

Description

This invention is concerned with joining shackles or links for chain, and in particular, joining shackles for stud-link marine anchor chain.

Dismantlable joining shackles are known for joining chain and probably the most common type of joining shackle presently in use is the Kenter shackle (see UK Patent 7951 of 1906) comprising two interlocking machined C-shaped parts held in engagement by an interlocking central stud and a long taper pin through all three parts. Other types of joining shackle are known from U.K. Patents 906 548 and 1 108 172 and German Patent 1 269 428. The joining shackles of these patents comprise a pair of U-pieces each including flanged ends which in the assembled condition of the shackle provide abutting flange pairs, and the U-pieces are held together by a pair of centrally positioned half shells defining coupling means having recesses to receive and hold the U-piece flanges, the half shells being coupled by a central bolt. These shackles can be simply disassembled by releasing the central bolt and removing the half shells, and these shackles effect improvements by locating coupling elements in the central regions of the links clear of bends in the limbs so that minimal additional tensile stresses arise due to bending moments but the shackles of these patents have limited ability to carry high tensile loads. Additionally dimensional limitations imposed on these joining shackles to permit them to be inserted through the apertures in common links of stud-link chain and be compatible with ship's deck machinery so constrains the design of the interlocking parts that only small radii can be employed in stress reducing fillets at internal section discontinuities. In consequence, high stress concentrations occur inside the assembled shackle at these fillets. This leads to failure under cyclic loading at a total number of cycles much less than that which cause failure of the common links of stud-link chain.

Fatigue tests in sea water have shown that a Kenter joining shackle has only one-third of the cyclic load life of corresponding common links of stud-link chain. For this reason offshore drilling vessels have had no alternative for more than 15 years but to use continuous lengths up to [1524M] of stud-link chain for each anchor to avoid the known high incidence of fatigue failures of joining shackles in service.

It is an object of the present invention to provide an improved joining shackle or link obviating or mitigating the above disadvantages.

This object is met in the present invention by arranging the axial length of the flange receiving recesses in the coupling means of the unassembled link to be shorter than the axial length of the corresponding flanges whereby when the link is assembled pressure reaction is created on the flanges by the coupling means to establish substantial compression preload in the flanges and substantial tension preload in the coupling means.

The joining shackle or link of the present invention can withstand high tensile load, but even more significantly has a substantially greater cyclic load life than previous joining shackles.

In a preferred embodiment, each recess receives an abutting flange pair and wedge surfaces are provided to facilitate placement of the flanges in the recesses of the housings, and preferably these wedge surfaces are formed by machining the abutting surfaces of the facing flanges of the U-pieces so that these abutting surfaces are inclined relative to a plane transverse to the plane of the link. This enables the axial length of the abutting flange pair when the flanges are not in alignment to be shorter than or substantially equal to the axial length of the recess and consequently the flange pair can be conveniently fitted in the recess by aligning the flanges under pressure so as to expand the recess. The incline of the flange abutting surfaces can be less than 5° and preferably less than 2° .

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:-

Fig. 1 shows a side view of a joining link for a link chain, according to the present invention;

Fig. 2 shows a plan view, partly in section, of the joining link of Fig. 1;

Fig. 3 shows a detailed inside view of one of the clamping shells of the joining link;

Fig. 4 shows a sectional end view of the shell of Fig. 3 through section Y—Y;

Fig. 5 shows a side view of a chain joining link, according to another embodiment of the present invention;

Fig. 6 shows an end view of the link of Fig. 5;

Fig. 7 shows an interior view of one of the clamping shells of the link of Fig. 5;

Fig. 8 shows a sectional end view of the shell through section Y—Y in Fig. 7;

Fig. 9 is a sectional plan view of the shell through section A—A in Fig. 7;

Figs. 10 to 12 show sectional details X—X; Y—Y; Z—Z of Fig. 9.

Referring to Figs. 1 to 4, a joining shackle 1 or link for chain sections, such as anchor chain sections, comprises a pair of identical U-members 2 arranged in facing relationship, and the facing ends of the U-members carry flanges 3. The facing and abutting surfaces 4 of the flanges 3 are laterally inclined slightly by an angle α (see Fig. 2) from a plane P—P which is normal to the mid plane M—M of the shackle 1 so that these surfaces 4 constitute lateral wedge surfaces. The angle α can have a value up to 5° , but $1\frac{1}{2}^\circ$ is preferable. The two U-members 2 are held together by coupling means 5 now described.

Thus, the coupling means 5 comprises a pair of facing half-shells 6 (referred to simply as shells for convenience) which fit over the positioned U-members 2 at a mid-location thereof, and each half-shell 6 includes recesses 7 (see Fig. 3) shaped to receive the abutting flanges 3 and the adjacent limb portion 3A so that each pair of abutting flanges 3 is accommodated in a housing defined

by a pair of facing recesses 7 of the shells 6. The limbs 3A of the U-members 2 taper adjacent the flanges 3 so that the overall width of the coupling means 5 (see Fig. 2) can be maintained at a size meeting operational requirements of the shackle 1, e.g. enabling the link to pass through a hawse pipe (or hole) or fit between the land portions, (i.e. whelps) between link receiving pockets of a chain wheel, e.g. a cable lifter or wildcat. The outer surfaces of the shells 6 are smoothly contoured to blend with the surfaces of the U-members 2.

The half-shells are clamped together by pairs of cap screws 8 each screw pair being associated with a respective limb with the screws of the pair on either side of the limb 3A at positions 9 to enable uniform drawing, so that eight screws 8, in all are present.

When the shells 6 are drawn together by tightening the screws 8 in the correct sequence (to A₀), the shells 6 react against the U-members 2 to move these members 2 into alignment and pressure reaction is created at the inclined wedge surfaces 4 of the flanges 3 to establish compression preload in these flanges 3 and tension preload in the coupling means 5.

The present shackle 1 utilises the principle of stress reduction at fatigue susceptible fillets by preloading which principle has not hitherto been applied to joining shackles because the dimensional limitations necessary to permit the shackle to be inserted through the apertures in common links of stud-link chain precludes the use of flanges and bolts of sufficient size to sustain the static breaking load of the common links.

Edges and corners of the flanges 3 and also of the half-shells 6 are suitably radiused to minimise stress concentration. Additionally an aperture 10 is provided centrally in each half-shell 6 such that the cross-sectional area of shell sections K—K and L—L on either side of the transverse mid-plane T—T of the flange recess 7 is substantially equal to give a substantially uniform stress distribution in the half-shells 6 on either side of the flange recess 7.

Each of the sliding contact faces 4 between the U-members 2 and between shells 6 and U-members 2 are electroplated with zinc to a coating thickness of approximately 0.005 mm. This reduces the coefficient of lubricated static friction between the faces from 0.16 to 0.04 and correspondingly reduces the load in the set-screws 8 necessary to draw the shells together during assembly of the connector.

The load reduction so achieved allows 16mm to 18mm set-screws to be used for a connector for 76mm chain, where otherwise the screws needed would be too large for the room available in the connector shells.

During assembly, a coating of sealant compound is smeared over non-sliding faces between shells 6 and between shells 6 and the U-members 2 and also is smeared around the heads of the set-screws 8 to prevent ingress of sea water into the connector to corrode the

machined internal surfaces and possibly produce fatigue crack initiating pitting of these surfaces.

The joining shackle 1 is coupled to adjacent chain sections by fitting the U-members 2 on respective link ends, of the sections, and then coupling the U-members by virtue of utilising the coupling means 5 so that the joint is preloaded as above described. The joined chain will be subjected to cyclic loading, the chain load being carried from one U-member 2 of the shackle to the other via the coupling means 5, but it is contended that stress concentrations in the joining shackle 1 due to this cyclic loading can be maintained within acceptable limits due to the preloading of the shackle 1 as explained above.

In a particular example for a 76mm chain joining shackle, the overall thickness of the mating flanges of the U-members 2 are made greater than the corresponding aperture width in the shells into which they are assembled by between 0.05mm and 0.16mm. In one example, the 76mm chain joining shackle has a recess width of 42.36mm so that for a flange increase size of 0.05mm to 0.16mm the mating flanges 3 will have a thickness 0.12% to 0.38% greater than the recess width. The 1½° inclined face angle α between flanges 3 permits almost complete assembly of the connecting link, without the set-screws 8 in place, leaving a separation between shells 6 of between 2mm and 6mm depending on machining tolerances achieved during manufacture. Insertion and turning of the set-screws 8 draws the shells 6 together and forces the U-members 2 to slide into alignment along the one and a half degree inclined faces 4 of the flanges 3. The shells 6 are forced to expand over the flanges 3 which, in turn, are compressed by the shells 6. Since the cross-sectional areas of the shells 6 and flanges 3 are chosen to give approximately equal spring constants in tension and compression, for cyclic tensile loads in the U-members 2 less than twice the static compressive preload in each flange pair 3 of between 70 × 10³ Kg and 210 × 10³ Kg (depending on tolerances), the cyclic tensile stress in the shells 6 is halved.

This allows cyclic loading of the shackle up to thirty per cent of chain breaking load without separating the one and a half degree inclined faces 4 of the flanges 3 due to elastic stretching of the shells 6. The resulting fifty per cent reduction of cyclic stresses in the shells 6 allows a relatively small internal fillet radius of 6mm to be used within the shells. This, in turn, gives room in the connector for larger 8mm fillet radii at the roots of the flanges 3 and so reduces the chance of early fatigue failure of the U-members 2 due to high stress concentration at the flange roots.

In the second embodiment of the present invention shown in Figs. 5 to 12, a joining shackle 1 is provided for joining chain sections made in accordance with the applicant's U.K. patent specification No. 1574440. Thus in this case the two U-members 2 are not similar but

one 2A has a concave part-cylindrical internal end surface 11 for mating with a complementary convex interior surface of the end link of one chain section while the other member 2B has a concave part-cylindrical internal end surface 12 for mating with a complementary concave surface of a chain link of the other section. The coupling means 5 are however almost exactly similar to those of the first embodiment and like parts carry like reference numerals. Since a chain according to specification No. 1574440 can be of reduced dimension, there is less restraint in the breadth dimension of the coupling means 5 and consequently each limb 3A of the U-members 2 can be of substantially uniform width rather than of marked tapering end form as in the first embodiment. Additionally, the central aperture 10 of the half-shells 6 ensuring uniform stress distribution will be of reduced size. The joining shackle of this embodiment functions in an exactly similar manner to that of the first embodiment.

To facilitate release of the half-shells from the U-members, wedge shaped recesses 13 can be provided in the shells 6, these recesses 13 serving to receive wedge elements (bars) which react against a respective U-member 2 for shell release. For dis-assembly of the joining shackle, wedge pieces are driven in between the shells and U-members at the recesses 13 provided following slackening off of the set-screws 8 until a gap of just over 3mm appears between shells and the U-members. Two steel spacers 3mm thick are then inserted between the shells 6 and the U-members 2 at each side of the shackle such that re-tightening of the set-screws 8 induces a high shearing force across the $1\frac{1}{2}^\circ$ inclined faces 4 between the flanges 3 to break the joint between the U-members 2 and move them apart sideways 2mm to 6mm. This removes the preload in the joint and permits the shells 6 to be removed from the U-members 2 on slackening off and removing the set-screws 8.

The shells 6 are thus seen to act in the same manner as the bolts in a conventional preloaded flange joint but the setscrews 8 of the shells do not carry cyclic loading in the same manner.

Modifications are of course possible in the arrangements. For example two similar U-members (either 2A or 2B) could be used in the shackle of the second embodiment, either having convex internal ends 11 or concave internal ends 12.

Claims

1. A chain joining link for joining separate axially arranged chain sections, said link comprising a link-shaped assemblage (1) including a pair of opposed U-portions (2) having end flanges (3), coupling means (5) including recesses (7) defining housings to receive the end flanges (3) of the U-portions (2) so that the link can be placed in an assembled and closed condition, and fastening means (9) for securing of the coupling means (5) characterised in that the axial length of the recesses (7) of the un-assembled link is shorter than the axial dimension of the corresponding

flanges (3) whereby when the link is assembled a pressure reaction is created on the flanges (3) the coupling means (5) to establish substantial compression preload in the flanges (3) and substantial tension preload in the coupling means (5).

2. A chain joining link according to claim 1 characterised in that the coupling means comprise half shells (6) including recesses receiving an opposing flange pair (3) and in that wedge surfaces (4) are provided on the opposing flange pairs (3) such that when the half shells are drawn together on assembly by the fastening means (9), the half shells (6) react against the opposing flange pairs (3) to move the flanges of each pair into alignment.

3. A chain joining link according to claim 1 characterised in that the wedge surfaces (4) comprise abutting surfaces of the opposing flange pairs, said abutting surfaces (4) being inclined at a small angle (α) relative to the plane P—P, transverse to the mid-plane M—M of the link so that the axial dimensions of an opposing flange pair (3) when not in alignment, may be shorter than substantially equal to the axial length of the recess (7).

4. A chain joining link according to claims 2 or 3 characterised in that the fastening means comprises a plurality of bolts substantially uniformly distributed over the half shells (6).

5. A chain joining link according to claim 1 characterised in that the cross-sections of the portion of the half shells (6) at the recesses which lie over a flange pair (3) are symmetrical about the transverse mid-plane (T—T) of the respective recess (7) which mid-plane (T—T) extends axially but at right angles to the plane of the link.

6. A chain joining link according to claim 1 characterised in that an elongate aperture (10) is present in a central part of each half shell (6) to ensure that said cross-sections are symmetrical about said transverse mid-plane (T—T).

7. A chain joining link according to any one of the preceding claims, characterised in that the flange (3) at each end of a U-portion (2) comprises a pair of opposed flanged portions extending away from the link in the direction of the link's mid-plane M—M.

8. A chain joining link according to claim 1 characterised in that each limb of a U-portion converges toward the flange (3) of the link, and enable shell fastening bolts (9) to be located in the half shell (6) adjacent the flange (3).

9. A chain joining link according to any one of the preceding claims, characterised in that the axial length of the flanges (3) is greater than the axial length of the corresponding recesses (7) in which the flanges are received by an amount between 0.12% and 0.38% of the axial length of the recess (7).

10. A chain joining link according to claim 1 characterised in that the small inclined angle (α) of the abutting surface (4) is less than 5° and preferably less than 2° .

11. A chain joining link according to claim 1

one 2A has a concave part-cylindrical internal end surface 11 for mating with a complementary convex interior surface of the end link of one chain section while the other member 2B has a concave part-cylindrical internal end surface 12 for mating with a complementary concave surface of a chain link of the other section. The coupling means 5 are however almost exactly similar to those of the first embodiment and like parts carry like reference numerals. Since a chain according to specification No. 1574440 can be of reduced dimension, there is less restraint in the breadth dimension of the coupling means 5 and consequently each limb 3A of the U-members 2 can be of substantially uniform width rather than of marked tapering end form as in the first embodiment. Additionally, the central aperture 10 of the half-shells 6 ensuring uniform stress distribution will be of reduced size. The joining shackle of this embodiment functions in an exactly similar manner to that of the first embodiment.

To facilitate release of the half-shells from the U-members, wedge shaped recesses 13 can be provided in the shells 6, these recesses 13 serving to receive wedge elements (bars) which react against a respective U-member 2 for shell release. For dis-assembly of the joining shackle, wedge pieces are driven in between the shells and U-members at the recesses 13 provided following slackening off of the set-screws 8 until a gap of just over 3mm appears between shells and the U-members. Two steel spacers 3mm thick are then inserted between the shells 6 and the U-members 2 at each side of the shackle such that re-tightening of the set-screws 8 induces a high shearing force across the $1\frac{1}{2}^\circ$ inclined faces 4 between the flanges 3 to break the joint between the U-members 2 and move them apart sideways 2mm to 6mm. This removes the preload in the joint and permits the shells 6 to be removed from the U-members 2 on slackening off and removing the set-screws 8.

The shells 6 are thus seen to act in the same manner as the bolts in a conventional preloaded flange joint but the setscrews 8 of the shells do not carry cyclic loading in the same manner.

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flanges (3) whereby when the link is assembled pressure reaction is created on the flanges (3) by the coupling means (5) to establish substantial compression preload in the flanges (3) and substantial tension preload in the coupling means (5).

2. A chain joining link according to claim 1, characterised in that the coupling means (5) comprise half shells (6) including recesses (7) receiving an opposing flange pair (3) and in that wedge surfaces (4) are provided on the opposing flange pairs (3) such that when the half shells (6) are drawn together on assembly by the fastening means (9), the half shells (6) react against the opposing flange pairs (3) to move the flanges of each pair into alignment.

3. A chain joining link according to claim 2, characterised in that the wedge surfaces (4) comprise abutting surfaces of the opposing flange pairs, said abutting surfaces (4) being inclined at a small angle (α) relative to the plane P—P, transverse to the mid-plane M—M of the link so that the axial dimensions of an opposing flange pair (3), when not in alignment, may be shorter than or substantially equal to the axial length of the recess (7).

4. A chain joining link according to claims 2 or 3 characterised in that the fastening means (9) comprises a plurality of bolts substantially uniformly distributed over the half shells (6).

5. A chain joining link according to claim 2 characterised in that the cross-sections of that portion of the half shells (6) at the recesses (7) which lie over a flange pair (3) are symmetrical about the transverse mid-plane (T—T) of the respective recess (7) which mid-plane (T—T) extends axially but at right angles to the plane of the link.

6. A chain joining link according to claim 5, characterised in that an elongate aperture (10) is present in a central part of each half shell (6) to ensure that said cross-sections are symmetrical about said transverse mid-plane (T—T).

7. A chain joining link according to any one of the preceding claims, characterised in that the flange (3) at each end of a U-portion (2) comprises a pair of opposed flanged portions extending away from the link in the direction of the links mid-plane M—M.

8. A chain joining link according to claim 7, characterised in that each limb of a U-portion (2) converges toward the flange (3) of the link, to enable shell fastening bolts (9) to be located in the half shell (6) adjacent the flange (3).

9. A chain joining link according to any one of the preceding claims, characterised in that the axial length of the flanges (3) is greater than the axial length of the corresponding recesses (7) in which the flanges are received by an amount between 0.12% and 0.38% of the axial length of the recess (7).

10. A chain joining link according to claim 3, characterised in that the small inclined angle (α) of the abutting surface (4) is less than 5° and preferably less than 2° .

11. A chain joining link according to claim 2,



characterised in that the half shells (6) abut when the link is in the assembled condition.

12. A chain joining link according to claim 2 characterised in that the wedge means (4) are coated with a low friction coating to facilitate drawing together of the half shells (6) during link assembly.

Patentansprüche

1. Ketten-Verbindungselement zur Verbindung separater axial angebrachter Kettenteile, bestehend aus einer bindegliedförmigen Montagevorrichtung (1) einschließlich zweier gegenüberliegender U-förmiger Teile (2) mit Endflanschen (3), einer Kupplungsvorrichtung (5) mit Aussparungen (7) als Gehäuse zur Aufnahme der Endflanschen (3) der U-förmigen Teile (2), so daß das Verbindungselement in einer festen und geschlossenen Umgebung angebracht werden kann, und Befestigungsvorrichtungen (9) zur Sicherung der Kupplungsvorrichtung (5), dadurch gekennzeichnet, daß die axiale Länge der Aussparungen (7) des nicht montierten Verbindungselements kürzer als die axiale Abmessung der entsprechenden Flansche (3) ist, wobei bei Montage des Verbindungselements durch die Kupplungsvorrichtung (5) eine Druckreaktion auf die Flansche (3) erzeugt wird, wodurch eine erhebliche Verdichtungsvorspannung in den Flanschen (3) und eine beträchtliche Zugvorspannung in der Kupplungsvorrichtung (5) geschaffen wird.

2. Ketten-Verbindungselement nach Anspruch 1, dadurch gekennzeichnet, daß die Kupplungsvorrichtung (5) aus Halbschalen (6) mit Aussparungen (7) zur Aufnahme eines sich gegenüberliegenden Flanschpaares (3) besteht und an den sich gegenüberliegenden Flanschpaaren (3) Keiflächen (4) vorhanden sind, so daß die Halbschalen (6) bei Zusammenziehen durch die Befestigungsvorrichtungen (9) während der Montage gegen die sich gegenüberliegenden Flanschpaare (3) reagieren und so die Flansche jedes Paares anordnen.

3. Ketten-Verbindungselement nach Anspruch 2, dadurch gekennzeichnet, daß die Keiflächen (4) Grenzflächen der sich gegenüberliegenden Flanschpaare darstellen, wobei die Grenzflächen (4) in einem kleinen Winkel (α) relativ zur Ebene P—P und transversal zur Ebene M—M des Verbindungselements geneigt sind, so daß die axialen Abmessungen eines sich gegenüberliegenden Flanschpaares (3) in nicht angeordnetem Zustand im Vergleich zur axialen Länge der Aussparung (7) kürzer oder im wesentlichen gleich lang sein können.

4. Ketten-Verbindungselement nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die Befestigungsvorrichtungen (9) aus einer Mehrzahl von Bolzen besteht, die im wesentlichen gleichmäßig über die Halbschalen (6) verteilt sind.

5. Ketten-Verbindungselement nach Anspruch 2, dadurch gekennzeichnet, daß die Querschnitte des an den Aussparungen (7) gelegenen Abschnitts der Halbschalen (6), welche über

einem Flanschpaar (3) liegen, über der transversalen Mittelebene (T—T) der entsprechenden Aussparung (7) symmetrisch sind, wobei die Mittelebene (T—T) sich axial, jedoch im rechten Winkel zur Ebene des Verbindungselements erstreckt.

6. Ketten-Verbindungselement nach Anspruch 5, dadurch gekennzeichnet, daß eine längliche Öffnung (10) in einem mittleren Teil jeder Halbschale (6) vorhanden ist, um sicherzustellen, daß die Querschnitte über der transversalen Mittelebene (T—T) symmetrisch sind.

7. Ketten-Verbindungselement nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Flansch (3) an jedem Ende eines U-förmigen Teils (2) aus zwei sich gegenüberliegenden Flanschabschnitten besteht, die sich in Richtung der Verbindungselemente in der Mittelebene M—M von dem Verbindungselement weg erstrecken.

8. Ketten-Verbindungselement nach Anspruch 7, dadurch gekennzeichnet, daß jedes Glied eines U-förmigen Teils (2) in Richtung des Flanschs (3) des Verbindungselements konvergiert, damit Bolzen (9) zur Schalenbefestigung in der am flansch (3) angrenzenden Halbschale (6) angebracht werden können.

9. Ketten-Verbindungselement nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die axiale Länge der Flansche (3) um einen Betrag zwischen 0,12% und 0,38% der axialen Länge der Aussparung (7) größer ist als die axiale Länge der entsprechenden Aussparungen (7), in welchen die Flansche aufgenommen werden.

10. Ketten-Verbindungselement nach Anspruch 3, dadurch gekennzeichnet, daß der kleine Neigungswinkel (α) der Grenzfläche (4) kleiner als 5° und vorzugsweise kleiner als 2° ist.

11. Ketten-Verbindungselement nach Anspruch 2, dadurch gekennzeichnet, daß die Halbschalen (6) bei montiertem Verbindungselement aneinanderstoßen.

12. Ketten-Verbindungselement nach Anspruch 2, dadurch gekennzeichnet, daß die Keilvorrichtungen (4) zur Erleichterung eines Zusammenziehens der Halbschalen (6) während der Montage des Verbindungselements mit einem Überzug von geringer Reibungsfähigkeit überzogen sind.

Revendications

1. Un maillon de liaison de chaîne pour relier des sections séparées de chaîne disposées axialement, ledit maillon comprenant un assemblage en forme de maillon (1) avec une paire de sections en U opposées (2) ayant des brides de fermeture (3), des moyens de couplage (5) incluant des emboîtements (7) définissant des emplacements pour recevoir les brides de fermeture (3) des sections en U (2) de manière à ce que le maillon puisse être assemblé et fermé, et des moyens de fixation (9) pour immobiliser les moyens de couplage (5) caractérisé en ce que la longueur axiale des emboîtements (7) du maillon non-assemblé



est plus courte que la dimension axiale des brides correspondantes (3) et lorsque le maillon est assemblé une réaction de pression est créée sur les brides (3) les moyens de couplage (5) pour établir une précharge de compression importante dans les brides (3) et une précharge de tension importante dans les moyens de couplages (5).

2. Un maillon de liaison de chaîne conformément à la revendication 1, caractérisé en ce que les moyens de couplage (5) comprennent des demi-enveloppes (6) ayant des emboîtements (7) recevant une paire de brides opposées (3) et en ce que les surfaces de la clavette (4) sont prévues sur les paires de brides opposées (3) de manière à ce que les demi-enveloppes (6) soient rapprochées l'une vers l'autre sur assemblage par les moyens de fixation (9), les demi-enveloppes (6) réagissent contre les paires de brides opposées (3) pour aligner les brides de chaque paire.

3. Un maillon de liaison de chaîne conformément à la revendication 2, caractérisé en ce que les surfaces de la clavette (4) comprennent des surfaces d'about des paires de brides opposées, lesdites surfaces d'about (4) étant inclinées à un angle petit (θ) relatif au plan P—P, transversal au demi-plan M—M du maillon de manière à ce que les dimensions axiales d'une paire de brides opposées (3), lorsque non alignée, puissent être plus courtes que, ou pratiquement égales à, la longueur axiale de l'emboîtement (7).

4. Un maillon de liaison de chaîne conformément aux revendications 2 ou 3 caractérisé en ce que les moyens de fixation (9) comprennent une pluralité de boulons distribués pratiquement uniformément sur les demi-enveloppes (6).

5. Un maillon de liaison de chaîne conformément à la revendication 2 caractérisé en ce que les sections transversales de cette portion des demi-enveloppes (6) au niveau des emboîtements (7) qui se trouvent sur une paire de brides (3) soient symétriques aux environs du demi-plan transversal (T—T) de l'emboîtement respectif (7) dont le demi-plan (T—T) s'étend axialement mais en angles droits par rapport au plan du maillon.

6. Un maillon de liaison de chaîne conformément à la revendication 5, caractérisé en ce qu'une ouverture allongée (10) est présente dans la partie centrale de chaque demi-enveloppe (6) pour s'assurer que lesdites sections transversales sont symétriques aux environs dudit demi-plan transversal (T—T).

7. Un maillon de liaison de chaîne conformément à n'importe laquelle des revendications précédentes, caractérisé en ce que la bride (3) située à chaque extrémité d'une section en U (2) comprend une paire de sections fixées par bride qui s'écarte du maillon en direction du demi-plan M—M du maillon.

8. Un maillon de liaison de chaîne conformément à la revendication 7, caractérisé en ce que chaque membre d'une section en U (2) converge vers la bride (3) du maillon, pour permettre que les boulons de fixation d'enveloppe (9) soient situés dans la demi-enveloppe (6) près de la bride (3).

9. Un maillon de liaison de chaîne conformément à n'importe laquelle des revendications précédentes, caractérisé en ce que la longueur axiale des brides (3) est plus grande que la longueur axiale des emboîtements correspondants (7) dans lesquelles se logent les brides qui sont plus longues que la longueur axiale de l'emboîtement de 0,12% à 0,38%.

10. Un maillon de liaison de chaîne conformément à la revendication 3, caractérisé en ce que le petit angle incliné (θ) de la surface d'about (4) est inférieur à 5° et, de préférence, inférieur à 2°.

11. Un maillon de liaison de chaîne conformément à la revendication 2, caractérisé en ce que les demi-enveloppes (6) se rencontrent lorsque le maillon est assemblé.

12. Un maillon de liaison de chaîne conformément à la revendication 2, caractérisé en ce que les moyens de clavette (4) sont recouverts d'un enduit garantissant un minimum de friction pour faciliter la rencontre des demi-enveloppes (6) lors de l'assemblage de maillon.

