Oversættelse af europæisk patenterkraft

Patent- og Varemærkestyrelsen

Int.Cl.: G 02 B 6/44 (2006.01) G 08 B 13/08 (2006.01) H 01 H 13/18 (2006.01)

Oversættelsen bekendtgjort den: 2015-02-16

Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: 2014-11-12

Europæisk ansøgning nr.: 12003902.9

Europæisk indleveringsdag: 2012-05-18

Den europæiske ansøgningens publiceringsdag: 2012-12-12

Prioritet: 2011-06-10 DE 102011103935

Designerede stater: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

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Benævnelse: Overvågningssystem til glasfiber-netfordeler

Fremdragne publikationer:
CN-C- 100 381 845
GB-A- 2 431 919
JP-A- 8 054 551
The invention relates to a monitoring system for the closure state of the door or the cover of a housing for a glass fibre network distributor in accordance with the preamble of Claim 1.

The glass fibre network distributor can be a cabinet, which is positioned above the ground and is provided with a door or an underground shaft, which is accessible by way of a shaft cover. Located in the glass fibre network distributor are only glass fibre cables, which are spliced within the network distributor and then extend to the individual consumers, i.e. buildings. No copper cables, through which current may be supplied, are typically provided in the glass fibre network distributors. Highly porous glass fibre cables are routed from a central office into the network distributor and there split and routed, via e.g. micropipes, to individual buildings. These glass fibre cables serve to transmit telecommunication signals.

It is important with such glass fibre network distributors constantly to be able to check whether their door or shaft cover is properly closed or has been opened by unauthorised persons, for instance as a result of vandalism. In this event, an alarm of the network distributor must be transmitted without delay to a central monitoring system.

JP 200 1 296 111 A discloses an optical cable laid in the street with associated cable shafts, wherein the covers of these cable shafts are secured with the aid of an optical monitoring device. A number of optical cables are arranged in parallel, whereby one of these cables is connected to the central monitoring system and to the sensor units. The monitoring system includes a central control, measuring and monitoring unit, which is separated from the cable shafts and which includes means for transmitting and receiving light pulses through the optical cable and analysing them, and a tensioning device arranged in each shaft in the form of a metallic spring and an actuating element, which engages the cover of the cable shaft in order to detect its closure state. When the cover is closed, the tensioning device is spaced from the optical cable and when the cover is open it presses laterally against the optical cable so that it is curved.
This has the result that the light pulses transmitted through the optical cable are sent back modified in dependence on their forced curvature.

Chinese Patent Application 100 381 845 C discloses a monitoring unit, in which an elastic ring constitutes the tensioning device, to which two strands of the optical cable are secured at diametrically opposed positions. The elastic ring is compressed laterally to form an ellipse in dependence on the closure state of a door, whereby the optical cable is caused to curve.

It is the object of the present invention to provide a monitoring system for the closure state of the door or the lid of a housing or shaft of a glass fibre network distributor without electric power (which is not available) being used as an energy source.

This object is solved in accordance with the invention by the features of Claim 1.

Advantageous embodiments of the invention are characterised in the dependent claims.

The invention provides that a control, measurement and monitoring unit, which is spatially separated from the housing of the glass fibre network distributor, is connected by means of a glass fibre guide or cable, which is not used for telecommunication, to a tensioning device, which is accommodated in the housing of the glass fibre network distributor or in the shaft. The invention makes use of the fact that a glass fibre guide can be provided with a grid or similar optically acting marking, preferably by a laser, and that light pulses transmitted through the glass fibre guide are sent back in altered form when the glass fibre guide is stretched by the application of a force.

In order to make use of this effect, the tensioning device is provided in the housing of the glass fibre network distributor with means which stretch the glass
fibre guide or relieve it, i.e. release it, depending on whether the door or the cover of the housing is open or closed.

The central control, measurement and monitoring unit has means for transmitting light pulses through the glass fibre guide arranged for the monitoring system and for receiving the returning light pulses and for analysing them, for which purpose the control, measurement and monitoring unit is provided with a computer.

The construction is preferably such that the glass fibre guide is untensioned, i.e. not stretched, when the door is closed or the cover is closed. If the door/cover is opened, the glass fibre guide is tensioned and thus stretched, which is detected by the alteration of the returning light pulses.

An opened door or cover does, however, not necessarily mean that the housing has been opened by an unauthorised person. A technician who has to perform work in the glass fibre network distributor could basically inform the control centre, e.g. by means of a mobile telephone, in order to prevent a false alarm. However, since such a procedure does not function reliably, it is further proposed with great advantage that an optical key associated with the technician is connectable to the glass fibre guide, which includes means to send associated light pulses through the glass fibre guide to the control, measurement and monitoring unit, which in this manner checks the authorisation for opening the door or the cover. Only when the control centre receives light pulses indicating the open state of the door or the cover without associated light pulses from the optical key of a technician is it certain for the control centre that damage which is immediately to be rectified has occurred. In this event the computer issues an alarm signal.

The control, measurement and monitoring unit can monitor a relatively large number, for instance 40 to 50, of glass fibre cables and thus glass fibre network distributors. The light pulses in the glass fibre cables are naturally different in
order that the returning wavelengths can be associated with the respective network distributors.

The invention further provides that the tensioning unit includes a housing, in which a fastening element for the glass fibre guides is located, which preferably serves as a seat for a compression spring, which bears at its other end against the housing. When the fastening element is released, it is acted on by the compression spring so that the glass fibre guide is tensioned and thus stretched.

Also arranged in the housing is a pivotal lever, which is pressed by the actuating element of the tensioning device, when the door or cover is closed, against the fastening element such that the spring is compressed and the glass fibre guide is thus relieved or not stretched. The lever preferably has an approximately right-angled shape, whereby the lower lever arm, in the installed position, can press against the fastening element whilst the other arm inclined to it terminates in a fork. In accordance with a further proposal, engaging in this fork is the offset end section of a rod, which is connected to a push button slidably mounted laterally on the housing, i.e. arranged approximately at right angles to the glass fibre guide. This push button is pre-stressed in an associated housing portion by a compression spring so that it moves out of the housing away from the lever - when it is not prevented from doing so by an impediment. This impediment is the door or the cover, in whose vicinity the push button (and thus the entire housing) is positioned.

Accordingly, when the door (or the cover) is closed, the push button is forced back into its housing portion, whereby the rod connected to it pivots the lever so that it forces the fastening element for the glass fibre guide back against the force of the engaging compression spring so that the glass fibre guide is not stretched (or only slightly stretched). If the door (cover) is, on the other hand, open, the push button is released and thus pulls the lever back from the fastening element of the glass fibre guide so that it is moved a little by the force of its spring and thus stresses and stretches the glass fibre guide.
It is further proposed that an optical interface for the optical key is arranged outside the housing tensioning device so that the optical key can send its associated light pulses to the control centre either, as is preferred, via the glass fibre guide extending further to the interface or via an additional glass fibre guide.

The monitoring system in accordance with the invention thus indicates reliably when the door or the cover of a network distributor is open and, in the particularly preferred embodiment, with the optical key, also gives information about whether the opening was authorised or unauthorised.

One embodiment of the tensioning device in accordance with the invention will be described below in more detail with reference to the drawings, in which:

Figure 1 shows the tensioning device when the door or cover is closed;

Figure 2 shows the tensioning device when the door or cover is open and

Figure 3 shows the tensioning device in the state illustrated in Figure 2 with the optical key attached.

Figures 1 to 3 show purely schematically an embodiment of a tensioning device for a glass fibre guide 1, which is introduced into a hollow tube 2 with a connecting piece 3 into the housing 4 of the tensioning device 5. Firmly attached to the glass fibre guide 1 within the housing 4 is a fastening element 6, which acts as a spring seat for a helical compression spring 7, which bears at the other end against an inner wall of the housing 4. This spring 7 pre-tensions the fastening element 6 and thus the glass fibre guide 1 upwardly in the views shown in the figures.

Situated in a lateral housing portion 8 there is a push button 9, which, in the view of Figure 1, is pressed into the housing 8 by a door, which is not illustrated, of the housing of a glass fibre network distributor against the force of a helical
spring 10, which bears against the flange 11 on the push button 9 and against
an opposed spring seat 12.

The spring 10 biases the push button 9 towards the outer surface of the housing
portion 8.

Connected to the push button 9 is a rod 13, the end portion 14 of which is ang-
led and engages in a fork-shaped section 15 of a substantially right-angled lever
16. The lever 16 is pivotal about a central pivot 17 and has an arm 18 in-
clined at about 90°, within the pivotal range of which the fastening element 6 is
situated. When the push button 9 is pressed inwardly and held by the door (or
lid), which is not shown, the arm 18 of the lever 16, which has been rotated in
the clockwise direction presses against the fastening element 6, whereby this is
pushed a little downwardly against the force of the spring 7 so that the glass
fibre guide 1 is unstressed and thus not stretched.

Figure 2 shows the state of the tensioning device when the door or cover is
open, whereby the push button 9 moves out of the housing portion 8 under
spring force until the flange 11 on the push button 9 engages the housing wall.
The rod 13 is also pulled to the left so that the angled end section 14 pivots the
lever 16 away from the fastening element 6. The fastening element with the
glass fibre guide 1 attached to it is thus pushed upwardly, whereby the glass
fibre guide 1 is tensioned and thus stretched.

The glass fibre guide 1 extends further from the fastening element 6 through the
upper wall 19 of the housing 4 and is connected on the outer side of the hou-
sing 4 to an optical interface 20. The optical interface 20 is suitable for the at-
tachment of an optical key 21, which can send associated light pulses through
the glass fibre guide 1.

It lies within the scope of the invention that the mechanical tensioning device
can be so constructed that the glass fibre guide is stretched, when the door is
closed, and unstretched or less stretched, when the door is open.
Patentkrav

1. Overvågningssystem til lukketilstanden for døren eller låget på en glasfiber-netfordelers hus,
5 indeholdende
en central styre-, måle- og overvågningsenhed, som er rumligt adskilt fra glasfiber-netfordelerens hus, og som har midler til udsendingen og modtagelsen af lysimpulser og disse uddyttelse,
en i huset anbragt spændeindretning (5),
10 og en glasfiber-leder (1), som ikke uddytes til telekommunikationen, og som er forbundet med styre- og overvågningsenheden og spændeindretningen (5),
hvorved spændeindretningen (5) har et aktiveringsled (9), som registrerer dørens eller lågets lukketilstand, og hvorved glasfiber-lederen (1) er forsynet med et tilhørende gitter,
ved hjælp af hvilket de lysimpulser, som udsendes fra styre-, måle- og overvågningsenheden ved hjælp af glasfiber-lederen (1), sendes modificeret tilbage i afhængighed af dets udstærknning,

ekendetegnet ved,
at spændeindretningen (5) omfatter et hus (4), hvori der er anbragt et fastgørelseselement (6) til glasfiber-lederen (1), og som er forspændt af en fjeder (7) med henblik på at udstrække glasfiber-lederen (1) i aksial retning, og
at der i huset (4) endvidere er anbragt en svingbar vægtstang (16), som trykkes således imod fastgørelseselementet (6) ved hjælp af aktiveringsleddet (9) ved lukket dør eller dæksel, at fjeren (7) komprimeres og glasfiber-lederen (1) af
lastes.
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2. Overvågningssystem ifølge krav 1,

ekendetegnet ved,
at endvidere en optisk nøgle (21) er indrettet til at kunne forbindes med glasfiber-lederen (1) med henblik på at erkende tilhørende lysimpulser fra styre-, måle- og overvågningsenheden, og som dermed afprøver adgangen til at åbne døren eller låget.
3. Overvågningssystem ifølge krav 1,

kendetegnet ved,

at aktiveringsleddet (9) er en tryknap, som trykkes tilbage imod en fjeders (10) kraft ved hjælp af den lukkede dør eller det lukkede låg og trykker vægtstangen (16) imod aktiveringselementet (6) med en stang (13, 14).

4. Overvågningssystem ifølge et af kravene 1 til 3,

kendetegnet ved,

at der uden for huset til den optiske nøgle (21) er anbragt et optisk interface (20), som via glasfiber-lederen (1) eller en yderligere glasfiber-leder er indrettet til at kunne forbindes med styre-, måle- og overvågningsenheden.

5. Overvågningssystem ifølge et af kravene 1 til 4,

kendetegnet ved,

at styre-, måle- og overvågningsenheden har midler til fremstilling af et alarm-signal, når den modtager de lysimpulser, som viser åbningstilstanden, uden lysimpulsen fra en berettiget optisk nøgle.

6. Overvågningssystem ifølge et af kravene 1 til 5,

kendetegnet ved,

at glasfiber-netfordelerens hus er forbundet med den centrale styre-, måle- og overvågningsenhed med en egen glasfiber-leder.

7. Overvågningssystem ifølge et af kravene 1 til 5,

kendetegnet ved,

at flere efter hinanden liggende (kaskadeagtige) huse er forbundet med den centrale styre-, måle- og overvågningsenhed med en fælles glasfiber-leder.