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

(57) The finding concerns an integrated device for the detection and indication of obstacles for a motorised system of gates and the like, which comprises at least one transmitter (3) and a 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 indicating to the control unit of the actuator (6) of the gate when said signal is blocked by an obstacle; said transmitter (3) and receiver (4) comprise at least one flashing luminous indicator light, activated during the opening and closing steps. Such a device is **characterised in that** the activation of the indicator light of the receiver element (4) is controlled by receiving the infrared signal from the transmitter (3) coupled with it (fig.1).

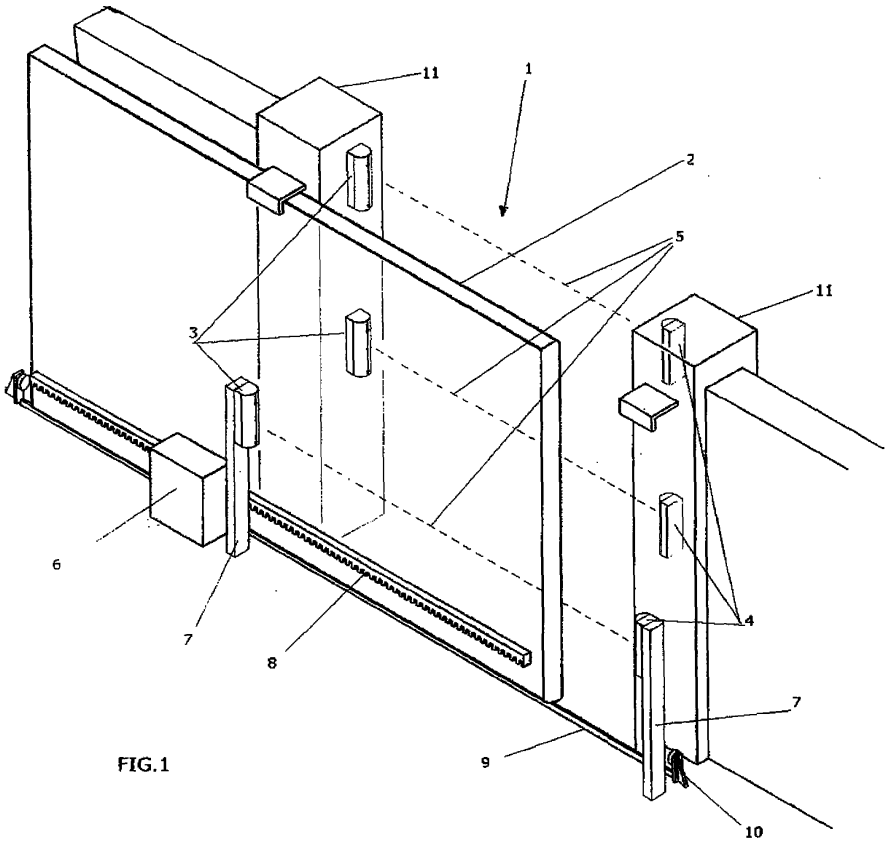

FIG.1

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Description

[0001] The present finding concerns an integrated device for the detection and indication of obstacles for a motorised system of gates, 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] In general, the light indicator device is a dedicated device and it is installed separately with respect to the other elements of the system. In some cases it integrates the radio antenna of the radio-frequency receiver of the unit. Its location on the installation site must be such as to make it at least visible from outside the access opening, generally positioned above and on one side of the system. The installation of a flashing light almost always requires the arrangement of channels for cabling the supply cables. In the current state of the art, some examples of integration of the light indicator device with other elements of the system are known. For example, in vehicle barriers, the indicator device (hereafter indicated also as flashing light) is integrated in various ways in the box, which is also the seat of the gear motor, through a dome lamp formed on the upper part thereof. In other cases the flashing lights are directly integrated in the mobile shaft of the vehicle barrier so as to make the moving part more visible.

[0005] It should thus be clear that the integration of the indicator system in the operator box or in the shaft makes the installation easier for the operator, eliminating additional cabling operations, since it is already provided by the manufacturer of the automation directly at the factory, or it can be provided in a kit as a dedicated accessory.

[0006] No less important is the integration of the flashing light respecting the look of the object. In the case of gates or automatic doors, the motorisation of which is obtained subsequently, in the current state of the art integrated flashing lights are not known.

[0007] The purpose of the present finding is that of making a light indicator device (or flashing light) integrated with the safety elements of the system, to satisfy the need to make the aforementioned installation easier, ensuring that the indicator light is visible and eliminating the drawbacks of the solutions known in the current state of the art. In particular the solution, according to the finding, proposes to permanently eliminate the need of cables and of accessories dedicated to the light indicator device, combining the obstacle detection function with the indicator function, without however limiting the visibility of the apparatus. The integration eliminates the need of making an additional cable: the manufacturer provides a single device, integrating both the indicator and detection functions supplied by a single source. The light source consists of one or more power LEDs, 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.

[0008] One or more LED lights can be 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 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 installa-

tion.

[0009] 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 1) 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.

[0010] 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.

[0011] The integration of the indicator system with the device for detecting obstacles provides the user and the installer with a series of advantages. First of all, there is the ease of installation and the simplification of the cabling carried out on site, but of no less importance is the possibility of integrating the indicator function with the obstacle detection function, 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.

[0012] A variant of this solution consists of a further integration of the transmitter element 3 and of the receiver 4 into a single unit, being the infrared beam reflected by a polarising mirror placed in the point in which the receiver 4 was previously positioned. This solution is known in the state of the art as a reflection photocell, whereas what is not known is the integration with a flashing indicator element, which also in this case can provide the function of indicating the manoeuvre and, in the case in which there are faults, the function of diagnosing the correct operation. In this case, the failed alignment between the transmitter/receiver element and the polarising reflector mirror, or the fault of the control circuit, indicates which of the devices, in an assembly of many reflection photocells connected in series, generates the fault or the failed alignment, to the user.

[0013] 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 $t = 1\mu s$, with a periodicity of $\Delta t0 = 1ms$). 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 Is, with a period $\Delta t1 = 20\mu s$), 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.

[0014] 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 =10μs , to t'=20μs. The sending of the packet P occurs with a periodicity indicated in the figure as ΔT (generally of the order of 1 s).

[0015] 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.

[0016] 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 THE DETECTION AND INDICATION OF OBSTACLES FOR A MOTORISED SYSTEM OF GATES AND THE LIKE, comprising at least one transmitter (3) and a 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 indicating to the control unit of the actuator (6) of the gate when said signal is blocked by an obstacle, comprising said transmitter (3) and receiver (4) at least one flashing luminous indicator light (15) activated during the opening and closing steps, the device being **characterised in that** the activation of the indicator light of the receiver element (19) is controlled by receiving the infrared signal (5) from the transmitter (3) coupled with it.

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 transmitter (3) and receiver (4) elements are integrated in a single unit and the infrared signal (5) is reflected by a polarising mirror arranged on the opposite side of the access opening.

5. DEVICE, according to one or more of the previous claims, **characterised in that** the flashing of the indicator light of the receiver element (19) is synchronised with that of the transmitter element (3), by sending a sequence of infrared pulses, with at least two transmission frequencies.

6. DEVICE, according to claim 5, **characterised in that** the synchronisation is carried out by transmitting a sequence of pulses, with at least two different signal durations.

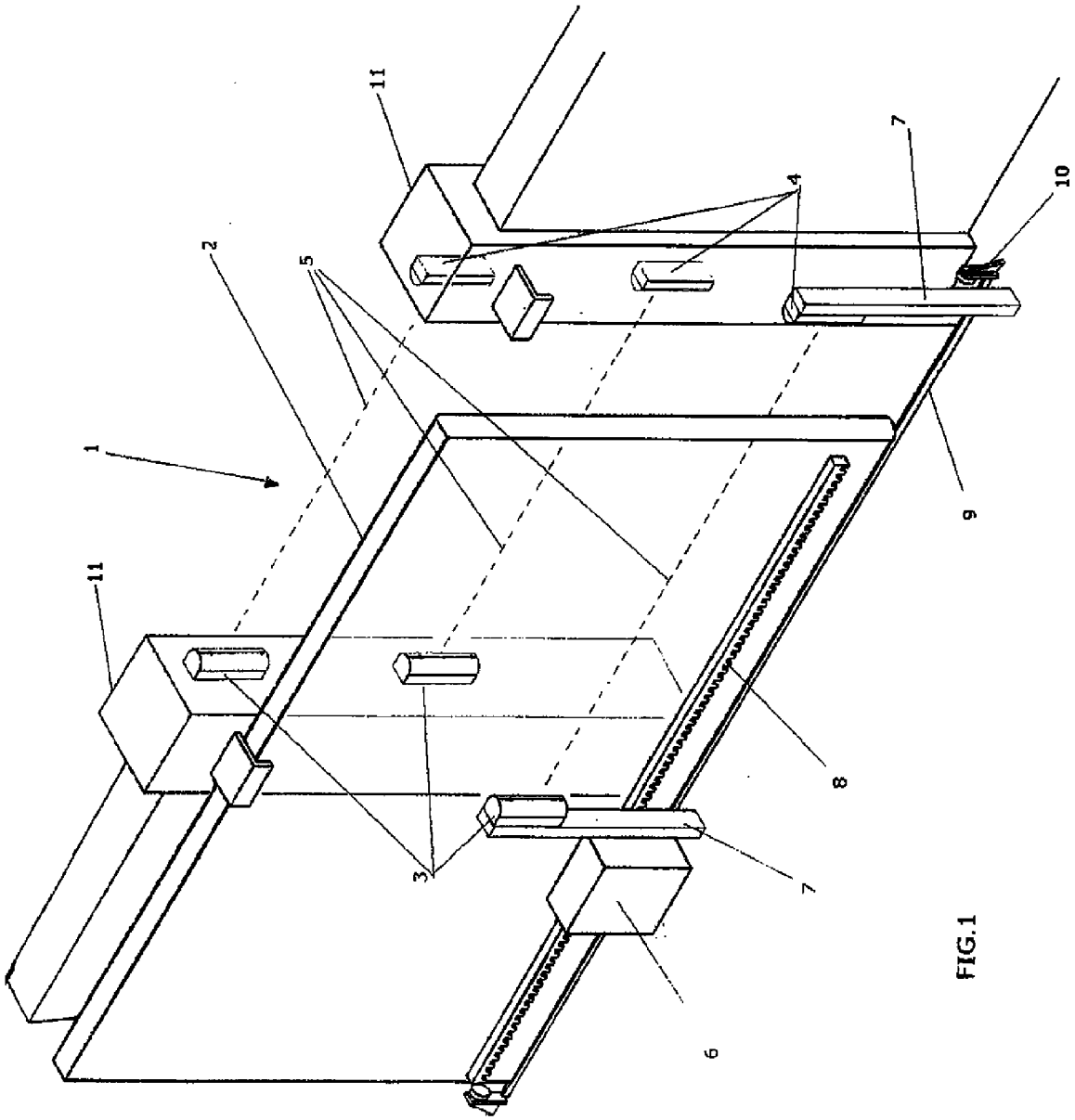

FIG.1

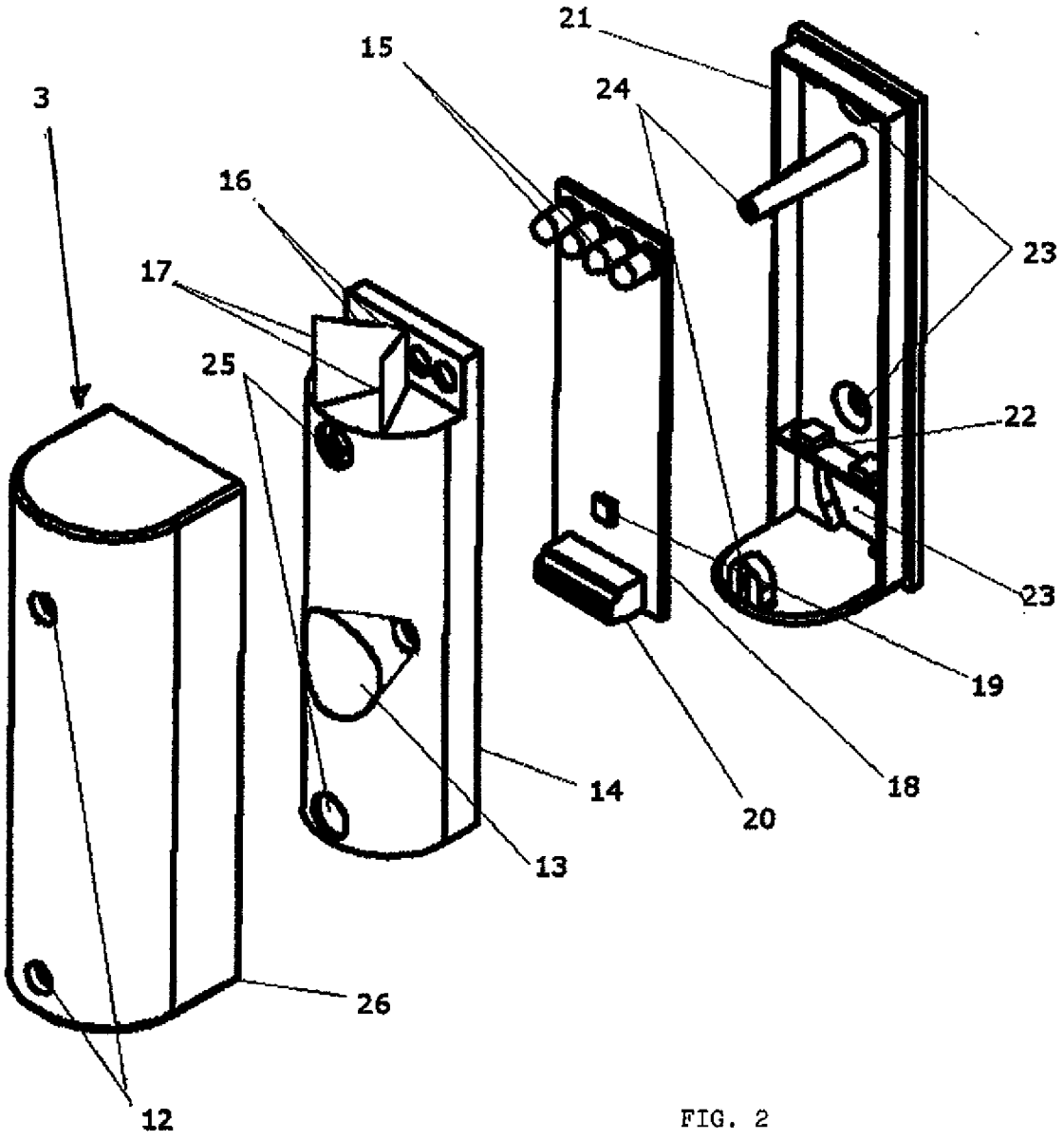

FIG. 2

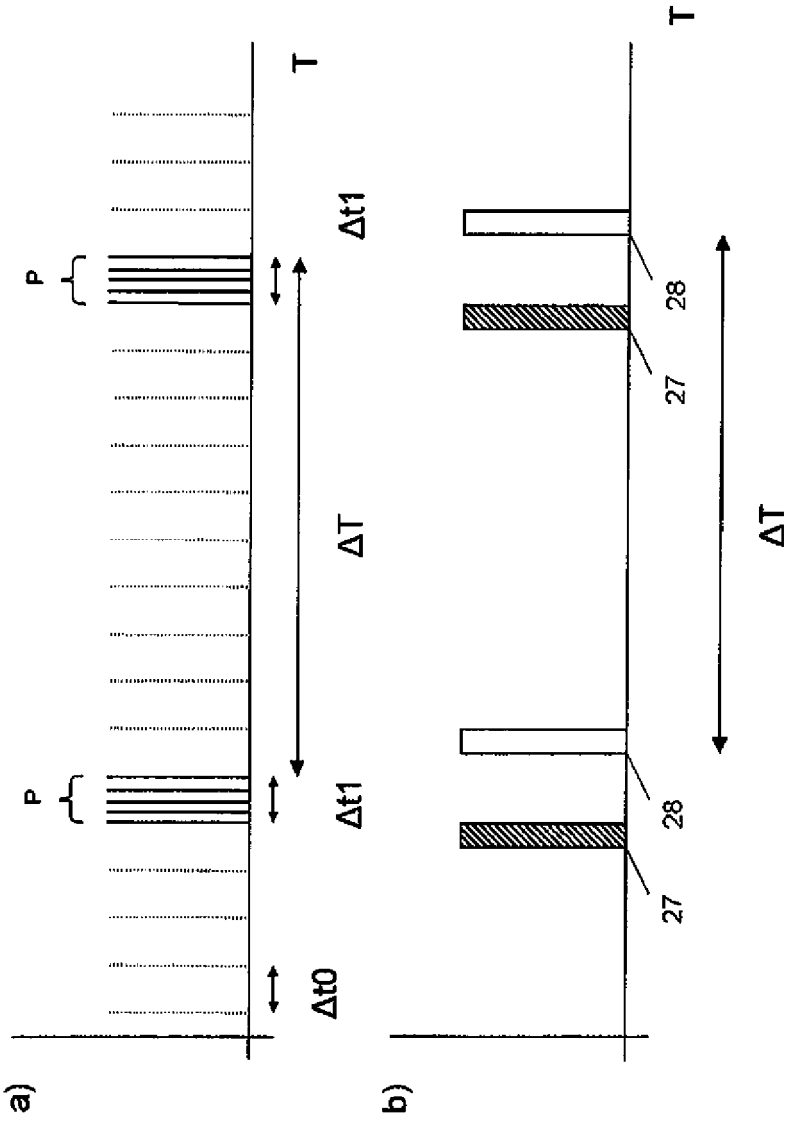

FIG. 3

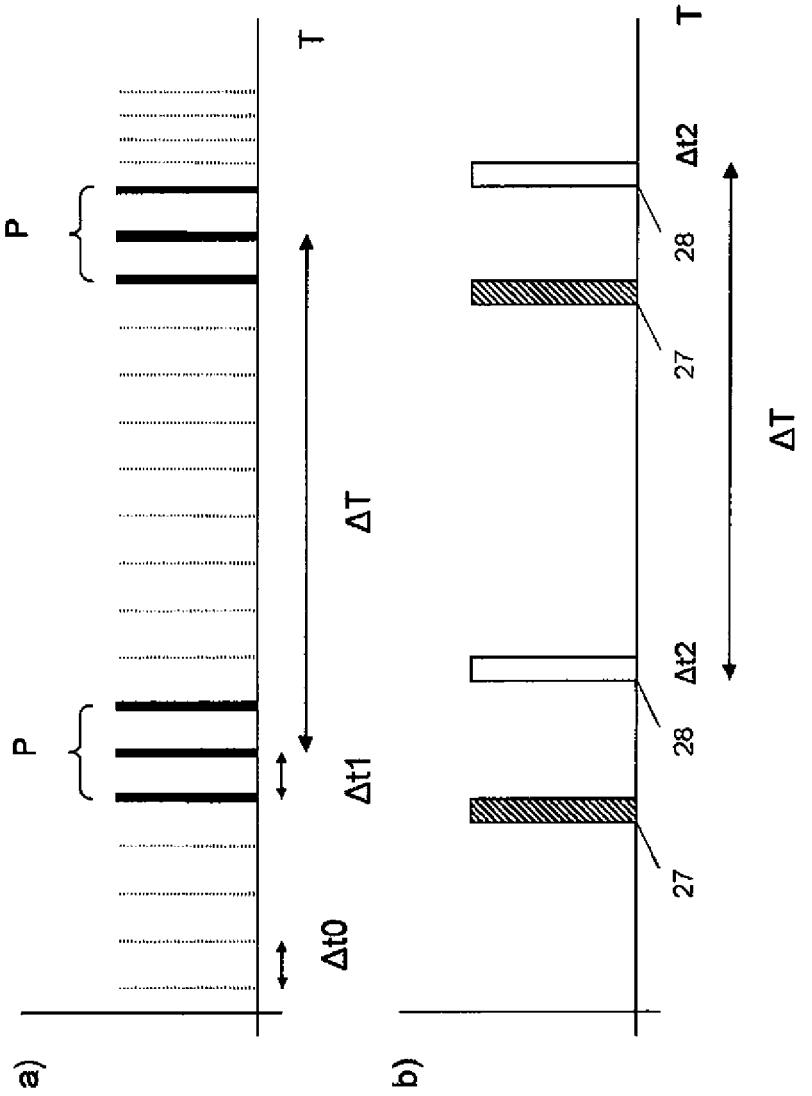

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 1955

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2008/094229 A1 (MARCHETTO OSCAR [IT] ET AL) 24 April 2008 (2008-04-24) * paragraphs [0004], [0023], [0024], [0029] * * figures * -----	1	INV. E05F15/00 E05F15/14
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TECHNICAL FIELDS SEARCHED (IPC)

E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 August 2010	Van Kessel, Jeroen

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 16 1955

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12-08-2010

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