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(72) (73) Feltaláló(k) és szabadalmas(ok):
**Keuschnig, Günter, 1020 Wien (AT)**

(74) Képviselő:
**Horváthné Faber Enikő, ADVOPATENT Szabadalmi és Védjegy Iroda, Budapest**

(54) **Eljárás cső függőleges fektetésére, és berendezés ehhez**

## BACKGROUND OF THE INVENTION

The invention relates to a method for the perpendicular laying of a pipe, preferably a steel pipe, in a ground, preferably earthy ground, wherein the pipe is positioned at first in a perpendicularly aligned manner above a laying location and repetitive force pulses are delivered to a face end of the pipe which is remote from the ground by means of a preferably hydraulically driven striker of a striking apparatus in order to ram said pipe into the ground, according to the preamble of claim 1, and a respective striking apparatus and a respective striking plate.

## DESCRIPTION OF THE PRIOR ART

Pipes laid perpendicularly in the ground are often used as the basis for foundations of buildings above ground. A broad field of application relates to sound insulation walls, which usually consist of plate-shaped sound protection elements which are arranged between supports protruding vertically from the ground and are fixed thereto. In order to ensure secure anchoring of the supports, they are introduced into pipes previously laid perpendicularly in the ground. The pipes are then filled with concrete.

The laying of the pipes in the ground occurred up until now by means of a vibrating technology. Vibrating apparatuses are used for this purpose, which drive the pipes perpendicularly into the ground by means of oscillating elements which are mounted on unbalanced masses and which are moved under considerable input of energy. The problematic aspect is the positioning of the pipes which can often only occur in a highly imprecise manner.

The far greater problem in these known methods is the compaction of the ground which occurs in the course of the vibrating process,

which renders the laying process even more difficult, and the expenditure of force required for the laying needs to be increased with progressing duration of the laying process.

Methods are already known (see DE 29 00 221 A1 or DE 197 34 966 A1 for example) in which the compaction of the ground is substantially prevented during the laying process and the required energy input is lower than in conventional methods. DE 29 00 221 A1 shows a ramming apparatus which is driven by a pressure medium and which comprises a housing in which a striking body is displaceably guided and rests on a strike transmission apparatus 11, which rests on its part on a ramming part 10, i.e. a perpendicularly arranged pipe.

It is an object of the present invention to provide a method for the perpendicular laying of a pipe, preferably a steel pipe, in a ground, with which a cost-effective modular configuration of the striking apparatus and an attachment to various construction machines is enabled.

## SUMMARY OF THE INVENTION

This object is achieved in accordance with the invention by the method according to claim 1, according to which a pipe is positioned at first in a perpendicularly aligned manner above a laying location and repetitive force pulses are delivered to a face end of the pipe which is remote from the ground by means of a preferably hydraulically driven striker of a striking apparatus in order to ram said pipe in the ground, such that its perpendicular positioning above the laying location occurs by suspending the pipe on the striking apparatus. The laying of the pipe can thus be arranged in an especially simple way, and the inadvertent compaction of the ground is prevented in any case by the method according to claim 1. Furthermore, the mechanical configuration of the striking apparatus is cost-effective,

requires little maintenance and is sturdy. A rapid laying process is enabled by the method.

The striking apparatus comprises in a preferred embodiment a preferably hydraulically operating drive apparatus which is arranged in a housing and which drives a striker that is mounted in a linearly movable manner in the housing, and comprises a striking plate which is fixed to the housing and is preferably suspended, and the striker can be moved from a position not making contact with the striking plate to a position making contact with the striking plate outside of the housing and vice versa. This provides a modular compact variant of an embodiment of the striking apparatus, which is suitable for rapid mounting on a construction machine such as an excavator or a similar utility vehicle.

In order to transmit the repetitive force pulses of the striker onto the pipe, it is further provided that the striking plate makes contact with the face end of the pipe remote from the ground at least in the position where contact is established with the striker.

The striking plate of the striking apparatus has a substantially cylindrical base body, comprising a first face end facing away from the striker and a second face end facing a contact surface of the striker, wherein a depression is provided on the second face end, which depression is preferably adjusted with respect to its shape and dimensions to the contact surface. The depression allows a constant distribution of force within the striking plate.

In order to fix the position of the striking plate upon contact with the pipe, it can be provided that it comprises a substantially cylindrical base body, having a first face end on which a cylindrical shoulder is provided, which shoulder is arranged concentrically to the cylindrical base body and has a smaller diameter than the base body. The shoulder protrudes into

the interior of the pipe and thus prevents lateral slippage of the striking plate.

In order to ensure that the striking plate is suitable for attachment in pipes with different inner diameters, it is further provided in an especially preferred variant of the embodiment that the striking plate has a substantially cylindrical base body, having a first face end on which several cylindrical shoulders are provided, which shoulders are arranged concentrically to the cylindrical base body and respectively have a smaller diameter than the base body, wherein the several shoulders have different diameters with respect to each other and the diameters of the several shoulders decrease with increasing distance thereof from the base body.

In order to prevent canting of the striking plate with the face end of the pipe which is remote from the ground and to facilitate centric application of the striking plate on the pipe, the jacket surface of the one shoulder or the respective jacket surfaces of the several shoulders respectively enclose an obtuse angle with the first face end of the base body.

For the purpose of ensuring a distribution of the forces occurring on the face end facing the striker as uniform as possible, the striking plate comprises a depression on a second face end opposite of the first face end, which depression is provided for accommodating a contact surface of a striker.

Since the striking plate has a high weight, it comprises openings for the purpose of easy handling capability, which openings enable the suspension of the striking plate by means of cable or other holding elements. The openings are preferably arranged as boreholes. The anchoring within said openings can be achieved for example in such a way that the cable or holding elements are respectively fixed on a pin situated transversely to the axis of the borehole. The fixing can alternatively also be realised by

continuous openings, whose diameter expands in the direction of the first face end and is thus suitable of accommodating a respectively formed region of the cable or holding element, e.g. a wedge-shaped body, and is thus prevented from moving in the direction of the second face end.

In an especially preferred variant of the embodiment, the striking apparatus is attached to a construction machine, e.g. an excavator or a similar utility vehicle. The construction machine is arranged with a chassis and a jib arranged thereon, wherein the end region of the jib facing away from the chassis is formed by the striking apparatus with a striking plate.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be explained below in closer detail by reference to an embodiment shown in the drawings, wherein:

Fig. 1 shows a side view of a construction machine, including the striking apparatus, the striking plate and the pipe;

Fig. 2 shows a top view of the striking plate;

Fig. 3 shows a bottom view of the striking plate;

Fig. 4 shows a side view of the striking plate.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 shows a side view of a construction machine 18, including the striking apparatus 4, the striking plate 9 and the pipe 1. The illustration shows a construction machine 18, e.g. an excavator or a similar utility vehicle, on the chassis 19 of which a jib 20 is attached, whose end region 21 is formed by a striking apparatus 4 in accordance with the invention, or on whose end region 21 a striking apparatus 4 in accordance with the

invention is attached by means of conventional quick-change apparatuses.

The striking apparatus 4 per se comprises a housing 6, a drive apparatus 7 arranged in said housing, and a striking plate 9 which is fixed to the housing and is preferably suspended.

The preferably hydraulically driven drive apparatus 7 drives a striker 8, which during the method in accordance with the invention strikes a depression 15 in the striking plate 9, which on its part makes contact with the pipe 1. The striking plate 9 is suspended in this case by means of cable or holding element 17 on the housing 6, wherein the striking plate 9 comprises openings 16 in which the cable or holding elements 17 are anchored.

The striking plate 9 per se consists of a cylindrical base body 10, which in the illustrated embodiment comprises two shoulders 12, 13 on a first face end 11 facing away from the striker. The jacket surfaces 23 (see Fig. 4) of the shoulders 12, 13 respectively enclose an obtuse angle $\alpha$ (see Fig. 4) with the first face end 11 of the base body. A second face end 14 of the striking plate 9 which faces the striker comprises the depression 15, which is suitable for absorbing force pulses of the striker 8 via its contact surface 24. The striking plate 9 is situated in the working position above the pipe 1, which is fixed by means of a flexible connecting element 22 to the housing 6. The connecting element 22 can be arranged as a retaining strap for example.

Fig. 2 shows the layout of the striking plate 9 according to Fig. 1, which shows a view of the second face end 14 of the striking plate 9. The depression 15 is situated in the centre. The openings 16 arranged in the boundary region are additionally visible.

Fig. 3 shows the first face end 11 of the striking plate 9 which is opposite of the second face end 14. The shoulders 12, 13 are situated in its centre. The striking plate 9 can alternatively also comprise three, four or five shoulders. Furthermore, the cylindrical base body 10 and the jacket surfaces 23 (see Fig. 4) are visible.

Fig. 4 shows a side view of the striking plate 9. The shoulders 12, 13 are visible, whose respective jacket surfaces 23 respectively enclose an obtuse angle $\alpha$ with the first face end 11 of the base body.

FUNCTIONALITY OF THE INVENTION

The functionality of the invention shall be explained below by reference to an example.

In order to lay a pipe 1 perpendicularly in the ground 2, it is provided in accordance with the invention to position the pipe 1 at first perpendicularly above the laying location 3 and to apply by means of the striker 8 repetitive force pulses onto the striking plate 9 and thus onto the face end of the pipe 5 remote from the ground 2 in order to ram said pipe into the ground 2. The pipe 1 is fixed in this process by means of a connecting element 22 to the housing 6, which on its part is connected to a construction machine 18. The positioning of the pipe 1 occurs through a respective positioning of the housing 6, whose position is predetermined by the construction machine 18. The perpendicular alignment of the pipe 1 occurs by gravity.

The construction machine 18 can be moved in the ambient environment either independently, or it can be arranged on a carriage in order to erect a foundation of noise protection walls for example, which are to be mounted parallel to the traffic rails. The construction machine 18 comprises a chassis 19 and a

jib 20 which is arranged thereon, whose end region 21 which faces away is formed by the striking apparatus 4.

If the pipe 1 is situated at the laying location 3, the striking plate 9 is moved towards the face end 5 of the pipe 1 which is remote from the ground 2, so that at least one of the shoulders 12, 13 protrudes into the interior of the pipe 1. It is thus preferably but not mandatorily provided that the face end 11 of the striking plate 9 also makes contact with the face end 5 of the pipe 1. Since the striking plate 9 is suspended on the housing 6, only a low aligning force is required for the correct movement or placement of the striking plate 9 on the pipe 1, which force can be applied by a construction worker for example. The striker 8 is in a non-contacting position and is now accelerated in order to impact the depression 15 of the striking plate 9 in a contacting position and to thus transmit a force pulse over a large area onto said striking plate and thus onto the pipe 1. In the event that the striking plate 9 is moved at first merely towards the face end 5 of the pipe 1 which is remote from the ground 2, so that at least one of the shoulders 12, 13 protrudes into the interior of the pipe 1, the contact established between the striking plate 9 and the face end 5 of the pipe 1 also occurs in the course of the impact of the striker 8 on the striking plate 9.

Finally, the striker 8 is moved from the depression 15 back to a non-contacting position, which enables a renewed acceleration of the striker 8 to the contacting position. As a result of a repetition of this process, the pipe 1 is successively driven into the ground 2 until the desired end position is reached. The connecting elements 22 can already be released once the pipe 1 is situated in a stable position, which is generally already achieved before reaching the end position.

LIST OF REFERENCE NUMERALS

| | |
|---|---|
| 1 | Pipe |
| 2 | Ground |
| 3 | Laying location |
| 4 | Striking apparatus |
| 5 | Face end of pipe |
| 6 | Housing |
| 7 | Drive apparatus |
| 8 | Striker |
| 9 | Striking plate |
| 10 | Cylindrical base body |
| 11 | First face end of the base body |
| 12 | Shoulder |
| 13 | Shoulder |
| 14 | Second face end of the base body |
| 15 | Depression |
| 16 | Openings |
| 17 | Cable or holding element |
| 18 | Construction machine |
| 19 | Chassis |
| 20 | Jib |
| 21 | End region |
| 22 | Connecting element |
| 23 | Jacket surface of the shoulder/shoulders |
| 24 | Contact surface of the striker |

EP 2 530 205

# ELJÁRÁS CSŐ FÜGGŐLEGES FEKTETÉSÉRE, ÉS BERENDEZÉS EHHEZ

## Szabadalmi igénypontok

1. Eljárás cső (1), különösen acélcső függőleges fektetésére talajban (2), előnyösen földes talajban (2), amely eljárásban a csövet (1) először függőlegesre állítva pozicionáljuk egy fektetési hely (3) felett, és verőberendezés (4) előnyösen hidraulikusan meghajtott verőtestével (8) ismétlődő erőimpulzusokat adunk a cső (1) talajtól (2) távolabbi homlokoldalára (5) a cső talajba (2) veréséhez, **azzal jellemezve, hogy** a cső (1) függőleges pozicionálása a fektetési hely (3) felett a csőnek (1) a verőberendezésre (4) függesztésével történik.

2. Verőberendezés (4) az 1. igénypont szerinti eljárás végrehajtására, amely verőberendezés házban (6) elhelyezett, előnyösen hidraulikusan működő hajtóberendezést (7) tartalmaz, amely a házban (6) lineárisan mozgathatóan ágyazott verőtestet (8) hajt meg, valamint a verőberendezés a házon (6) rögzített, előnyösen felfüggesztett verőlapot (9) tartalmaz, továbbá a verőtest (8) a verőlappal (9) nem érintkező helyzetből a verőlappal (9) érintkező, a házon (6) kívüli helyzetbe mozgatható és fordítva, **azzal jellemezve, hogy** a verőlap (9) egy lényegében hengeres alaptesttel (10) rendelkezik, amelynek egy első, a verőtesttől (8) távolabbi homlokoldala (11), valamint egy

második, a verőtest (9) érintkezőfelülete (24) felőli homlokoldala (14) van, és a második homlokoldalon (14) egy előnyösen méret és alak tekintetében az érintkező-felülethez (24) hozzáigazított mélyedés (15) van kialakítva.

3. Verőlap (9) a 2. igénypont szerinti verőberendezéshez (4), amely verőlap (9) egy lényegében hengeres alaptesttel (10) rendelkezik egy első homlokoldallal (11), amelyen egy hengeres, a hengeres alaptesttel (10) koncentrikusan elhelyezett, az alaptestnél (10) kisebb átmérőjű nyúlvány (12) van kialakítva, **azzal jellemezve, hogy** a verőlap (9) az első homlokoldallal (11) átellenes második homlokoldalon (14) mélyedéssel (15) van ellátva, amely a verőtest (8) érintkezőfelületének (24) befogadására van kialakítva.

4. Verőlap (9) a 3. igénypont szerinti verőberendezéshez (4), **azzal jellemezve, hogy** egy lényegében hengeres alaptesttel (10) rendelkezik egy első homlokoldallal (11), amelyen lépcsősen több hengeres, a hengeres alaptesttel (10) koncentrikusan elhelyezett, az alaptestnél (10) kisebb átmérőjű nyúlvány (12, 13) van kialakítva, a nyúlványok (12, 13) különböző átmérőjűek, és a nyúlványok (12, 13) átmérője az alaptesttől (10) növekvő távolsággal csökken.

5. A 3. vagy 4. igénypont szerinti verőlap (9), **azzal**

**jellemezve, hogy** az egyetlen nyúlvány (12) palástfelülete (23), ill. a több nyúlvány (12, 13) mindenkori palástfelülete (23) tompaszöget ($\alpha$) zár be az alaptest első homlokoldalával (11).

6. A 2.-5. igénypontok egyike szerinti verőlap (9), **azzal jellemezve, hogy** a verőlap (9) nyílásokkal (16) van ellátva, amelyek lehetővé teszik a verőlap (9) felfüggesztését kötél- vagy más tartóelemek (17) segítségével.

7. Építőgép (18) alvázzal (19) és ezen elhelyezett darugémmel (20), **azzal jellemezve, hogy** a darugémnek (20) az alváztól (19) távolabbi végrészét (21) a 2. igénypont szerinti verőberendezés (4) alkotja, amely a 3.-6. igénypontok egyike szerinti verőlappal (9) rendelkezik.

A meghatalmazott:

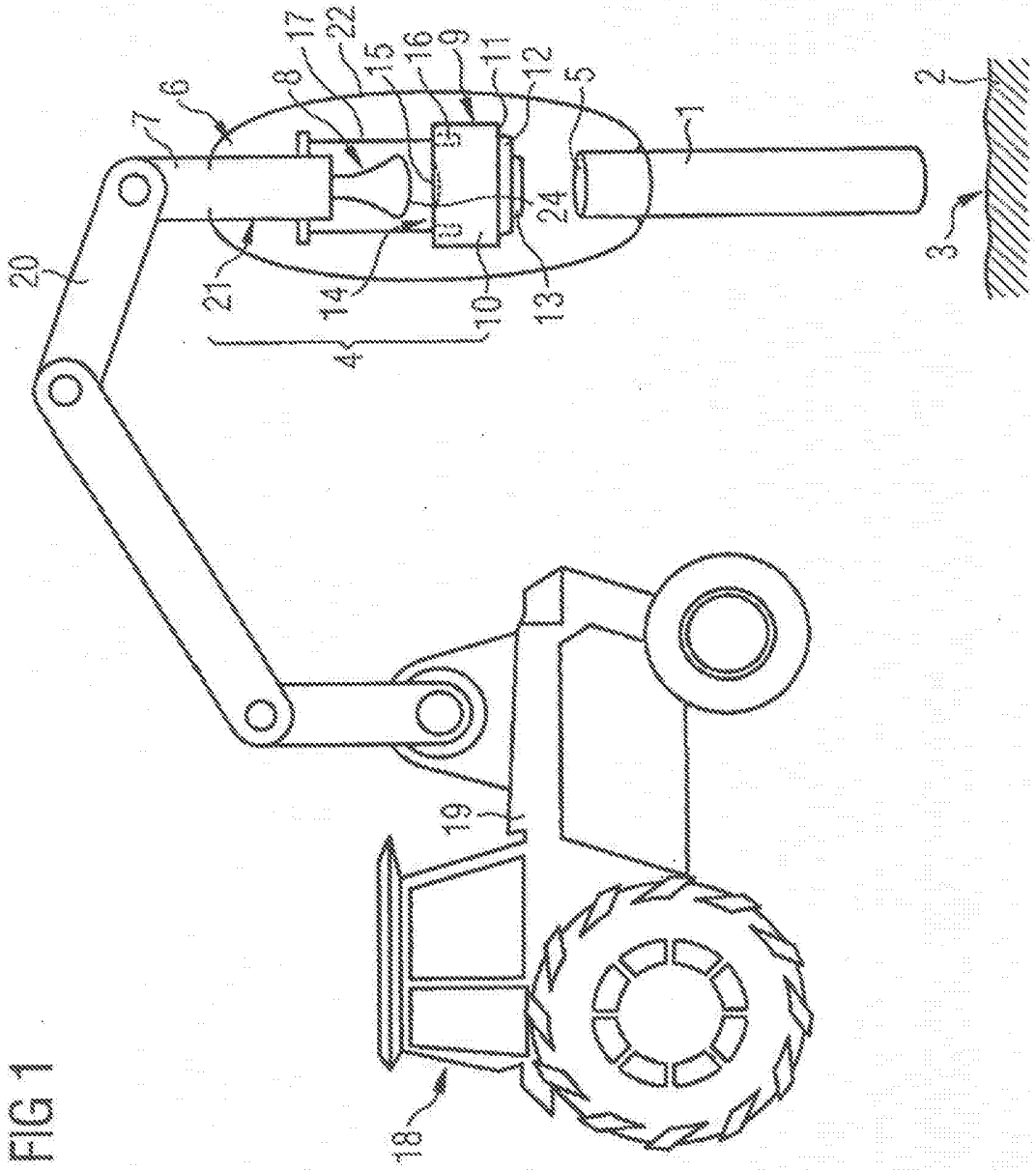


FIG 1

FIG 2

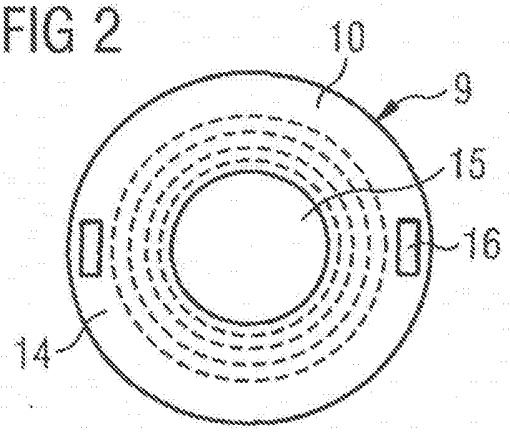


FIG 3

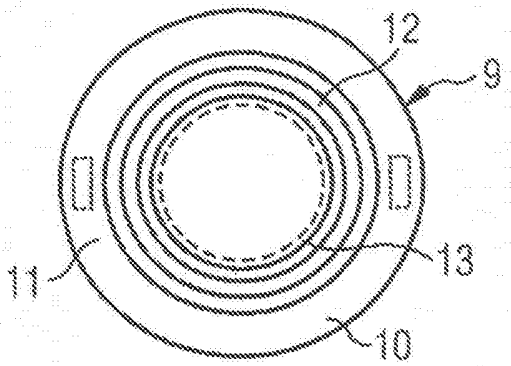


FIG 4