Feb. 25, 1969 G. WEY 3,429,126

METHOD OF PRODUCING A CONTINUOUS BORE PILE WALL

Filed Jan. 21, 1966 Sheet 1 of 4

Fig. 1

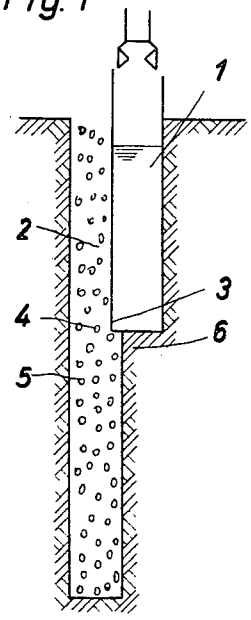


Fig. 2

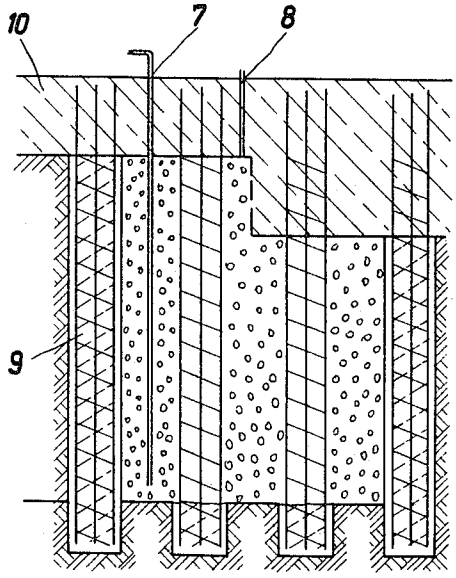


Fig. 3

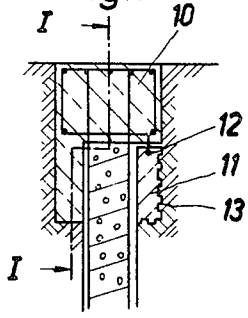


Fig. 4

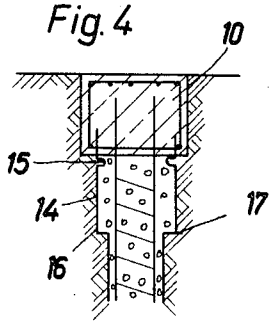
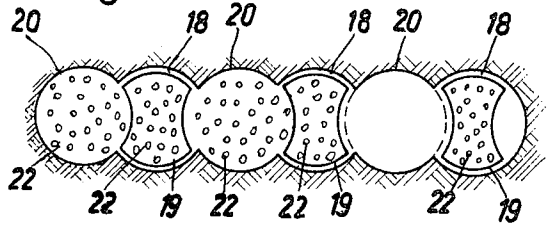


Fig. 5



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Filed Jan. 21, 1966 Sheet 2 of 4

Fig. 6

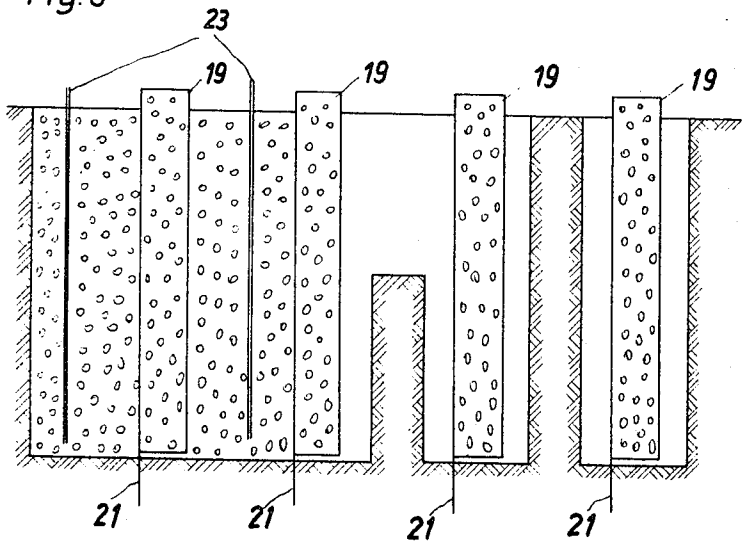


Fig. 7

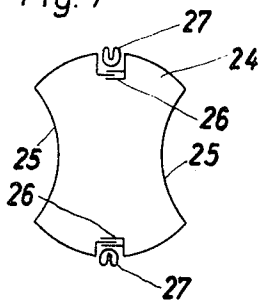


Fig. 8

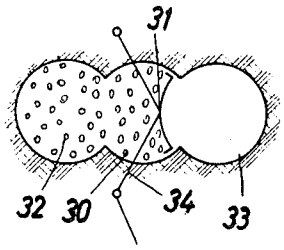


Fig. 9

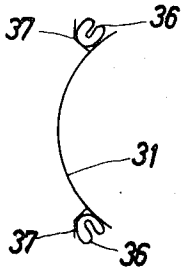


Fig. 10

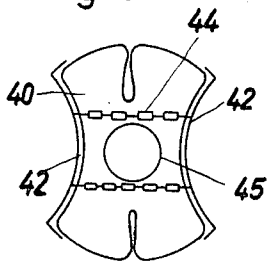
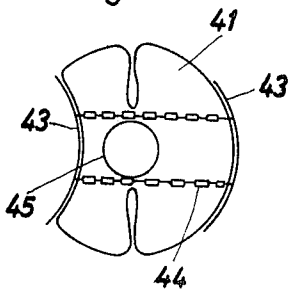


Fig. 11



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METHOD OF PRODUCING A CONTINUOUS BORE PILE WALL

Filed Jan. 21, 1966

Fig. 12

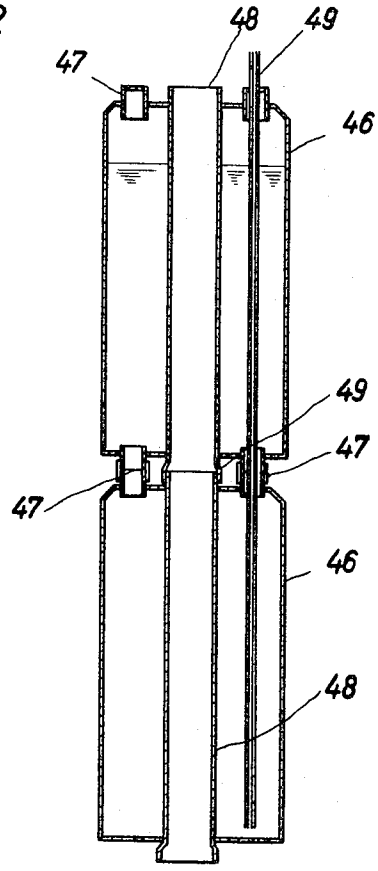
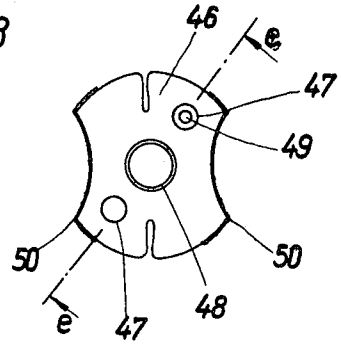


Fig. 13



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METHOD OF PRODUCING A CONTINUOUS BORE PILE WALL

Filed Jan. 21, 1966 Sheet 4 of 4

Fig. 14

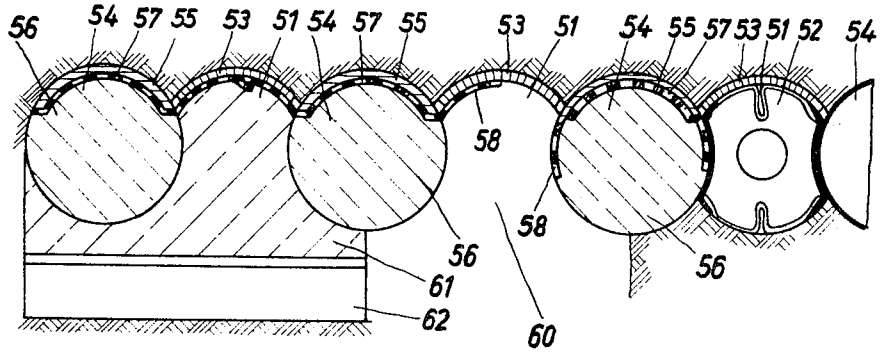
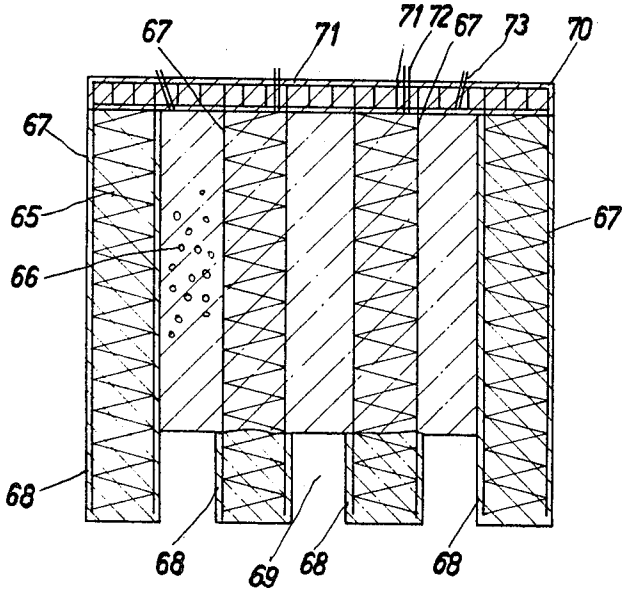


Fig. 15



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United States Patent Office 3,429,126
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3,429,126

METHOD OF PRODUCING A CONTINUOUS BORE PILE WALL

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U.S. Cl. 61—35 5 Claims
Int. Cl. E02d 5/34, 5/12

ABSTRACT OF THE DISCLOSURE

The method disclosed herein is for constructing a continuous wall of piles for retaining walls, the sides of excavations and the like, and comprises boring a plurality of holes such that in the final ararngement of bore holes the distance between the centers of two adjacent holes is less than the diameter of each hole, placing a filling material or removable filling member which can be shaped to the profile of an adjacent overlapping bore hole in each hole before boring an overlapping adjacent hole and thereafter filling the bore holes with concrete and/or injecting cement grout into the filling material.

This invention concerns a process for the construction of a coherent piling wall for shoring of ground excavations, retaining walls etc. In particular the object of the invention is the building of a sheetpiling-wall by drilling holes into the ground, being spaced at a distance from one another (between centers) inferior to the diameter of the hole.

One already known process consists of filling bored holes with stones and subsequently another hole is drilled into the ground in such a way that the following hole is cutting the preceding one. This method has the disadvantage that by lowering the adjacent hole earth is introduced into the voids of the stones having been placed before, so that a complete injection with grout cannot be carried out any more. In consequence the required resistance and strength is not obtained, penetration of water and flushing of earth materials and a collapse of the construction is possible.

The object of the invention is to avoid these disadvantages. According to the invention, this is secured by supplying the preceding hole with a screen, the profile of which can be formed according to the diameter of the subsequent hole before this is being drilled.

Several methods exist for the practical carrying out of the process. The invention is realized in principle by application of a screen consisting of a filling with a material allowing an easy cutting of the existing pile by the following drilling hole, or the use of a screen forming a shoring, the profile of which corresponds to the diameter of the adjacent hole to be lowered.

The invention shall further be described by drawings, showing various examples of execution. The drawings demonstrate:

FIGS. 1 and 2. The process according to the invention by application of a screen consisting of a filling material.

FIGS. 3 and 4. Top girder for the execution of the process according to FIGS. 1 and 2.

FIGS. 5 and 6. Process according to invention by application of a screen forming a shoring.

FIG. 7. Shoring by using tubular casings.

FIG. 8. Variation of the process according to invention shown in FIGS. 5 and 6.

FIG. 9. A shoring for the process according to FIG. 8.

FIGS. 10 and 11. Variations for shorings.

FIGS. 12 and 13. Ditto, according to FIGS. 10 and 11 for great depths.

FIG. 14. A further variation of the process according to invention corresponding to FIGS. 5 and 6.

FIG. 15. Process according to invention with armed piles.

FIG. 1 shows a partially bored hole **1**, cutting an adjoining, already bored hole **2** in **3**. The previously bored hole **2** is filled with stones **4**, the voids of which are filled with a mass or material **5** such as a slurry which may contain a pore forming material and which can be readily cut when boring the subsequent hole. The mass **5** prevents earth material **6** from penetrating into the voids of the stones **4** during boring of the hole **1**. The mass **5** is, as shown in FIG. 2, introduced by injection pipes **7**; another pipe **8** is placed in a way that air or water can escape. After the injection of the mass **5** the pipe **8** is closed and the injection in pipe **7** continued with pressure, so that the injected material penetrates into the adjacent ground in order to produce an additional sealing against penetrating underground water or underground currents. A suitable method is the use of a suspension or emulsion, which later can be removed easily, for example by flushing water being pumped through the aggregates; after which an injection of concrete or grout is injected. Under certain circumstances, for example if only a waterproof sealing is required, an injection of clay jelly using admixtures of colloidal chemicals and cement can be made. Preferably single bored concrete piles with a continuous armature **9** are carried out, bearing the pressure on the top girder **10**.

FIGS. 3 and 4 show a section of a preferable construction of the top girder **10**. The junction with a closing wall **11** is made inflexible or flexible by a joining belt **12**, which is provided with ribs **13** in order to prevent an escape of injected grout when pressure is applied along the wall **16**. FIG. 4 shows a top girder **10** with plates **14** on the side provided with folds **15** and canes **16** or angles **17** in order to prevent leaking.

FIGS. 5 and 6 show a process according to invention wherein the screen comprises a removable filler member to form a shoring. FIG. 5 is a horizontal, FIG. 6 a vertical cross section, illustrating a first row of holes **18** drilled such that the distance between their centers is less than twice the diameter of the holes. Subsequently shorings or removable filler members **19** are lowered into these holes **18** and a second row of holes **20** between the first row of holes **18** is bored. The shoring **19** show a profile formed according to the diameter of the holes **20** to be drilled. The shorings **19** can be provided with an anchorage **21** by which they are fixed in the ground. Then then filling of the holes **20** with coarse aggregates **22** is carried out as well as the filling of the shorings **19**; after this operation the shorings are removed. Finally the voids of the aggregates are injected with grout through pipes **23**. FIG. 7 shows a process according to the invention using a shoring **19** having a form of a tubular case **24** with two opposite concave surfaces **25**. This tube can be formed of two parts, these being connected by fish plates **26** between which tubes **27** are placed through which air and water can escape.

A further form of the process according to the invention is represented in FIG. 8; here the single bore holes are lowered continuing in one direction by introducing into a bored hole **30** a shoring **31** and coarse aggregates

32 before the overlapping subsequent hole 33 is drilled. The shorings 31 can be fixed by special anchorages 34. After the removal of the shorings 31 the voids of the stones 32 are injected with grout. FIG. 9 represents a shoring 31 being used for such purposes. It consists of a curved plate at the side of which air and water escape tubes 36 are fixed, being protected by plates 37. Instead of the tubes with protecting plates it is possible to fix angles with flexible belts at the side of the shoring.

FIGS. 10 and 11 represent a further suitable form of shoring consisting of a flexible tube 40, 41 being enclosed by stiff curved plates 42, 43 turned to the joining holes with a corresponding form and which are suitably connected by chains 44 or ropes. In the center a passing filling tube 45 is placed.

FIGS. 12 and 13 represent a shoring tube to be used for great depths, consisting of several units 46, which are placed one above the other and connected with junctions 47 which can be loosened again. The filling tube 48 in the center has at the bottom a bell-shaped enlargement 49, so that the tubes can be pushed one on the other. The junctions 47 are formed in such a way that a water pipe 49 can be passed and the tube units 46 are connected with one another so that these can be filled with water and emptied again. FIG. 13 shows the view on the top of the unit 46 designed in FIG. 12, where in the nozzle junction 47 a water pipe 49 is introduced and in the center the filling tube 48 is to be seen. As described above the tubular unit is provided at the sides with plates 50 of suitable shape.

In FIG. 14 it is referred to another alternative application of the process, according to which a first row of bored holes 51 are spaced at a distance less than twice the diameters of the bore holes 51. Into these holes 51 are introduced shorings 52 and on the wall side protective plates 53. As already described a second row of holes 54 is sunk between the holes 51 of the first row, thereafter either auxiliary tubes to be later removed and bearing on their outer surface insulating sheets remaining in the bore holes or protective plates 55 or shells are lowered into the holes 54 of the second row, being aligned with the already placed plates 53 and finally the remaining part of the hole 54 is filled with concrete 56. The joints between the plates 53, 55 are injected with grout and the shorings 52 removed of the holes 51, of the first row. On the inside area of the plates 53, 55 a member 57 can be fixed, the member 57 being fixed on the plates 53 with overlapping parts 58 which are folded or turned to the plates 53 after the removal of the shoring 52. The plates 53, 55 can also be provided with overlapping angular borders. A further development of the process is the excavation of the earth 60 on the inner side of the curved plates 53, 55 and the application of a concrete facing 61 and, if necessary of an angular supporting foundation 62 as shown in the left part of FIG. 14.

FIG. 15 shows the construction of a wall of bored piles with armature 65. This armature 65 is introduced into single piles 67 between the parts filled with stones 66. These piles 67 can, as shown in FIG. 15 be bored deeper into the ground 69, and after the placement of the armature 65 and the aggregates 66 in the lower part 68 of the hole 67 be filled with ordinary concrete or injected with grout. Subsequently on the upper part of the wall-section a horizontal girder 70 is placed in ordinary concrete with armature 71 and apertures 72 for the injection tubes and nozzles 73 for the escape of air or water. The armature 65 of the pile is tied to the horizontal girder 70. After the hardening of the concrete in the bottom of the piles 68 the voids in the stones are injected. It is also possible to build a concrete anchorage in the lower part of the piles, when all piles are bored to the same depth; in this case after the hardening of the concrete in the lower part it proceeds in the same way. It has proved to be advantageous to divide the wall into different parts by the construction of piles in ordinary concrete, in order to limit the size of the single injection zones.

What I claim is:

1. A method of constructing a continuous wall of piles for retaining walls, the sides of excavation and the like, comprising boring a plurality of holes such that in the final arrangement of bore holes the distance between the centers of two adjacent holes is less than the diameter of each hole, placing a screen which is shaped to the profile of each bore hole in each hole before boring an overlapping adjacent hole and thereafter filling the bore holes with a permanent setting material,

said screen comprising a removable filling member, said boring of said holes is achieved by boring a first row of holes, the distance between the centers of two adjacent holes in said first row being less than twice the diameter of the holes in the first row, placing a removable filling member in each hole in said first row, boring a second row of holes between the holes in said first row, filling all the holes with coarse filling material, removing the filling members and injecting said setting material into said filling material.

2. A method of constructing a continuous wall of piles for retaining walls, the sides of excavation and the like, comprising boring a plurality of holes such that in the final arrangement of bore holes the distance between the centers of two adjacent holes is less than the diameter of each hole, placing a screen which is shaped to the profile of each bore hole in each hole before boring an overlapping adjacent hole and thereafter filling the bore holes with a permanent setting material,

said screen comprising a filling member, said boring of said holes being achieved by boring a first row of holes, the distance between the centers of two adjacent holes in said first row being less than twice the diameter of the holes in the first row, placing a protective plate or shell and a filling member in each hole in the first row, the plates being placed on the side which will form an outerface of the finished wall, boring a second row of holes between the holes in the first row, placing auxiliary pipes in the holes of the second row, said auxiliary pipes being provided with waterproofing material on their outer surfaces, filling the auxiliary pipes with said setting material in the form of concrete, removing the pipes from the holes before the concrete sets and simultaneously injecting grout into the cavities formed by the auxiliary pipes.

3. A method of constructing a continuous wall of piles for retaining walls, the sides of excavation and the like, comprising boring a plurality of holes such that in the final arrangement of bore holes the distance between the centers of two adjacent holes is less than the diameter of each hole, placing a screen which is shaped to the profile of each bore hole in each hole before boring an overlapping adjacent hole and thereafter filling the bore holes with a permanent setting material,

said screen comprising a filling member and said boring of said holes being achieved by boring a first row of holes, the distance between the centers of two adjacent holes in said first row being less than twice the diameter of the holes in the first row, placing a protective plate or shell and a filling member in each hole in the first row, the plates being placed on the side which will form an outerface of the finished wall, boring a second row of holes between the holes in the first row, placing further protective plates in the holes of the second row, said further protective plates being aligned with the plates in the first row of holes, filling the holes with said setting material in the form of concrete, injecting grout into the joints between the plates and removing the filling members from the holes in the first row.

4. The method set forth in claim 3 wherein waterproof-

ing material is provided on the inside of the protective plates.

5. The method set forth in claim 3 wherein the earth on the inner side of the plates is excavated and a concrete facing applied to said inner side.

References Cited

UNITED STATES PATENTS

2,791,886	5/1957	Veder	61—35 X
2,539,670	1/1951	Ognibene	61—59
2,555,359	6/1951	Montague	61—531 X
3,195,311	7/1956	Degen	61—35

FOREIGN PATENTS

226,160	3/1963	Austria.
1,072,071	3/1954	France.
244,444	3/1912	Germany.
814,873	9/1951	Germany.
959,660	6/1964	Great Britain.
307,433	5/1933	Italy.
513,402	2/1955	Italy.
545,787	7/1956	Italy.

OTHER REFERENCES

DAS 1,093,736 November 1960, German printed application to Helfmann.

JACOB SHAPIRO, *Primary Examiner.*

U.S. Cl. X.R.

61—53.62, 53.66, 59