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(54) **A CONNECTION ASSEMBLY FOR CONNECTING PIPES**

(57) The present invention relates to a connection assembly for connecting pipes, comprising two pipes (1a, 1b) having internal threads (3) on an inner surface of the pipe arranged at an end portion (2) of the pipe over a distance (d), and a tubular connection member (5) having external threads (3) at an outer surface adapted to engage with the internal threads of the pipes (1a, 1b). The tubular connection member (5) has an outer diameter adapted to be inserted into bores of the pipes (1a, 1b), whereby the pipes (1a, 1b) are in contact with each other when the tubular connection member (5) is arranged in the bores and both pipes are fully engaged in the tubular connection member. The tubular connection member has an end portions (6) comprising an angled surface, whereby the angle ($\alpha$) of the angled surface in relation to longitudinal axis is more than 125°.

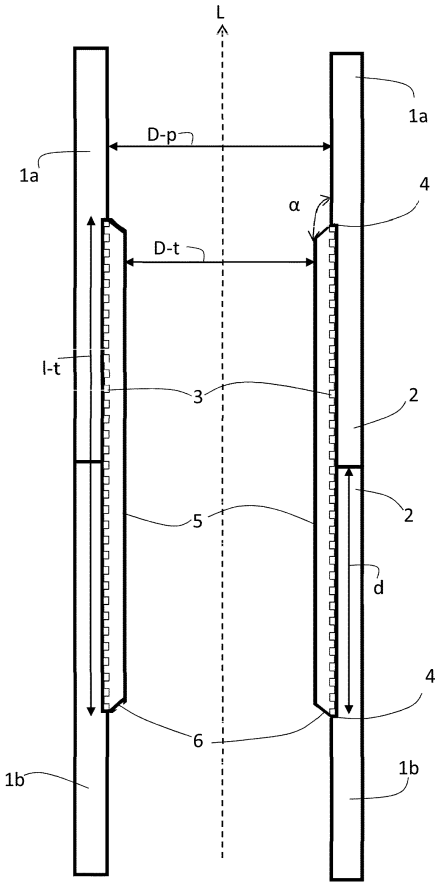


Fig 1

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## Description

### Technical field

**[0001]** The present invention relates to a connection assembly for connecting pipes, comprising two pipes having internal threads on an inner surface of the pipe arranged at an end portion of the pipe over a distance d, and a tubular connection member having external threads on an outer surface adapted to engage with the internal threads of the pipes.

### Background

**[0002]** Drilling with steel pipes is done by using a sequence of long pipes that are drilled through sand and stone in the ground. 1 to 12-meter-long steel pipes may be used. These pipes can be increased in length by the addition of extra pipes, which are fastened on the first pipe. Fastening is done by screwing the second pipe, which has an external thread on an outside surface, on an internal thread positioned on an inside surface of a fastening portion positioned on an end portion of the first pipe.

**[0003]** A problem with the fastening portion is that it bulges from the outer surface of the pipes. This causes the pipes to stick in the ground during drilling because sand, mud and stone rest on the bulges and prevent the pipes from moving upwards or downwards.

**[0004]** A solution has been found by providing a pipe, wherein at the end of each pipe half the thickness of the wall of the pipe is used to provide a thread. One end of the pipe has these threads on the inside and one end of the pipe has these threads on the outside so that internal threads can be screwed on external threads. A disadvantage of this solution is that the thickness of the wall of the pipe is reduced by 50%. Such a reduction is too much to withstand the excessive stresses applied on the pipes during drilling. The tensile, circumferential and elastic stress causes the material at these types of connections to crack. Cracks can propagate to final rupture.

**[0005]** Another solution is by welding the pipes together. This provides a direct contact between the endings of the pipes, whereby the tensile yield strength is not reduced by a thinner wall of a connection assembly. The problem is that welding is time consuming making welding an expensive alternative to use in practice.

**[0006]** US3361448 discloses a drill rod assembly between two pipes with internal threads adapted to receive a coupling device of a magnesium alloy comprising external threads at two end portions. The coupling device comprises a centre portion with an outer diameter substantially corresponding to the outer diameter of the pipe. The two end portions have a smaller outer diameter than the centre portion allowing it to engage inside the bore of the pipes. Both ends of the centre portions comprise a shoulder adapted to bear against the end portions of the pipes. The centre part is subjected to high tensile yield stress caused by the compression of the end portions of the coupling device and by the endings of the pipes bearing directly on the centre part. The thinner wall at the connection point reduces the strength to withstand the stresses, such as circumferential stresses, at the connection point during drilling. This reduction in strength is partly compensated for by using a material, such as a magnesium alloy for the coupling device. To further strengthen the connection a ceramic coating is used on the threads, which coating breaks into small pieces on a surface of the threads. Upon screwing and other pressures, these pieces form a stable connection between the pipes.

**[0007]** US4813717 discloses a connection for oil well tubing. This connection comprises a centre portion and two connecting joints at end portions with tapered external threads. The centre part of the connection has the same outer diameter as the pipes. It is subjected to high tensile yield stress and the thinner wall at the connection point reduces the strength as mentioned above. This loss in strength is mainly compensated for by the pipes having an internal tapered thread with a loadbearing flank angle of 75° or more. The angle of the threads can be dimensioned depending on the stresses that need to be managed by the connection. Besides, if needed, the length of the connection can be altered and the thickness of the inner wall of the connection may be increased. However, dimensioning the threads, altering length and thickness of walls is complex, expensive and time consuming.

**[0008]** There is a need for a simpler and more cost-effective manner to connect pipes or rods during drilling. The connection must be easy and quick to apply during drilling as well as strong enough to withstand the forces applied on it during drilling to prevent cracking of the metal. At the same time the outer diameter at the connection point should be the same as the outer diameter of the pipes.

### Summary

**[0009]** It is an aim of the present invention to at least partly overcome the above-mentioned problems and to provide an improved connection assembly for connecting pipes.

**[0010]** One aspect of the invention provides a connection assembly for connecting pipes during drilling comprising two pipes having internal threads on an inner surface of the pipe. The internal threads are arranged at an end portion of the pipe over a distance along the length of the pipe. The assembly also comprises a tubular connection member having external threads at an outer surface adapted to engage with the internal threads of the pipes.

**[0011]** The tubular connection member has an outer diameter adapted to be inserted into bores of the pipes. The pipes are in contact with each other at the end portions of the pipes when the tubular connection member is arranged in the bores and both pipes are fully engaged

in the tubular connection member. The tubular connection member has an end portions comprising an angled surface, whereby the angle of the angled surface in relation to longitudinal axis is more than 125°

**[0012]** An advantage of the connection assembly is that the endings of the connecting pipes are in contact with each other. This causes the tensile yield strength to be split between the pipes and the connection member. Further, the thickness of the wall of the connection member plus the pipes is larger than the thickness of the walls of the pie. This improves withstanding circumferential stresses and tensile strength at the connection, in contrast to the prior art connection devices, where a loss of strength at the connection needs to be compensated by using dimensioned threads or ceramic coatings, etc. Also, no material needs to be removed as would have been needed if the connection member had an outer surface directly bearing on the outer surface of the pipes.

**[0013]** Threads may be square or not. Threads may be radiused at a base of threads. The connection assembly provides a simple and cost-effective structure that can be constructed and used in a simple manner.

**[0014]** In another aspect, the internal and external threads are turned in the same direction as the direction of rotation of a drill. Drilling conditions may be with a left or right rotation of the drill string. Right-handed threads are used if drilling is done in a right rotation. This prevents the pipes and connection member from unscrewing during drilling.

**[0015]** In a further aspect, the internal and external threads extend parallel along a longitudinal axis of the pipes. The internal and external threads all have the same length. The internal and external threads all have the same shape and form. This provides for a simple and cost-effective construction since no tapering or dimensioning of threads is needed. In one aspect, the threads are not tapered. In a further aspect, a shoulder at the distance indicates an end of the internal threads of the pipe. A shoulder at the end of the threads on the internal surface of the pipes provides for a stop. The tubular connection member cannot be screwed further into the pipes than the shoulder. This prevents screwing the tubular connection member deeper than necessary into the pipe. The tubular connection member can neither become disconnected during drilling.

**[0016]** In another aspect, the ratio of an inner diameter of the pipe to a length of the tubular connection member is between 2:3 and 1:4. In one aspect, the ratio is at least 2:3. In another aspect the ratio is at least 1:2 or at least 1:3.

**[0017]** In a further aspect, the ratio of a thickness of a wall of the pipe to a length of the tubular connection member is between 1:50 and 1:10. In one aspect, the ratio is at least 1:30 In another aspect, the ratio is at least 1:25. In a further aspect, the ratio is at least 1:20.

**[0018]** A proper ratio prevents or minimises a reduction in tensile strength and modulus elastic stresses at the threads. This prevents or minimises cracking of the metal at the connection.

**[0019]** In yet another aspect, a depth of threads on the inner surface of the pipes is less than one sixth of the thickness of the wall of the pipe. In one aspect, the depth of the threads is at the most one fourth of the thickness of the outer wall.

**[0020]** The thickness of the wall of the tubular connection member is preferably the same as that of the pipes. This would provide a simple and cost-effective connection member. The depth of the threads on the pipes and the depth of the threads on the connection member should be such that the total thickness of the walls of both the pipe and the connection member is larger than the thickness of the wall of the pipes. This is not always the case in the known connections. Such a total thickness increases strength of the connection by improving the load for circumferential stresses and tensile strength at the connection.

**[0021]** In yet a further aspect, a material of the tubular connection member is the same as a material of pipes. An advantage of the connection member of the disclosure is that the material of the member does not need to be a stronger type of alloy to withstand the loss in forces on the joining connection of the pipes, because the joining connection in the connection assembly of the disclosure is strong due to the way the assembly is constructed with a tubular connection member positioned inside the bore of the pipes that connect at their end portions. Thus, different materials to compensate for loss in circumferential stresses are not needed. This reduces costs for manufacturing the connection member.

**[0022]** In one aspect, the tubular connection member has end portions that are at least partially abutted. The end portion may comprise an angled surface. The angle of the angled surface in relation to longitudinal axis may be more than 95°, or may be more than 125°, or may be more than 135°, or may be more than 145°. Abutted or angled end portions prevent materials from getting stuck at the connection member when being put into or taken out of the pipes. Material that may run through the pipes, such as a drill or fluid, pass more smoothly through the pipes when the end portions of the connection member are abutted. In one aspect, the pipes are exclusively adapted for fluid transport through the pipes. In yet a further aspect,, the pipes are not adapted for fluid transport through the pipes.

## Brief description of the drawings

**[0023]** The invention will now be explained more closely by the description of different aspects of the invention and with reference to the appended figures.

Fig. 1 schematically illustrates a vertical cross-section of a connection assembly of the disclosure.

Fig. 2 illustrates an enlarged view of a part of a connection assembly of the disclosure.

Detailed description

**[0024]** Figure 1 shows a cross-section of an example connection assembly for connecting two pipes, 1a and 1b. The pipes have an end portion 2, a wall thickness Tk-p and an inner diameter D-p. The pipes have internal threads 3 on an inner surface of the pipe 1a, 1b. The internal threads are arranged over a distance d from the end portion 2 of the pipe and extend substantially parallel or parallel along a longitudinal axis L of the pipes 1a, 1b. A shoulder 4, at the distance d, indicates an end of the internal threads of the pipes.

**[0025]** The connection assembly also comprises a tubular connection member 5 having external threads 3 at an outer surface that extend substantially parallel or parallel along a longitudinal axis L of the pipes 1a, 1b. The threads are adapted to engage with the internal threads 3 of the pipes 1a, 1b. A length of the threaded inner surface d of each pipe 1a, 1b is substantially equal to, or equal to, half the length l-t of the tubular connection member 5. The tubular connection member has a wall thickness Tk-t and an inner diameter D-t.

**[0026]** The tubular connection member 5 has an outer circumference adapted to be engaged with the inner circumference of the pipes. The tubular connection member has an outer diameter adapted to be inserted into the bores of the pipes 1a, 1b. Thus, the outer surface of the connection member can engage with the inner surface of the pipes 1a, 1b. In figure 1, both pipes are fully engaged with the tubular connection member 5. As shown, the end portions 2 of the pipes are in contact with each other.

**[0027]** The threads 3 may be square or not. Threads may be radiused at a base of threads. The threads may be dimensioned with loadbearing flanges at different thread angles, such as 75° or more. According to some aspects, the internal threads form a helical ridge and the external threads forms a corresponding helical ridge, which engages the helical ridge of the internal thread. The internal and external threads are preferably the same in height, shape and form.

**[0028]** The rotation of the internal and external threads 3 are the same direction as the rotation of a drill. Thus, if drilling is done in a right rotation, the threads are right-handed threads.

**[0029]** The ratio of an inner diameter of the pipe D-p to a length l-t of the tubular connection member 5 is for example between 2:3 and 1:4. The ratio may be at least 2:3, or at least 1:2, or at least 1:3.

**[0030]** The ratio of a thickness of a wall Tk-p of the pipe to a length l-t of the tubular connection member 5 is for example between 1:50 and 1:10. The ratio may be at least 1:30, or at least 1:25, or at least 1:20.

**[0031]** The pipes may have a length of 1 to 12-meter. The inner diameter D-p of the pipes varies depending on the use of the pipes 1a, 1b, but may be between 180 and 250 mm, or between 195 and 205 mm. The thickness of the wall Tk-p of the pipes varies likewise. The thickness may be between 5 and 20 mm, or between 10 and 15 mm. The length l-t of the tubular connection member may thus be between 100 and 750 mm.

**[0032]** In standard ground drilling, e.g. in preparation of grounds prior to building houses and the like, pipes may have a wall thickness Tk-p of about 12.5 mm, an inner diameter D-p of about 203 mm. The length l-t of the tubular connection member may then be about 320 mm.

**[0033]** The threads may have a depth D-th such that the total thickness Tk-t of the wall of the connection member plus the thickness Tk-p of the wall of the pipes is larger than the thickness of the walls of the pipes 1a, 1b (Tk-p + Tk-t > Tk-p).

**[0034]** The depth of threads D-th on the internal surface of the pipes and on the outer surface of the connection member is for example between one eighth and one third of the thickness Tk-p of the wall of the pipe. The depth of threads D-th may be less than one sixth of the thickness Tk-p of the wall of the pipe. The depth of the threads 3 may be at the most one fourth of the thickness Tk-p of the wall of the pipes 1a, 1b.

**[0035]** The thickness Tk-t of the wall of the tubular connection member 5 is preferably the same as that of the pipes. The depth of threads on the external surface of the connection member is for example between one eight and one third of the thickness Tk-t of the wall of the tubular connection member. The depth of threads D-th may be less than one sixth of the thickness Tk-t of the wall. The depth of the threads 3 may be at the most one fourth of the thickness Tk-t of the wall.

**[0036]** The tubular connection member 5 can be manufactured from the same or a different material than the pipes. The tubular connection member 5 may be manufactured from the same material as the pipes. Examples of materials are steel, stainless-steel.

**[0037]** The tubular connection member 5 has for example end portions 6 as shown in figure 1. The end portion 6 may abut against the shoulder 4.

**[0038]** The end portion 6 comprises an angled surface. The angle $\alpha$ of the angled surface in relation to longitudinal axis L may be between 95 and 175°, or between 115 and 155°, or between 125 and 145°, or between 130 and 140°. An angle $\alpha$ of more than 125° or between 130 and 140° increases ease of transport of materials and fluids through the pipes.

**[0039]** In a further aspect, a shoulder 4 is not present. In this case, the external threads 3 on the tubular connection member 5 are adapted to be moved past the internal threads of the pipes, thereby preventing the tubular connection member from being unscrewed from the pipes if the drill rotates backwards.

**[0040]** The present invention is not limited to the aspects disclosed but may be varied and modified within the scope of the following claims.

Reference list

**[0041]**

| | |
|---|---|
| 1, 1a, 1b | pipes |
| 2 | end portion of pipe |
| 3 | threads |
| 4 | shoulder |
| 5 | a tubular connection member |
| 6 | end portion of tubular connection member |
| Tk-p | wall thickness of pipe |
| Tk-t | wall thickness of tubular connection member |
| D-p | inner diameter pipe |
| D-t | inner diameter of tubular connection member. |
| d | distance |
| L | longitudinal axis |
| l-t | length of the tubular connection member |
| D-th | depth of threads |

**Claims**

**1.** A connection assembly for connecting pipes during drilling, comprising

- two pipes (1a, 1b) having internal threads (3) on an inner surface of the pipe arranged at an end portion (2) of the pipe over a distance (d),
- a tubular connection member (5) having external threads (3) at an outer surface adapted to engage with the internal threads of the pipes (1a, 1b),

**characterized in that**
the tubular connection member (5) has an outer diameter adapted to be inserted into bores of the pipes (1a, 1b), whereby the pipes (1a, 1b) are in contact with each other when the tubular connection member (5) is arranged in the bores and both pipes are fully engaged in the tubular connection member, wherein the tubular connection member (5) has an end portions (6) comprising an angled surface, whereby the angle ($\alpha$) of the angled surface in relation to longitudinal axis (L) is more than 125°.

**2.** The connection assembly according to claim 1, wherein the internal and external threads (3) extend parallel along a longitudinal axis (L) of the pipes (1a, 1b).

**3.** The connection assembly according to any one of the preceding claims, wherein a shoulder (4) at the distance (d) indicates an end of the internal threads of the pipes (1a, 1b).

**4.** The connection assembly according to any one of the preceding claims, wherein the ratio of an inner diameter (D-p) of the pipes (1a, 1b) to a length (l-t) of the tubular connection member (5) is at least 2:3.

**5.** The connection assembly according to any one of claims 1 to 5, wherein the ratio of a thickness of a wall (Tk-p) of the pipes (1a, 1b) to a length (l-t) of the tubular connection member (5) is at least 1:20.

**6.** The connection assembly according to any one of the preceding claims, wherein a depth (D-th) of threads (3) is less than one sixth of a thickness (Tk-p) of the wall of the pipes (1a, 1b).

**7.** The connection assembly according to any one of the preceding claims, wherein a material of the tubular connection member (5) is the same as the material of pipes (1a, 1b).

**8.** The connection assembly according to any one of the preceding claims, whereby the angle ($\alpha$) of the angled surface in relation to longitudinal axis (L) is more than 135°.

**9.** The connection assembly according to any one of the preceding claims, wherein the internal and external threads (3) are turned in the same direction as the rotation of a drill.

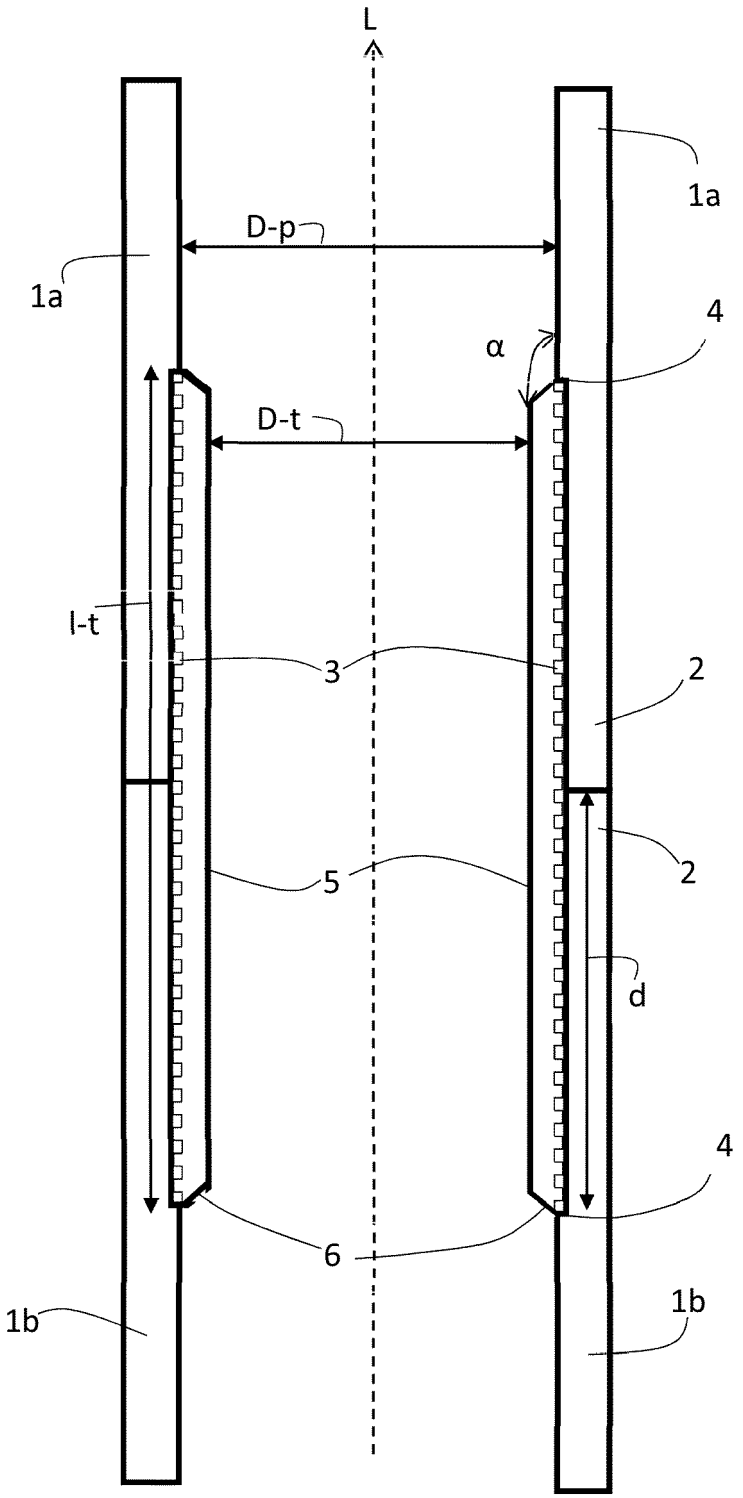


Fig 1

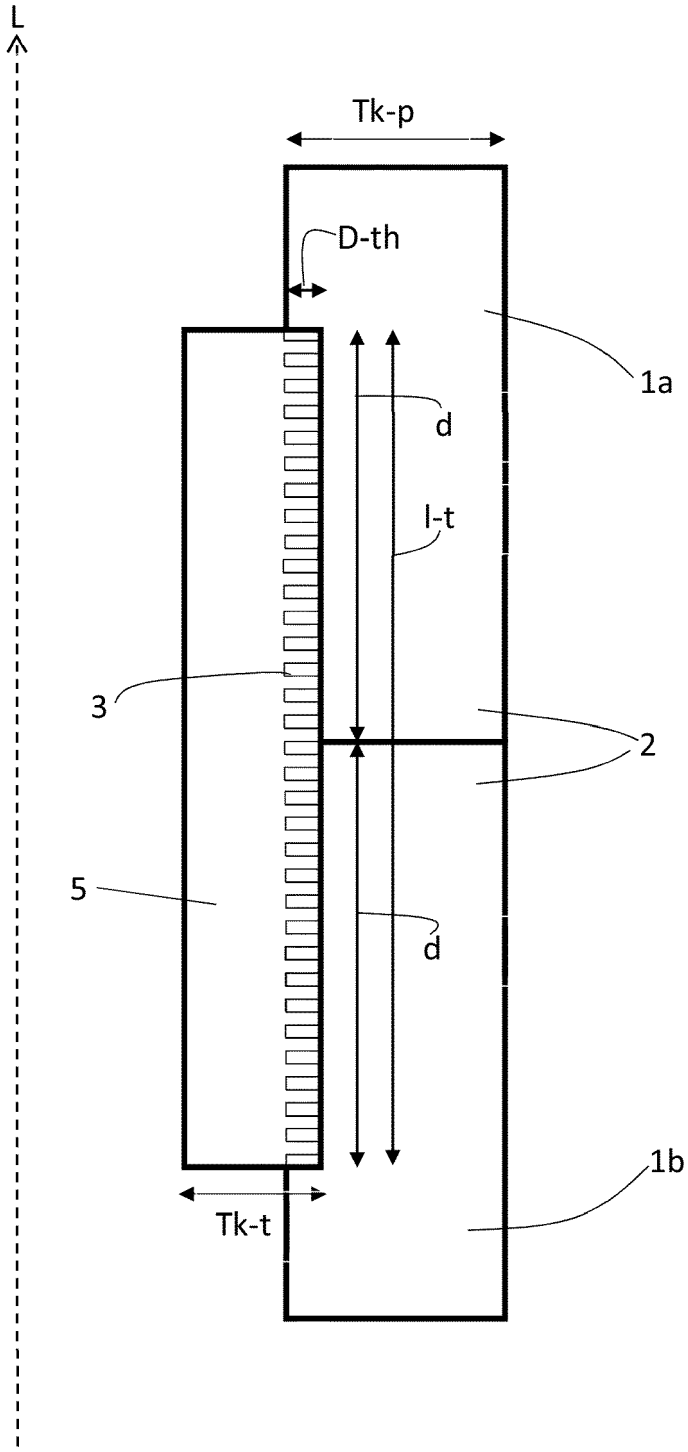


Fig 2

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# EUROPEAN SEARCH REPORT

Application Number
EP 19 18 1463

## DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 21 January 2020 | Beran, Jiri |

CATEGORY OF CITED DOCUMENTS

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 18 1463

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