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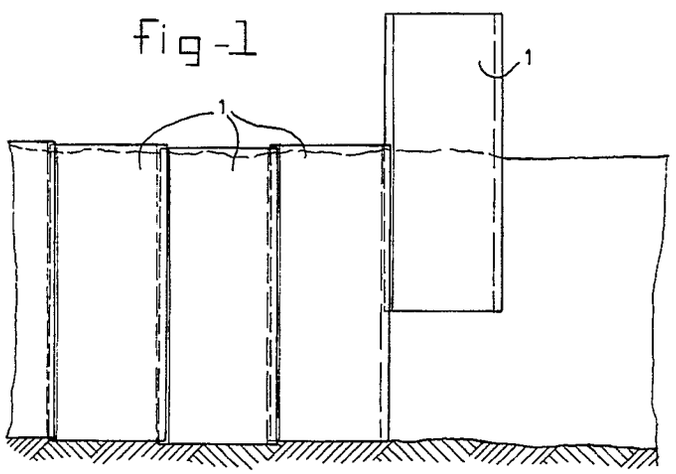
(54) Lock monitoring system.

(57) In a process for monitoring the closure of two lock halves (2, 3) which are to be brought into engagement with each other, one (2) of which is fitted on a longitudinal edge of a screen panel (1) fitted in the ground, while the other (3) is fitted on a longitudinal edge of a screen panel (1) which is pressed and/or vibrated and/or driven into the ground, signalling devices (4, 10, 12, 13, 14, 17, 20, 21, 22) are fitted in or on said lock halves (2, 3) at one or more positions and can indicate that the second lock half (2) is taking up the correct engagement position in the first lock half (3) at the above-mentioned positions. Several types of signalling devices are suggested, eg. devices moving along with the panel to be placed in the ground when the lock halves are engaging correctly, or devices which are cut through, or which are released and float upwards to the surface, or which transmit and receive an electromagnetic or an acoustic signal, or which create a potential field.

Fig-1



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LOCK MONITORING SYSTEM

The invention relates to a process for monitoring the closure of two lock halves which are to be brought into engagement with each other, one of which is fitted on a longitudinal edge of a screen panel fitted in the ground, while the other is fitted on a longitudinal edge of a screen panel which is pressed and/or vibrated and/or driven into the ground.

For the isolation of polluted soil and groundwater use can be made of walls extending vertically into the ground. In many cases, rigid panels (e.g. steel panels) are driven into the ground adjacent to each other to form those walls. These panels are interconnected by means of locks extending over the length of the panels. Recently, increasing use is being made of walls formed in the ground from a liquid, hardenable mixture in which a liquid-tight HDPE screen is formed in order to increase the impermeability. This sheet screen is made up of flexible panels of a width of, for example, 2 metres. These flexible panels are generally interconnected by means of plastic locks. The sheet screen is placed as a screen in a trench made in the ground. The trench is generally filled with a liquid mixture in the first phase of production. The trench is produced, for example, as follows: An H-shaped section is pressed into the ground to a predetermined depth, using a mobile crane and a vibrating device. This section is provided with a filling pipe through which a liquid mixture is pumped, while the H-shaped section is pulled upwards. The space produced through the pulling is thus filled up simultaneously with the mixture. The process is repeated with overlap to form a continuous wall of any desired length. In a second phase the sheet screen is pressed into the liquid-filled wall. The trench can also be produced, for example, by the deep wall system. The liquid mixture can be made hardenable at any desired moment and can be made of, for example, bentonite with water or a mixture of, for example, bentonite, cement and water. Each panel is connected at the bottom side to a steel shoe which is driven into the ground by means of a steel plate. The panels are interconnected by means of the above-mentioned locks to form a liquid-tight screen. The insertion must now take place in such a way that the locks have little or no load placed upon them. At the bottom side the sheet screen or rigid panel must be connected to a watertight layer, for example of a natural clay or an injected synthetic layer. Fitting of a flexible sheet in a trench filled with liquid is much easier then driving rigid panels directly into the ground, also resulting in much lower earth vibrations induced during fitting. The invention is concerned with both types of panels.

It is not uncommon to lower the groundwater level inside an area shut off by a screen of the above mentioned type. This ensures that only a groundwater flow directed towards this area is possible. Protection from pollution of groundwater intended for drinking water is very important. Pollution which could occur as the result of certain civil engineering or other projects must be isolated by means of a wall from the ground below in the environment, leakage having to be limited by the screen so that any pollution can be controlled. Even without the lowering of said groundwater level, the screen of the above mentioned type must, of course, be as liquid-tight as possible.

There are a number of disadvantages involved in fitting a liquid-tight sheet screen by sliding rigid or flexible panels into each other using locks. A major disadvantage is that during the fitting of a screen panel one lock half can come out of the lock half of the already fitted screen panel. This situation can occur if, despite all precautionary measures, the lock halves are too heavily loaded. At rigid panels directly driven into the ground, groundloads as well as an improperly set placing device can tear the lock halves apart. In the first instance at flexible panels this will not be caused by the mixture, which at the time of fitting of the screen is a thin liquid, but too great a load can be placed on the locks if the placing device is not properly set. Thus, if the locking edges of two adjacent screen panels do not engage with each other over the entire height, the liquid leakage in that area will be considerable.

It is impossible without aids to establish whether the lock halves of two adjacent screen panels are engaging with each other over the full height of the screen.

The invention makes a contribution to accurate and efficient monitoring of the engagement of the lock halves of two adjacent screen panels with each other.

According to the invention, the process mentioned in the introduction is to this end characterized in that signalling devices are fitted in or on said lock halves at one or more points and can indicate that the second lock half is taking up the correct engagement position in the first lock half at the above-mentioned point or points.

For flexible screen panels made of plastic, which are pressed or vibrated into a thin liquid material, the signalling devices can be realized in many ways. Due to the fact that the mixture is a thin liquid during the placing of the screen panels,

fragile signalling devices can also be used. Use can also be made of upward forces which are characteristic of liquid media. Since the flexible screen panels are made of plastic, use can be made, inter alia, of signalling devices which are based on conductive or electromagnetic action. In contrast with this is the technique of fitting rigid (steel) plates into the ground to form a screen, using considerable larger driving forces which can vary strongly, whereby the type of signalling devices to be used is limited and the material of the screen also limits the applicable signalling methods. Therefore, only few signalling devices mentioned can be used for fitting rigid sheets into the ground.

A number of embodiments of signalling devices according to the present invention can produce only one monitoring measurement per placing operation. The most obvious solution is to fit said signalling devices in such a way that the monitoring of the closure of two lock halves to be brought into engagement with each other takes place at the end of the placing operation. If the signalling device shows that the lock halves are not in engagement with each other, then there are two possibilities, viz:
the whole panel just fitted must be removed completely, following which the placing operation is carried out again, or
an additional seal is provided along said lock over the entire height of the screen.

The latter operation in particular is extremely expensive, while the removal and refitting of a screen panel takes extra time, during which the mixture hardens further.

Another disadvantage of such signalling devices can be illustrated as follows:
It has been found in practice that during the fitting of a screen panel of flexible material, where the lock half has to engage with the lock half of a panel already fitted, the lock halves do not engage with each other over a certain height of the screen. Engagement does take place above and below that area. A signalling device which monitors the engagement of the lock halves at the end of the fitting operation will not be capable of noting such an area.

In order to avoid this, according to the present invention signalling devices can be distributed over the height of the screen panel. This gives the advantage that the correct engagement of the lock halves can be monitored at different places. This means that it is possible to take action already at an early stage, while the risk of places being present where the lock halves do not engage in each other is greatly reduced.

According to a preferred embodiment of the device according to the present invention, the signalling device comprises a long element which is fitted on the panel already placed in the ground, while between the ends said element describes a loop whose shape is lost on passing of the panel which is fitted, or where the loop is conveyed along if the lock halves assume the correct engagement position. Such an element can be extended in such a way that this is noticeable above ground.

The element can be used, for example, to transmit force or to conduct electricity, light or a liquid or a gas. If the element guides a force, for example in the form of a rope or cable, the loop must be carried along by the lock half of the screen panel which is being fitted, which is indicated above ground through the fact that the element is being pulled into the ground. In other cases the loop is pulled into a line, causing the flow to be interrupted or the pressure to fall off. By connecting the correct indicating devices to the line above ground, it is possible to establish that the loop loses its shape through passing of the correctly engaging lock half of the screen panel being fitted. If the line conducts electricity, the fact that a lamp which is connected to the line in conjunction with a power source goes out will indicate that the lock halves at the position of the loop are assuming the correct engagement position. Such devices can easily be realised and are cheap to use, while the forces necessary are essentially low.

Another embodiment of the device according to the invention, which is only applicable when initially a trench filled with liquid is made in the ground, makes use of the upward forces which the liquid mixture exerts on bodies immersed in it. This embodiment is characterized by fixing in or on one of the above-mentioned lock halves bodies which are released by the engaging other lock half and then drift upwards through the mixture. Such bodies can be, for example, gas bubbles which are stored in cartridges or, for example, solid or hollow plastic balls such as, for example, table tennis balls. By providing such bodies with a code it can be established precisely at what point the screen panel is no longer being fitted in the correct manner.

A further embodiment of the device according to the present invention makes use of a transmitter and a receiver. The signal produced by the transmitter and received by the receiver can in this case supply information in different ways. A number of ways will be discussed below with reference to several preferred embodiments.

The transmitter can, for example, create a potential field. The receiver can carry out measurements in this potential field, the measured potential varying with the distance from the transmitter. By comparing the received potential with a reference value, it is possible to check whether the placing

operation is taking place in the correct manner. For this purpose, the transmitter is fitted in or on one lock half, while the receiver is introduced into or placed on the other lock half. If the two lock halves are engaging in the correct manner, a potential which is different from that when the lock halves are not engaging with each other is measured. Such a device can be achieved in different ways, and a preferred embodiment thereof will be discussed in the description of the figures.

It is also possible for the transmitter to create an electromagnetic field on which the receiver carries out measurements. Such device can't be used for steel panels. The signal received will be stronger or weaker depending on the distance between the receiver and the transmitter. Comparison of the signal received with a reference can provide the proof that the two lock halves are engaging with each other in the correct manner. Such a system can be formed in such a way that as the lock halves engage with each other over a greater length of the screen panels the received signal increases. If the lock halves are engaging with each other correctly, this increase must take place according to a predetermined relation. Any deviations from this relation can indicate that the two lock halves are no longer engaging with each other, so that the panel being fitted is pulled fully or partially out of the bentonite or the ground in order to allow the two lock halves to engage in each other, following which the fitting operation can be continued. Such a process is also possible for certain embodiments in which the transmitter creates a certain potential field.

Yet another embodiment of the device according to the present invention in which use is made of a transmitter and a receiver works as follows:
If the lock halves are engaging correctly with each other, sound signals will be emitted during the fitting of the screen panel in the ground trench. Such sound signals can be picked up by a microphone fitted on the spot, and recorded above ground. It is possible, on the basis of the length of the part of the screen panel already introduced into the ground, to forecast when the next sound signal will be emitted. If the forecast is not correct, this means that the lock halves are not enga ging with each other correctly. Adequate measures can then be taken.

In a final embodiment of the device according to the invention use is made of a lock half part which is brought into engagement with the mating lock half of the screen panel already in the ground prior to the engagement of the lock half of the panel to be brought in the ground. This lock half part is connected to a long element extending above ground. The lock half part is moved downwards along the lock half of the panel already fitted in the ground by the lower edge of the panel to be fitted in the ground if the lock halves are engaging correctly with each other. The movement of this lock half part can be monitored e.g. with the aid of a long element connected to the lock half part end extending above ground, disappearing into the ground. When the panels are fitted into a liquid filled trench, the lock half part can be regained when the lower edge of the panel fitted in the ground has a cut-out.

Of course, other variants of embodiments falling within the scope of the present invention are also possible.

The invention will now be explained in greater detail with reference to the drawings.

Fig. 1 shows a number of screen panels in side view.

Fig. 2a shows a top view in cross-section of a lock half provided with a device according to the present invention.

Fig. 2b shows in cross-section a variant of the device shown in Fig. 2a.

Fig. 3 shows a top view in cross-section of a lock half provided with another device according to the invention.

Fig. 4 shows in top view in cross-section a lock half on which according to an embodiment of the present invention floating bodies are fitted.

Fig. 5 shows in perspective view the lock halves which are provided with a different embodiment of the present invention.

Fig. 6 shows in perspective another embodiment of the present invention which is fitted in the lock halves, a part of one of the lock halves being omitted.

Fig. 7 shows in perspective view a lock edge which is provided with an acoustic signalling device.

Fig. 8 shows in perspective another embodiment of the present invention using a lock half part.

Fig. 1 shows screen panels 1 which are placed in the ground with the lock halves engaging with each other. The righthand screen panel is not yet fully in the ground. The lock halves can be achieved as shown in Fig. 2a, where a male lock half 2 projects into a female lock half 3. At the beginning of the placing of each subsequent screen panel, one lock half is engaged with the other, and the lock half of the panel to be fitted then moves along the lock half of the fitted panel, while the whole screen panel sinks downwards through weight, pressure, force or vibration. The moving lock half can now be used to put a signalling device into action at predetermined locations. This can be achieved, for example, as shown in Fig. 2a by a rope 4 situated in the lock half of the screen panel already fitted. The rope 4 must now be fitted in such a way that the other lock half, if it

is engaging in the correct manner, can carry the rope 4 on its movement downwards or can break it. In this case this is achieved in a simple manner through the fact that the rope 4 crosses the cavity which is enclosed by the female lock half 3. Such a rope can be fitted at different heights in the lock half, but it is preferable to fit the rope in such a way that it is broken or carried along by the other lock half at the end of the fitting operation.

Fig. 2b shows how the rope 4 can be fitted on the male lock half 2, with the rope 4 on the outside of the male lock half 2 running along it upwards. In this case the rope 4 moves away from the lock half 2. The female lock half 3 can now extend between the rope 4 and the outside of the lock half, as shown in Fig. 2b. The bottom edge of the female lock half will then carry along the rope 4 where it projects out of the male lock half 2, which proves that the two lock halves are engaging with each other correctly.

Fig. 3 shows another way in which a rope 4 can be fitted at a lock half. This method is preferable particularly when the rope 4 has to be fitted on the male lock half 2 and is essentially only applicable when the panels are fitted into a liquid filled trench. The rope 4 in this case is partially supported by a fork 5 comprising a supporting part 6, 6' projecting from the plane of the screen panel and a part 7, 7' extending parallel to the screen. The rope 4 is now placed in a loop in such a way that the female lock half 3 can carry along the line. The rope 4 can be continued running upwards to above ground. The moving lock half will carry along this rope on its movement downwards and this is shown above ground by part of the rope disappearing in the ground. If an electrically conducting wire is used instead of rope, then a power source and, for example, a lamp can be connected to these lines at ground level. The downward moving lock half then has to be able to pull the conductor 4 apart, which can be recorded above ground. In the event of electrical conductivity, use can advantageously be made of the conductors 8 and 9 already situated in the screen panel, as shown in Fig. 2. These conductors are used to check the welds which are produced during fitting of a lock half on a screen panel. The conductor 4 can then be connected simply to said conductors 8, 9, which helps to save costs.

Other embodiments are, of course, also possible within the scope of the device according to the present invention, in which use is made of a rope or line 4 which assumes a different shape as a result of movement of the lock half downwards. For example, the fork 5 can be made up only of the elements 6 and 7. In addition, the rope or the conductor 4 can, of course, also be broken or carried along by elements other than the lock halves, which elements are, for example, specially fitted for this purpose. The conductor 4 can also conduct light or a liquid medium.

Fig. 4 shows in another example of an embodiment how floating bodies can be used as the signalling device, when the panels are fitted in a liquid filled trench. In this specific case balls 10 are fitted on the female lock half 3. These balls are made in such a way that, if they have the freedom to do so, they float upwards through the bentonite mixture. If the other lock half, which in this case is the male lock half 2, is engaging in the correct manner, then this lock half 2 will free all floating bodies in succession to drift towards the surface during its downward movement. In this case an element 11 releases the ball 10 for this purpose. If the lock halves do not project into each other correctly over a certain screen panel height, then the floating bodies situated in this area will remain present. These bodies thus do not go to the surface, and it is now possible to determine fairly accurately the position where the placing went wrong. Adequate measures can then be taken. The balls 10 can be, for example, hollow plastic bodies and the like. Causing a gas to develop also falls within the scope of this embodiment.

Fig. 5 shows an embodiment of one of the devices within the scope of the present invention. Use is made here of a transmitter and a receiver, the transmitter creating a potential field. In this case the male lock half 2 has fitted in it a wire 12 extending over the full or part of the height of the screen panel. The wire is connected to a pulsating or alternating voltage source. A voltage of at least about 2,000 volts will be necessary in order to create a sufficiently strong potential field. A wire 13 also running over the full or part of the height of the screen panel is fitted in the female lock half 3. The conductor 13 is connected to a device which can measure the strength of the potential at the position of the conductor 13. If the strength of the potential field is kept constant by the correct setting of the voltage source, the measured potential will depend on the distance of the conductor 12 from the conductor 13, and also on the height of the overlapping region of the conductors 13 and 12. If the two lock halves are engaging correctly with each other, the overlapping region of the conductors 13 and 12 will increase during the downward movement of the screen panel with the female lock half 3. The measured potential will consequently show a proportional increase. This proportionality can be checked by using for it the distance over which the screen panel to be fitted has already sunk into the ground. If without the potential field changing the increase in the measured potential no longer keeps pace with the increase in the distance over which the screen

panel is situated in the ground, the cause of this must be sought in the change in the distance between the conductors 13 and 12. This means that the lock halves are no longer engaging correctly with one another. It can now be determined very accurately where the lock halves are not engaging properly, while adequate measures can be taken. For amplification of the transmitted or received signal, the conductors 13 and 12 can be different conductors connected in parallel. Of course, it is also possible to create and record a potential field in a different way, while it is certainly not necessary for a constant field to be created over a certain height of the screen panel.

Fig. 6 shows the possibility for achieving a device which is within the scope of the present invention, in which use is made of a transmitter which creates an electromagnetic field. Such device essentially is not applicable for steel panels. Such a transmitter can be fitted in the male lock half 2, as shown, for example, in the figure. The female lock half then contains the receiver. One of the two lock halves is connected to the screen panel already fitted in the ground, while the other is connected to the screen panel to be fitted. In the preferred embodiment shown here the transmitter is formed by a number of parallel conductors 14 extending in line with each other over the full or part of the height of the screen panel. The conductors 14 are now interconnected in such a way at the top and bottom side that a winding pattern is produced, forming a two- dimensional coil with ends 15 and 16. An alternating or pulsating power source is connected to said ends. This creates around the conductors 14 a magnetic field which is virtually constant over the height over which the conductors extend. The recei ver comprises an identically composed two-dimensional coil of conductors 17 with ends 18 and 19. A device which measures the magnetic field strength to which the conductors 17 are exposed can be connected to these ends 18 and 19. The measured signal will vary with the distance between the conductors 14 and 17 and with the length of the overlapping region of the conductors 14 and 17. It is now also possible to check the progress of the fitting operation in the same way as described for the embodiment of Fig. 5. Here again the receiver will record an increase of in this case the magnetic field strength, which increase is disrupted if the two lock halves are no longer engaging properly with each other. Of course, it is also possible to place the transmitter in the female lock half and the receiver in the male lock half. Solutions in which measurements are not carried out continuously over the height of the screen panel also fall within the scope of the present invention. For example, a number of transmitters can be fitted one above the other extending over a particular height, by means of which the receiver more or less receives a number of brief signals during the fitting operation. The essential factor is that the transmitter creates an electromagnetic field to which the receiver can react correctly.

Fig. 7 shows an example of an embodiment of the present invention where use is made of a transmitter and a receiver in which the transmitter transmits an acoustic signal. For the sake of clarity, a part of the female lock half 3 is omitted here. The transmitter can in this case comprise a number of sources which in this case are fitted on the male lock half 2. This lock half is fixed on the screen panel already placed in the ground. Spring elements 20 are in this case provided on the lock half. These elements 20 are tensioned. The female lock half 3 of the screen panel to be placed in the ground must now be capable of releasing the springs when the two lock halves are engaging correctly. The springs 20 thereby produce a noise which can be picked up by a microphone 21 fitted in the vicinity. This microphone 21 is located in the ground trench in the vicinity of the screen panel to be fitted, or on said screen panel. Instead of spring elements 20, other embodiments are also possible such as, for example, wooden elements which are broken, or the like. As is the case for all other embodiments of the devices of the present invention, the transmitters of the acoustic signal can also be fitted on the female lock half, and they can even be fitted in such a way that other elements of the screen panel which are, for example, fitted specially for this purpose put the transmitters into operation.

Finally, fig. 8 shows an embodiment in which a lock half part 22 is used. In this case, this lock half part 22 is a male lock half. This part 22 is inserted from above into the female lock half 3 of the panel already fitted in the ground, prior to insertion of male lock half 2 of the panel to be fitted in the ground. when the lock halves 2, 3 are engaged properly, the lock half part 22 will be driven along the female lock half 3 by the lower edge of the male lock half 2 moving downwards. A rope 23 connected to the downwards moving lock half piece 22 and extending above ground will be pulled into the ground, which shows if the engagement of lock halves 2, 3 is adequately. If the engagement of the lock halves 2, 3 is incorrect, the lock half part 22 will not be driven downwards so the rope 23 is not pulled into the ground, and adequate steps can be taken. At the end of the fitting procedure, the lock half part 22 has entered the lower edge of the female lock half 3, as shown. Thanks to the cut-out 24 at the lower edge of the panel which was already fitted in the ground, the lock half part 22 can be withdrawn from the female

lock half 3 and can be pulled up above ground using rope 23.

It is, of course, clear that within the scope of the invention various other embodiments are possible. when fitting panels into a liquid filled trench, as a result of the thin liquid nature of the liquid mixture in the ground trench, and due to the fact that the screen panel with the lock halves can be made of plastic, very many possible embodiments can be achieved for carrying out monitoring of the correct engagement of the lock halves. Some of these embodiments can of course also be used for rigid (steel) panels which are driven into the ground without initially producing of a trench. The different embodiments can in this case be based on different natural principles, while both sturdy and fragile devices are possible.

Claims

1. Process for monitoring the closure of two lock halves (2, 3) which are to be brought into engagement with each other, one (2) of which is fitted on a longitudinal edge of a screen panel (1) fitted in the ground, while the other (3) is fitted on a longitudinal edge of a screen panel (1) which is pressed and/or vibrated and/or driven into the ground, characterized in that signalling devices (4, 10, 12, 13, 14, 17, 20, 21, 22) are fitted in or on said lock halves (2, 3) at one or more positions and can indicate that the second lock half (2) is taking up the correct engagement position in the first lock half (3) at the above-mentioned positions.

2. Signalling device for using the process according to Claim 1, characterized in that the signalling device comprises a long element (4) which is fitted on the panel already placed in the ground and extends above ground, the element (4) being carried along by the panel to be placed in the ground, if the lock halves (2, 3) are engaging correctly with each other.

3. Signalling device for using the process according to Claim 1, characterized in that the signalling device comprises a conductor (4) which is fitted on the panel fitted in the ground, the conductor (4) being broken by the panel to be fitted in the ground.

4. Signalling device according to Claim 3, characterized in that one end of the conductor (4) is connected to a first conductor (8), and the other end to a second conductor (9) which is continued until it is above ground.

5. Signalling device according to Claim 2, 3 or 4, characterized in that the long element (4) or the conductor is supported partially by a fork (5), comprising a supporting part (6) projecting from the panel face, with a part (7) extending parallel to the screen.

6. Signalling device according to Claims 3 - 5, characterized in that the conductor (4) is connected to an electricity, light, liquid or gas source which indicates breakage of the line.

7. Signalling device for using the process according to Claim 1, characterized in that the signalling device comprises bodies (10) floating upwards in the liquid mixture.

8. Signalling device according to Claim 7, characterized in that the bodies (10) comprise vapour or gas bubbles or balls floating on liquid.

9. Signalling device for using the process according to Claim 1, characterized in that the signalling device comprises a transmitter and a receiver.

10. Signalling device according to Claim 9, characterized in that the transmitter transmits an electromagnetic signal.

11. Signalling device according to Claim 10, characterized in that fitted in the lock half of one panel is a wire (14) which forms the transmitter and which runs up and down in a particular winding pattern in one plane a number of times over a part of the height of the lock half, while the ends (15, 16) of the wire (14) are connected to a voltage source, and a wire (17) which forms the receiver, and the ends of which are connected to the receiving device, is fitted in the lock half of the other panel.

12. Signalling device according to Claim 9, characterized in that the transmitter creates a potential field.

13. Signalling device according to Claim 12, characterized in that the transmitter is formed by at least one wire (12) extending in the lock half over the height of the edge, and connected to a voltage source, while at least one wire (13) which is connected to the receiving device is fitted in a corresponding manner in the lock half of the other panel.

14. Signalling device according to Claim 9, characterized in that the transmitter transmits an acoustic signal.

15. Signalling device according to Claim 14, characterized in that the acoustic signal is caused by the breaking of a connection.

16. Signalling device according to Claim 14 or 15, characterized in that the acoustic signal is created by springs being released or elements of wood, metal and the like giving way.

17. Signalling device for using the process of claim 1, characterized in that the device comprises a lock half part (22) which is brought into engagement with the mating lock half (2, 3) of the screen panel already in the ground prior to the engagement of the lock half (3, 2 resp.) of the panel to be brought in the ground, such that this part (22) is moved downwards along the lock half (2, 3) of the panel already fitted in the ground by the lower edge of the panel to be fitted in the ground if the lock halves (2, 3) are engaging correctly with each other.

18. Signalling device according to claim 17, characterized in that the panel already fitted in the ground has a cut-out (24) at the lower edge corner for removal of the lock half part (22) after the panel to be fitted in the ground is brought in place.

Fig-1

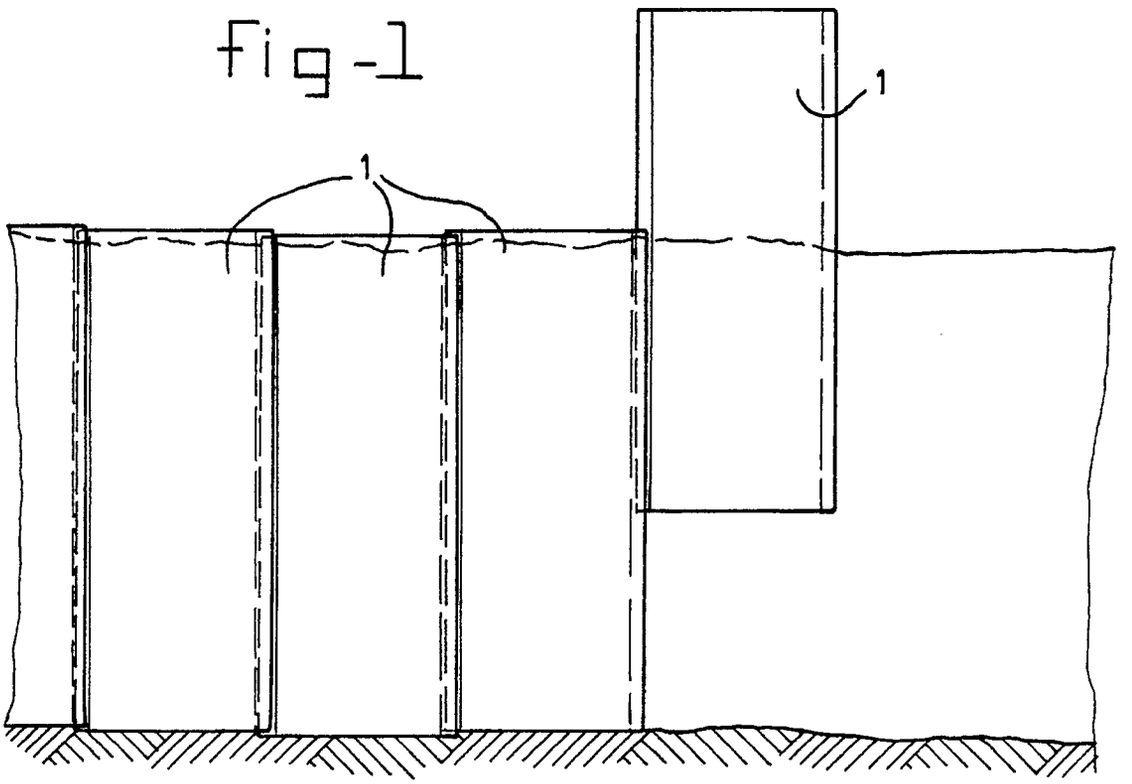


Fig-2a

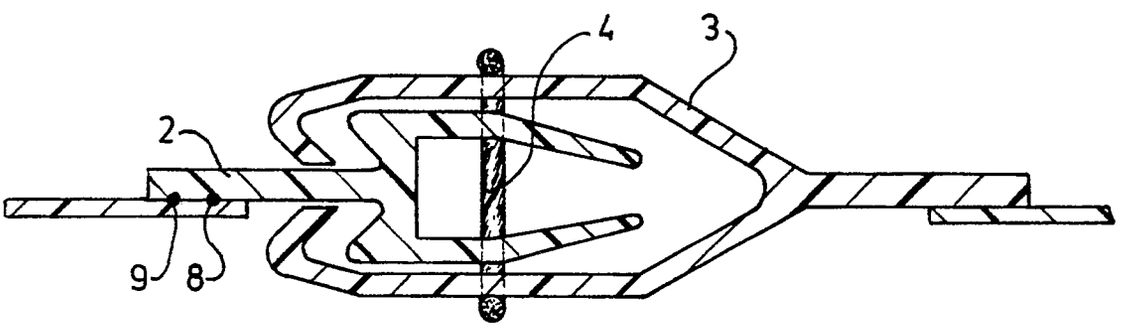


Fig-2b

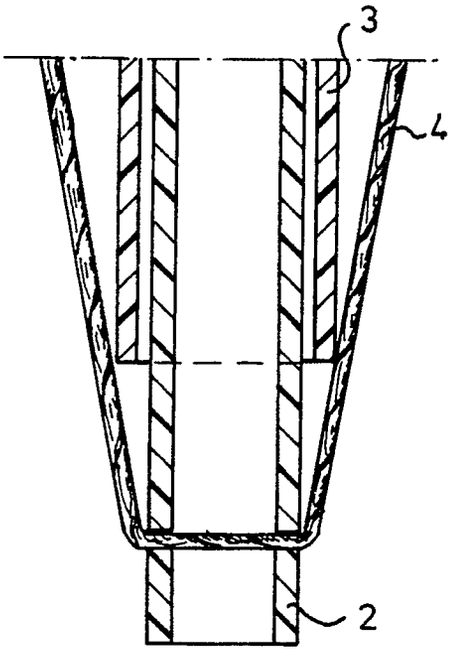


Fig-3

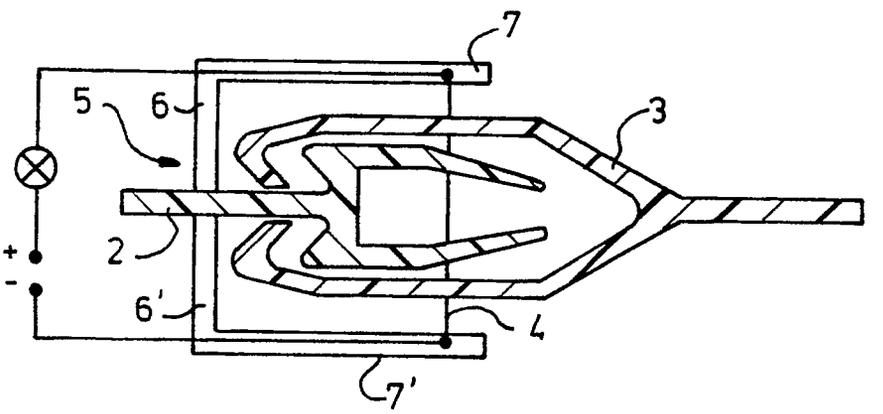


Fig-4

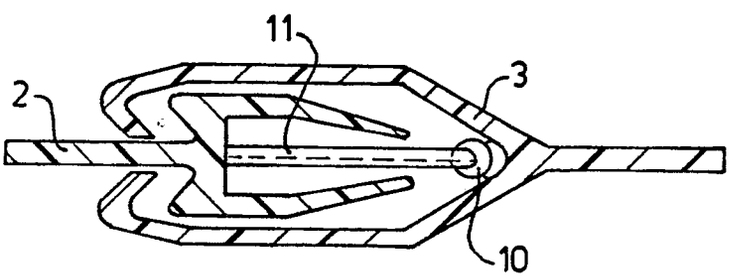


Fig-5

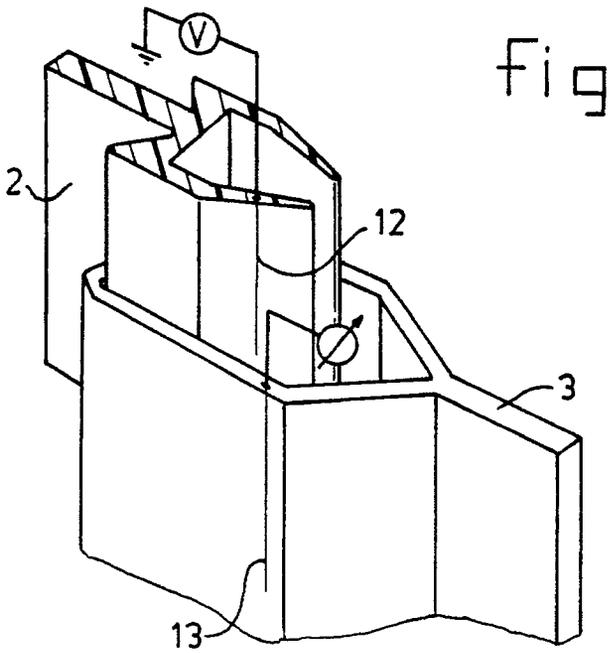


Fig-6

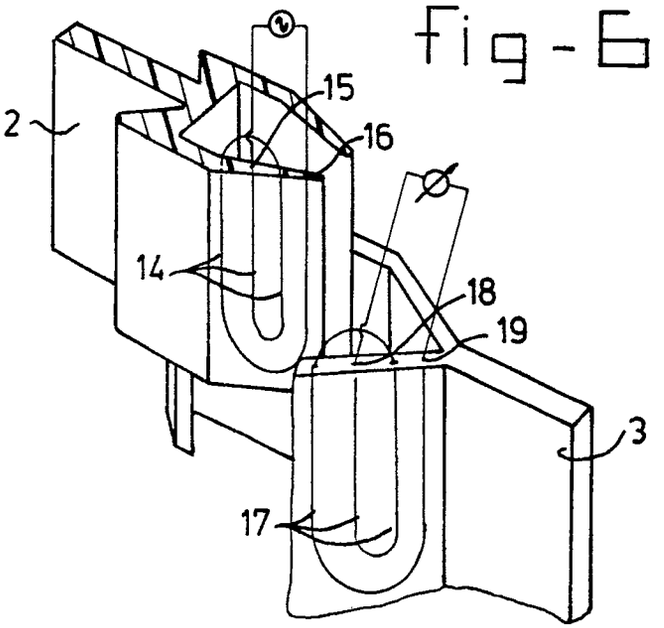


Fig - 7

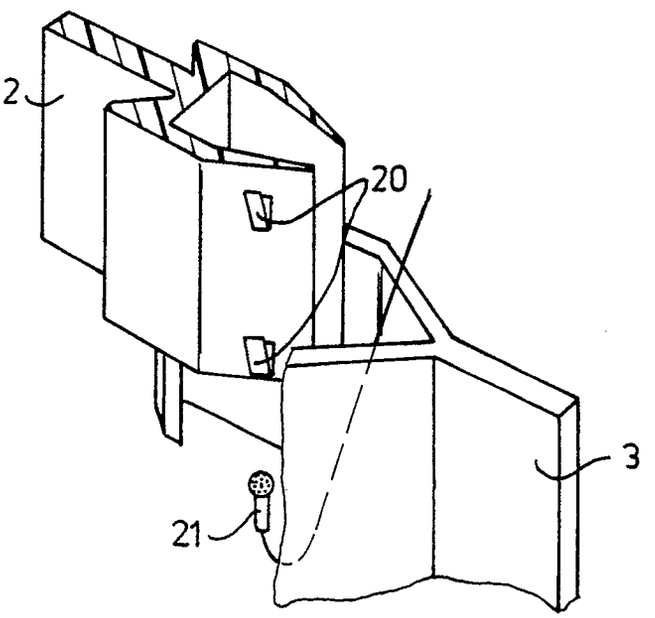
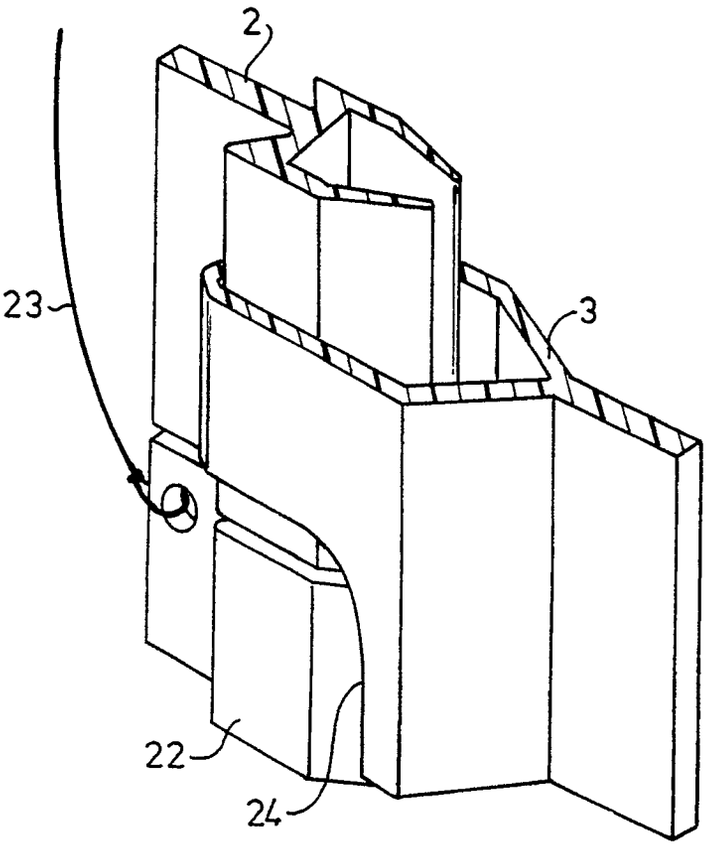


Fig-8



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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 3231

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 141 463 (HOLLANDSCHE BETONGROEP) * Page 1, lines 1-9; page 2, lines 4-32; page 3, lines 5-28; figures 1-3 *	1,3,4,6	E 02 D 19/18 E 02 D 13/06
A	NL-A-8 603 243 (VAN HATTUM EN BLANKEVOORT) * Page 1, lines 5-21,25-31; page 2, lines 10-25; page 4, lines 3-12; fig. *	1,6,10,12	
A	NL-A-7 908 262 (HOLLANDSCHE BETON GROEP) * Page 2, lines 8-40; page 3, lines 1-7,21-40; page 4, lines 1-12; figures 1-3 *	1,2,3,4,6	
A	DE-C-2 245 59 (BUSEMANN) * Page 1, lines 51-70; page 2, lines 1-2,12-18,55-67,85-108; figures 1-4 *	1,2,3,4,6	
A	EP-A-0 286 068 (SCHLEGEL LINING TECHNOLOGY)		
A	DE-A-3 540 270 (WAYSS UND FREYTAG)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
E 02 D

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	04 March 91	RUYMBEKE L.G.M.

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