.
6. Motor.
7. Support columns.
8. Rack.
9. Track.
10. Mechanical end-stop.
11. Side pillars.
12. Outer half-shell holes for fixing screws.
13. Deviator cone.
14. Lid.
15. LED indicator.
16. Holes for LED indicators.
17. Deflector.
18. Printed circuit.
19. Photodiode.
20. Terminal box.
21. Base.
22. Support element.
23. Cable hole.
24. Fixing tabs.
25. Inner half-shell holes for fixing screws.
26. Semi-transparent outer half-shell.
27. Emission of indicating pulses of the transmitter.
28. Emission of indicating pulses of the receiver.

Claims

1. Integrated device for obstacle detection and travel indication for a motorized gate or the like, transmitter (3) and one receiver (4) of an infrared signal (5), arranged on the outer sides of the access opening (1) controlled by the gate (2) or the like and signaling to the control unit of the actuator (6) of the gate when said signal is blocked by an obstacle, both said transmitter (3) and receiver (4) comprising a flashing luminous indicator light (15) activated during the open-

ing and closing of the gate for indicating gate travel, wherein the activation of the indicator light (15) of the receiver (4) is controlled by receiving the infrared signal (5) from the transmitter (3) coupled with said receiver (4), so that in case of gate travel with malfunctioning obstacle detection, the indicator light (15) of the transmitter (3) is activated, whereas the indicator light (15) of the receiver (4) is not activated, thereby indicating said malfunctioning of said obstacle detection.

2. Device, according to claim 1, **characterised in that** the light beam (5) emitted by the flashing indicator light (15), is deviated in an outward direction from the access opening by a symmetric optical deflector (17).
3. Device, according to claim 1 or 2, **characterised in that** the operation of the flashing luminous indicator light (15) can be selected with many modes, of which at least one is for indicating the opening and closing manoeuvre of the actuator (6), with a fixed flashing frequency and a variable frequency, according to the alignment of the transmitter (3) and receiver (4) pair of the infrared signal (5).
4. Device, according to one or more of the previous claims, **characterised in that** the flashing of the indicator light of the receiver (4) is synchronised with that of the transmitter (3), by sending a sequence of infrared pulses, with at least two transmission frequencies.
5. Device, according to claim 4, **characterised in that** the synchronisation is carried out by transmitting a sequence of pulses, with at least two different signal durations.

Patentansprüche

1. Integrierte Vorrichtung zur Hinderniserkennung und Verfahrensanzeige für ein motorisiertes Tor oder dergleichen, die mindestens einen Sender (3) und einen Empfänger (4) für ein Infrarotsignal (5) umfasst, die auf den Außenseiten der von dem Tor (2) oder dergleichen kontrollierten Zugangsöffnung (1) angeordnet sind und der Steuereinheit des Aktuators (6) des Tors melden, wenn dieses Signal durch ein Hindernis gesperrt wird, wobei sowohl der Sender (3) als auch der Empfänger (4) einen Blinkleuchtmelder (15) umfassen, der während des Öffnens und Schließens des Tors aktiviert wird, um auf das Verfahren des Tors hinzuweisen, wobei die Aktivierung des Leuchtmelders (15) des Empfängers (4) durch den Empfang des Infrarotsignals (5) von dem mit diesem Empfänger (4) gekoppelten Sender (3) gesteuert wird, so dass im Falle des Verfahrens des Tors mit

versagender Hinderniserkennung der Leuchtmelder (15) des Senders (3) aktiviert wird, während der Leuchtmelder (15) des Empfängers (4) nicht aktiviert wird, wodurch das Versagen der Hinderniserkennung angezeigt wird.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der vom Blinkleuchtmelder (15) emittierte Lichtstrahl (5) von einem symmetrischen optischen Deflektor (17) in eine Richtung nach außerhalb der Zugangsöffnung abgelenkt wird.
3. Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Betrieb des Blinkleuchtmelders (15) mit vielerlei Modi werden kann, von denen mindestens einer zur Anzeige des Öffnungs- und Schließvorgangs des Aktuators (6) mit einer festen Blinkfrequenz und einer variablen Frequenz entsprechend der Fluchtung des Paares aus Sender (3) und Empfänger (4) für das Infrarotsignal (5) dient.
4. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Blinken des Leuchtmelders des Empfängers (4) mit dem des Senders (3) synchronisiert wird, indem eine Folge von Infrarotimpulsen mit mindestens zwei Übertragungsfrequenzen gesendet wird.
5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** die Synchronisation durch Übertragen einer Impulsfolge mit mindestens zwei verschiedenen Signaldauern erfolgt.

Revendications

1. Dispositif intégré pour la détection d'obstacles et l'indication de déplacement pour une porte motorisée ou similaire, comprenant au moins un émetteur (3) et un récepteur (4) d'un signal infrarouge (5), agencés sur les côtés externes d'une ouverture d'accès (1) contrôlée par la porte (2) ou similaire, l'émetteur et le récepteur étant montés séparés de manière opposée et signalant à l'unité de commande de l'actionneur (6) de la porte quand ledit signal est bloqué par un obstacle, lesdits émetteur (3) et récepteur (4) comprenant tous les deux un voyant lumineux clignotant (15) activé durant l'ouverture et la fermeture de la porte pour indiquer le déplacement de la porte, dans lequel l'activation du voyant lumineux (15) du récepteur (4) est commandée par la réception du signal infrarouge (5) provenant de l'émetteur (3) couplé avec ledit récepteur (4), de manière que, en cas de déplacement de la porte avec détection d'obstacle défectueuse, le voyant lumineux (15) de l'émetteur (3) soit activé, alors que le voyant lumineux (15) du récepteur (4) n'est pas activé, en indiquant ainsi ledit fonctionnement défectueux de ladite détection

d'obstacles.

2. Dispositif selon la revendication 1, **caractérisé en ce que** le faisceau lumineux (5) émis par le voyant lumineux clignotant (15) est dévié dans une direction extérieure à partir de l'ouverture d'accès par un déflecteur optique symétrique (17). 5

3. Dispositif selon la revendication 1 ou 2, **caractérisé en ce que** le fonctionnement du voyant lumineux clignotant (15) peut être sélectionné avec de nombreux modes, parmi lesquels au moins un est pour indiquer la manoeuvre d'ouverture et de fermeture de l'actionneur (6), avec une fréquence de clignotement fixe et une fréquence variable, en fonction de l'alignement de la paire d'émetteur (3) et de récepteur (4) du signal infrarouge (5). 10 15

4. Dispositif selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** le clignotement du voyant lumineux du récepteur (4) est synchronisé avec celui de l'émetteur (3), en transmettant une séquence d'impulsions infrarouges, avec au moins deux fréquences de transmission. 20 25

5. Dispositif selon la revendication 4, **caractérisé en ce que** la synchronisation est effectuée en transmettant une séquence d'impulsions, avec au moins deux durées de signalisation différentes. 30

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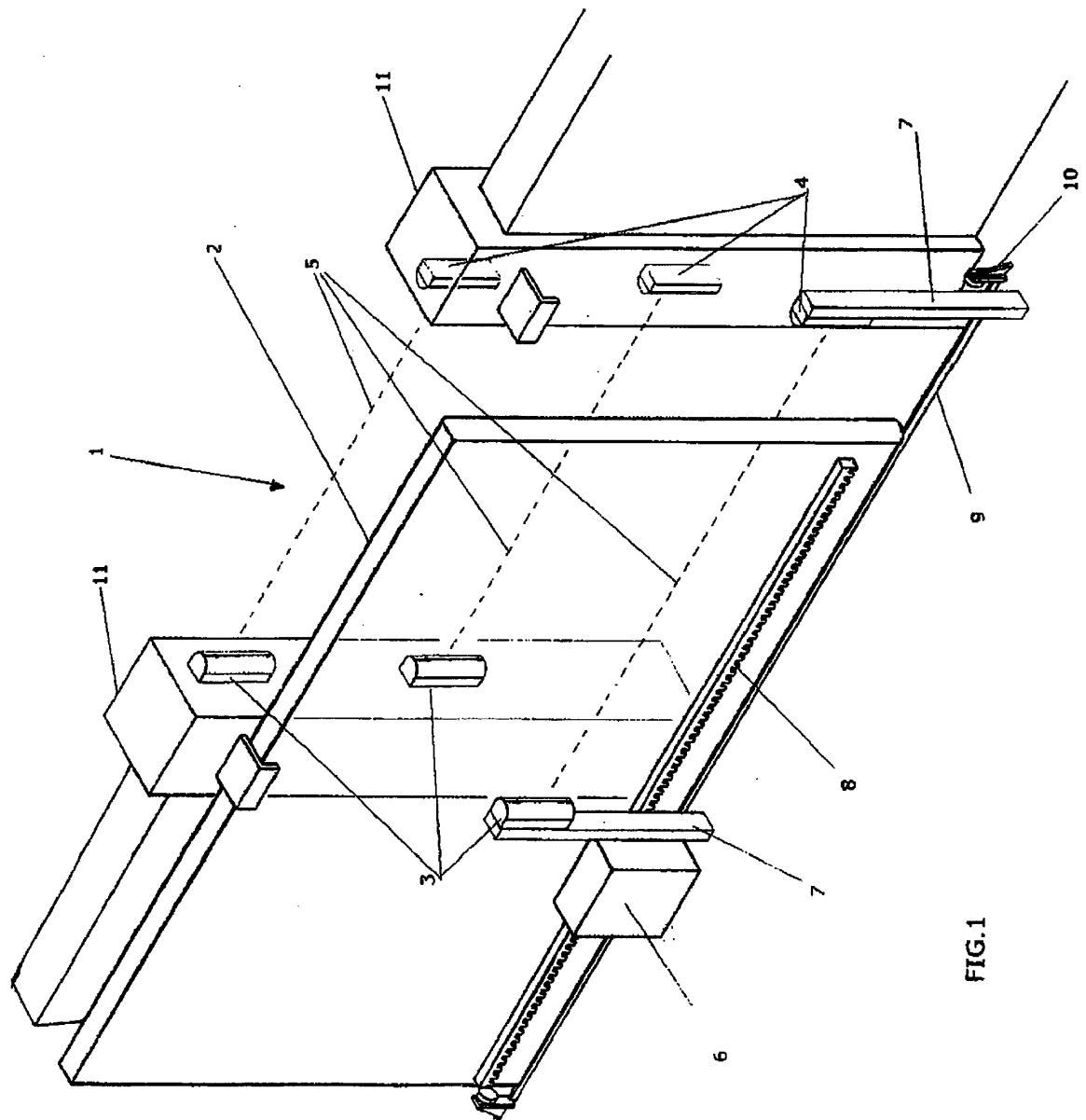


FIG.1

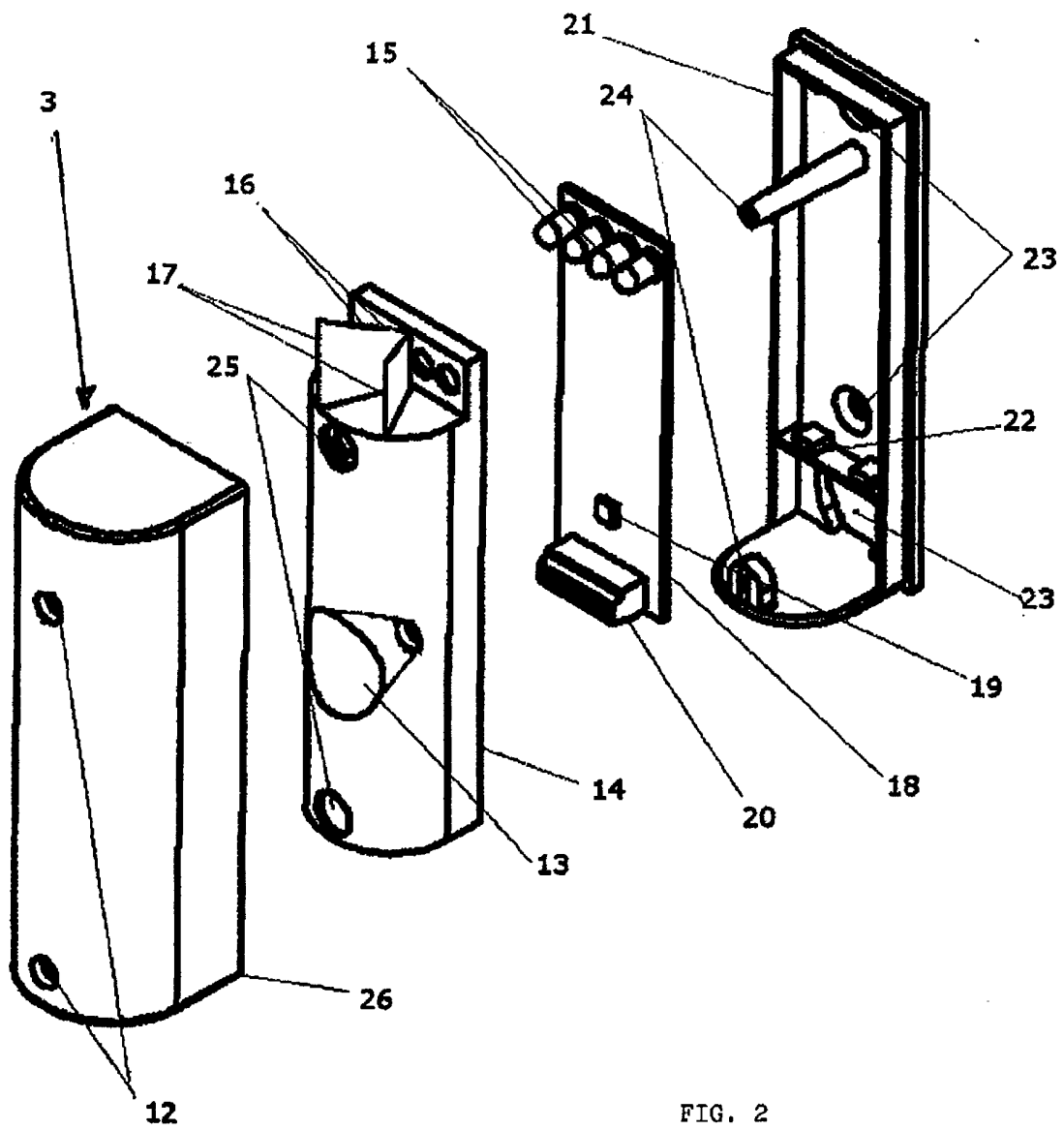


FIG. 2

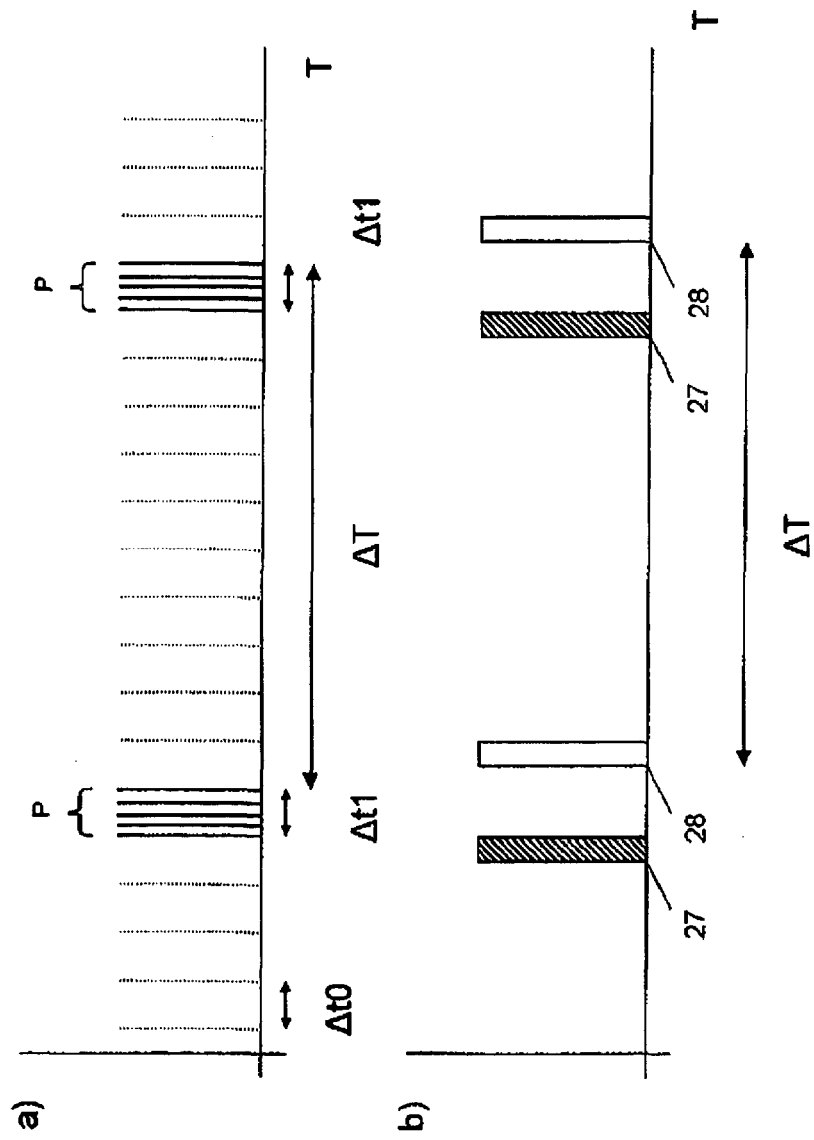


FIG. 3

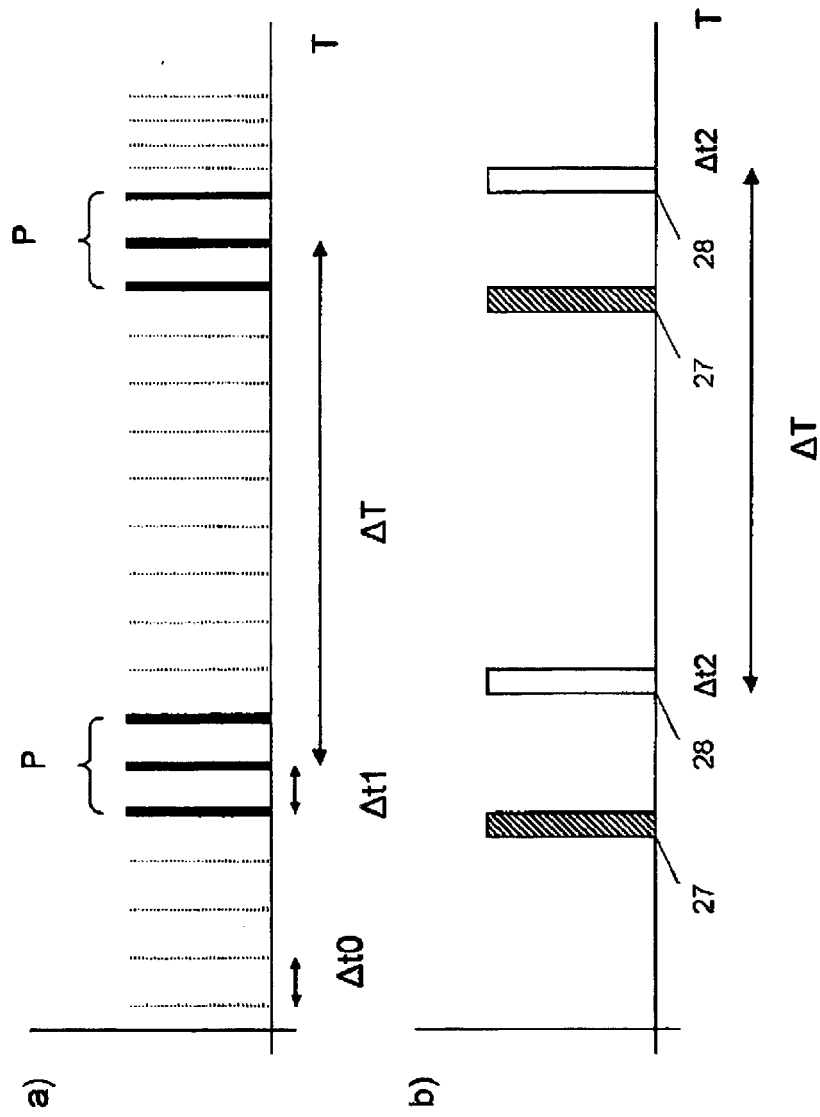


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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