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The present invention relates to a device for connecting two structural parts, particularly of concrete, separated by a joint, which device is suitable for the absorption of shearing forces acting in one direction and/or in its opposite direction, comprising a bolt, whose one region is insertable in the first structural part, and a sleeve, which is insertable in the second structural part, and which serves the receiving of the other region of the bolt, with reinforcement elements installed on the bolt and the sleeve, which reinforcement elements each have a first plate directed toward the joint, on which first plate bracket portions are installed on opposite-situated sides, which extend away from the joint, and the first plate has an opening, through which in each case the bolt or respectively the sleeve is led, and the space between the first plate and the bracket portions is filled in by a filling material.

When, in above-ground engineering and in underground engineering, structural parts such as roof slabs, floor slabs, ceilings, walls, retaining walls and so forth are supposed to be connected together, it is necessary to provide joints between the structural parts to be connected together. These structural parts are usually made of concrete, but other correspondingly suitable materials can also be used. These joints are necessary so that expansions of the structural parts during temperature fluctuations as well as contraction and creep influences can be compensated. At the same time these structural parts should be connected together in such a way that shearing forces can be transmitted from one structural part to another without affecting the above-described expansions. In many cases bolt-sleeve connections are thereby chosen; the bolt part is disposed in a first structural part in such a way that the one end region of the bolt protrudes out of the respective structural part; this protruding end region of the bolt penetrates into a sleeve, which is disposed in the other structural part. Via this bolt-sleeve connection the shearing forces arising between the structural parts can be transmitted optimally; the bolt is held in the sleeve in a longitudinally displaceable way, whereby the expansions of the structural parts can be compensated. The sleeve can also be designed in a known way such that slight lateral shifts of the bolt in the sleeve are also made possible.

With these kinds of connections of structural parts, high loads act upon the bolt-sleeve connection, in particular on the joint edge. In a corresponding way

the concrete surrounding the bolt and the sleeve in these regions is likewise very heavily loaded. To prevent the concrete on the joint edge in these regions having the highest load peaks from breaking off, the bolt and the sleeve in this area are each provided with a plate, which plates are additionally provided with bracket regions protruding into the structural parts. Achieved with these plates, preferably made of steel, with bracket regions, is that the forces to be transmitted to the structural part are distributed as much as possible over a larger region of the concrete. Achieved accordingly is that the fracture toughness of the concrete in this region can be improved. Such a device can be taken, for example, from the document EP 0 773 324 B1. To prevent devices of this kind from being able to corrode, they must be made of non-rusting materials. Such materials have a correspondingly high price.

The object of the present invention thus consists in creating a device for connecting two structural parts separated by a joint whereby the material costs can be kept as minimal as possible and whereby an optimal holding in the corresponding structural parts and an optimal force transmission to the corresponding structural parts, and vice-versa, are facilitated.

According to the invention this object is achieved in that at least the two lateral surfaces of the filling material, which are limited by the first plate and the bracket portions, are provided with projections and depressions, which are moulded into the filling material and in that the filling material (7) is a high performance mortar-type material.

By providing projections and depressions at least on the two lateral surfaces of the filling material, an optimal anchoring is achieved of these thus formed reinforcement elements in the corresponding structural part. The transmission of the shearing forces from the bolt or respectively from the sleeve to the corresponding structural part or respectively vice-versa can thereby be supported in an optimal way. Through the corresponding configuration of the reinforcement elements on the bolt and on the sleeve, the first plate can have a lesser thickness; in a corresponding way the bracket regions can have a lesser thickness, whereby material can be saved and the material costs can be reduced. On the one hand, the desired strength can be achieved by the filling material

being a high performance mortar-type material, and, on the other hand, this mortar-type material can be poured into moulds correspondingly disposed around the bolt or respectively sleeve and can subsequently harden.

Preferably the lateral surfaces of the filling material have a concave
5 curvature. Thereby achieved is that the anchoring in the material of the structural parts is additionally improved; through the concave curvatures a formfitting connection is moreover obtained of the reinforcement elements to the structural parts.

Preferably the projections and depressions are designed as ridges and
10 grooves, which run substantially parallel to the bracket portions. With these ridges and grooves the transmission of the shearing forces from the bolt and sleeve to the structural parts, and vice versa, is additionally improved; the surface regions absorbing the forces become enlarged.

Preferably the ridges and the grooves have a triangular cross section;
15 the force transmission is thereby optimal.

Another advantageous embodiment of the invention consists in that the apex angle of the triangular cross section of the ridges and grooves is about 60° to 120°. The surfaces of the ridges and grooves absorbing the force thereby have an optimal inclination in order to be able to absorb the shearing forces as well as
20 possible.

Preferably the apex angle of the triangular cross section of the ridges and grooves of a lateral surface is of differing size, whereby shearing forces which have different directions can also be optimally absorbed.

Preferably the end regions of the bracket portions remote from the first
25 plate are provided with bends, whereby an optimal connection between plate and bracket regions and the enclosed filling material is achieved.

A further advantageous embodiment of the invention consists in that the rear surface formed by the filling material between the two bends is likewise

provided with projections and depressions and the rear surface also has a concave curvature. The anchoring of the reinforcement element in the structural part is thereby additionally improved.

Another advantageous embodiment of the invention consists in that the
5 end regions of the bends opposite one another abut one another and are
connected together and enclose the bolt or respectively the sleeve. Thereby
achieved is that the filling material is optimally surrounded.

The end regions of the bends situated opposite one another can also
overlap one another and be provided with openings through which the bolt or
10 respectively the sleeve protrude. It is thereby not necessary to additionally
connect the bends to one another.

Preferably inserted into the bracket portions are tension bolts, which
penetrate the two bracket portions and the filling material, and a reinforcement
can thereby be achieved.

15 Embodiments of the device according to the invention will be explained
more closely, by way of example, with reference to the attached drawings.

Figure 1 shows in a three-dimensional representation a first
embodiment of the device according to the invention, consisting of bolt and
sleeve, each provided with reinforcement elements;

20 Figure 2 shows in a three-dimensional representation a second
embodiment of the device according to the invention with bolt and sleeve and
reinforcement elements;

Figure 3 shows in a three-dimensional representation a third
embodiment of the device according to the invention with bolt and sleeve and
25 reinforcement elements;

Figure 4 shows a side view of the third embodiment of the inventive
device according to Figure 3;

Figure 5 shows a view from above of the third embodiment of the inventive device according to Figure 4;

Figure 6 shows a view of a reinforcement element of a sleeve, in which the bends are connected together and welded;

5 Figure 7 shows a view of a reinforcement element of a sleeve in which the bends overlap one another; and

Figures 8 to 11 show views of reinforcement elements with differently designed projections and depressions.

The device according to the invention for connecting two structural
10 parts, a first embodiment of which is shown in Figure 1, is composed in each case of a bolt 1 and a sleeve 2. Installed on the bolt 1 and on the sleeve 2 is in each case a reinforcement element 3. Each of these reinforcement elements comprises a first plate 4, which is aligned in each case perpendicular to the bolt or respectively sleeve 2. Installed on oppositely situated ends of this first plate 4 are
15 bracket portions 5, which are provided with bends 6 on the end regions remote from the respective first plate 4.

The space formed between the bracket portions 5 and the bends 6 is filled in by a filling material 7. This filling material can be a high performance grout, but of course other suitable materials are usable. For introducing this filling
20 material 7 into the said space a mould can be produced in a known way by means of which the said space is enclosed, so that the pourable filling material 7 can be poured into this mould. After the hardening of this filling material 7 the mould can be removed; the filling material 7 then forms a body which fills in the said space and correspondingly encloses the bolt 1 or respectively the sleeve 2.

25 The lateral surfaces 8 of the body formed by this filling material 7 have a concave curvature 9. Moreover provided on the lateral surfaces 8 are projections 10 and depressions 11, which are designed here, in the embodiment shown, as ridges 12 and grooves 13 which run substantially parallel to the respective bolt 1 or respectively sleeve 2. These ridges 12 and grooves 13 can

have a triangular cross section, for example. This triangular cross section can be of differing size. Other shapes can also be used, as will still be described later.

The rear surface 14 of the filling material 7 existing between the bends 6 of the two bracket portions 5 can likewise have a concave curvature 9; here too 5 projections 10 and depressions 11 can be provided, which correspond preferably to the shape of the projections 10 and depressions 11 of the lateral surfaces 8.

Inserted in addition into the reinforcement elements 3 can be tension bolts 16, which each penetrate the bracket portions 5 and the filling material 7, which will still be described in detail later.

10 In a known way (not shown), the thus designed bolts 1 and sleeves 2 are inserted into the structural parts to be connected together. The respective sleeve 2 is thereby fixed to the sheathing or shuttering of the one structural part to be formed, for which purpose nail holes 15 are provided on the first plate 4. This structural part is then filled with concrete. After hardening, the sheathing or
15 shuttering is removed. Afterwards the second structural part is constructed. For this purpose bolts 1 are pushed into the sleeves 2. The respective structural part is then likewise filled with concrete. An optimal connection of the two structural parts is thereby obtained via the bolts and the sleeves. The first plates 4 are disposed in the respective structural parts each in a way flush with the surfaces
20 forming the joint.

To obtain a long life for the bolt and sleeve, these as well as the corresponding parts of the reinforcement elements are made of a corrosion-resistant material, for example non-rusting steel. Of course other suitable materials can also be used, however.

25 The second embodiment shown in Figure 2 for connecting two structural parts separated by a joint is constructed in an identical way as the first embodiment shown in Figure 1. The only difference is that the ridges 12 and grooves 13 in this second embodiment have a larger triangular cross section than those in the first embodiment. In addition the apex angle of this triangular cross-
30 sectional shape is likewise larger, as will still be described in detail later.

In Figure 3, a third embodiment can be seen of the device according to the invention for connecting two structural parts separated by a joint, in which the triangular cross-sectional shape of the ridges and grooves have a greater height compared with the second embodiment shown in Figure 2. Moreover the rear surface 14 of the bolt 1 is also visible here, which is designed in an identical way as the rear surface 14 of the sleeve 2.

Figures 4 and 5 show a side view or respectively a view from above of the third embodiment of the device according to the invention for connecting two structural parts separated by a joint, as is shown in Figure 3. Thereby visible in particular is how the tension bolts 16 are inserted into the reinforcement elements 3. These tension bolts 16 each penetrate the bracket portions 5 and filling material 7. These tension bolts 16 prevent the bracket portions 5 from being able to be forced apart, should the situation arise, whereby the resistance of these reinforcement elements 3 can be improved. In a simple way, these tension bolts 16 can be formed by a hexagonal bolt with a nut placed thereon, which results in an especially inexpensive solution. Likewise visible from these two figures is that in each case in the first plate 4 of bolt 1 and sleeve 2 an opening 18 is made through which the bolt 1 or respectively the sleeve 2 can protrude and in which openings the bolt 1 or respectively the sleeve 2 are fixed, for example through welding.

Figure 6 shows a different embodiment of a reinforcement element 3, which is placed here on a sleeve 2; of course this reinforcement element 3 could also be placed on a bolt. This reinforcement element 3 once again comprises a first plate 4, which is provided with the corresponding bracket portions 5. The bends 6 have a greater length, so that they abut one another. The abutting regions of these bends 6 are connected together, for example through welding. Introduced into the space formed by the first plate, the bracket portions and the bends is once again the filling material 7. The lateral surfaces 8 of this filling material 7 are designed in the same way as the lateral surfaces of the previously described embodiments of the device according to the invention. The first plate 4, the bracket portions 5 and the bends 6 thus form a closed loop, whereby an optimal strength of the thus designed reinforcement element 3 can be obtained. The tension bolts 16 shown in Figure 6 could be omitted.

Figure 7 again shows a reinforcement element 3, which is placed on a sleeve 2, which however could of course also be place on a bolt 1. This reinforcement element 3 is constructed in the same way as the embodiment described in Figure 6. The difference is that the bends have a greater length, so that they overlap one another. The connection of these two bends 6 is achieved by the sleeve 2, which is fixed through openings 7 correspondingly made in the overlapping regions of the bends 6. Thus obtained also here in principle is a closed loop through the first plate 4, the two bracket portions 5 and the bends 6 overlapping one another, with the advantages already mentioned with respect to Figure 6.

Shown in Figures 8 to 11 is in each case a reinforcement element 3, which is placed on a sleeve 2. Of course these reinforcement elements 3 could also be placed on a bolt. These reinforcement elements 3 have, as has been previously described, a filling material 7, by means of which the lateral surfaces 8 are formed. As has already been described in the foregoing, these lateral surfaces 8 are provided, for example, with ridges 12 and grooves 13.

Figure 8 shows ridges 12 having a triangular cross section. The apex angle α of these triangular cross sections here is about 60° . The lateral surfaces 8 have a relatively slight concave curvature 9.

In Figure 9 the ridges 12 likewise have a triangular cross section. In contrast to the example shown in Figure 8, these ridges are designed smaller; the apex angle α is likewise about 60° . The lateral surfaces 8 have a greater concave curvature 9 than in the example according to Figure 8.

In the example according to Figure 10, the ridges 12 likewise have a triangular cross section, the apex angle α here however is about 90° . The lateral surfaces 8 have a relatively great concave curvature 9.

Figure 11 shows an example in which the ridges 12 have a curved surface. The lateral surfaces 8 once again have a relatively great concave curvature 9.

In the examples shown in Figure 8 to Figure 11 for design of the ridges and grooves, the respective rear surfaces are designed in a way corresponding to the lateral surfaces. Of course this does not necessarily have to be the case.

In the examples shown in Figure 8 to Figure 11 for design of the ridges and grooves, the ridges each have an identical shape and size over the entire lateral surfaces and rear surfaces. However this does not have to be the case. For example, ridges with differing cross-sectional shapes and, if need be, differing apex angles could be used over the lateral surfaces and the respective rear surface.

Obtained by means of the projections and depressions, which are provided on the lateral surfaces formed by the filling material and, if need be, the rear surface of the reinforcement element, is an optimal anchoring of these reinforcement elements in the respective structural parts. Part of the effective shearing forces can be transmitted in an optimal way through the surface regions which are formed by the flanks of the projections and depressions. This transmission is especially optimal in the embodiment examples in which the projections are designed as ridges and the depressions as grooves. Of course a majority of the effective shearing forces will be transmitted via the bracket portions. An additional improvement of the anchoring and the transmission of the forces is obtained by providing concave curvatures of the lateral surfaces and, if need be, of the rear surface. The size of the projections and depressions, the angles which the corresponding surfaces of the flanks have, the shape of the projections and the choice of magnitude of the concave curvatures of the lateral surfaces and, if need be, of the rear surface can be adapted in an optimal way to the type of application and to the material, for example, of which the structural part is made.

Owing to the composite construction of the reinforcement elements and the optimal design of the shape and thereby the optimal force transmission, the thickness of the first plate and of the bracket portions as well as the bends can be kept minimal, so that savings can be achieved with respect to material, which has a corresponding effect on the price, in particular with the use of non-rusting steel.

Patentkrav

1. Indretning til at forbinde to byggeelementer, især af beton, adskilt af en fuge, hvilken indretning er egnet til absorptionen af forskydningskraft der virker i en retning og/eller i dens modstående retning, omfattende en bolt (1), hvis ene
5 region er indsætningsmulig i det første byggeelement, og en bøsning (2), der er indsætningsmulig i det andet byggeelement, og som tjener modtagelsen af den anden region af bolten (1), med forstærkningselementer (3) installeret på bolten (1) og bøsningen (2), hvilke forstærkningselementer hver har en første plade (4) rettet mod fugen, på hvilken første pladebøjledelene (5) er installeret på modsat-
10 beliggende sider, der strækker sig væk fra fugen, og den første plade (4) har en åbning (18), gennem hvilken bolten (1) eller respektivt bøsningen (2) er ført, og rummet mellem den første plade (4) og bøjledelene (5) er fyldt op af et fyldstofmateriale (7), **kendetegnet ved at** mindst begge sideflader (8) af fyldstofmaterialet (7), der er begrænset af den første plade (4) og bøjledelene
15 (5), er tilvejebragt med fremspring (10) og fordybninger (11), der er støbt ind i fyldstofmaterialet (7) og ved at fyldstofmaterialet (7) er et højstyrke mørtel-type-materiale.

2. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 1,
20 **kendetegnet ved at** sidefladerne (8) af fyldstofmaterialet (7) har en konkav krumning (9).

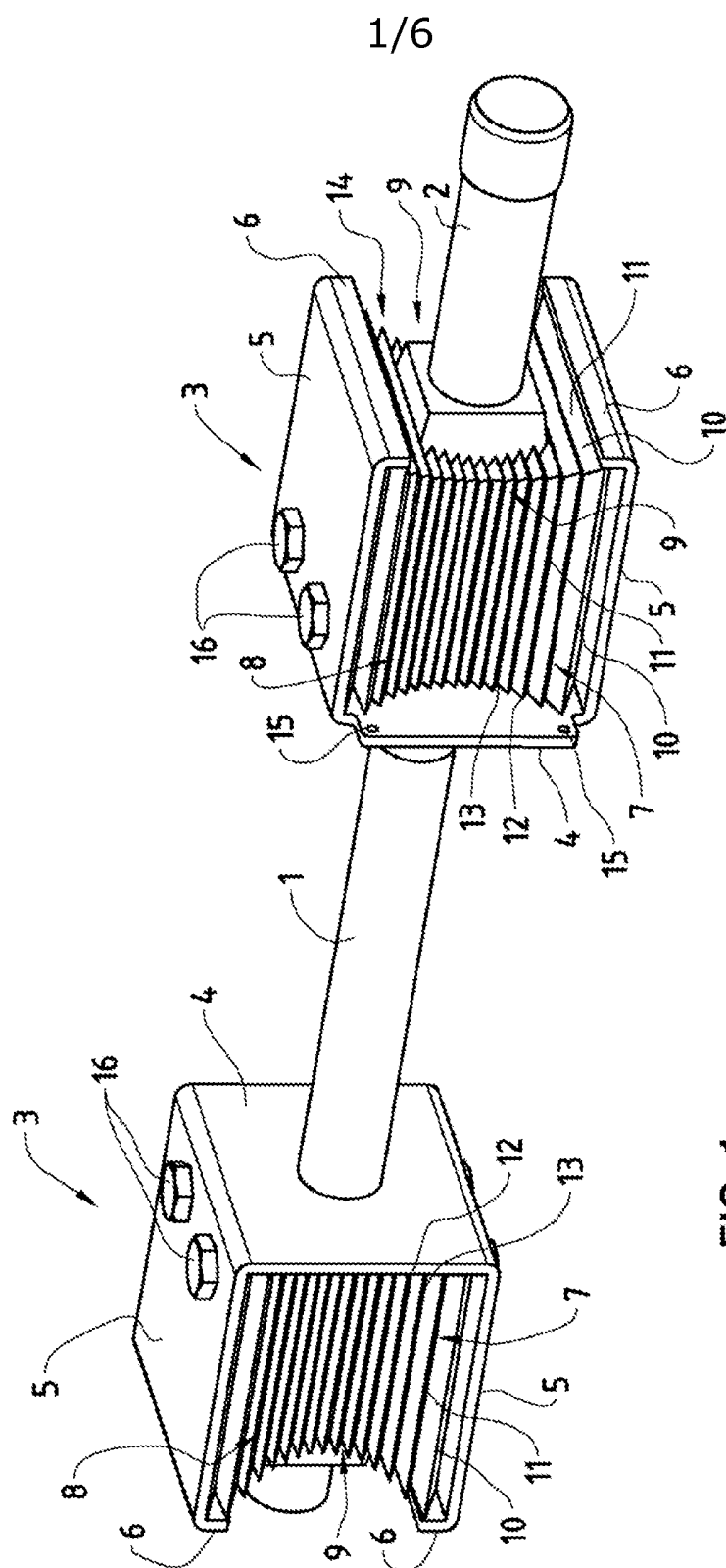
3. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 1 eller 2, **kendetegnet ved at** fremspringene (10) og fordybningerne (11) er
25 udformet som kanter (12) og riller (13), der løber i det væsentlige parallelt med bøjledelene (5).

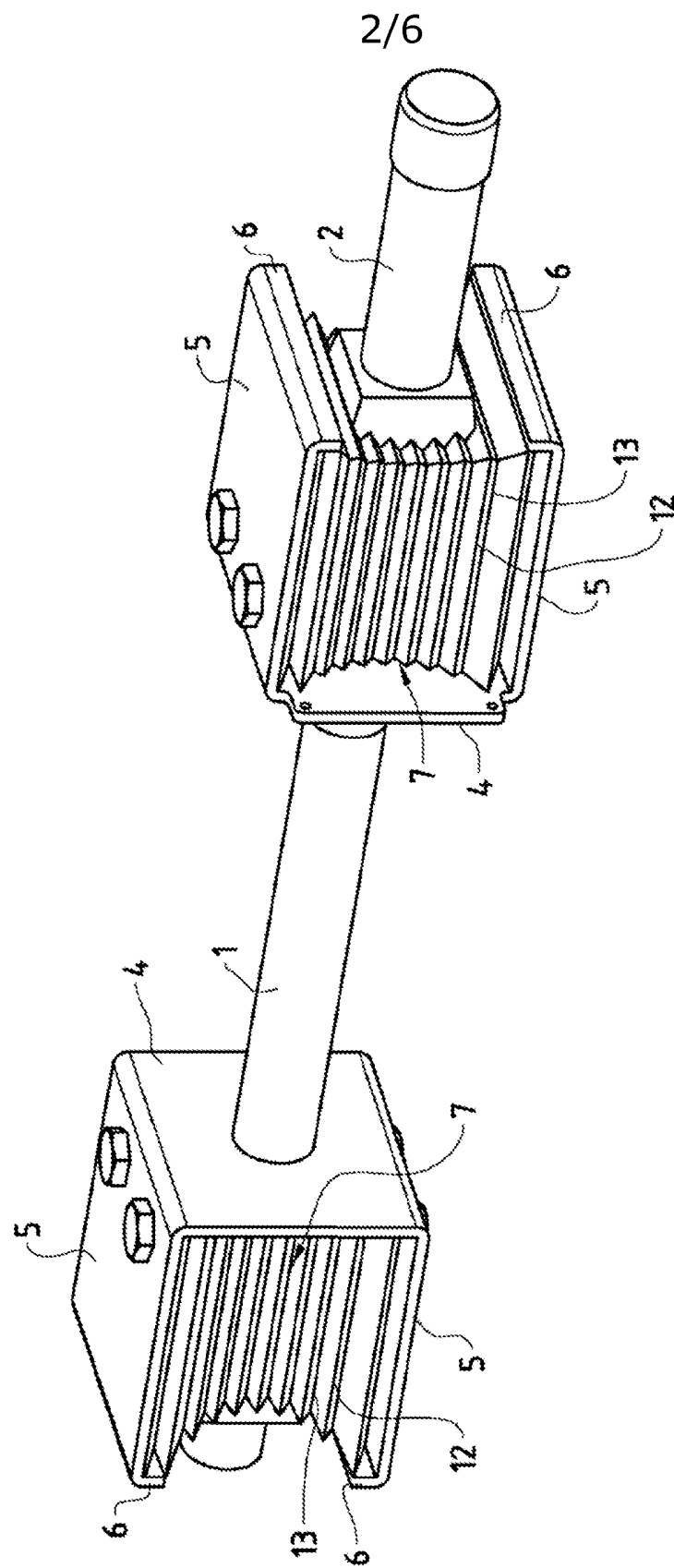
4. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 3,
kendetegnet ved at kanterne (12) og rillerne (13) har et trekantet tværsnit.

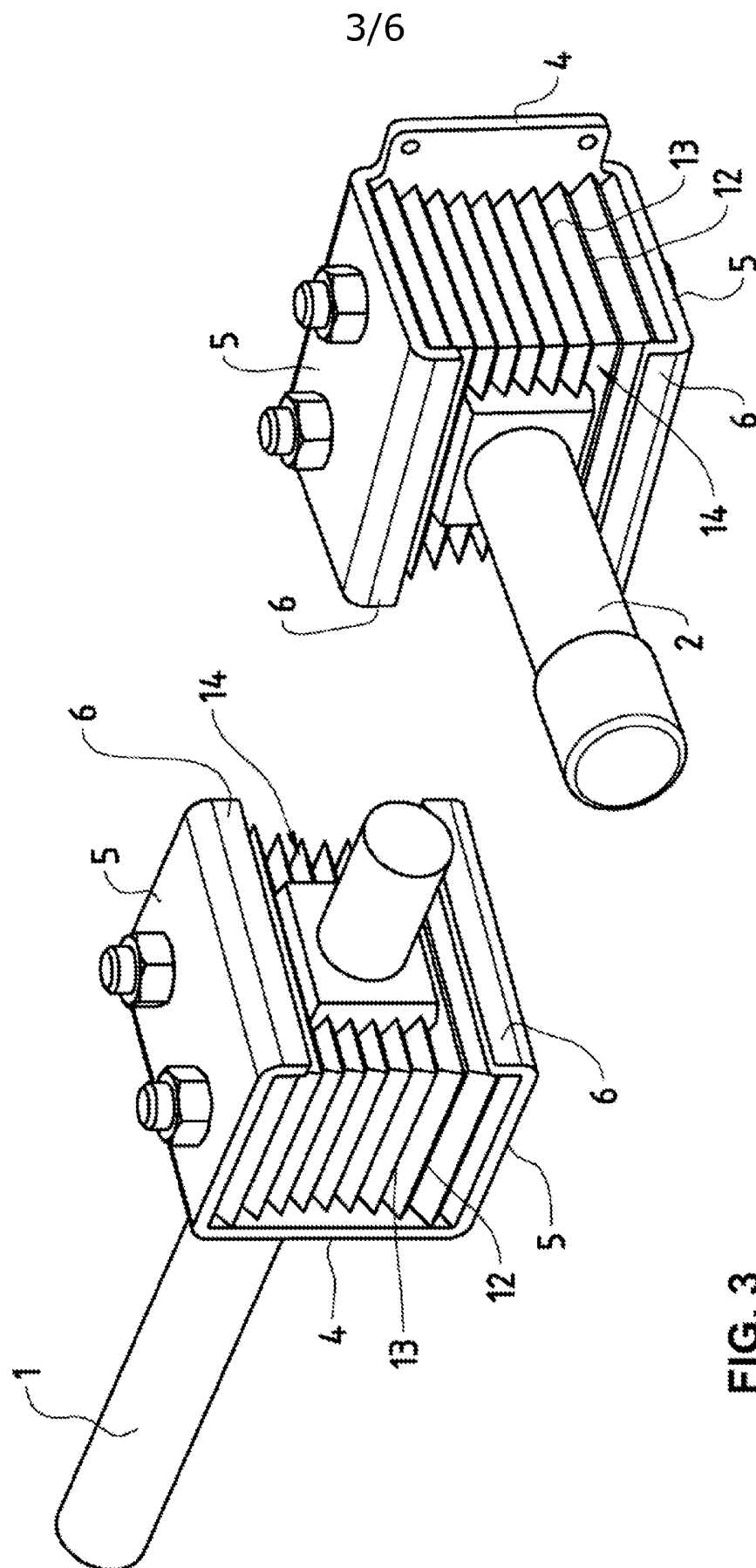
30

5. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 4, **kendetegnet ved at** topvinklen α af det trekantede tværsnit af kanterne (12) og rillerne (13) er ca. 60° til 120°.

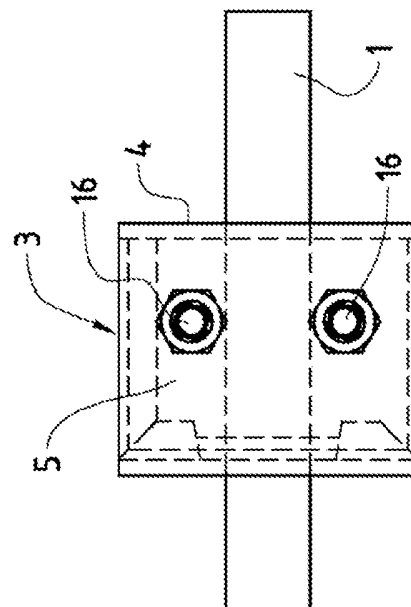
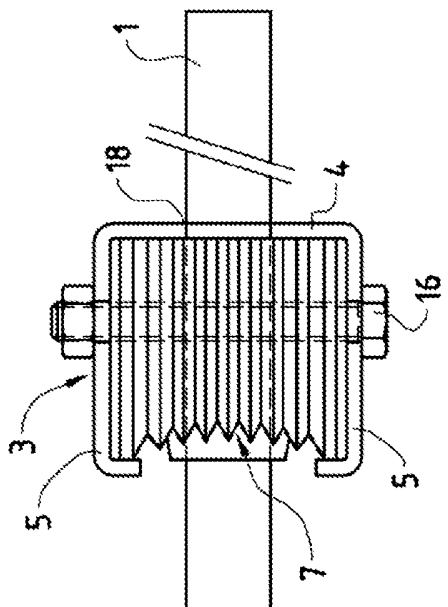
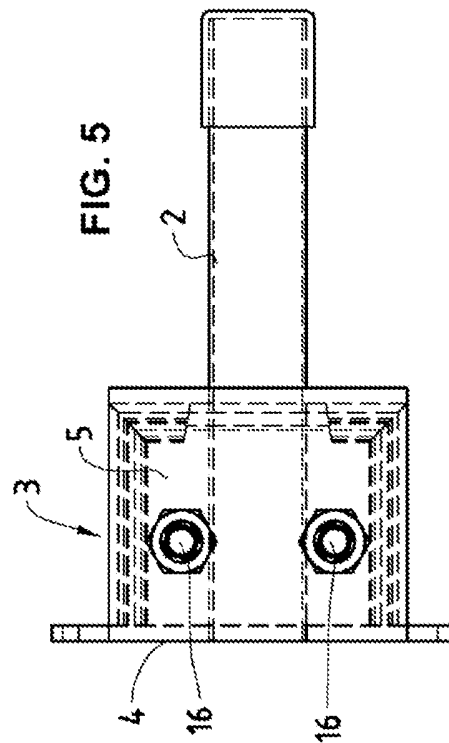
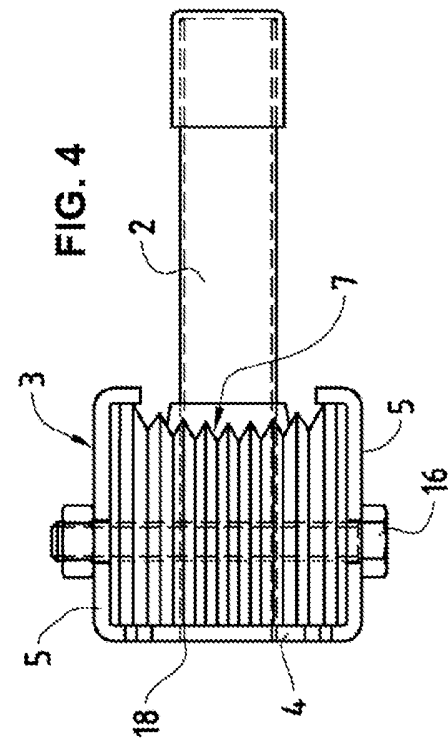
6. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 4, **kendetegnet ved at** topvinklen α af det trekantede tværsnit af kanterne (12) og rillerne (13) af en lateral flade (8) er af forskellig størrelse.
- 5 7. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 3, **kendetegnet ved at** kanterne (12) og rillerne (13) har forskellige tværsnitsformer.
8. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge et hvilket
10 som helst af kravene 1 til 7, **kendetegnet ved at** enderegionerne af bøjledelene (5) der vender væk fra den første plade (4) er tilvejebragt med bøjninger (6).
9. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 8, **kendetegnet ved at** bagfladen (14) dannet af fyldstofmaterialet (7) mellem de
15 to bøjninger (6) er ligeledes tilvejebragt med fremspring (10) og fordybninger (11) og bagfladen (14) også har en konkav krumning (9).
10. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 8, **kendetegnet ved at** enderegionerne af bøjningerne (6) modstående hinanden
20 grænsende op til hinanden og er forbundet sammen og omgiver respektivt bolten (1) eller bøsningen (2).
11. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge krav 8, **kendetegnet ved at** enderegionerne af bøjningerne (6) beliggende modstående
25 hinanden overlapper hinanden og er tilvejebragt med åbninger (17) gennem hvilke respektivt bolten (1) eller bøsningen (2) rager frem.
12. Indretning til at forbinde to byggeelementer adskilt af en fuge ifølge et hvilket
som helst af kravene 1 til 11, **kendetegnet ved at** indsat i bøjledelene (5) er
30 spændbolte (16), der gennemborer de to bøjledele (5) og fyldstofmaterialet (7).







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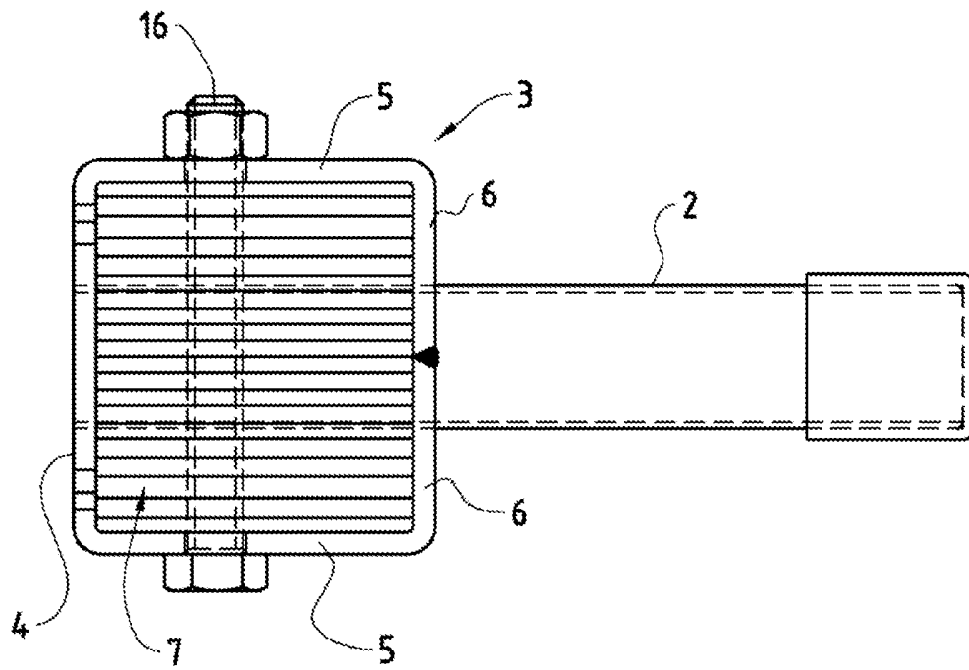


FIG. 6

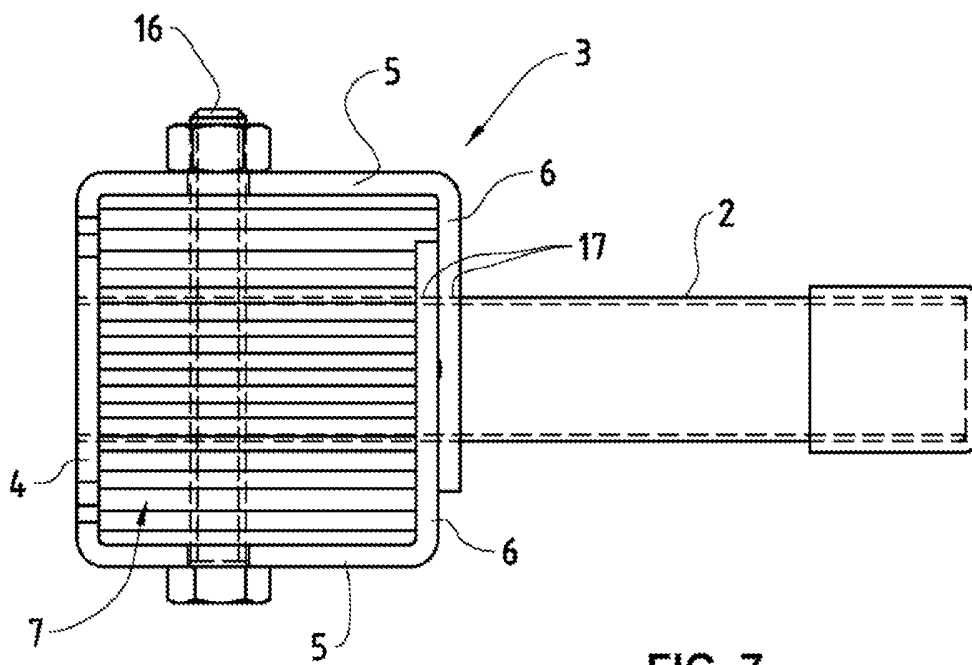


FIG. 7

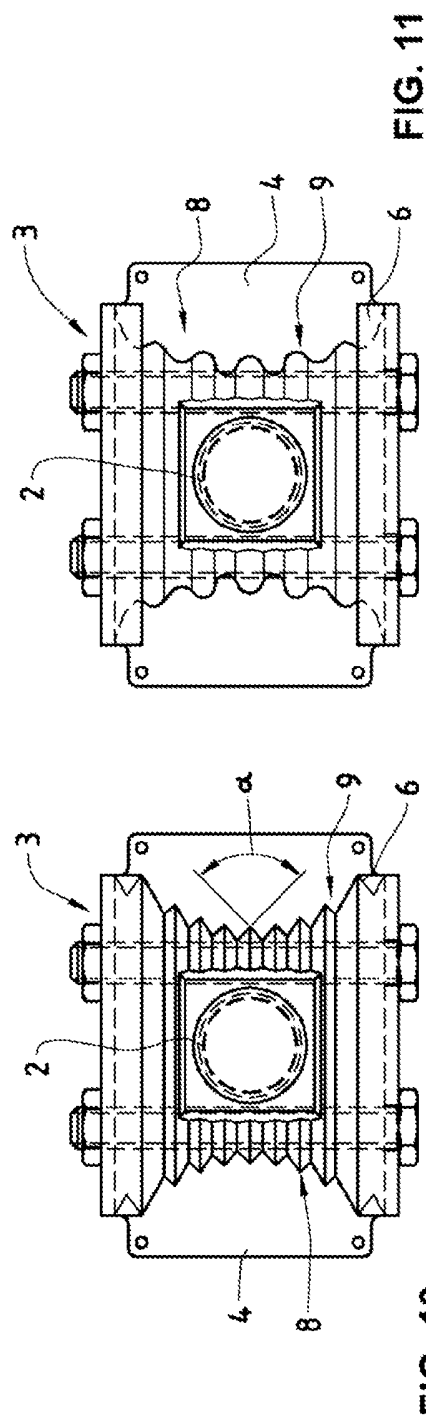
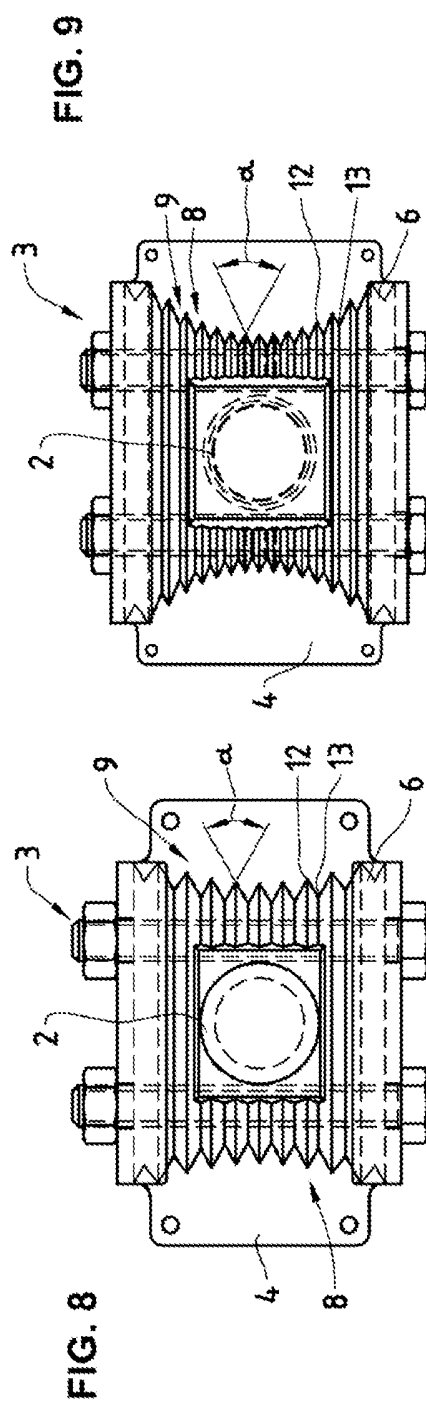


Fig. 1