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(54) **CONNECTING STRUCTURE SUBJECT TO A VARIABLE LOAD AND HOISTING APPARATUS EQUIPPED THEREWITH**

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STRUCTURE DE CONNEXION SOUMISE A UNE CHARGE VARIABLE ET APPAREIL DE LEVAGE EQUIPE DE CETTE STRUCTURE

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(73) Proprietor: **Stinis Beheer B.V.**
2931 AB Krimpen aan De Lek (NL)

(72) Inventor: **STINIS, Cornelis**
NL-2931 AB Krimpen Aan De Lek (NL)

(74) Representative: **Bartelds, Erik et al**
Arnold & Siedsma,
Advocaten en Octrooigemachtigden,
Sweelinckplein 1
2517 GK Den Haag (NL)

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Description

[0001] The invention relates to a connecting structure subject to a variable load, comprising at least one connecting element and at least one anchoring member supporting the connecting element, the connecting element and the anchoring member each comprising at least one primary contact surface, said primary contact surfaces engaging each other during use. Such a connecting structure is known, for instance in the form of a so-called "twist-lock".

[0002] Such a connecting structure is known from DE-A-2 042 357.

[0003] A twist-lock is a connecting structure which is used for engaging containers during hoisting thereof, for instance when loading or unloading container ships. Standard containers comprise engagement points on their corners for handling and fixing thereof, the so-called "corner castings". These corner castings form strengthened corners, in which an oblong opening is formed. A twist-lock may engage in this opening. A twist-lock consists of a pin or shaft having a hammerhead on its end, the pin being received with its other end in a bushing or collar, which in turn is connected to a rotating actuating mechanism. The actuating mechanism may rotate the twist-lock over 90 degrees between a position in which the hammerhead may be inserted into the oblong opening and a position in which the hammerhead is locked in this opening.

[0004] For the known twist-lock conventionally two connecting methods are used for anchoring the connecting element, i.e. the pin or shaft, in the anchoring member, viz. the collar or bushing. It is possible to provide both the connecting element and the anchoring member with threading, and thus simply establish a screw connection between these two parts. It is also possible to provide these parts with cooperating protrusions and recesses. In that case the anchoring member may be formed by a number of segments, which are brought together around the connecting element, after which an outer collar is slid over these segments to keep them together. The outer collar is usually secured in the connecting element by means of a screw or pin.

[0005] The known connecting structures have the drawback that the dimensions of the shaft of the connecting element are limited by the space available in the corner casting. This means that the connecting element cannot be dimensioned for an 'endless' lifespan, or at least a lifespan exceeding that of the hoisting apparatus. Therefore, cracks will form in the connecting element at some time, with the additional problem that the condition of the connecting element cannot be properly monitored. As the connecting structures are subject to relatively heavy and variable loads during connection of the hoisting apparatus to the containers and during lifting and lowering of the containers, the danger of a part of the connecting structure failing, specifically due to fatigue, is relatively great. In this connection it is also important that such heavily loaded structures are usually made of steel, the fatigue characteristics of which are hard to measure or predict. When such a connecting structure fails and the container suspended therefrom falls, there is a great risk of personal injury. Moreover, the material damage will usually also be substantial.

[0006] Therefore, by way of precaution such twist-locks have until now usually been replaced after a predetermined period of time, also when no cracking was visible. This is obviously expensive, also because the hoisting apparatus must be taken out of operation to this end.

[0007] The invention therefore has for its object to provide a connecting structure of the type described above, of which the condition may be detected more easily than that of conventional structures, and which further has a longer safe life. In accordance with the invention, this is accomplished in such a connecting structure, in that the connecting element and the anchoring member each further comprise at least one secondary contact surface, said secondary surfaces being spaced apart during use but engaging each other upon deformation of the connecting element and/or the anchoring member. By using such secondary contact surfaces loads on the connecting element may safely be transferred to the anchoring member, even when the connecting element and/or the anchoring member are already deformed by overloading.

[0008] In order to prevent the secondary contact surfaces from already partially carrying the load at a time that the load bearing capacity of the primary contact surfaces has not yet been exceeded, the spacing of the secondary contact surfaces is preferably such, that these only engage upon plastic deformation, for instance cracking of the connecting element and/or the anchoring member.

[0009] The connecting structure preferably comprises means for detecting engagement of the secondary contact surfaces. In this way it is possible to recognize the threat of failure of the connecting structure in good time. When these detecting means comprise markings arranged on the connecting element and/or the anchoring member, which for instance become visible with the deformation of the structure that leads to engagement of the secondary contact surfaces, the detection may easily take place visually.

[0010] All this may be accomplished in relatively simple fashion, when the primary and secondary contact surfaces are spaced apart in the main loading direction.

[0011] A structurally simple embodiment is obtained, when the connecting element includes a shaft extending in the main loading direction, the anchoring member comprises a collar at least partially enclosing the shaft, and the primary and secondary contact surfaces are formed on the outside of the shaft and the inside of the collar, respectively.

[0012] For an optimum load bearing capacity of the connecting structure it is preferred that the shaft in-

cludes an end received in the collar and an opposite free end, and in that the primary contact surface is farther removed from the free end than the secondary contact surface. In this way the primary contact surfaces are arranged in the most heavily loaded part of the structure.

[0013] A simple embodiment is obtained when the primary and secondary contact surfaces are formed by cooperating cams and grooves. In order to maximize the force transmitting surface, the cams are advantageously annular, and the grooves extend over the entire periphery of the shaft and/or collar.

[0014] In case the connecting structure is to be used as twist-lock, the connecting element preferably includes a hammer shaped end and the anchoring member is connected to an actuating device for rotating the anchoring member and the connecting element.

[0015] The invention further relates to an apparatus for hoisting objects, in particular containers, comprising at least one movable hoisting frame including one or more connecting structures of the type described above.

[0016] The invention will now be illustrated by way of an example, with reference being made to the annexed drawing, in which:

Fig. 1 is a perspective view of a hoisting apparatus including a plurality of connecting structures in accordance with the invention,
Fig. 2 is a partially cross-sectional elevation of this connecting structure in its intact condition,
Fig. 3 shows a detail according to the arrow III in fig. 2,
Fig. 4 is a view corresponding to fig. 2 of the connecting structure in partially failed condition, and
Fig. 5 is a detail in accordance with the arrow V in fig. 4.

[0017] A hoisting apparatus 1 (fig. 1) for picking up a container 2 is formed by a frame 3 which is suspended from a plurality of cables 5 guided over pulleys 4. In the shown embodiment the frame 3 is a telescopic frame, having a main body 6 and two pairs of inner and outer telescopic arms 7,8. At the end of each telescopic arm 8 a transverse beam 9 is arranged, having a connecting structure or "twist-lock" 11 in accordance with the invention at each of its corners. Also positioned at these corners are fixing members or "flippers" 13 which are pivotable about respective axes 12.

[0018] Each connecting structure 11 is formed by a connecting element 14 which is received in a anchoring member 15. This anchoring member 15 is connected to an actuating arm 16, which in turn is connected to an actuating mechanism (not shown). This actuating mechanism can rotate the assembly of connecting element 14 and anchoring member 15 abount an axis 17.

[0019] In the shown embodiment the anchoring member 15 is provided with a spherical part 26 that is journalled in a correspondingly shaped dish 27 in the transverse beam 9, in order to allow minor pivoting movement of the connecting structure 11 with respect to the hoisting frame 3.

[0020] The connecting element 14 comprises a shaft 18 having a hammerhead 19 on its free end, which is shaped and dimensioned such, that it may be inserted into an oblong opening 20 in a corner part or "corner casting" 21 of the container 2, and may be hooked in this opening by rotation about the axis 17 over 90°.

[0021] The connecting element 14 and the anchoring member 15 include primary contact surfaces 22 and 23, respectively, which engage each other for transferring the load due to the weight of the container 2 suspended from the four connecting structures 11. These primary contact surfaces 22 and 23, respectively, are formed by a cam 24 on the inside of the anchoring member 15 which protrudes in a groove 25 in the shaft 18 of the connecting element 14. The anchoring member 15 is embodied as a segmented collar 28, the segments of which are kept together by an outer collar 29 being slid over these segments.

[0022] Both the cam 24 of the collar 28 and the groove 25 in the shaft 18 of the connecting element 14 are annular, and extend over the entire periphery of the connecting element 14 and the collar 28, such that a relatively large force transmitting surface is formed, and the resulting stresses in the material are limited as much as possible. Nevertheless, there is a risk that the connecting element 14 and/or the anchoring member 15 will undergo plastic deformation and may eventually even fail. As the consequences of failure of a connecting structure 11 in this field may be serious, considering the risk of both personal injury and material damage, the connecting element 14 and the anchoring member 15 further include secondary contact surfaces 30 and 31, respectively, which do not engage during normal use, and will only start carrying part of the load at the time that the load bearing capacity of the connecting structure 11 threatens to be seriously reduced by deformation or even partial failure of the connecting element 14 and/or the anchoring member 15.

[0023] To this end the primary and secondary contact surfaces 22,23 and 30,31, respectively, are spaced apart in the main loading direction, in this case the longitudinal direction of the shaft 18, with the primary contact surfaces 22 and 23, respectively, being formed on the part of the shaft 18 and the collar 28 which is remote from the hammerhead 19. In this way, in the normal intact condition the loads are efficiently transferred from the connecting element 14 to the anchoring member 15 and from there through the bearing dish 27 into the structure of the hoisting frame 3.

[0024] As stated above, the secondary contact surfaces 30 and 31, respectively, do not engage during normal use of the connecting structure 11, when the connecting element 15 and the anchoring member 15 are hardly or not at all deformed, but are spaced a distance d apart. This distanced may be chosen such that the secondary contact surfaces 30 and 31, respectively, on-

ly start helping to carry the load at the time that the connecting element 14 has failed at the primary contact surfaces 22 and 23, respectively. The distanced may vary between several tens of microns and one or more millimetres.

[0025] In the illustrated embodiment the secondary contact surfaces 30 and 31, respectively, are also formed by a cam 33 at the inside of the collar 28 and a groove 34 in the shaft 18 of the connecting element 14.

[0026] By adding secondary contact surfaces which start carrying load at the time that the primary contact surfaces cannot transfer forces any longer, as the corresponding part of the structure 11, usually the connecting element 14 has failed locally, it is prevented that such failure of a part of the connecting structure 11 has disastrous consequences. By simultaneously visualizing the deformation, in the shown embodiment by a downward displacement of the connecting element 14 over distance d with respect to the anchoring member 15, the user may also be alerted to the partial failure of the connecting structure, after which this structure may be further monitored and eventually replaced. The deformation may be visualized by means of markings on for instance the part of the connecting element 14 which is normally arranged within the anchoring member 15, which markings will only become visible with the deformation that leads to the secondary contact surfaces 30 and 31, respectively, starting to carry the load. In this way the lifespan of the connecting structure 11 is substantially lengthened, and unnecessary and premature replacement of parts thereof may be avoided, so that the cost of the structure and the cost of use are reduced.

[0027] It should be noted that it is not necessary for the connection through the secondary contact surfaces 30 and 31, respectively, to have the same lifespan as that through the primary contact surfaces 22 and 23, respectively. This connection only needs to hold until a next inspection of the structure, or until the deformation is detected. A lifespan which corresponds to 50 to 90 percent, preferably 65 to 80 percent, for instance approximately 75 percent of the lifespan of the main connection through the primary contact surfaces 22 and 23, respectively, is usually sufficient.

[0028] Although the invention has been illustrated above with reference to an embodiment thereof, it will be clear that it is not limited thereto. Apart from the secondary contact surfaces also tertiary, quaternary and further contact surfaces could be provided, in order to include even further security. Besides, the contact surfaces could also be arranged at different points between the various parts, and the mutual location of the primary and secondary contact surfaces could be chosen differently. Moreover, it is not necessary for these surfaces to be embodied as cams and grooves, but it is also conceivable that two or more threaded segments are used. The detection of the engagement of the secondary contact surfaces may also be performed in a different way than visually. It is conceivable that for instance use could be made of contacts being closed at the time of engagement, measurement of the distance between the secondary contact surfaces or other techniques. Finally, the connecting structure in accordance with the invention could also be used in other fields of technology.than in hoisting containers.

[0029] Consequently, the scope of the invention is determined solely by the annexed claims.

Claims

1. Connecting structures (11) subject to a variable load, comprising at least one connecting element (14), and at least one anchoring member (15) supporting the connecting element (14), the connecting element (14) and the anchoring member (15) each comprising at least one primary contact surface (22, 23), said primary contact surfaces engaging each other during use, **characterized in that** the connecting element (14) and the anchoring member (15) each further comprise at least one secondary contact surface (30, 31), said secondary surface (30, 31) being spaced apart during use but engaging each other upon deformation of the connecting element and/or the anchoring member.

2. Connecting structure as claimed in claim 1, **characterized in that** the spacing of the secondary contact surfaces (30, 31) is such, that these only engage each other upon plastic deformation of the connecting element (14) and/or the anchoring member (15).

3. Connecting structure as claimed in claim 2, **characterized in that** the spacing of the secondary contact surfaces (30, 31) is such, that these only engage upon the formation of cracks in the connecting element (14) and/or the anchoring member (15).

4. Connecting structure as claimed in any of the preceding claims, **characterized by** means for detecting engagement of the secondary contact surfaces (30, 31)

5. Connecting structure as claimed in claim 4, **characterized in that** the detecting means comprise markings arranged on the connecting element (14) and/or the anchoring member (15).

6. Connecting structure as claimed in any of the preceding claims, **characterized in that** the primary and secondary contact surfaces (30, 31) are spaced apart in the main loading direction.

7. Connecting structure (11) as claimed in any of the preceding claims, **characterized in that** the connecting element (14) includes a shaft extending in

the main loading direction, the anchoring member (15) comprises a collar (28) at least partially enclosing the shaft (18), and the primary and secondary contact surfaces (22, 23, 30, 31) are formed on the outside of the shaft (18) and the inside of the collar (28) respectively.

8. Connecting structure as claimed in claim 6 and 7, **characterized in that** the shaft (18) includes an end received in the collar (28) and an opposite free end, and **in that** the primary contact surface (22, 23) is farther removed from the free end than the secondary contact surfaces (30, 31).

9. Connecting structure as claimed in any of the preceding claims, **characterized in that** the primary and secondary contact surfaces (22, 23, 30, 31) are formed by cooperating cams (33) and grooves (34).

10. Connecting structure as claimed in claim 7 or 8 and **9, characterized in that** the cams (33) are annular and the grooves (34) extend over the entire periphery of the shaft (18) and/or the collar (28).

11. Connecting structure as claimed in any of the preceding claims, **characterized in that** the connecting element (14) includes a hammershaped end and the anchoring member (15) is connected to an actuating device for rotating the anchoring member (15) and the connecting element (14).

12. Apparatus for hoisting objects, in particular containers, comprising at least one movable hoisting frame including a plurality of connecting structures (11) as claimed in any of the preceding claims.

Patentansprüche

1. Einer wechselnden Last ausgesetzte Verbindungsstruktur (11) mit wenigstens einem Verbindungselement (14) und wenigstens einem Verankerungselement (15), dass das Verbindungselement (14) trägt, wobei das Verbindungselement (14) und das Verankerungselement (15) jeweils wenigstens eine primäre Kontaktfläche (22, 23) aufweisen, wobei die primären Kontaktflächen im Betrieb miteinander im Eingriff sind, **dadurch gekennzeichnet, dass** das Verbindungselement (14) und das Verankerungselement (15) jeweils weiterhin wenigstens eine zweite Kontaktfläche (30, 31) aufweisen, wobei die sekundären Flächen (30, 31) während des Betriebes zueinander beabstandet sind, jedoch bei Verformung des Verbindungselementes und/oder des Verankerungselementes miteinander in Eingriff gelangen.

2. Verbindungsstruktur nach Anspruch 1, **dadurch gekennzeichnet, dass** der Abstand der sekundären Kontaktflächen (30, 31) so ist, dass diese nur bei plastischer Verformung des Verbindungselementes (14) und/oder des Verankerungselementes (15) in Eingriff gelangen.

3. Verbindungsstruktur nach Anspruch 2, **dadurch gekennzeichnet, dass** der Abstand der sekundären Kontaktflächen (30, 31) so ist, dass diese nur bei Bildung von Rissen in dem Verbindungselement (14) und/oder dem Verankerungselement (15) in Eingriff gelangen.

4. Verbindungsstruktur nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** Mittel zum Detektieren des Eingriffes der sekundären Kontaktflächen (30, 31).

5. Verbindungsstruktur nach Anspruch 4, **dadurch gekennzeichnet, dass** die Detektiermittel Markierungen aufweisen, die an dem Verbindungselement (14) und/oder dem Verankerungselement (15) angeordnet sind.

6. Verbindungsstruktur nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die primären und sekundären Kontaktflächen (30, 31) in der Hauptlastrichtung beabstandet sind.

7. Verbindungsstruktur (11) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet , dass** das Verbindungselement (14) einen Schaft aufweist, der sich in der Hauptlastrichtung erstreckt, das Verankerungselement (15) einen Ring (28) aufweist, der wenigstens partiell den Schaft (18) umschließt, und die primären und sekundären Kontaktflächen (22, 23, 30, 31) an der Außenseite des Schaftes (18) bzw. der Innenseite des Ringes (28) ausgebildet sind.

8. Verbindungsstruktur nach Anspruch 6 und 7, **dadurch gekennzeichnet, dass** der Schaft (18) ein Ende, welches in dem Ring (28) aufgenommen ist, und ein gegenüberliegendes freies Ende hat, und dass die primäre Kontaktfläche (22, 23) von dem freien Ende weiter als die sekundäre Kontaktfläche (30, 31) entfernt ist.

9. Verbindungsstruktur nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die primären und sekundären Kontaktflächen (22, 23, 30, 31) durch Zusammenwirken von Nocken (33) und Nuten (34) gebildet sind.

10. Verbindungsstruktur nach Anspruch 7 oder 8 und 9, **dadurch gekennzeichnet, dass** die Nocken (33) ringförmig sind und die Nuten (34) sich über den gesamten Umfang des Schaftes (18) und/oder

des Ringes (28) erstrecken.

11. Verbindungsstruktur nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verbindungselement (14) ein hammerförmiges Ende aufweist und das Verankerungselement (15) mit einer Betätigungsvorrichtung zum Drehen des Verankerungselementes (15) und des Verbindungselementes (14) verbunden ist.

12. Vorrichtung zum Heben von Gegenständen, insbesondere Containern, mit wenigstens einem bewegbaren Heberahmen mit einer Anzahl von Verbindungsstrukturen (11) wie in einem der vorstehenden Patentansprüche beansprucht.

Revendications

1. Structure de connexion (11) soumise à une charge variable, comprenant au moins un élément de connexion (14) et au moins un membre d'ancrage (15) supportant l'élément de connexion (14), l'élément de connexion (14) et le membre d'ancrage (15), comprenant chacun au moins une surface de contact primaire (22, 23), lesdites surfaces de contact primaires s'emboîtant les unes dans les autres lors de l'utilisation, **caractérisée en ce que** l'élément de connexion (14) et le membre d'ancrage (15) comprennent en outre chacun au moins une surface de contact secondaire (30, 31), lesdites surfaces de contact secondaires (30, 31) étant espacées lors de l'utilisation, mais s'emboîtant les unes dans les autres lors de la déformation de l'élément de connexion et/ou du membre d'ancrage.

2. Structure de connexion selon la revendication 1, **caractérisée en ce que** l'espace entre les surfaces de contact secondaires (30, 31) est tel que ces surfaces ne s'emboîtent les unes dans les autres que lors de la déformation plastique de l'élément de connexion (14) et/ou du membre d'ancrage (15).

3. Structure de connexion selon la revendication 2, **caractérisée en ce que** l'espace entre les surfaces de contact secondaires (30, 31) est tel que ces surfaces ne s'emboîtent les unes dans les autres que lors de la formation de crevasses dans l'élément de connexion (14) et/ou dans le membre d'ancrage (15).

4. Structure de connexion selon l'une quelconque des revendications précédentes, **caractérisée par** des moyens permettant de détecter l'emboîtement des surfaces de contact secondaires (30, 31).

5. Structure de connexion selon la revendication 4, **caractérisée en ce que** les moyens de détection comprennent des marquages placés sur l'élément de connexion (14) et/ou sur le membre d'ancrage (15).

6. Structure de connexion selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les surfaces de contact primaires et secondaires (30, 31) sont espacées les unes des autres dans la direction de chargement principale.

7. Structure de connexion (11) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'élément de connexion (14) comprend un arbre (18) s'étendant dans la direction de chargement principale, **en ce que** le membre d'ancrage (15) comprend un collier (28) contenant au moins partiellement l'arbre (18) et **en ce que** les surfaces de contact primaires et secondaires (22, 23, 30, 31) se forment respectivement à l'extérieur de l'arbre (18) et à l'intérieur du collier (28).

8. Structure de connexion selon les revendications 6 et 7, **caractérisée en ce que** l'arbre (18) comprend une extrémité reçue dans le collier (28) et une extrémité opposée libre et **en ce que** la surface de contact primaire (22, 23) est retirée de l'extrémité libre à une plus grande distance que la surface de contact secondaire (30, 31).

9. Structure de connexion selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les surfaces de contact primaires et secondaires (22, 23, 30, 31) se forment grâce à une coopération des cames (33) et des rayures de grippage (34).

10. Structure de connexion selon la revendication 7 ou 8, **caractérisée en ce que** les cames (33) sont de forme annulaire et les rayures de grippage (34) s'étendent sur toute la périphérie de l'arbre (18) et/ou du collier (28).

11. Structure de connexion selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'élément de connexion (14) comprend une extrémité en forme de marteau et **en ce que** le membre d'ancrage (15) est relié à un dispositif d'activation pour faire tourner le membre d'ancrage (15) et l'élément de connexion (14).

12. Appareil permettant de lever les objets, en particulier les conteneurs, comprenant au moins un cadre de levage mobile contenant une pluralité de structures de connexion (11), comme revendiqué dans l'une quelconque des revendications précédentes.

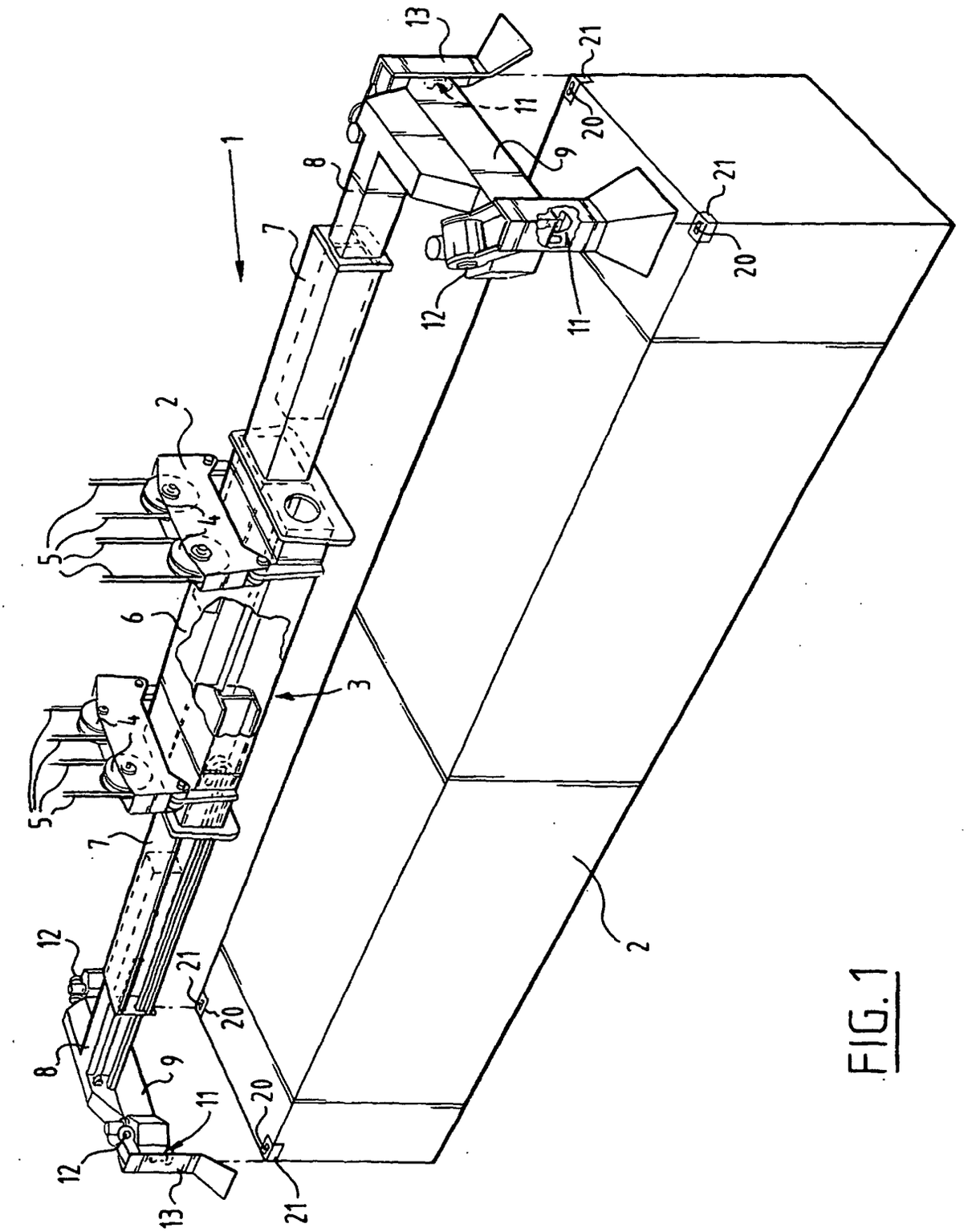


FIG. 1

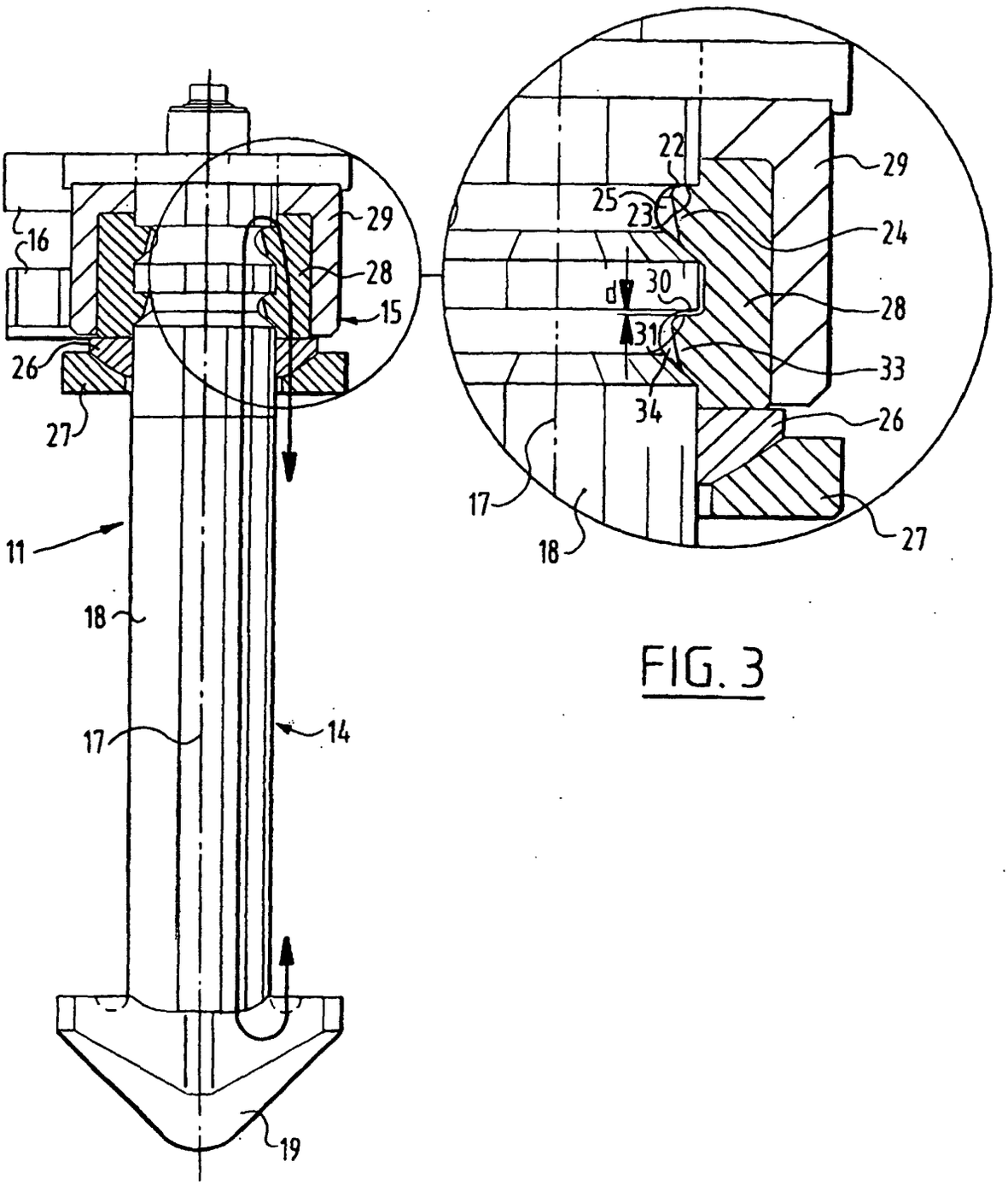


FIG. 2

FIG. 3

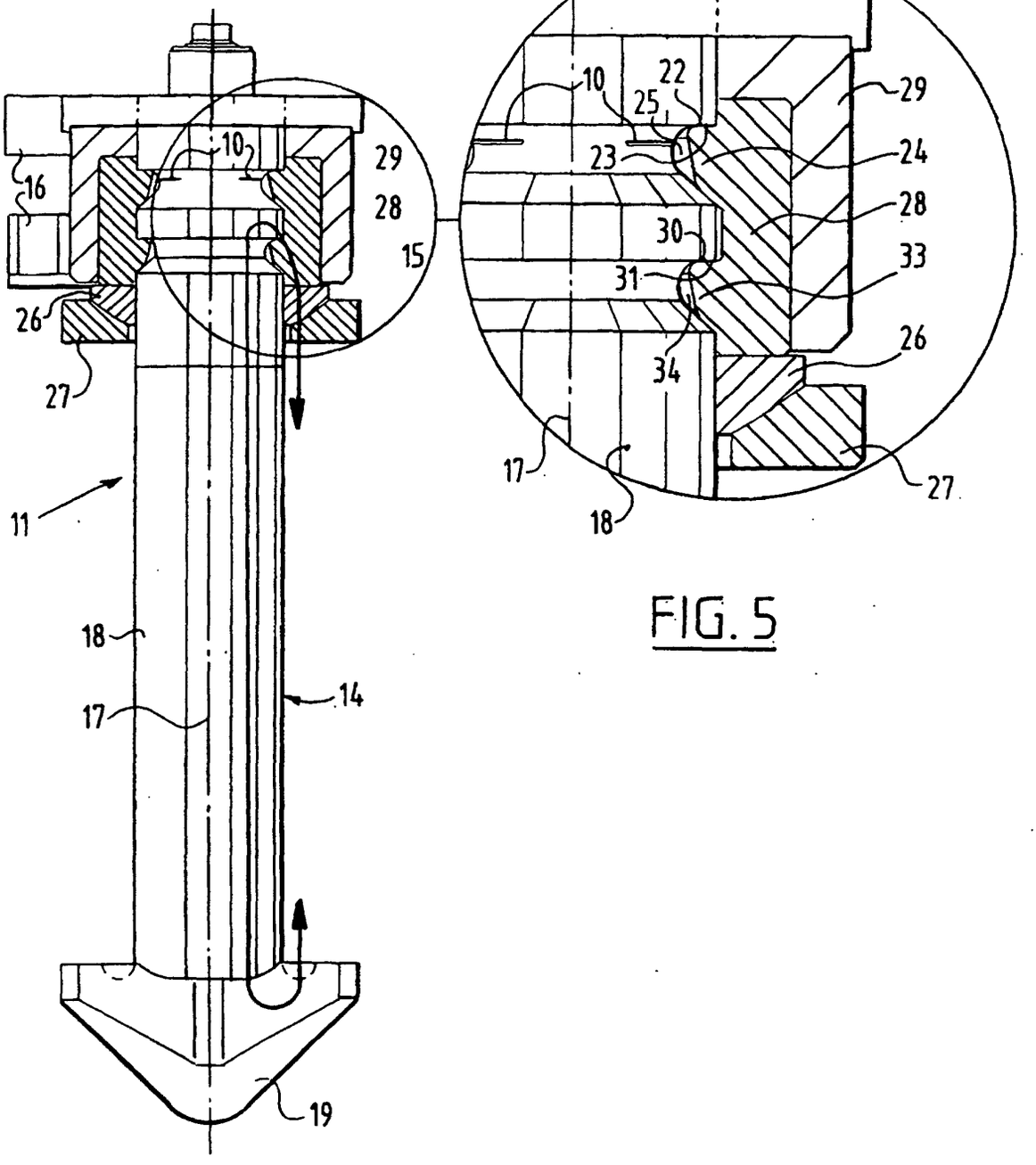

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FIG. 4

FIG. 5