EUROPEAN PATENT SPECIFICATION

Date of publication of patent specification: 03.11.93
Int. Cl.: F16G 13/06, F16B 19/00
Application number: 90101824.2
Date of filing: 30.01.90

Connecting pin and method using the connecting pin.

Priority: 30.01.89 JP 1003989
Date of publication of application:
08.08.90 Bulletin 90/32
Publication of the grant of the patent:
03.11.93 Bulletin 93/44
Designated Contracting States:
DE FR GB IT
References cited:
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FR-A- 2 398 907
US-A- 3 276 308
US-A- 4 494 945

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Description

The present invention relates to a chain connecting pin according to the preamble of the main claim and to a connecting method using the chain connecting pin.

A chain such as a drive chain for use in a bicycle for operatively connecting a front gear attached to a crank shaft and a rear hub includes, as its connecting elements, a pair of inner plates each defining pin holes at opposed ends thereof and a pair of outer plates each defining corresponding pin holes at opposed ends thereof. These inner and outer plate are overlapped at their ends so as to align the respective corresponding pin holes with each other. Then, a connecting pin is forcibly inserted into the common pin hole defined by the overlapped inner and outer plate. As a plurality of inner and outer plates are connected in series with each other, there is formed one chain loop.

On some occasions e.g. for entraining the chain on a particular or different combination of a front gear and a rear gear or for eliminating unnecessary looseness of the chain which may occur through an extended period of use, the chain length must be adjusted. For such chain length adjustment, one or plurality of connecting pins (the number depends on the amount of adjustment needed) are completely withdrawn from the pin holes of the respective plates of the chain by using a pin attaching-detaching device so as to detach the corresponding plates. Then, the inner plates and the outer plates at the free ends of the disconnected chain are again overlapped with each other in the manner described above and are connected by forcibly inserting the pin into the pin hole to form a new chain loop. The disconnecting operation of the chain can be alternately effected without the complete withdrawal of the connecting pin. In this case, the pin is not completely withdrawn from the connecting hole of the plates but is withdrawn just enough to permit detachment of the plates, such that one longitudinal end of the pin is retained at the pin hole of the outer or inner plate to be maintained. With completion of a plate detaching operation, the pin which one end is retained at the hole of the outer (inner) plate is pushed, by its opposite end, into a hole of the new inner (outer) plate to form a new complete chain loop. A chain length adjustment for increasing the chain length can be effected in substantially the same manner as described above.

The pin attaching-detaching device used in the above operations, as illustrated in Fig. 5, includes a base member A, a control rod C attached in the base member A through a threaded engagement, the rod C having a pin push shaft B at a terminal end thereof, and a chain receiving portion E defining a receiving hole D for receiving the pin push shaft B. In operation, an outer face of an outer plate pair to be disconnected from the chain is fitted to an end face of the chain receiving portion E. In this condition, the control rod C is operated, i.e. rotated to cause a leading end of the pin push shaft B to come into contact with an end face of the connecting pin. As the rod C is further rotated, the push shaft B pushes the connecting pin out of the pin hole of the outer plate pair and the inner plate pair aligned therewith. With completion of necessary chain length adjustment as described above, the withdrawn (completely or partially withdrawn) pin is again used for connecting a new pair of inner and outer plates.

However, if the chain length adjustment is carried out by using the above-described pin attaching-detaching device without complete withdrawal of the connecting pin, an operator feels it very difficult to determine the withdrawal amount of the pin just enough for plate detachment.

Further, since the pin push shaft B moves into the pin hole from which the pin has been withdrawn, the operator can know whether or not the pin has been withdrawn by a proper amount for the plate detachment only after releasing the control rod therefrom. For this reason, an inexperienced operator often has to repeat the operation in a trial and error manner. With either complete or partial withdrawal of the connecting pin, the chain connecting operation after the chain length adjustment has been very troublesome and time-consuming.

Moreover, when the pin is withdrawn from the pin hole, this withdrawal motion can damage the pin through the friction associated therewith. Accordingly, even if the pin can be successfully inserted into the hole again, the damaged pin may not be retained at the pin hole properly or sufficiently, and an inadvertent pin detachment tends to occur after the chain length adjustment.

A connecting pin according to the preamble of the main claim is known from US-A-4 495 945. This connecting pin uses a nut for fastening the pin which requires additional tool and time.

The present invention attests to the above drawbacks of the prior art. And, the primary object of the invention is to provide an improved connecting pin and connecting method using this pin which permits easier pin connecting operation and more reliable connection after the operation.

This inherent problem is solved by a chain connecting pin according to the characterizing part of the main claim.

The invention also relates to a connecting method using the above-described connecting pin. Functions and effects of the above construction will be described next.
For interconnecting a plurality of connecting members each defining a connecting hole, for e.g. connecting free ends of a disconnected chain by overlapping the inner and outer plates of the chain ends, as the inserting portion is inserted into the connecting hole of the overlapped plates, this inserting portion can be reliably retained within the hole. Then, under this condition, as the terminal face of the pin body is pressed by an appropriate tool, the pin body can be readily inserted into the hole as being guided by the tapered face of the inserting portion. After complete insertion of the pin body, the inserting portion, which now projects from the chain plates, can be removed, i.e. detached from the pin body at the detachable connecting portion by applying a shearing force there-to. With this, the chain connecting operation completes.

Further and other objects, features and effects of the invention will become apparent from the following more detailed description of the embodiments of the invention with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Accompanying drawings Figs. 1 through 5 illustrate a preferred embodiment of the present invention; in which,

Fig. 1 is a front view of a connecting pin of the invention,
Fig. 2 is a section view of major portions in which a pair of inner plates and a pair of outer plates of a chain are connected with each other through an overlapped arrangement,
Fig. 3 is a section view of the major portions in which an inserting portion of the connecting pin is forcibly inserted into a through hole of the overlapped inner and outer plates,
Fig. 4 is a section view of the major portions in which a pin body of the connecting pin is fitted in the through hole, and
Fig. 5 is a view illustrating a connecting operation of a chain using the connecting pin of the invention and a pin attaching-detaching device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A connecting pin and a connecting method using the connecting pin relating to the present invention will be particularly described with reference to accompanying drawings by way of example where the pin and the method are used for a drive chain of a bicycle entrained between a front gear and a rear gear.

The illustrated chain includes a pair of inner plates 5, 5 each defining connecting holes 51, 51 at opposed ends thereof, a pair of outer plates 6, 6 each defining connecting holes 61, 61 corresponding to the holes 51, 51 at opposed ends thereof, a cylindrical bush 7 fitted in the connecting holes 51, 51 of the inner plates 5, 5 for setting an inter-distance between these plates 5, 5, and a roller 8 rotatably fitted on an outer periphery of the bush 7. Inner end faces of the outer plates 6, 6 are overlapped on outer end faces of the inner plates 5, 5 with the respective connecting holes 61 being aligned with side openings of the bush 7. Then, the invention's connecting pin is inserted through the connecting holes 61 and the opposite side openings of the bush 7 aligned with the holes 61 so as to connect the inner plates 5, 5 and the outer plates 6, 6 with each other. A plurality of (i.e. a looped series of) this connection constitute the bicycle drive chain.

In one preferred embodiment of the present invention illustrated in Fig. 1, the connecting pin includes a pin body 1, an inserting portion 2 and a detachable connecting portion 3 positioned between the pin body 1 and the inserting portion 2, the connecting portion 3 having a smaller diameter than the pin body 1 and the inserting portion 2. The pin body 1 is actually used for the connection between the inner plate pair 5 and the outer plate pair 6 as the body 2 is forcibly inserted through the connecting hole 61 of one outer plate 6, the inner cylindrical hole of the hollow bush 7 and then through the connecting hole 61 of the other outer plate 6 of the pair. Further, one terminal end of this pin body 1 is intergrally connected via the detachable connecting portion 3 with the inserting portion 2 having a tapered face 21 adjacent the connecting portion 3. The inserting portion 2 is forcibly insertible into and frictionally retainable at the connecting holes 61 and the inner hole of the bush 7 communicating therewith.

More particularly, the pin body 1 has a diameter slightly larger than that of the connecting hole 61 and has a length slightly greater than an inter-distance between the pair of outer plates 6 and 6. Further, the pin body 1 has a pair of flanges 11 and 12 at opposite longitudinal ends thereof for preventing the pin body 1 from inadvertently slipping out of the connecting holes 61, 61.

In the above construction, it is also conceivable to form an annular groove 13 at a portion of the pin body 1 more inside than the flange 11, the groove 13 being formed as a shallow dip relative to the outer periphery of the pin body 1 and having a width equal to the thickness of the outer plate 6. With this arrangement, as the pin body 1 is forcibly inserted into the connecting hole 61, the peripheral edge of the connecting hole 61, by its elastic resilience against the forcible insertion of the pin body 1, snaps into the annular groove 13. This is
advantageous for further reliably preventing inadvertent withdrawal of the pin body 1 from the connecting holes 61.

The inserting portion 2 consists essentially of the tapered face 21 substantially continuous with the flange 11 through a peripheral face 21a having a diameter equal to the flange 11 and larger than the connecting hole 61 and of a longitudinal straight portion 22 having a diameter smaller than the connecting hole 61 and the bush hole. When this longitudinal straight portion 22 is inserted through the connecting hole 61 of the one outer plate 6, the hole of the bush 7 and then through the connecting hole 61 of the other outer plate 6, the tapered face 21 comes into frictional contact with the peripheral edge of the connecting hole 61 of the former outer plate 61 and the inserting portion 2 is retained in this condition. In the above forcible inserting operation, the tapered face 21 causes elastic deformation, i.e. diameter increase of the connecting hole 61.

The detachable connecting portion 3 is formed by annually cutting an intermediate peripheral portion of the connecting pin between the flange 11 and the tapered face 21. Thus, the detachable connecting portion 3 has a reduced diameter relative to the pin body 1 so that the portion 3 can be easily detached from the body 1 by applying shearing force to the inserting portion 2.

Moreover, the detachable connecting portion 3 has a length shorter than the thickness of the outer plate 6 of the chain so as to facilitate the insertion of the inserting portion 2 into the connecting hole 61.

The detachable connecting portion 3 can have a rectangular or V-notch like cross section in place of the circular one described above. Thus, the cross sectional shape of the detachable connecting portion can vary conveniently. Also, this connecting portion 3 can be formed by any convenient method such as forging or plastic deformation using a press machine, other than the cutting method described above.

It is preferred for the detachable connecting portion 3 to have a reduced diameter than the pin body or the inserting portion. However, even if the connecting portion 3 has the same diameter as the pin body and the inserting portion, such easily detachable arrangement can also be achieved by means of adhesive which permits easy detachment of the inserting portion 2 after the chain connecting operation. Further alternately, the detachable connection can be achieved also by a threaded engagement between the pin body and the inserting portion. That is, what is referred to as the detachable connecting portion in this invention should be understood as to cover all these detachable connecting means.

The chain connecting operation using the connecting pin having the above-described construction will be more particularly described next.

First, for connecting free ends of a disconnected chain, the inner end faces of the outer plates 6, 6 are overlapped on the outer end faces of the inner plates 5, 5, with the connecting holes 61 and the hole of the bush 7 being aligned with each other. In this condition, the inserting portion 2 is inserted through the one connecting hole 61, the bush hole and then the other connecting hole 61, whereby the inserting portion 2 can be frictionally retained in the connecting holes 61. Thereafter, the free end face of the pin body 1 is pushed by means of the control rod C of the pin attaching-detaching device which has been described hereinbefore with reference to Fig. 5. With this pushing operation, the tapered face 21 of the inserting portion 2 gradually enlarges the periphery of the connecting holes 61 to allow easy insertion of the pin body 1 subsequent thereto. The inserting operation is continued until the inserting movement is stopped as the flange 12 formed at the terminal end of the pin body 1 comes into abutment against the outer peripheral edge of the outer plate 6. Next, the pin attaching-detaching device is removed from the chain. In this condition, the inserting portion 2 substantially entirely projects out of the connecting holes 61. Then, this projecting inserting portion 2 is fitted into the receiving hole D of the pin attaching-detaching device and the device is wrenched relative to the chain, the detachable connecting portion 3 is sheared away from the pin body 1.

According to the above described connecting pin and the method using this pin of the present invention, the inserting operation of the pin body 1 into the connecting holes 61 can be carried out while the inserting portion 2 is inserted into and frictionally retained at the connecting holes 61. Therefore, the inserting operation can be effected very easily and efficiently.

Further, the pin body 1 has the flanges 11 and 12 at the opposite ends thereof. Thus, once the pin body 1 is fitted in the connecting holes 61, the pin body 1 will not easily slip out of the holes 61. Moreover, if the annular groove 13 is formed at one end portion of the pin body 1 so that the peripheral edge of the connecting holes 61 may be snapped into the groove 13, the pin body 1 can be more reliably retained in the connecting holes 61.

It is to be noted that the flanges 11, 12 and the annular groove 13 of the pin body 1 do not constitute the essential parts of the invention and therefore these elements can be eliminated according to the necessity and convenience.

In the foregoing embodiment, the inserting portion 2 is formed with the tapered face 21 and the longitudinal straight portion 22. Instead, this insert-
ing portion 2 can have a different configuration. For instance, it is conceivable to form the entire inserting portion 2 with a tapered shape. Also, the length of this inserting portion 2 is not limited to the one described in the foregoing embodiment.

The foregoing embodiment has been described by way of the bicycle drive chain. However, it is to be understood that the connecting pin and the connecting method of the present invention can be used in many other applications for connecting various elements having through holes.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A chain connecting pin for connecting a pair of inner plates (5) and outer plates (6) of a chain through connecting holes (51, 61), said connecting pin including an inserting portion (2), a pin body (1) for connecting said inner plates (5) and outer plates (6), and a detachable connecting portion (3) for detachably connecting said inserting portion (2) and said pin body (1) in alignment with each other characterized in that at least part of outer peripheries of said inserting portion (2) defines a conical tapered face (21) extending from a portion having substantially the same diameter as or smaller diameter than said connecting hole(s) (61) of the outer plate(s) (6) to a portion having a larger diameter toward said detachable connecting portion (3), and that said pin body (1) has a diameter slightly larger than said chain connecting hole (61) at least in a connecting region with a chain.

2. A chain connecting pin as claimed in Claim 1, characterized in that said detachable connecting portion (3) has a section smaller than that of said inserting portion (2) and pin body (1).

3. A chain connecting pin as claimed in Claim 1 or 2, characterized in that said conical tapered face (21) is defined in a region adjacent said detachable connecting portion (3).

4. A chain connecting pin as claimed in any one of Claims 1 through 3, characterized in that said pin body (1) includes radially projecting flanges (11, 12) in opposite end regions thereof.

5. A chain connecting pin as claimed in any one of Claims 1 through 4, characterized in that an annular groove (13) is defined in an outer periphery of an end portion of said pin body (1) for receiving the outer plate of the chain.

6. A method for connecting an inner plate and an outer plate of a chain using a chain connecting pin as claimed in any one of Claims 1 through 5, characterized by aligning the connecting holes defined in the outer plate and inner plate, inserting said inserting portion (2) into the aligned holes, inserting the pin body (1) into the connecting holes while pulling said inserting portion (2) out of the holes after passing through a connecting hole of the conical tapered face (21), and removing the projecting inserting portion (2) at the detachable connecting portion (3).

Patentansprüche

1. Kettenverbindungsbolzen zum Verbinden eines Paares Innenplatten (5) und Außenplatten (6) einer Kette über Verbindungslöcher (51, 61), wobei der Verbindungsbolzen einen Einführabschnitt (2), einen Bolzenkörper (1) zum Verbinden der Innenplatten (5) und der Außenplatten (6) sowie einen lösbaren Verbindungsabschnitt (3) zur lösbaren Verbindung zwischen dem Einführabschnitt (2) und dem Bolzenkörper (1) in gegenseitiger Ausrichtung aufweist, dadurch gekennzeichnet, daß zumindest in einem Teil des Außenumfangs des Einführabschnitts (2) eine konisch verjüngte Fläche (21) ausgebildet ist, die sich von einem Abschnitt, der im wesentlichen den gleichen Durchmesser wie das Verbindungslöch (die Verbindungslöcher) (61) der Außenplatte(n) oder einen kleineren Durchmesser als dieses aufweist, zu einem Abschnitt erstreckt, der zum lösbaren Verbindungsabschnitt (3) hin einen größeren Durchmesser aufweist, und daß der Bolzenkörper (1) einen Durchmesser aufweist, der etwas größer als das Kettenverbindungsloch (61) zumindest in einem Bereich der Verbindung mit einer Kette ist.

2. Kettenverbindungsbolzen nach Anspruch 1, dadurch gekennzeichnet daß der lösbare Verbindungsabschnitt (3) einen kleineren Querschnitt
als der Einführabschnitt (2) und der Bolzenkörper (1) aufweist.

3. Kettenverbindungbolzen nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die konisch verjüngte Fläche (21) in einem Bereich nahe dem lösbaren Verbindungsabschnitt (3) ausgebildet

4. Kettenverbindungbolzen nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Bolzenkörper (1) in seinen einander gegenüberliegenden Endbereichen radial vorstehende Flansche (11, 12) aufweist.

5. Kettenverbindungbolzen nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß auf einer Außenumfangsline eine Ringnut (13) zur Aufnahme der Außenplatte der Kette ausgebildet ist.

6. Verfahren zum Verbinden einer Innenplatte und einer Außenplatte einer Kette eines Kettenverbindungbolzens nach einem der Ansprüche 1 bis 5, gekennzeichnet durch die folgenden Schritte:
   - Ausrichten der in der Außenplatte und in der Innenplatte ausgebildeten Verbindungslöcher,
   - Einführen des Einführabschnitts (2) in die ausgerichteten Löcher,
   - Einführen des Bolzenkörpers (1) in die Verbindungslöcher unter Herausziehen des Einführabschnitts (2) aus den Löchern nach Durchführung der konisch verjüngten Fläche (21) durch ein Verbindungslocht, und
   - Entfernen des vorstehenden Einführabschnitts (2) an dem lösbaren Verbindungsabschnitt (3).

Revendications

1. Axe de jonction de chaîne pour joindre une paire de plaques intérieures (5) et de plaques extérieures (6) d’une chaîne au travers d’orifices de jonction (51, 61), le dit axe de jonction comprenant une partie d’insertion (2), un noyau d’axe (1) pour joindre les dites plaques intérieures (5) et les dites plaques extérieures (6) et une partie de jonction détachable (3) pour joindre de manière détachable la dite partie d’insertion (2) et le dit noyau d’axe (1) en les maintenant alignés, CARACTÉRISÉ : en ce que, au moins une partie des périphéries extérieures de la dite partie d’insertion (2) forme une face conique effilée (21) s’étendant d’une partie ayant un diamètre sensiblement égal ou inférieur à celui de l’orifice ou des orifices de jonction (61) de la ou des plaques extérieures (6) à une partie de plus grand diamètre en direction de la dite partie de jonction détachable (3) et,
   - en ce que le dit noyau d’axe (1) a un diamètre légèrement supérieur à celui du dit orifice de jonction de chaîne (61) au moins dans la région de jonction avec une chaîne.

2. Axe de jonction de chaîne selon la revendication 1 CARACTÉRISÉ en ce que la dite partie de jonction détachable (3) possède une section inférieure à celle de la dite partie d’insertion (2) et du dit noyau d’axe (1).

3. Axe de jonction de chaîne selon la revendication 1 ou 2 CARACTÉRISÉ en ce que la dite face conique effilée (21) est formée dans une région adjacente à la dite partie de jonction détachable (3).

4. Axe de jonction de chaîne selon l’une quelconque des revendications 1 à 3 CARACTÉRISÉ en ce que le dit noyau d’axe (1) présente des collettes faisant saillie dans la direction radiale (11, 12) dans ses régions d’extrémité opposées.

5. Axe de jonction de chaîne selon l’une quelconque des revendications 1 à 4 CARACTÉRISÉ en ce qu’une rainure annulaire (13) est formée dans une périphérie extérieure d’une partie d’extrémité du dit noyau d’axe (1) pour recevoir la plaque extérieure de la chaîne.

6. Méthode de jonction d’une plaque intérieure et d’une plaque extérieure d’une chaîne en utilisant un axe de Jonction de chaîne selon l’une des revendications 1 à 5 caractérisée en ce qu’elle consiste :
   - à aligner des orifices de jonction formés dans la plaque extérieure et la plaque intérieure,
   - à introduire le noyau d’axe (1) dans les orifices de connexion tout en poussant la dite partie d’insertion (2) en dehors des orifices, après avoir fait passer une face conique effilée (21) à travers un orifice de jonction et,
   - à éliminer la partie d’insertion faisant saillie (2) sur la partie de jonction détachable (3).