

TRIPLE FOLDING FASTENER

The invention relates to a fastener, particularly a folding fastener according to the claims. It more particularly relates to a folding fastener for a wrist-watch having three folding arms which can be locked.

Fasteners for straps of the opening out type having two articulated arms are known. These arms are articulated to one another by one of their ends, thus permitting an increase in the diameter of the strap so as to be able to remove and put back again said strap by sliding it over the wrist. In the folded down state, said articulated arms are applied to one another and maintained in place by a projection of one of the arms, which engages in a recess of the other arm.

A first disadvantage of a fastener having two folding arms is the limited opening out action. On the one hand, the length of each folding arm must be smaller than the width of the wrists. On the other hand, the situation can arise where users have wide hands and/or wear rings, other straps, etc., which complicates the removal and the putting back on again of the strap and causes nuisances.

A second disadvantage of a fastener having folding arms is the limited overall dimensions. Often one of the articulated arms folds down into a cutout of the other arm in order to avoid a thickness increase of the fastener. The thickness of the elements is a crucial criterion in watch-making and must be of a minimum nature.

A third disadvantage of a fastener with folding arms is the limited reliability and stability. Due to wear or deformation, the fastener may unexpectedly open, which gives rise to other nuisances.

Therefore the object of the present invention is to provide a solution to these problems by creating a generally applicable, folding fastener, e.g. for a wrist-watch, which has a particularly compact construction compatible with known and proven manufacturing methods.

This object is achieved by the invention defined by the claims.

The invention will now be described in detail in conjunction with figs. 1 to 16.

Fig. 1 is a part sectional side view of a detail of a first preferred embodiment of a folding fastener in the closed state showing the folding arms and a locked cover.

Fig. 2 is a plan view of a detail of the first preferred embodiment of a folding fastener in the closed state showing an opening in the folded down cover.

Fig. 3 is another plan view of a detail of the first preferred embodiment of a folding fastener in the closed state showing the interlacing of the locked folding arms.

Fig. 4 is a plan view of a detail of the first preferred embodiment of a folding fastener in the partly open state, showing the still locked folding arms and the unlocking of the cover and an outer arm.

Fig. 5 is a plan view of a detail of the first preferred embodiment of a folding fastener in the partly open state, showing the articulation of the unlocked cover.

Fig. 6 is another plan view of a detail of the first preferred embodiment of a folding fastener in the partly open state, showing a central arm and an intermediate arm in locked form and the articulation of the outer arm and the unlocked cover.

Fig. 7 is a plan view of a detail of the first preferred embodiment of a folding fastener in the open state showing the unlocking of the central arm and the intermediate arm.

Figs. 8 and 9 are plan and bottom views of a detail of the first preferred embodiment of a folding fastener in the completely open state showing the folding arms and the unlocked cover.

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Fig. 10 is a part sectional side view of a detail of a second preferred embodiment of a folding fastener in the closed state, showing the unlocking of an intermediate arm and a cover by pulling a strap strand.

Fig. 11 is a plan view of a detail of the second preferred embodiment of the folding fastener in the partly open state, showing the unlocked intermediate arm and the articulation of the outer arm and the cover in the unlocked state.

Fig. 12 is another plan view of a detail of the second preferred embodiment of a folding fastener in the open state showing the articulation of the folding arms and the cover in the unlocked state.

Fig. 13 is a plan view of a detail of a third preferred embodiment of a folding fastener in the closed state, showing a cover locked on a terminal link.

Fig. 14 is another plan view of a detail of the third preferred embodiment of the folding fastener in the partly open state, showing the still locked folding arms and the unlocking of the cover.

Fig. 15 is another plan view of a detail of the third preferred embodiment of a folding fastener in the partly open state, showing the articulation of a central arm on raising the terminal link.

Fig. 16 is a sectional view of a detail of a folding fastener showing a preferred embodiment of a contact means with crosspiece and thin-walled tube.

These embodiments of a folding fastener describe three preferred, complementary aspects of the invention. These preferred embodiments are in no way limitative and in particular can be combined without passing beyond the scope of the invention. Figs. 1 to 9 show a preferred embodiment of a folding fastener, having the different elements and the different stages of the opening/closing mechanism of the folding fastener in several side, plan

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and bottom views. Figs. 10 to 15 show a preferred embodiment of a folding fastener showing a variation of the locking of the folding arms. Figs. 13 to 15 show a preferred embodiment of a folding fastener revealing a variation in the locking of the cover.

With respect to the three preferred embodiments, the folding fastener preferably comprises three folding arms 1, 2, 3. A central arm 1 and an intermediate arm 2 are articulated to one another by one of their ends. These inner arms 1, 2 can be locked to one another. In addition, the intermediate arm 2 and outer arm 3 are articulated to one another by one of their ends. Once the central arm 1 and intermediate arm 2 are locked and folded down on the outer arm 3, a cover 4 arranged in detachable manner on the central arm 1 permits a locking of said fastener by folding down the cover 4 on the outer arm 3. This construction with three folding arms is in no way limitative. With the knowledge of the present invention, the expert can implement various non-illustrated variants without passing outside the scope of the present invention. It is e.g. possible to implement a folding fastener with only two folding arms or with more than three folding arms.

Said folding fastener is characterized by three folding arms 1, 2, 3 interlaced with one another. The central arm 1 can be entirely included within the cutout in the two intermediate edge strips 2.1, 2.2 of the intermediate arm 2 and the intermediate arm 2 can be entirely included in the cutout between the two outer edge strips 3.1, 3.2 of the outer arm 3. This leads to a particularly slender and elegant construction, because there is no summation of the various folding arms 1, 2, 3. Preferably, the central arm 1 and the edge strips 2.1, 2.2, 3.1, 3.2 are connected by pins 5, 7, 8 and by a contact means 6.

Hinge pins 7, 8 serve as a hinge for the folding arms 1, 2, 3. Preferably, the outer arm 3 and intermediate arm 2 are detachably interconnected about the hinge pin 7 located at the rear end of the fastener (i.e. the side remote from the attachment pin 5) and the intermediate arm 2 and central arm 1 are detachably interconnected about the hinge pin 8 located at the end in front of the fastener (i.e. on the side of the attachment pin 5).

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An attachment pin 5 is e.g. fixed with the aid of a screw to the outer edge strips 3.1, 3.2. This leads to a solid, non-detachable connection of the two outer edges 3.1, 3.2 of the outer arm 3. Other fixing arrangements are obviously possible, whilst remaining within the scope of the invention. Said attachment pin 5 can fulfil several supplementary functions. In the two preferred embodiments of a fastener according to figs. 1 to 12, said attachment pin 5 can permit the detachable fixing of a first strap strand 100. Such a strap 100 is e.g. made from an elastic material and can in particular be a leather strap strand in the manner shown in fig. 10. The use of other basic materials for the elastic strap such as e.g. a plastics material is obviously possible and is not limited by the invention. In the preferred embodiment of a fastener according to figs. 13 to 15, said attachment pin 5 can permit the detachable fixing of a first end 200 of a strap and permits the fixing of the cover 4. Such a strap e.g. comprises flexible links, which can be made from a metallic material. Preferably, said flexible links are manufactured from stainless steel and/or gold. The use of other base materials is obviously possible and is in no way restricted by the invention.

A contact means 6 is e.g. fixed by driving in to the outer edge strips 3.1, 3.2. Solidly fixed in this way, said contact means 6 forms part of the outer arm 3 and leads to a further rigidification of the outer edge strips 3.1, 3.2 of the folding fastener. This leads to an additional stabilization or reinforcement of the connection of the two outer edges 3.1, 3.2 of the outer arm 3, already interconnected by the attachment pin 5. Said contact means 6 can fulfil several supplementary functions. According to the preferred embodiment of a fastener of figs. 1 to 9, a lateral portion 6.12 of said contact means 6 can be in tangential contact with the ends of the central arm 1 and with the ends of the intermediate arm 2 when the folding fastener is in the closed state. Such a tangential contact of the central arm 1 and intermediate arm 2 makes it possible to further rigidify the closed folding fastener. According to the preferred embodiments of a fastener of figs. 10 to 15, a lateral portion 6.12 of said contact means 6 can permit a tangential contact with one end of the central arm 1 and can permit a notch or locking contact with a concave end 2.6 of the intermediate arm 2. This notch contact is not limited solely to the intermediate

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arm 2. It is possible to implement a notch contact fastener with several of the inner folding arms, i.e. with the intermediate arm and the central arm. According to the third preferred embodiment of a fastener according to figs. 13 to 15, ends 6.14 of said contact means 6 can permit a notch contact with the side walls 14 of the cover 4. This notch contact is not limited to the cover 4. It is possible to implement a notch contact fastener with any other detachable element of the fastener, e.g. with one or more terminal links of the strap.

Preferably, said contact means 6 is a pin driven in non-detachable manner into holes of the two outer edges 3.1, 3.2. Other fixing variants are clearly possible whilst remaining within the scope of the present invention. Fig. 16 shows another preferred embodiment of the contact means 6 in the form of a crosspiece 61 arranged in non-detachable manner within a thin-walled tube 62. This preferred construction of a contact means 6 permits a reinforcement of the connection of the two outer edges 3.1, 3.2 by the crosspiece 61 and gives a certain elasticity to the contact means 6, because the thin wall of tube 62 is elastic. More specifically, the central portion of said crosspiece 61 is e.g. provided with one or more reinforcements 611, permitting in said central portion an essentially inelastic tangential contact of the thin wall or lateral portion 6.12 of the tube 62 with one end of the central arm 1. However, the portion deprived of one or more reinforcements 611 gives space separating tube 62 and crosspiece 61 and permits the elastic extension of said tube 62, e.g. for an elastic notch contact with the end 2.6 of the intermediate arm 2. In order to permit a centring of the central arm 1 during its opening/closing, the crosspiece 61 is placed with a limited clearance in guide holes of the outer edge strips 3.1, 3.2. Said elastic and preferably metallic contact means 6 and its thin wall preferably has a thickness of 0.15 mm. For a smaller thickness, the maximum bending stress becomes excessive (the deformation force is too high and ratchet motion becomes difficult), whilst for a greater thickness the elastic constant of the tube 62 becomes excessive (the thin wall is deformed beyond the reversible elastic limit and the ratchet motion is not pronounced). Thus, for a tube 62 manufactured using a metallic material, e.g. a stainless steel, elastic tube, a thickness of 0.15 mm represents an ideal choice, permitting both a closing force or

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ratchet motion in a clearly defined form (which is definitely felt without being excessive or inadequate), whilst still guaranteeing an easy machining of the contact means 6. It has proved advantageous to choose a tube 62 from a different material (e.g. Nivaflex, Phynox, etc.) to the steel of the folding arms 1, 2 or the crosspiece 61, which guarantees a good friction coefficient. The use of such a pair of different materials as a result of its molecular structure and hardness difference is ideal and permits significant ratchet motion variations, because the elasticity of the stainless steel is not constant and its chemical composition is not that of an elastic tube. The use of other basic materials is clearly possible and is not restricted by the invention.

The quality of a fastener is not only defined by its purely technical characteristics, but also by the impression which it makes on the user. Unlike in the case of known fasteners, which do not use such an elastic contact means provided with a crosspiece and a thin-walled tube with a pair of different materials, it is possible to individually adjust the forces and in particular adjust the ratchet motion characteristics of the folding fastener. For example, by replacing the tube by another thicker or thinner or more elastic or less elastic tube, it is possible to individually adjust the response of the ratchet motion, i.e. the ratio between the hardness and the quickness of the ratchet action. Such an adjustment represents an important criterion for the user, comparable with the elegance and fineness of the fastener. The speed with which the fastener can be opened and closed can also give a good impression. This criterion often plays a decisive part, e.g. when buying a watch having such a folding fastener.

When use is made of the folding fastener for a strap with elastic strands (in particular leather strands) according to the embodiments of figs. 1 to 12, said fastener preferably has a cover 4 with an upper, partly open portion in its centre, resulting from a very flat fastener with minimum overall dimensions. Figs. 2 and 10 show that a second strap strand 110 can be fixed by resting on the cover 4 and a rod 4.11 linking the side walls 14 of the cover 4. Said second strap strand 110 partly adopts the curvatures of the contact surfaces of the inner walls of the upper portion of the cover 4

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and also adapts perfectly to the curvature of the corresponding contact surfaces of rod 4.11. The shape of the contact surfaces of the participating elements is chosen in such a way that the curvature of a second strap strand caused by the rod 4.11 is contained in the central opening 4.12 of the upper portion of cover 4. The curvatures of a second strap strand 110 caused by the curvatures of the inner walls of the upper portion of the cover 4 stabilize and reinforce the fixing of the second strap strand 110. Preferably, the cover 4 is detachably or interchangeably connected to the central arm 1 via said rod 4.11. The implementation of the cover 4 of figs. 1 to 9 and 10 to 12 differs by the fact that in the preferred embodiment according to figs. 10 to 12, the central opening 4.12 is positioned further to the centre of the cover 4, giving more space for the second strap strand 110 and permitting a more pronounced pivoting of the cover 4 about the rod 4.11 with strap strand 110 in threaded form. The appearance of said fastener is particularly elegant, because it is very flat since, compared with other fasteners, the thickness of the upper portion of the centrally open cover has been gained. In addition, said fastener with cover 4 open in its centre does not have a heavy, solid appearance.

The folding fastener is characterized by two separate lockings, i.e. a first locking between two of the folding arms 1, 2, 3 and a second locking effected by at least one of the two folding arms 1, 2, 3 and the cover 4.

The first, preferred embodiment of figs. 1 to 9 shows a first locking performed by a first locking means, e.g. in the form of one or more spring balls 9 of the central arm 1 with at least one first pendant, e.g. in the form of one or more clearances 2.9 of the intermediate arm 2.

The second and third, preferred embodiments of figs. 10 to 15 show a first locking effected by a first locking means, e.g. in the form of a concave end 2.6 of the intermediate arm 2 with at least one first pendant e.g. in the form of one or more lateral portions 6.12 of a contact means 6 of the outer arm 3.

The first and second, preferred embodiments according to figs. 1 to 12 show a second locking effected by a second locking means, e.g. in the form of

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bosses 10 on the side walls of the cover 4 with at least one second pendant, e.g. in the form of one or more clearances 3.10 of the outer arm 3.

The third, preferred embodiment according to figs. 13 to 15 shows a second locking e.g. in the form of flat, side walls 14 of cover 4 with at least one second pendant, e.g. in the form of one or more ends 6.14 of the contact means 6 of outer arm 3.

The first, preferred embodiment of figs. 1 to 9 shows a first locking effected by a first locking means, e.g. formed by two spring balls 9 placed in lateral holes of the central arm 1. Each spring ball 9 is constituted by a ball connected to a spring. These relaxed springs are fixed to the interior of said lateral holes in such a way that the balls project slightly beyond the side walls outside the central arm 1. By folding the central arm 1 down onto the intermediate arm 2, said central arm 1 is entirely included in the cutout between the two edge strips 2.1, 2.2 of the intermediate arm 2. The spring balls 9 are located in the vicinity of the first pendants, e.g. in the form of clearances 2.9 of intermediate arm 2. The spring balls 9 are elastically compressed and kept in said first, closed position by notches 2.5 located in said clearances 2.9. With the knowledge of the present invention, the expert can implement other, not illustrated variants, without passing outside the scope of the invention.

The second and third, preferred embodiments according to figs. 10 to 15 show a first locking effected by a first locking means, e.g. in the form of a concave end 2.6 of the intermediate arm 2 with a first pendant, e.g. in the form of a lateral portion 6.12 of a contact means 6 of outer arm 3. By folding down the central arm 1 and intermediate arm 2 on the contact means 6, said arm 2.6 ratches and is elastically compressed by notching on said lateral portion 6.12. With the knowledge of the present invention, the expert can implement other, not illustrated variants without passing beyond the scope of the invention. It is e.g. possible to implement a notch contact fastener not only with the intermediate arm, but also and in identical manner with the central arm. The contact means 6 can be a solid pin or can be constituted by a crosspiece 61 and a thin-walled tube 62 according to fig. 16.

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The first and second, preferred embodiments according to figs. 1 to 12 show a second locking e.g. constituted by two bosses 10 placed on the side walls of cover 4. By turning the cover 4 down onto the outer arm 3, said bosses 10 are located in the vicinity of second pendants, e.g. in the form of clearances 3.10. The side walls of cover 4 are elastically expanded and said bosses 10 are maintained in said second, closed position by notches 3.5 in the said clearances 3.10. With the knowledge of the present invention, the expert can implement other, not illustrated variants, e.g. a notching of the cover 4 with an inner arm 1, 2, or e.g. the use of flat side walls 14 in the interior of cover 4 instead of using bosses 10 within the cover 4, without passing beyond the scope of the invention.

The third, preferred embodiment according to figs. 13 to 15 shows a second locking, e.g. in the form of side walls 14 within the cover 4 with second pendants e.g. in the form of ends 6.14 of the contact means 6 of the outer arm 3. Said contact means 6 is fixed within guide holes of the outer arm 3 in such a way that its ends 6.14 project slightly beyond the outer side walls of the outer arm 3. The contact means 6 can be a solid pin and/or can be constituted by a crosspiece 61 and a thin-walled tube 62 according to fig. 16. By folding down the cover 4 onto the folding arms 1, 2, 3, said flat side walls 14 are positioned in the vicinity of ends 6.14. The side walls 14 of cover 4 are elastically expanded and maintained in said first, closed position. With the knowledge of the present invention, the expert can implement other, not shown variants, e.g. a notching of the cover 4 with an inner arm 1, 2, or e.g. the use of bosses 10 within the cover 4 in place of flat side walls 14 within cover 4, without passing beyond the scope of the invention.

The folding fastener is characterized by a novel and original opening mechanism. The fastener is e.g. designed for use with an elastic, preferably leather strap and/or for use with a strap having flexible links (preferably of stainless steel and/or gold). These two precise uses of the fastener differ through the preferred embodiment of the opening mechanism. It is obvious that these embodiments are interchangeable, i.e. the preferred embodiments of a fastener for use with an elastic strap can also be used for a strap having flexible links.

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The opening of the closed fastener for a strap with elastic strands according to the two embodiments of figs. 1 to 12 takes place by successively undoing the two lockings of the two locking means 9, 2.6, 10, 14 with the corresponding pendants 2.9, 6.12, 3.10, 6.14.

The unlocking of the second locking means (two bosses 10 within the side walls of the cover 4 or flat side walls 14 of the cover 4) e.g. takes place by pulling the terminal end of the second strap strand 110 in the direction of the opening force arrow F, making it possible to raise said cover 4 (cf. fig. 10). By applying such an opening force F to the fastener, it is possible to draw out the side walls of the cover 4, which are closed by the notching of the bosses 10, respectively the flat side walls 14 of the cover 4 in the clearances 3.10 or respectively on the ends 6.14 of the outer arm 3.

The thus freed cover 4 can pivot around the rod 4.11. As the second strap strand 110 adopts perfectly the curvatures of the contact surfaces of the inner walls of the upper portion of cover 4, it also perfectly adopts the curvature of the corresponding contact surfaces of rod 4.11 and also adopts a portion of the outer surface of the folding arms 2, 3 defined by the hinge pin 7 located at the rear end of the fastener and the cover 4 essentially located in the centre of the fastener. Due to the elasticity of the second strap strand 110, the latter can be slightly compressed, leading to a certain stiffening. The greater the pulling on the terminal end of the second strap strand 110 in the opening force arrow direction F, the more the cover 4 pivots around the rod 4.11 and the greater the reaction R transmitted by the second strap strand 110 bearing in the region 23 of the outer surfaces of the intermediate arm 2 and/or outer arm 3 of the fastener. This stiffening is not necessary, but aids such a bearing of the strap strand 110 on the folding arms 2, 3. With the knowledge of the present invention, the expert can implement other, not illustrated variants, e.g. the use of a strap having flexible links or the use of a partly reinforced, elastic strap, without passing outside the scope of the invention.

The strap strand 110, cover 4 and central arm 1 linked in this way by the

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strap strand 110 form a lever able to bear on the outer surfaces of the intermediate arm 2 and/or outer arm 3. By using said reaction R, this lever makes it possible to e.g. discontinue the tangential contact of the end of the central arm 1 with a first pendant e.g. in the form of a lateral portion 6.12 of a contact means 6 of outer arm 3 (cf. fig. 11). This detachment of the ends of the central arm 1 essentially takes place by pivoting the central arm 1 around the contact means 6. Said contact means 6 can be a solid pin and/or can be constituted by a crosspiece 61 and a thin-walled tube 62 according to fig. 16.

Once the central arm 1 is detached and whilst continuing to pull the strap strand 110 with an opening force F for raising the cover 4 to a greater extent, the opening angle α formed by the longitudinal axes of the central arm 1 and the intermediate arm 2 increases, permitting further unlocking of a first locking means by releasing the notching of a concave end 2.6 of the intermediate arm 2 with the first pendant, e.g. in the form of a lateral portion 6.12 of a contact means 6 of outer arm 3 (cf. fig. 12). This unlocking of the concave ends 2.6 essentially takes place by elastically decompressing said intermediate arm 2 and/or thin-walled, elastic tube 62 when use is made of a contact means 6 constituted by a crosspiece 61 and a thin-walled tube 62 according to fig. 16.

The opening of the closed fastener for a strap having flexible links according to the third embodiment of figs. 13 to 15 takes place by successively undoing the two lockings of the two locking means with the corresponding pendants.

The unlocking of the second locking means (inner side walls of cover 4), e.g. takes place by directly raising the cover 4 in the direction of the cover opening force arrow F' (cf. fig. 14). By applying said cover opening force F' to the fastener, it is possible to remove the side walls 14 of the closed cover 4 by notching with the ends 6.14 of the contact means 6 of the outer arm 3. With the knowledge of the present invention, the expert can implement further variants without passing beyond the scope of the invention. In order to carry out a notching with ends of a contact means of the outer arm, it is e.g. possible to use flat side walls of the cover instead

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of providing bosses on the side walls of said cover. It is also possible to provide contact bosses on the lateral portions of the outer arm, which can e.g. replace the ends of a contact means. The contact means 6 can be a solid pin with ends 6.14 and/or can be constituted by a crosspiece 61 with ends 6.14 and a thin-walled tube 62 according to fig. 16.

When said fastener is in the closed state, the cover 4 partly rests on a terminal link 40. The freed cover 4 can pivot about the attachment pin 5 and the second strap strand 210 with a terminal link 40 become accessible. The precise function of said cover 4 is to prevent any accidental opening of the terminal link 40, where an opening force F can act. Preferably, the cover 4 partly rests on a projection 44 of the terminal link 40. More specifically, the contact ends of the cover 4 and terminal link 40 are adapted to one another, so that the appearance of said fastener is very flat and elegant. Compared with other fasteners, thickness is gained by flattening the upper portion of the contact end of the terminal link 40, so that it is not possible to distinguish the separation between the cover 4 and terminal link 40 when the cover 4 rests on said terminal link 40. The terminal link 40 is interchangeable about an attachment pin 50 placed in a hole of the central arm 1. By pulling the terminal end of the second strap strand 210 in the opening force arrow direction F , the terminal link 40 pivots about the attachment pin 50 and bears in a region 23 of the outer surfaces of the fastener outer arm 3, transmitting a reaction R . With the knowledge of the present invention, the expert can implement other variants, without passing outside the scope of the invention.

The strap strand 210, terminal link 40 and central arm 1 form a lever able to bear on the outer surfaces of the outer arm 3. By using said reaction R , said lever makes it possible to pivot the central arm 1 around the first pendant, e.g. formed by the contact means 6 of the outer arm 3 (cf. fig. 15).

Once the central arm 1 is freed from a tangential contact or a notch contact and whilst continuing to pull the strap strand 210 with an opening force F for further raising the terminal link 40, the opening angle formed by the longitudinal axes of the central arm 1 and intermediate arm 2

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increases, making it possible to unlock a first locking means by releasing the notching of a concave end 2.6 of the intermediate arm 2 with the first pendant, e.g. in the form of a lateral portion 6.1 of a contact means 6 of the outer arm 3 (not shown, but analogous to fig. 12). This unlocking of the concave ends 2.6 essentially takes place by elastically decompressing said intermediate arm 2 and/or the thin-walled, elastic tube 62 when use is made of a contact means 6 constituted by a crosspiece 61 and a thin-walled tube 62 according to fig. 16.

The main advantage of this lever opening mechanism bearing the strap strand 110 on folding arms 2, 3 is that it makes it possible to open the fastener with a relatively small opening force F . In comparison with the opening of a conventional fastener, where the opening force is obtained by directly pulling the folding arms to be unlocked, the present booster lever mechanism permits a significant reduction to the opening force. In the preferred embodiment of fig. 10, the lever ratio defined by the distance between the bearing region 23 and the lateral portion 6.12 of the contact means 6, makes it possible to reduce the opening force F by a factor of 6 compared with the opening force necessary when directly pulling on the folding arms to be unlocked. With the knowledge of the present invention, the expert can implement other, not illustrated variants of a lever, e.g. using a larger or smaller lever ratio, without passing beyond the scope of the invention.

The folding fastener is characterized by a double opening out, permitting an increase in the diameter of the strap so as to permit its easy removal and putting back into place again by sliding over the wrist. In view of the fact that in preferred manner three folding arms are used in place of the normal two, the diameter of the strap with open folding fastener is greater by the same amount, which permits the user to easily remove and then refit the strap. This is of interest for users with wide or large hands and/or who wear rings, other straps, etc.

The folding fastener is constructed with a minimum number of elements, which can be easily replaced or adjusted. It is easily possible to change and adapt the force of the first locking by replacing the spring balls

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and/or the concave ends by other spring balls or other concave ends, e.g. having different elastic characteristics. It is easily possible to change and adapt the force of the second locking by replacing the cover by another cover having bosses and/or inner side walls with a different shape. With the knowledge of the present invention, the expert can implement numerous variants.

The visible elements of the folding fastener are preferably metallic and are e.g. made from stainless steel and/or gold. The use of other basic materials is clearly possible and is not restricted by the invention. All the visible elements of the folding fastener, i.e. the folding arms, cover and pins are preferably machined in solid metal blocks and connected by positive engagement, which permits easy machining and a rapid variation to the appearance of the fastener. As these elements also have a considerable symmetry and stability, they guarantee a reliable operation and easy maintenance. Another important advantage is the complete avoidance of welds. In view of the fact that a high precision is required for an easy, repeated operation of the fastener and the technical difficulties encountered during the treatment of the chosen materials (reduction of hardness during welding, asymmetrical deformation during welding), it is advantageous to avoid any welding. With the knowledge of the present invention, the expert can clearly implement other fixing means for other basic materials, e.g. heat fusion for synthetic, heat-fusible materials, etc.

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CLAIMS

1. Folding fastener, having at least three folding arms (1, 2, 3) and a cover (4), characterized in that said folding arms (1, 2, 3) are articulated to one another and mutually interlaced and that said cover (4) is articulated with respect to the folding arms (1, 2, 3) permitting a locking of the folding fastener by locking said cover (4) on an outer arm (3).
2. Folding fastener according to claim 1, characterized in that it comprises a central arm (1), an intermediate arm (2) and an outer arm (3), said central arm (1) and said intermediate arm (2) being articulated to one another by one of their ends, said intermediate arm (2) and said outer arm (3) being articulated to one another by one of their ends.
3. Folding fastener according to claim 1 or 2, characterized in that said intermediate arm (2) is formed by two intermediate edge strips (2.1, 2.2) defining a cutout and that said outer arm (3) is constituted by two outer edge strips (3.1, 3.2) defining a cutout, said edge strips (2.1, 2.2, 3.1, 3.2) being connected by hinge pins (7, 8).
4. Folding fastener according to one of the claims 1 to 3, characterized in that said central arm (1) can be entirely included in a cutout between two intermediate edge strips (2.1, 2.2) of the intermediate arm (2) and that said intermediate arm (2) can be entirely included in a cutout between two outer edge strips (3.1, 3.2) of the outer arm (3).
5. Folding fastener according to one of the claims 1 to 4, characterized in that it comprises a contact means (6) for connecting and rigidifying the outer edge strips (3.1, 3.2) of the outer arm (3).
6. Folding fastener according to claim 5, characterized in that said contact means (6) is constituted by a pin with lateral portions and ends (6.14) or is constituted by a crosspiece (61) with ends (6.14) and a thin-walled tube (62) forming lateral portions.
7. Folding fastener according to one of the claims 1 to 6, characterized

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in that the closed fastener is opened by successively undoing two lockings of two locking means (9, 2.6, 10, 14) with corresponding pendants (2.9, 6.12, 3.10, 6.14).

8. Folding fastener according to one of the claims 1 to 7, characterized in that a first locking is implemented by a first locking means (9) of the central arm (1) with at least one first pendant (2.9) of the intermediate arm (2).

9. Folding fastener according to claim 8, characterized in that said first locking means (9) is constituted by two spring balls placed in lateral holes of the central arm (1), that two first pendants (2.9) in the form of clearances of the intermediate arm (2) are provided, so that by folding down the central arm (1) onto the intermediate arm (2), said central arm (1) is entirely included in the cutout between two intermediate edge strips (2.1, 2.2) of the intermediate arm (2) and that the spring balls in the vicinity of said clearances are elastically compressed and maintained in said first, closed position by notches (2.5) located in said clearances.

10. Folding fastener according to claim 5 or 8, characterized in that a contact means (6) is arranged in such a way that when the folding fastener is in the closed state, it is in tangential contact with the central arm (1) or with the central arm (1) and with the intermediate arm (2) in order to in this way rigidify the closed folding fastener.

11. Folding fastener according to one of the claims 1 to 7, characterized in that a first locking means (2.6) of the intermediate arm (2) takes place with at least one first pendant (6.12) of the outer arm (3).

12. Folding fastener according to claim 11, characterized in that a first locking means (2.6) is a concave end of the intermediate arm (2), that a first pendant (6.12) is in the form of a lateral portion of a contact means (6) located in the outer arm (3), so that by folding the central arm (1) and the intermediate arm (2) onto the outer arm (3), said central arm (1) is entirely included in the cutout between the two intermediate edge strips (2.1, 2.2) of the intermediate arm (2) and that the concave ends of the



central arm (1) and the intermediate arm (2) are in the vicinity of said lateral portion of the contact means (6) and that the first locking means (2.6) is elastically compressed and maintained by notching on said lateral portion of the contact means (6).

13. Folding fastener according to one of the claims 1 to 12, characterized in that it comprises an attachment pin (5) for permitting the detachable fixing of a first strap strand (100).

14. Folding fastener according to one of the claims 1 to 13, characterized in that it comprises a cover (4) with a central opening (4.12) in its upper portion and with a rod (4.11) linking the side walls of the cover (4), making it possible to fix a second strap strand (110) by resting on the contact surfaces of the inner walls of the cover (4) and on the contact surfaces of said rod (4.11).

15. Folding fastener according to one of the claims 1 to 7, characterized in that a second locking takes place by a second locking means (10, 14) of the cover (4) with at least one second pendant (3.10. 6.14) of the outer arm (3).

16. Folding fastener according to claim 15, characterized in that said second locking means (10) is constituted by two bosses placed on the side walls of the cover (4), that two second pendants (3.10) in the form of clearances of the cover (4) are provided, so that by folding the cover (4) down onto the outer arm (3) and with the central arm (1) and intermediate arm (2) entirely included in the cutout between two outer edge strips (3.1, 3.2) of the outer arm (3), said bosses are located in the vicinity of the clearances and are maintained in said second, closed position by notches (3.5) placed in said clearances.

17. Folding fastener according to claim 15, characterized in that said second locking means (14) is constituted by two flat side walls of the cover (4), that two second pendants (6.14) are in the form of ends of a contact means (6) placed in the outer arm (3), so that by folding the cover (4) down onto the outer arm (3) and with the central arm (1) and inter-

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mediate arm (2) entirely included in the cutout between two outer edge strips (3.1, 3.2) of the outer arm (3), said side walls are in the vicinity of said ends and are maintained in said second, closed position by notching on said ends of the contact means (6).

18. Folding fastener according to claim 15, characterized in that it comprises an attachment pin (5) in order to permit the detachable fixing of a first strap end (200) and to permit the fixing of a cover (4).

19. Folding fastener according to claim 7, characterized in that the unlocking of a second locking means (10, 14) of the cover (4) is implemented by pulling the terminal end of a second strap strand (110) under the effect of an opening force (F) making it possible to raise the cover (4) and draw out said second locking means (10, 14) from the cover (4), being closed by notching with at least one second pendant (3.10, 6.14) of the outer arm (3).

20. Folding fastener according to claim 19, characterized in that the second strap strand (110), cover (4) and central arm (1) are connected by the second strap strand (110) and form a lever able to bear in a region (23) of the outer surfaces of the intermediate arm (2) and/or the outer arm (3).

21. Folding fastener according to claim 19 or 20, characterized in that the unlocking of a first locking means (2.6) of the intermediate arm (2) is implemented by pulling the terminal end of a second strap strand (110) under the effect of an opening force (F) and a reaction (R) transmitted by the second strap strand (110) bearing in a region (23) of the outer surfaces of the intermediate arm (2) and/or the outer arm (3), making it possible to release the notching of said first locking means (2.6) of the intermediate arm (2) with at least one first pendant (6.12) of the outer arm (3).

22. Folding fastener according to claim 7, characterized in that the unlocking of a second locking means (10, 14) of cover (4) is implemented by raising the cover (4) under the effect of a cover opening force (F') making



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it possible to draw said second locking means (10, 14) out of the cover (4) being closed by notching with at least one second pendant (3.10, 6.14) of the outer arm (3).

23. Folding fastener according to claim 22, characterized in that when the fastener is in the closed state, the cover (4) partly rests on a terminal link (40), making it possible to prevent any accidental opening of the terminal link (40).

24. Folding fastener according to claim 22 or 23, characterized in that a terminal link (40) of a second strap strand (210) and the central arm (1) are connected by the second strap strand (210) and form a lever able to bear in a region (23) of the outer surfaces of the outer arm (3).

25. Folding fastener according to one of the claims 22 to 24, characterized in that the unlocking of a first locking means (2.6) of the intermediate arm (2) is implemented by pulling the terminal end of a second strap strand (110, 210) under the effect of an opening force (F) and a reaction (R) transmitted by the second strap strand (110, 210) bearing in a region (23) of the outer surfaces of the intermediate arm (2) and/or the outer arm (3), making it possible to release the notching of said first locking means (2.6) of intermediate arm (2) with at least one first pendant (6.12) of the outer arm (3).

26. Folding fastener according to claim 21 or 25, characterized in that the unlocking of said first locking means (2.6) of the intermediate arm (2) essentially takes place by pivoting the central arm (1) and/or the intermediate arm (2) about said at least one first pendant (6.12) and/or by elastically decompressing the intermediate arm (2).

27. Folding fastener according to claim 20 or 24, characterized in that the booster lever opening mechanism makes it possible to open the fastener with a relatively low opening force (F).

28. Folding fastener according to claim 27, characterized in that said booster lever opening mechanism makes it possible to reduce the opening

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force (F) by a factor of 6 compared with the opening force necessary when pulling directly on the folding arms (1, 2) to be unlocked.

29. Folding fastener according to one of the claims 1 to 28, characterized in that the visible elements of the folding fastener are joined without welds.

30. Folding fastener according to one of the claims 1 to 29, characterized in that the visible elements of the folding fastener are machined from solid metal blocks.

31. Strap with folding fastener according to one of the claims 1 to 30, characterized in that the folding fastener effects a double opening out permitting an increase in the diameter of the strap so as to permit its easy removal and putting back into place again by sliding over a wrist.

32. Strap with folding fastener according to claim 31, characterized in that the folding fastener is designed for the use of an elastic strap and/or a strap with flexible links.

This Sheet Has Been Replaced

