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(54) **POLDER PRINCIPLE USING SHIELDING WALLS AND METHOD FOR PRODUCING SAID POLDER**

POLDERPRINZIP UND -VERFAHREN UNTER VERWENDUNG VON SCHUTZWÄNDEN

CREATION D'UN POLDER AU MOYEN DE PAROIS ECRANS ET PROCEDE CORRESPONDANT

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Description

The invention relates to a polder construction comprising upright shielding walls which are located in the ground relatively wide apart at ground level and which are connected to one another at their lower ends in an essentially water-impermeable manner. The invention also relates to a method for implementing said polder construction.

Such a construction is known from NL-A-7.807.351. In this document a semi-circular shielding wall is inserted into the ground to form a water-tight enclosure which is subsequently excavated. The known shielding wall will be difficult to handle upon insertion into the ground and is cumbersome during transportation. Finally, the known semi-circular wall will experience a relatively large' upwardly directed force from the ground water, such that additional ballasting measures must be taken to obtain a static equilibrium situation.

In regions where the groundwater level is relatively high it is also known to apply other types of polder constructions for making watertight areas below ground level. To this end a surface region extending to below the groundwater table is provided with a watertight shield using so-called dam walls. Care being taken that the bottom of the dam walls project into an essentially horizontal, watertight layer located below the groundwater table. The water-tight layer can be a naturally occurring barrier layer composed of, for example, clay. Said watertight layer can also be a concrete floor or a watertight sand layer obtained by injection of, for example, water-glass or other injectable materials. The advantage in using a naturally occurring barrier layer is that a watertight polder construction is obtained immediately on inserting the dam wall into the ground, as a result of which excavation work can be carried out inside the polder construction without problems due to the ingress of groundwater from the surrounding area and the associated need for (temporary) well drainage with the associated adverse lowering of the groundwater level. If it is to offer adequate resistance to the groundwater pressure, a polder construction which has a naturally occurring watertight floor can usually be only partially excavated.

If said natural barrier layer is absent, it is necessary, after inserting the dam wall, to dig out the earth inside down to the level where the watertight floor has to be installed. This excavation work is usually carried out in the wet, because groundwater from the surrounding area continues to flow in freely via the underside. Lowering of the surrounding groundwater level can be used to restrict said flow. After the watertight floor has been installed, for example by pouring underwater concrete, the polder created can be emptied by pumping out. If the watertight floor is insufficiently heavy, ballast must be placed on top and/or tension posts or anchors connected to the floor are needed to offer adequate resistance to the upwards pressure of the groundwater.

Excavation work and well drainage are not necessary if use is made of injection to produce the watertight floor. However, the injection of large areas is expensive.

In view of the fact that the free space between the shielding walls of the known polder construction is essentially the same at the top and the bottom, a watertight floor of relatively large surface area is required if the area below ground has a relatively large floor area.

The aim of the invention is to provide an alternative polder construction and method for the implementation thereof, which in the case of the absence of a naturally occurring watertight floor is more effective than the known polder constructions which may use watertight walls and floors and described above, and which can be relatively easily constructed.

To this end the shielding walls inserted in the ground opposite one another delimit a funnel-shaped region narrowed towards the lower ends of the shielding walls. Thus during the production of the polder construction the shielding walls are inserted into the ground sloping towards one another, as a result of which the gap between them at the bottom becomes appreciably smaller than that at ground surface level. For example, the angle of slope of the shielding walls is more than 10° with respect to the vertical. Consequently, underground a watertight seal between the shielding walls located opposite one another has to be provided only in a relatively small region, whilst retaining a large floor surface area for the area below ground. This can be effected by injecting, for example, water-glass into the gap at the bottom of the shielding walls, but also by excavating the area enclosed by the shielding walls and pouring, for example, underwater concrete to seal the relatively small gap at the bottom of said area. Injection is to be preferred because on excavation is required to create the polder construction. However, in comparison with the conventional polder construction having a watertight floor produced in the wet, as a consequence of the small gap between the shielding walls less trouble from welding-up groundwater is experienced when excavation is carried out down to the bottom of the shielding walls. Anchoring of the watertight floor is also more secure, since said floor presses from below against the sloping shielding walls, which because of their inclined position are better able to absorb the upwards forces exerted by the watertight floor.

The invention also offers the possibility of transmitting foundation forces via the sloping shielding walls. In the case of the known polder constructions separate anchors or other foundation means are used for this purpose. Because the shielding walls located opposite one another are relatively close together at the bottom, a relatively rigid construction between said shielding walls is formed at this location. As a result the risk of deformation of the polder construction is reduced and more passive ground pressure action can be mobilised. For example, the enclosed area, can be excavated to greater depth as a result. Moreover, the shielding walls positioned in a funnel-like manner exert a more reliable ground-re-

taining and ground-stabilising action.

Furthermore, it is, of course, also possible to make use of a naturally occurring watertight layer. In such a case the invention is, for example, applicable if the quality of said naturally occurring watertight floor is reliable only within a small region. If there is a naturally occurring watertight layer but this is at too great a depth it is nevertheless possible, using the invention, to create an inexpensive polder construction which does not have to extend as far as said naturally occurring watertight layer.

It is known per se to insert shielding walls into the ground slightly sloping at an angle of no more than 5°. The aim in this case is to reduce the lateral pressure exerted by the ground on the shielding walls. The aim of the known positioning at a slight slope is not to insert shielding walls in the ground opposite to and sloping towards one another so that a region which is narrowed towards the bottom is confined, only a small region at the bottom thereof having to be made watertight. In addition, it is also known to dredge a funnel-shaped trench in the ground, after which the walls thereof are provided with a watertight lining using sheeting, which is stabilised with ballast, and the delimited area is then pumped dry, for example in order to produce a sunken road. The aim in this case is not to install the watertight lining without extensive excavation and to keep the excavated hole dry during work to create the polder construction.

Suitable shielding walls are all conventional bend-resistant shielding walls, such as steel dam wall plates, or soft shielding walls, such as sheeting screens. The length thereof is usually several tens of metres. Said wells are vibrated, pressed or driven directly into the ground or inserted in a narrow trench filled with bentonite or the like.

Although the invention has been discussed with reference to preventing groundwater welding up in areas below ground, the invention can also be used in other terrains.

Other advantages and details of the invention will become apparent from the following description of two non-limiting embodiments with reference to the drawings. In the drawings:

Fig. 1 shows a diagrammatic cross-sectional view of a polder construction according to the invention, used for a sunken railway; and

Fig. 2 shows a view, corresponding to Fig. 1, of an alternative.

Fig. 1 shows a trench 1 which has been made in the ground 2 and on the bottom of which two rail tracks 3 have been laid for the purposes of rail traffic 4. The tracks 3 are below the groundwater table 5. The trench is covered by a roof, shown as a conceptual roof 6, over which earth removed during excavation of the trench is tipped in a layer shown as a conceptual layer 7. Support pillars 8 are also shown conceptually.

Before excavating the trench 1, conventional steel dam wall plates 9 are vibrated into the ground in the conventional manner with the longitudinal sides linked to one another to provide a seal. According to the invention, to this end plates 9 are introduced into the ground 2 opposite one another some distance apart and sloping sharply towards one another, as a result of which a region which in the drawing is narrowed towards the bottom and is essentially V-shaped is delimited. The plates 9 leave a small gap at the bottom, which gap is sealed watertight using a plug 10. Said plug 10 is produced by injecting water-glass via an injection tube which runs down one plate 9 and through which a proximity switch was initially lowered (not shown). It can be seen that in the drawing the left plate 9 extends further downwards than the right plate 9. By this means it is advantageously ensured that the gap which is left at the bottom between the plates 9 is reliably and sufficiently small. At the plug 10 the gap is about one metre. At ground level the gap is about fifteen metres. The plates 9 extend about twenty metres deep.

Using the invention it is possible, in a particularly advantageous manner, to produce a watertight gully which is sunken to below the groundwater table and extends over a great length in a completely continuous process.

Fig. 2 shows an embodiment using flexible sealing shielding walls. In order to protect the flexible sheeting 11 against the lateral ground and water pressure, the trench 1 is excavated in such a way that a bank 12 remains on either side. This technique can, of course, also be used for more bend-resistant shielding walls.

Other variants of the invention are, of course, also possible within the scope of the appended claims. The important feature is that the dam wall plates are introduced into the ground opposite one another in such a way that they are relatively wide part at the top and relatively close together at the bottom.

Claims

1. Polder construction comprising upright shielding walls (9) which are located in the ground relatively wide apart at ground level and which are connected to one another at their lower ends in an essentially water-impermeable manner, characterised in that the shielding walls (9) located opposite one another delimit a funnel-shaped region narrowed towards the lower ends of the shielding walls (9).

2. Polder construction according to Claim 1, characterised in that the shielding walls (9) located opposite one another leave a gap at their lower ends which is small compared with the gap at ground level.

3. Polder construction according to Claim 1 or 2, characterised in that the shielding walls (9) located op-

posite one' another essentially touch one another at their lower ends.

4. Polder construction according to one of the preceding claims, characterised in that the shielding walls (9) located opposite one another enclose an essentially V-shaped region.

5. Polder construction according to one of the preceding claims, characterised in that a material forming a water-impermeable layer or plug (10), such as water-glass, is introduced between the shielding walls located opposite one another at their lower ends.

6. Polder construction according to one of the preceding claims, characterised in that one wall section always extends, beyond the associated wall section located opposite.

7. Polder construction according to one of the preceding claims, characterised in that an inverted truncated triangular surface region is excavated within the funnel-shaped region, as a result of which banking is present along the shielding walls.

8. Polder construction according to one of the preceding claims, characterised in that at ground level the gap between the shielding walls (9) located opposite one another is at least 5 metres and in that at the lower ends of the shielding walls (9) the gap is at most 3 metres and more particularly 1 metre.

9. Polder construction according to one of the preceding claims, characterised in that the shielding walls (9) located opposite one another enclose an angle of about 20° to 130°, preferably 60° to 100°.

10. Method for creating a polder construction according to one of the preceding claims, in which method shielding walls (9) are inserted into the ground opposite one another relatively wide apart at ground level, characterised in that the shielding walls are inserted in the ground sloping towards one another at their lower ends.

11. Method according to Claim 10, characterised in that the insertion of the shielding walls (9) is continued until the respective shielding walls virtually touch one another at their lower ends.

12. Method according to Claim 10 or 11, characterised in that following insertion a material forming a water-impermeable seal (10) is introduced at the lower end of the shielding walls in the gap formed between them.

Patentansprüche

1. Polderaufbau, der aufrechte Schutzwände (9) umfaßt, die im Erdboden relativ weit beabstandet auf Bodenniveau plaziert sind, und die an ihren Enden miteinander in im wesentlichen wasserundurchlässiger Weise miteinander verbunden sind, dadurch gekennzeichnet, daß die einander gegenüberliegend plazierten Schutzwände (9) eine trichterförmige Zone begrenzen, die sich zu den unteren Enden der Schutzwände (9) hin verengt.

2. Polderaufbau nach Anspruch 1, dadurch gekennzeichnet, daß die einander gegenüberliegend plazierten Schutzwände (9) an ihren unteren Enden einen Spalt belassen, der im Vergleich zum Spalt auf Bodenniveau klein ist.

3. Polderaufbau nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die einander gegenüberliegend plazierten Schutzwände (9) sich an ihren unteren Enden im wesentlichen aneinander berühren.

4. Polderaufbau nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die einander gegenüberliegend plazierten Schutzwände (9) eine im wesentlichen V-förmige Zone einschließen.

5. Polderaufbau nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß ein Material, das eine wasserundurchlässige Schicht oder einen Stopfen (10) bildet, wie etwa Wasserglas, an ihren unteren Enden zwischen die einander gegenüberliegend plazierten Schutzwände eingebracht ist.

6. Polderaufbau nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß sich ein einzelner Wandabschnitt stets über den gegenüberliegend plazierten zugeordneten Wandabschnitt hinaus erstreckt.

7. Polderaufbau nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß ein umgekehrter, kegelstumpfförmiger, dreieckiger Oberflächenbereich in der trichterförmigen Zone ausgehoben ist, wodurch als Folge eine Dammbildung entlang der Schutzwände vorhanden ist.

8. Polderaufbau nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß am Bodenniveau der Spalt zwischen den einander gegenüberliegend plazierten Schutzwänden (9) mindestens 5 Meter beträgt, und daß an den unteren Enden der Schutzwände (9) der Spalt höchstens 3 Meter und vorzugsweise 1 Meter beträgt.

9. Polderaufbau nach einem der vorhergehenden An-

sprüche, dadurch gekennzeichnet, daß die einander gegenüberliegend plazierten Schutzwände (9) einen Winkel von etwa 20° bis 130°, vorzugsweise 60° bis 100°, einschließen.

10. Verfahren zum Ausbilden eines Polderaufbaus gemäß einem der vorhergehenden Ansprüche, bei dem Schutzwände (9) am Bodenniveau einander gegenüberliegend relativ weit beabstandet in den Boden eingefügt werden, dadurch gekennzeichnet, daß die Schutzwände an ihren unteren Enden schräg zueinander hin in den Boden eingefügt werden.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß das Einfügen der Schutzwände (9) solange fortgesetzt wird, bis sich die jeweiligen Schutzwände an ihren unteren Enden virtuell berühren.

12. Verfahren nach Anspruch 10 oder 11, dadurch gekennzeichnet, daß im Anschluß an das Einfügen ein Material, das eine wasserundurchlässige Versiegelung (10) bildet, am unteren Ende der Schutzwände in den zwischen ihnen gebildeten Spalt eingebracht wird.

Revendications

1. Construction de polder comprenant des parois de protection dirigées vers le haut (9) qui sont disposées dans le sol en étant relativement espacées entre elles au niveau du sol, et qui sont raccordées entre elles à leurs extrémités inférieures d'une façon essentiellement imperméable à l'eau, caractérisée en ce que les parois de protection (9) disposées en regard l'une de l'autre délimitent une région en forme d'entonnoir se rétrécissant en direction des extrémités inférieures des parois de protection (9).

2. Construction de polder selon la revendication 1, caractérisée en ce que les parois de protection (9) disposées en regard l'une de l'autre laissent à leurs extrémités inférieures un espace qui est petit par rapport à l'espace au niveau du sol.

3. Construction de polder selon la revendication 1 ou 2, caractérisée en ce que les parois de protection (9) disposées en regard l'une de l'autre se touchent essentiellement mutuellement à leurs extrémités inférieures.

4. Construction de polder selon l'une des revendications précédentes, caractérisée en ce que les parois de protection (9) disposées en regard l'une de l'autre enferment une région essentiellement en forme de V.

5. Construction de polder selon l'une des revendications précédentes, caractérisée en ce qu'un matériau formant une couche ou bouchon imperméable à l'eau (10), tel que du verre soluble, est introduit entre les parois de protection disposées en regard l'une de l'autre à leurs extrémités inférieures.

6. Construction de polder selon l'une des revendications précédentes, caractérisée en ce qu'une section de paroi s'étend toujours au-delà de la section de paroi associée disposée en regard.

7. Construction de polder selon l'une des revendications précédentes, caractérisée en ce qu'une région ayant une surface de triangle tronqué inversé est creusée à l'intérieur de la région en forme d'entonnoir, en résultat de quoi des talus sont présents le long des parois de protection.

8. Construction de polder selon l'une des revendications précédentes, caractérisée en ce que, au niveau du sol, l'espace entre les parois de protection (9) disposées en regard l'une de l'autre est d'au moins 5 mètres, et en ce que, au niveau des extrémités inférieures des parois de protection (9), l'espace est d'au plus 3 mètres, et, plus particulièrement, de 1 mètre.

9. Construction de polder selon l'une des revendications précédentes, caractérisée en ce que les parois de protection (9) disposées en regard l'une de l'autre incluent un angle d'environ 20° à 130°, et, de préférence, de 60° à 100°.

10. Procédé pour créer une construction de polder selon l'une des revendications précédentes, dans lequel des parois de protection (9) sont insérées dans le sol en regard l'une de l'autre et relativement écartées l'une de l'autre au niveau du sol, caractérisé en ce que les parois de protection sont insérées dans le sol en pente l'une vers l'autre leurs extrémités inférieures.

11. Procédé selon la revendication 10, caractérisé en ce que l'insertion des parois de protection (9) se poursuit jusqu'à ce que les parois de protection respectives se touchent virtuellement entre elles à leurs extrémités inférieures.

12. Procédé selon la revendication 10 ou 11, caractérisé en ce qu'après l'insertion, un matériau formant un joint imperméable à l'eau (10) est introduit à l'extrémité inférieure des parois de protection dans l'espace formé entre elles.

fig-1

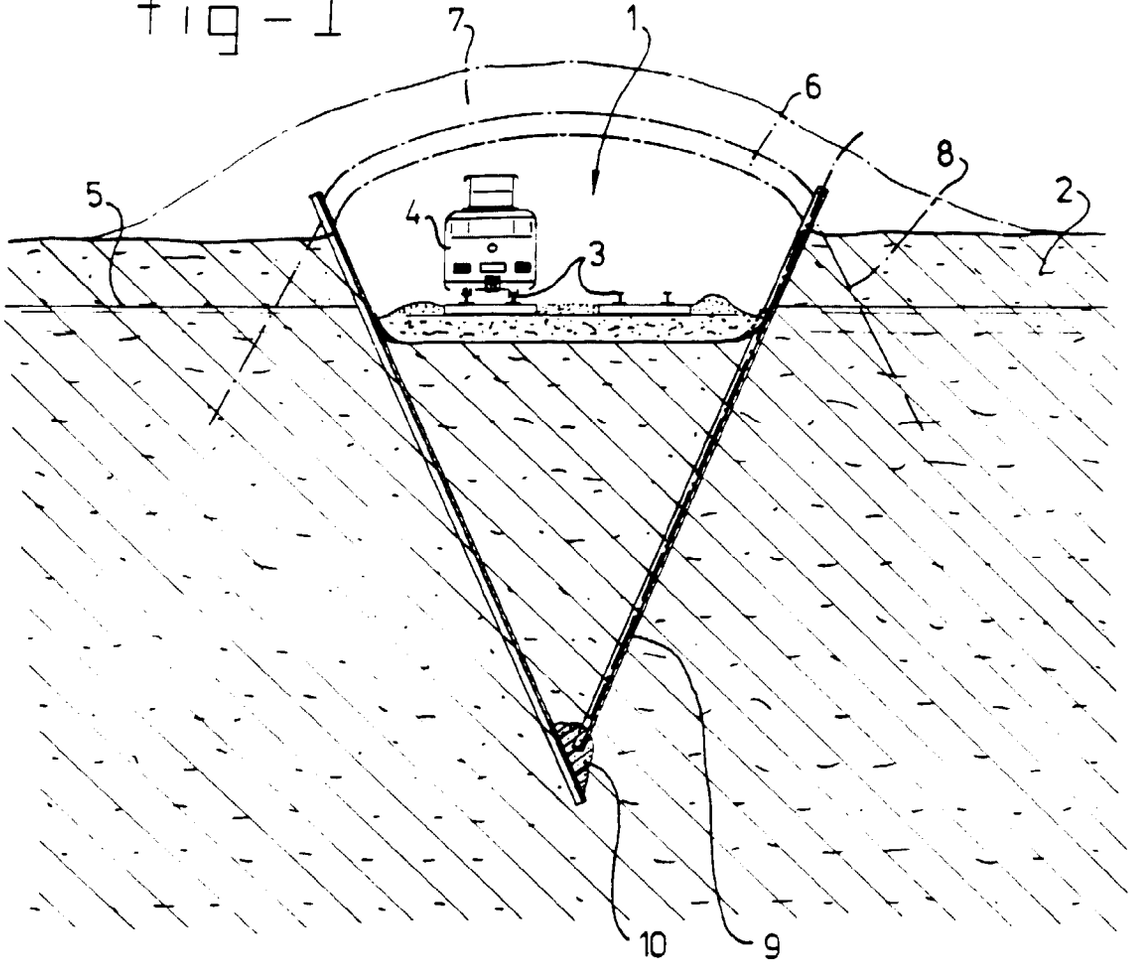

fig-2