(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 517 005 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.03.2025 Bulletin 2025/10

(21) Application number: **24195598.8**

(22) Date of filing: **21.08.2024**

(51) International Patent Classification (IPC):
E02D 5/64 *(2006.01)* ***E02D 5/56*** *(2006.01)*
E02D 5/80 *(2006.01)* ***E02D 3/08*** *(2006.01)*
E02D 7/22 *(2006.01)* ***E02D 5/52*** *(2006.01)*
E02D 27/50 *(2006.01)* ***E21B 17/10*** *(2006.01)*
E21B 7/06 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E02D 5/56; E02D 3/08; E02D 5/64; E02D 5/523; E02D 5/801; E02D 7/22; E02D 27/50; E21B 7/068; E21B 17/1078

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **28.08.2023 IT 202300017667**

(71) Applicant: **Dalla Gassa srl**
36073 Cornedo Vicentino (VI) (IT)

(72) Inventors:
- **DALLA GASSA, Gaetano**
  36073 Cornedo Vicentino (VI) (IT)
- **BISSON, Alberto**
  36100 Vicenza (IT)

(74) Representative: **Marchioro, Paolo**
Studio Bonini S.r.l.
Corso Fogazzaro, 8
36100 Vicenza (IT)

(54) **REINFORCEMENT KIT FOR SELF-DRILLING HOLLOW BARS PARTICULARLY SUITABLE FOR SELF-DRILLING MICROPILES**

(57) A reinforcement kit (1; 100) that can be coupled to self-drilling micropiles (2) provided with a continuous outer thread (3) and configured to be driven into a soil (T) to be consolidated. The reinforcement kit (1; 100) comprises a reinforcing tubular body (4) configured to be arranged coaxially on the outside of a self-drilling micropile (2) and screw means (5; 105) that are configured to be screwed on the outside of the self-drilling micropile (2) to tighten the reinforcing tubular body (4) between them and to restrain it in the desired position along the self-drilling micropile (2). In the reinforcing tubular body (4) a plurality of holes (7) passing through the thickness of its side wall (4e) are present.

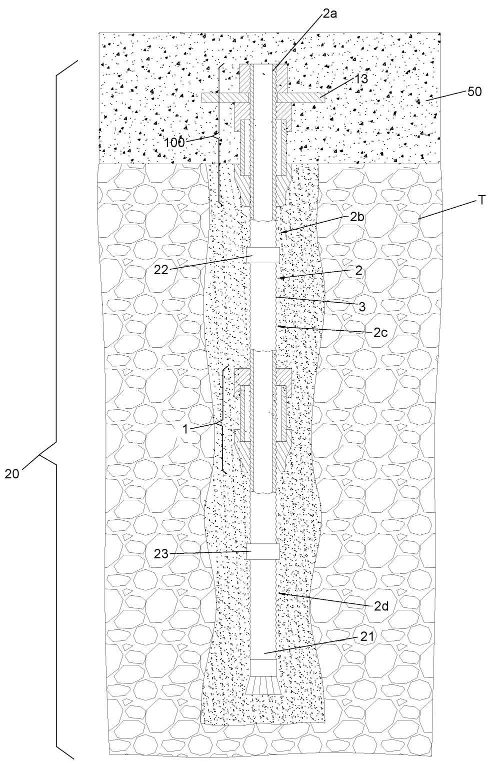

Fig.5

EP 4 517 005 A1

Description

[0001] The invention relates to a reinforcement kit for self-drilling hollow bars that are driven into a soil, particularly adapted to be applied to self-drilling micropiles with a continuous thread.

[0002] As known, in order to consolidate soils and civil and industrial buildings, micropiles are used which can be formed using various drilling and reinforcing techniques.

[0003] It should be noted that in the field of soil consolidation, all piles having an average diameter of up to 300 mm are generally considered as micropiles.

[0004] In addition, micropiles are generally reinforced with steel pipes of varying diameters and thicknesses that are cast in place with cement grout or micro-concrete.

[0005] A well-known type of micropiles, which are referred to as bored micropiles, involves the use of structural steel pipes of varying diameters and thicknesses that are driven into the soil within holes that are obtained using different drilling techniques.

[0006] The most common strength classes of steels used according to Italian standards are S275 and S355, and pipe diameters range from 60 to 244 mm, with thicknesses varying from 6 to 12.5 mm.

[0007] Finally, after insertion into the respective hole, each micropile is cemented with cement grout or micro-concrete.

[0008] Another well-known type of micropiles, known as ductile cast-iron driven micropiles, involves the use of a ductile cast-iron reinforcing pipe, generally with a diameter of between 100 and 170 mm, which is installed by beating with a hydraulic hammer.

[0009] This micropile can be simply beaten or, alternatively, it can be cemented with cement grout or micro-concrete.

[0010] A further well-known type of micropiles known as screwed micropiles employs structural steel pipes, normally class S275 or S355, generally having a diameter of between 76 and 152 mm.

[0011] A steel helix having a variable diameter - normally between 200 and 500 mm - and a variable height of between 300 and 600 mm is welded onto the tip of the reinforcing pipe.

[0012] Micropiles of this type can only be used in loose, fine grain-sized soils and the drilling of the hole is performed by rotation only, since it is the helix itself that, thanks to its rotatory motion, drives the micropile down into the soil by screwing it down to the designed quota.

[0013] Unlike other micropiling techniques, screwed micropiles are not normally cast in place.

[0014] A further well-known type of micropiles employs structural steel pipes that are statically driven into the soil by means of hydraulic jacks.

[0015] These micropiles involve the use of steel reinforcing pipes, normally class S275 or S355, with a diameter generally of between 60 and 152 mm and a thickness of between 6 and 12.5 mm, and are driven into loose soils that are easy to drill.

[0016] Some techniques also involve cementing the micropile with cement grout or micro-concrete.

[0017] Finally, the self-drilling micropile technology is well known, which involves the use of steel reinforcement pipes that are threaded externally along their entire length and are made of steels having higher mechanical properties compared to the steels making up the micropiles listed above.

[0018] By employing this technology, the reinforcing pipe acts as a drilling rod and injection pipe since, while the soil is being drilled, the cement grout is also injected in the hole being formed.

[0019] Thus, cementing takes place continuously, and when the reinforcing pipe insertion has reached the designed quota, the micropile is, as such, complete in all its installation steps.

[0020] All of the micropiling techniques listed above are usually used to consolidate civil and industrial buildings, as foundational works for both new constructions as well as recovery or conservative restoration.

[0021] All of the reinforcements listed above generally meet the geotechnical calculation regarding the bearing capacity of the pile itself, but they do not always meet the demand for shear resistance and horizontal limit load generated, above all, by seismic load combinations, due to the small size and often unsatisfactory thickness of the reinforcement pipes.

[0022] These shear stresses are particularly strong immediately below the foundation plane represented by rafts, plinths or continuous foundations of civil and industrial buildings and building structures in general.

[0023] In order to solve this problem, the designer has no other option than to improve the mechanical and geometric characteristics of the reinforcing pipe in terms of greater strength, particularly by increasing the diameter and thickness thereof or by changing the type of piles, however worsening the installation complexity, especially in small spaces, and consequently the related costs.

[0024] The use of self-drilling hollow bars has a number of recognised advantages over the use of the known-type micropiles described above.

[0025] First of all, the presence of the external thread in self-drilling hollow bars increases, compared to bars driven in by drilling, the adhesion between the bar and the grout that fills the hole made in the soil within which that bar is driven. In addition, the presence of the thread allows the tubular elements making up each self-drilling bar to be joined by threaded sleeves, and this makes it possible to improve the resistance at the joint if compared to the known-type micropiles that have been previously described, also allowing to certify the system tightness with the joint sleeve, which must withstand at least the nominal breaking load of the bar.

[0026] This is not the case for traditional micropile reinforcements.

[0027] Another advantage originates from the fact that self-drilling bars, if driven into brittle soils that, during drilling, tend to collapse into the hole being prepared, do not require the use of temporary casing pipes and this, in addition, improves the spreading of the grout into the soil and thus increases the average diameter given compared to drilling performed with the temporary casing.

[0028] A further advantage originates from the fact that, as there is no casing pipe, the outer surface of the injected grout is more uneven and therefore achieves greater adhesion to the soil.

[0029] The advantages of using self-drilling micropiles compared to the known micropiling techniques described are the same encountered also when the self-drilling micropiles are used as anchors, compared to known-type anchors comprising solid bars or strands both of which are pre-drilled when they are installed.

[0030] The advantages that have been listed herein cannot always be exploited by manufacturers due to the dimensional limitations of the diameters of the self-drilling bars available on the market.

[0031] In fact, self-drilling bars are produced by cold-rolling, and due to the technical difficulties in producing them and the associated high costs, they are only produced in diameters usually reaching up to 90/130 mm, and exceptionally are available in larger diameters.

[0032] This obviously limits their use as they are excluded all those applications wherein self-drilling bars of larger diameters and thicknesses would be required.

[0033] For example, when carrying out seismic reinforcement of building structures, the point of weakness of the bars, as said, is located immediately below the foundation plane where, in the event of an earthquake, particularly intense horizontal shear stresses develop that may not be withstood by the bars themselves.

[0034] In other situations, e.g. in the anchors, the point of weakness of the bars could also be located at an intermediate position along the bars.

[0035] In both situations, the builder is forced to use self-drilling bars with a greater section than the one required to withstand the normal stresses that develop during operation, simply because they are unable to withstand such stresses in their initial or intermediate segment.

[0036] If the section of the self-drilling bars required turns out to be greater than the values available on the market that have been mentioned above, the builder is forced to choose other types of micropiles or anchors, using as reinforcements the micropiles mentioned above, with solid or hollow section reinforcements, which are instead available with larger sections but whose use entails the disadvantages that have been listed above.

[0037] The present invention aims to overcome the drawbacks and limitations that have been described.

[0038] In particular, the aim of the invention is to make a reinforcement kit to increase the shear strength of a self-drilling hollow bar at a specific section thereof. The aim is achieved with the implementation of the reinforcement kit as described in the main claim to which reference will be made.

[0039] Advantageously, when carrying out seismic reinforcement on building structures, the use of the reinforcement kit of the invention makes it possible to increase the shear strength of a self-drilling bar only in the area of the bar itself where it is required to occur.

[0040] Basically, the reinforcement kit allows the self-drilling hollow bar to be shear-reinforced only where it is required, thus favouring the use of the self-drilling bars over known micropiles and anchors since, compared to the latter, the self-drilling hollow bar offers the advantage of greater speed of execution of the work and a lower cost.

[0041] Furthermore, advantageously, the use of self-drilling bars eliminates the dangers resulting from the removal of drilling debris that are produced when using other techniques.

[0042] By applying the reinforcement kit of the invention, the self-drilling bars can be installed as a replacement of reinforcement comprising known-type bars or pipes with a larger diameter, even in brittle soils and without using temporary casing pipes, resulting in a better spreading of the cement grout in the soil delimiting the inner wall of the hole into which the bar is driven in.

[0043] The aim and advantages of the invention will be better emphasised below during the description of preferred embodiments thereof, which are given hereinafter with reference to the attached drawing tables in which:

- Figure 1 represents the longitudinal sectional view of the reinforcement kit of the invention;
- Figure 2 represents the sectional view of another embodiment of the reinforcement kit of the invention;
- Figures 3 and 4 represent sectional views of embodiments of details that make up the reinforcement kit of the invention;
- Figure 5 represents the longitudinal sectional view of a soil consolidation system using the kit of the invention.

[0044] The reinforcement kit subject matter of the invention is shown in Figures 1 and 2, which represent two embodiments thereof based on the same solution idea, which are respectively denoted globally by **1** and **100.**

[0045] The reinforcement kit **1; 100** can be coupled externally to self-drilling hollow bars, preferably to self-drilling micropiles **2** provided with a continuous external thread **3,** e.g. the self-drilling micropile **2** in Figure 5 driven into the soil **T** to reinforce their resistant section.

[0046] According to the invention, the reinforcement kit **1; 100** comprises a reinforcing tubular body **4** which is arranged coaxially on the outside of the self-drilling micropile **2** and is comprised between screw means **5; 105** which are configured to be screwed on the outside of the self-drilling micropile **2** and tighten the reinforcing tubular body **4** between them to constrain it in the desired position with respect to the self-drilling micropile **2.**

[0047] It can be noted in Figure 1 that a plurality of holes **7** are present in the reinforcing tubular body **4** which pass through the thickness of its side wall **4e** so that, when the self-drilling micropile **2** is installed, the grout penetrates into the cavity **8** existing between the self-drilling micropile **2** and the reinforcing tubular body **4.**

[0048] It should be specified that the thread diameter of the screw means **5; 105** is smaller than the inner diameter of the reinforcing tubular body **4** so that when the reinforcement kit **1; 100** is coupled to the self-drilling micropile **2** the gap **8** is formed.

[0049] This improves the adhesion between the self-drilling micropile **2** and the reinforcing tubular body **4** making the system more integral.

[0050] In one embodiment, the reinforcement kit globally indicated by **1** is shown in the drawing in Figure 1 and provides that the screw means **5** comprise a first pipe-centring nut **9** having a first support surface **9a** facing the first annular end **4a** of the reinforcing tubular body **4** and being provided with a first internal thread **6a** that can be coupled to the outer thread **3** of the self-drilling micropile **2,** and a second pipe-centring nut **10** having a second support surface **10a** facing the second annular end **4b** of the reinforcing tubular body **4** and being provided with a second internal thread **6b** that can be coupled to the outer thread **3** of the self-drilling micropile **2.**

[0051] It can be noted that the pipe-centring nuts **9, 10** constrain the reinforcing tubular body **4** with respect to the self-drilling micropile **2** when they are screwed onto the self-drilling micropile **2** itself and their support surfaces **9a, 10a** contrast against the annular ends **4a, 4b** of the reinforcing tubular body **4.** Observing Figure 1, it can be noted that the presence of the reinforcing tubular body **4** makes it possible to increase the section of the self-drilling micropile **2** and therefore the shear resistance and also the moment resistance for the entire length **L** corresponding to the length of the reinforcing tubular body **4.** Advantageously, by using the reinforcement kit **1** of the invention it is possible to increase the strength of the self-drilling micropile **2** by reaching values that cannot be reached by using the self-drilling bars on the market, or values that can only be reached by using reinforcements comprising bars or pipes of a known type, which however have the drawbacks and limitations that have been described above.

[0052] The reinforcement kit **1** of the invention may be arranged in any area of the self-drilling micropile **2** that is to be reinforced, for example in an intermediate position, as noted in the embodiment in Figure 5.

[0053] According to the embodiment shown in Figure 2, the reinforcement kit of the invention is globally indicated with **100** and is particularly adapted to be applied as the head of a self-drilling micropile **2** which, as it can be noted in Figure 5, is incorporated at least partially and together with the upper end **2a** of the same self-drilling micropile **2,** into a reinforced concrete structure **50** insisting on the soil **T.**

[0054] Figure 5 represents the most general case in which the self-drilling micropile **2** is composed of a plurality of elements **2b, 2c, 2d** that are connected to each other by means of joint sleeves **22, 23.**

[0055] It can be noted in Figure 2 that the reinforcement kit of the invention indicated with **100** provides that the screw means **105** comprise a first pipe-centring nut **9** having a first support surface **9a** facing the first annular end **4a** of the reinforcing tubular body **4** and provided with a first inner thread **6a** that can be coupled to the outer thread **3** of the self-drilling micropile **2** and a second pipe-centring nut **10** having a second support surface **10a** facing the second annular end **4b** of the reinforcing tubular body **4** and provided with a second inner thread **6b** that can be coupled to the outer thread **3** of the same self-drilling micropile **2.**

[0056] In addition, the screw means **105** also comprise a tightening nut **12** provided with an inner thread **12a** that can be coupled to the outer thread **3** of the upper end **2a** of the same self-drilling micropile **2** and of a thrust surface **12b** facing a contrast surface **9b** belonging to the first pipe-centring nut **9.**

[0057] The pipe-centring nuts **9, 10** and the tightening nut **12** restrain the reinforcing pipe body **4** against the self-drilling micropile **2** when they are screwed to the self-drilling micropile **2** itself so that the support surfaces **9a, 10a** of the pipe-centring nuts respectively **9** and **10** contrast against the annular ends **4a, 4b** of the reinforcing tubular body **4** and the thrust surface **12b** of the tightening nut **12** forces against the contrasting surface **9b** of the first pipe-centring nut **9,** preferably but not necessarily by the interposition of a contrast plate **13,** as it can be noted in Figure 5.

[0058] In another embodiment, the thrust surface **12b** of the tightening nut **12** and the contrast surface **9b** of the first pipe-centring nut **9** may be in direct contact with each other.

[0059] The use of the reinforcement kit of the invention according to the embodiment **100** just described is particularly useful when carrying out seismic reinforcement of building structures since the weakness point of the reinforcements, including with the term "reinforcements" micropiles, bars or pipes, is located in their initial section immediately below the foundation plane where, in the event of an earthquake, horizontal shear stresses, that may not be withstood, develop.

[0060] In these cases, as previously mentioned, the increase in strength due to the use of the reinforcement kit **100** of the invention can reach values that would not be achieved even using self-drilling bars of the maximum diameter existing on the market, but only using reinforcements comprising bars or pipes of the known type.

[0061] In both the embodiments **1** and **100** of the reinforcement kit of the invention, a cylindrical seat **9c, 10c** is formed in the pipe-centring nuts **9, 10** which accommodates a corresponding annular end **4a, 4b** of the reinforcing tubular body **4** and is delimited at the bottom by the support surface **9a, 10a** of the same annular end

4a, 4b.

[0062] In addition, the reinforcing tubular body **4** has a circular cross-section whose outer diameter **4c** is at most equal to the inner diameter of the cylindrical seat **9c, 10c** and whose inner diameter **4d** is greater than the outer diameter of the self-drilling micropile **2.**

[0063] Thus, when the reinforcement kit **1; 100** is installed, the reinforcing tubular body **4** is firmly constrained between the pipe-centring nuts **9, 10.** Furthermore, the increase in strength of the self-drilling micropile **2** in the area where the reinforcement kit **1; 100** is placed is a function of the outer diameter and thickness of the reinforcing tubular body **4.**

[0064] From a constructional point of view, each of the pipe-centring nuts **9, 10** is preferably a single-piece body but can also be a composite body.

[0065] To this end, it can be noted in Figures 3 and 4 that, unlike the embodiments of Figures 1 and 2, each of the pipe-centring nuts **9, 10** comprises a first cylindrical sleeve **9d, 10d** and a second cylindrical sleeve **9e, 10e,** the inner thread **6a, 6b** being obtained in the latter.

[0066] The second cylindrical sleeve **9e, 10e** is arranged over a segment of its coaxial length within the first cylindrical sleeve **9d, 10d** and the cylindrical sleeves **9d, 10d** and **9e,10e** are connected to each other by welding **15.**

[0067] In addition, preferably, each reinforcement kit **1; 100** also comprises a milling ring **16** coaxially associated with the outside of the second pipe-centring nut **10** which facilitates the penetration of the self-drilling micropile **2** into the soil **T** when it is rotated by the rotary hammer.

[0068] Figure 5 shows, by way of example, a soil consolidation system **20** comprising a self-drilling micropile **2** that is driven into the soil **T** to be consolidated and is provided at the lower end with a disposable milling cutter **21.**

[0069] The self-drilling micropile **2** is associated with a reinforcement kit **1** arranged in one intermediate area thereof and a reinforcement kit **100** applied as a head in the area where the upper end **2a** of the self-drilling micropile **2** protrudes from the soil **T.**

[0070] According to the foregoing, the reinforcement kit of the invention, in both of its embodiments, achieves the intended purpose of increasing the shear strength of a self-drilling micropile **2.**

[0071] In fact, it was seen that the presence of the reinforcing tubular body **4** in the reinforcement kit increases the resistant section of the self-drilling micropile **2** in the area where the reinforcement kit is installed.

[0072] This is particularly advantageous in the case of seismic reinforcement of building structures where the use of the reinforcement kit of the invention makes it possible to increase the shear strength of the self-drilling micropile **2** only in the area of the bar where it is required to occur.

[0073] In other words, the reinforcement kit of the invention has the advantage of increasing the shear strength of the self-drilling micropile **2** only where this increase in strength is necessary.

[0074] Advantageously, this aspect puts self-drilling micropiles in competition with known reinforcement comprising bars or pipes and with known-type anchors comprising solid bars or strands, both of which are pre-drilled when they are installed, since, if compared to the latter, the reinforcement kit offers the advantage of greater speed of execution of the work and a lower cost.

[0075] By applying the reinforcement kit of the invention, self-drilling micropiles can be used as a replacement for larger-diameter drilled bars even in brittle soils and thus with no need to use temporary casing pipes, and with the advantage of achieving a better spreading of cement grout in the soil delimiting the inner wall of the hole within which the bar is driven in.

[0076] In the operational step, changes and variations may be made to the invention that have not been represented and described herein.

[0077] It is understood, however, that should these changes and variations fall within the scope of protection of the attached claims, they shall all be deemed to be protected by this patent.

Claims

1. Reinforcement kit (1; 100) that can be coupled to self-drilling hollow bars, preferably but not exclusively to self-drilling micropiles (2) provided with a continuous outer thread (3) and configured to be driven into a soil (T) to be consolidated, said reinforcement kit (1; 100) being **characterised in that** it comprises a reinforcing tubular body (4) configured to be coaxially arranged outside a self-drilling micropile (2) and comprised between screw means (5; 105) which are configured to be screwed outside said self-drilling micropile (2) to tighten said reinforcing tubular body (4) between them and to restrain it in the desired position along said self-drilling micropile (2).

2. Reinforcement kit (1; 100) according to claim 1, **characterised in that** in said reinforcing tubular body (4) a plurality of holes (7) are present which pass through the thickness of the side wall (4e) of said reinforcing tubular body (4) so that when said self-drilling micropile (2) is installed, the grout penetrates into a gap (8) existing between the self-drilling micropile (2) and the reinforcing tubular body (4).

3. Reinforcement kit (1; 100) according to claim 2, **characterised in that** the thread diameter of said screw means (5; 105) is smaller than the inner diameter of said reinforcing tubular body (4) so that when said reinforcement kit (1; 100) is coupled to said self-drilling micropile (2) said gap (8) is formed.

4. Reinforcement kit (1; 100) according to any one of

the preceding claims, **characterised in that** said screw means (5; 105) comprise:

- a first pipe-centring nut (9) having a first support surface (9a) facing a first annular end (4a) of said reinforcing tubular body (4) and provided with a first inner thread (6a) that can be coupled to said outer thread (3) of said self-drilling micropile (2);
- a second pipe-centring nut (10) having a second support surface (10a) facing a second annular end (4b) of said reinforcing tubular body (4) and provided with a second inner thread (6b) that can be coupled to said outer thread (3) of said self-drilling micropile (2),

said pipe-centring nuts (9, 10) constraining said reinforcing tubular body (4) externally to said self-drilling micropile (2) when screwed to said self-drilling micropile (2) and said support surfaces (9a, 10a) contrast against said annular ends (4a, 4b) of said reinforcing tubular body (4).

5. Reinforcement kit (100) according to claim 4, **characterised in that** said screw means (105) comprise a tightening nut (12) which is provided with an inner thread (12a) that can be coupled with said outer thread (3) of the upper end (2a) of said self-drilling micropile (2) and with a thrust surface (12b) facing a contrast surface (9b) belonging to said first pipe-centring nut (9),
said tightening nut (12) further constraining said reinforcing tubular body (4) with respect to said self-drilling micropile (2) when said thrust surface (12b) of said tightening nut (12) contrasts against said contrast surface (9b) of said first pipe-centring nut (9).

6. Reinforcement kit (100) according to claim 5, **characterised in that** between said thrust surface (12b) of said tightening nut (12) and said contrast surface (9b) of said first pipe-centring nut (9) a contrast plate (13) is interposed.

7. Reinforcement kit (1; 100) according to any one of the preceding claims 4 to 6, **characterised in that** a cylindrical seat (9c, 10c) is obtained in both said pipe-centring nuts (9, 10) which accommodates a corresponding annular end (4a, 4b) of said reinforcing tubular body (4) and is delimited at the bottom by said support surface (9a, 10a) of said annular end (4a, 4b).

8. Reinforcement kit (1; 100) according to claim 7, **characterised in that** said reinforcing tubular body (4) has a circular cross-section whose outer diameter (4c) is at most equal to the inner diameter of said cylindrical seat (9c, 10c).

9. Reinforcement kit (1; 100) according to any one of claims 4 to 8, **characterised in that** each of said pipe-centring nuts (9, 10) is a single-piece body.

10. Reinforcement kit (1; 100) according to any one of claims 4 to 9, **characterised in that** each of said pipe-centring nuts (9, 10) is a composite body comprising a first cylindrical sleeve (9d, 10d) and a second cylindrical sleeve (9e, 10e) wherein said inner thread (6a, 6b) is obtained and which is arranged coaxially and for a segment of its length within said first cylindrical sleeve (9d, 10d), said cylindrical sleeves (9d, 10d and 9e, 10e) being connected to each other by welding (15).

11. Reinforcement kit (1; 100) according to any one of claims 4 to 10, **characterised in that** it comprises a milling ring (16) coaxially associated with the outside of said second pipe-centring nut (10).

12. System (20) for consolidating soils (T) comprising at least one self-drilling micropile (2) that is driven into said soil (T) to be consolidated, **characterised in that** it comprises one or more reinforcement kits (1; 100) according to any one of claims 1 to 11 that are associated with said self-drilling micropile (2).

13. System (20) according to claim 12, **characterised in that** said self-drilling micropile (2) is provided with a disposable milling cutter (21) fixed at its lower end and comprises a plurality of elements (2b, 2c, 2d) which are connected to each other by means of joint sleeves (22, 23).

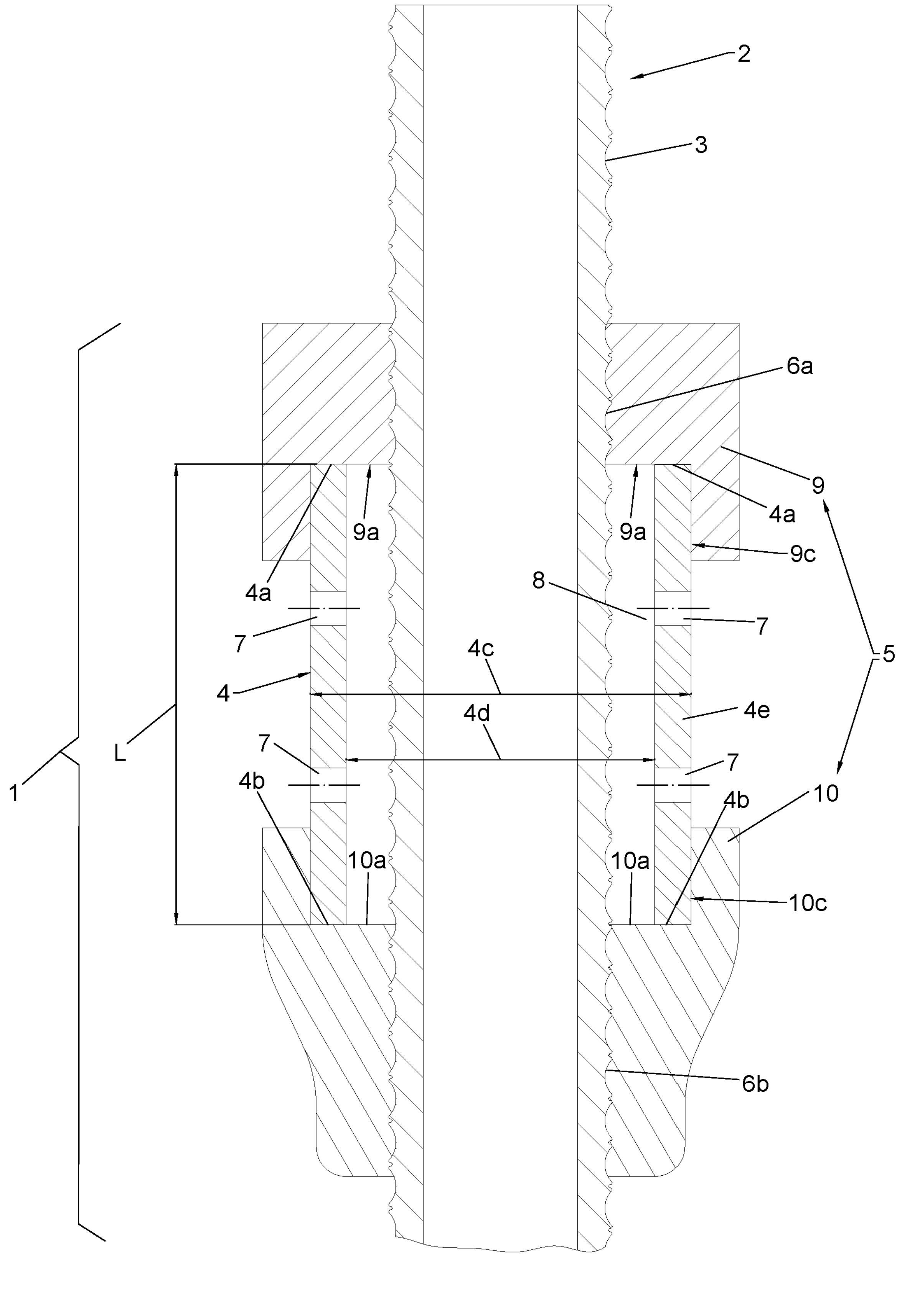

Fig.1

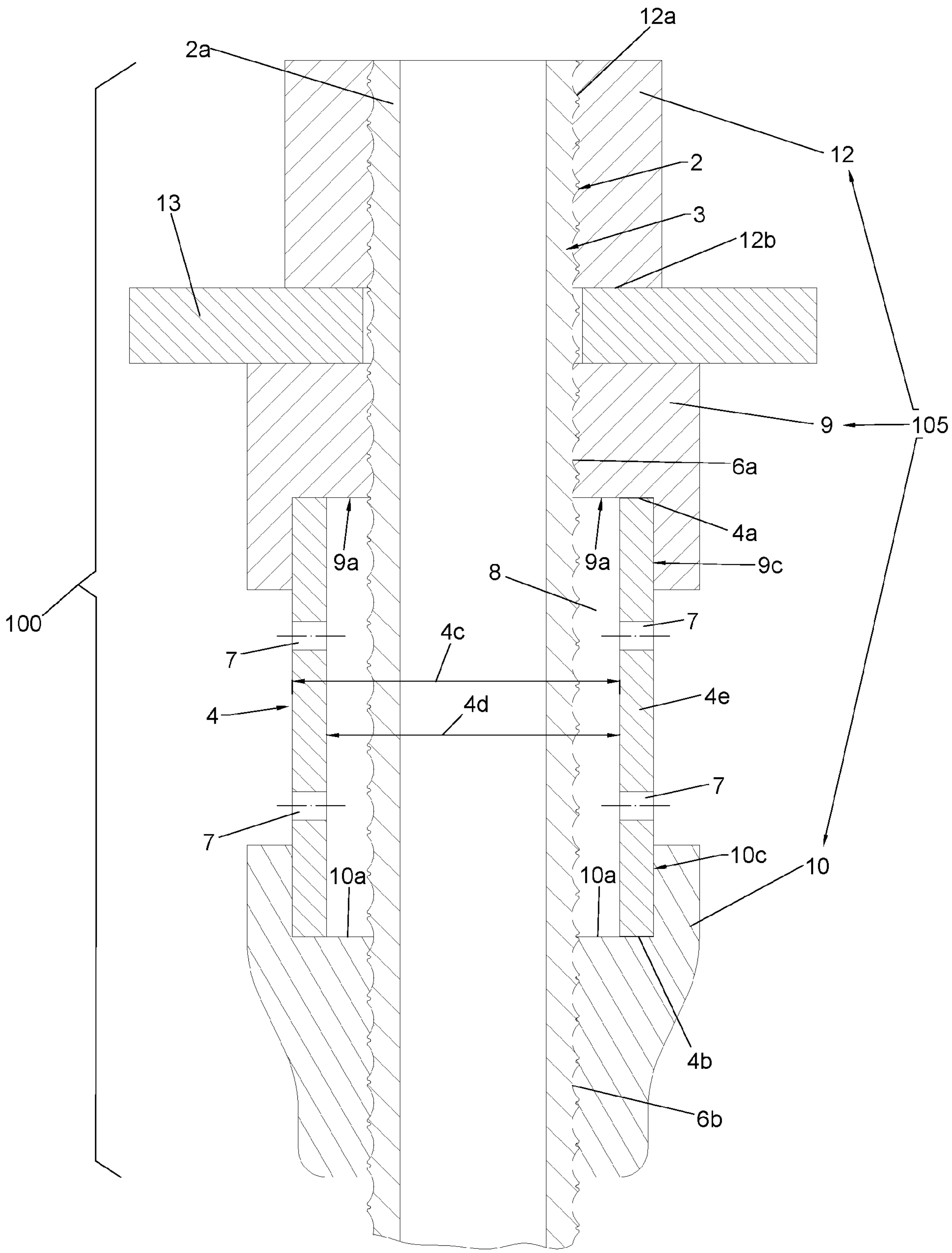
12a
2a
12
2
13
3
12b
9
105
6a
9a
9a
4a
9c
8
100
7
4c
7
4e
4
4d
7
7
10c
10
10a
10a
4b
6b

Fig.2

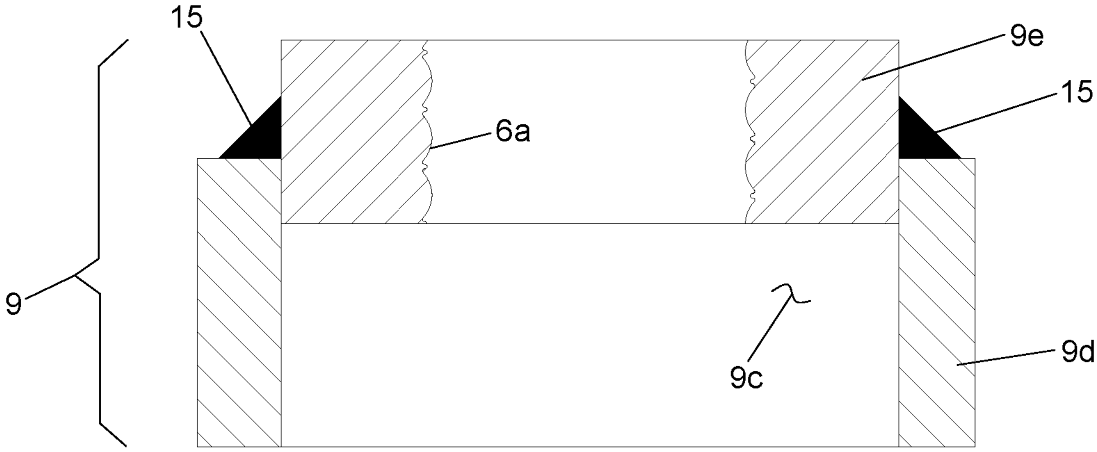

Fig.3

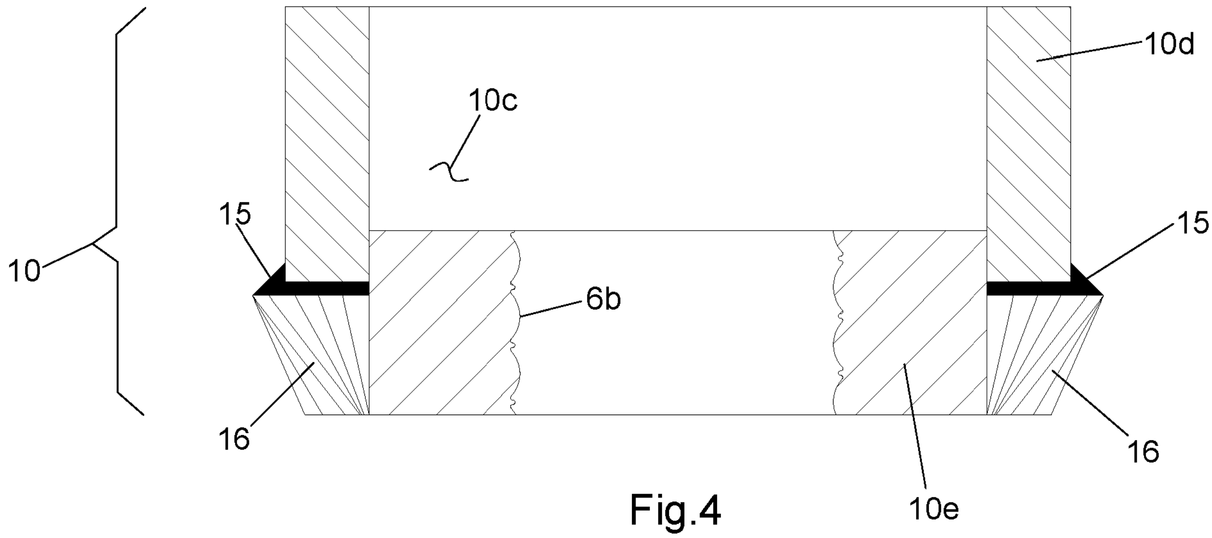

Fig.4

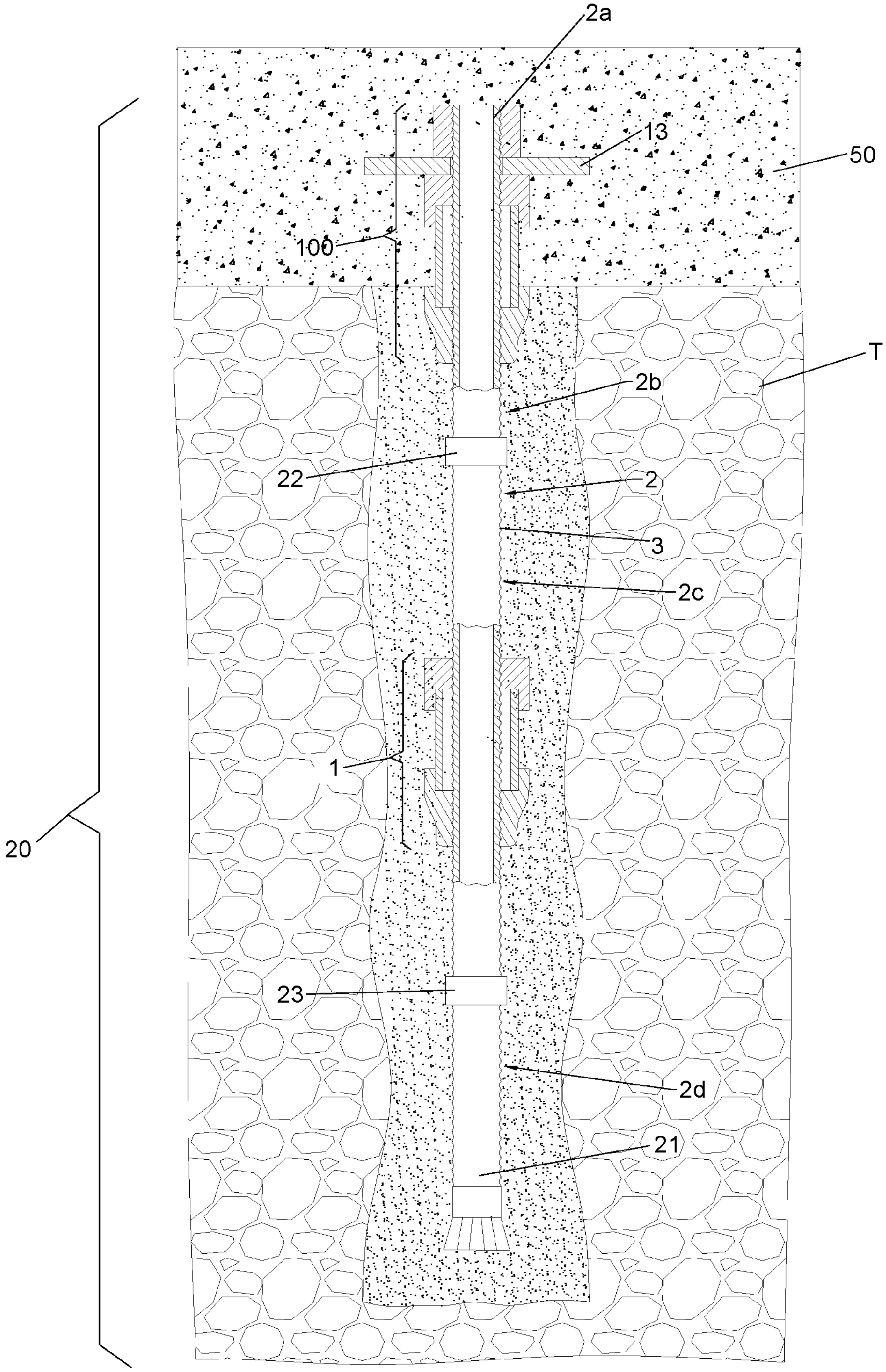

Fig.5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 19 5598

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	JP H07 82841 A (TOKYO TEKKO KK) 28 March 1995 (1995-03-28) * abstract * * paragraphs [0008] - [0016]; figures 1,2 *	1 2-13	INV. E02D5/64 E02D5/56 E02D5/80 E02D3/08 E02D7/22 E02D5/52 E02D27/50 E21B17/10 E21B7/06
X Y A	KR 2013 0000247 A (LEE DAE DONG [KR]) 2 January 2013 (2013-01-02) * paragraph [0049]; claim 1; figures 1-6,10,11 *	1,2,4, 7-9,12 13 3,5,6, 10,11	
Y A	EP 3 037 586 A1 (EDILSYSTEM S R L [IT]) 29 June 2016 (2016-06-29) * the whole document *	13 1,12	
Y A	US 2016/326873 A1 (SKOGSETH TROND [NO] ET AL) 10 November 2016 (2016-11-10) * abstract; figure 1 *	13 1,12	

TECHNICAL FIELDS SEARCHED (IPC)

E02D
E21B
E04H
F16B
E21D

The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	17 January 2025	Koulo, Anicet

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 19 5598

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-01-2025

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
JP H0782841	A	28-03-1995	NONE			
KR 20130000247	A	02-01-2013	NONE			
EP 3037586	A1	29-06-2016	EP	3037586	A1	29-06-2016
			ES	2642145	T3	15-11-2017
US 2016326873	A1	10-11-2016	AU	2016259862	A1	09-11-2017
			CA	2985032	A1	17-11-2016
			CL	2017002808	A1	06-07-2018
			CN	107820533	A	20-03-2018
			EA	201792483	A1	30-03-2018
			EP	3294991	A1	21-03-2018
			ES	2827019	T3	19-05-2021
			PL	3294991	T3	11-01-2021
			PT	3294991	T	19-10-2020
			US	2016326873	A1	10-11-2016
			WO	2016181219	A1	17-11-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82