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(54) Title: (MULTI-LOCK) MULTIPLE SECURITY BICYCLE LOCK SYSTEM

(57) Abstract: A bicycle lock (20) comprising a centrepiece (1), at least two lock arms (11, 13, 15) extending from the centrepiece (1) for each engaging one or more parts of a bicycle and/or an external element, at least two lock mechanisms for locking the lock arms (11, 13, 15) around or with the corresponding one or more parts of a bicycle and/or the external element, wherein the lock mechanisms are independent from each other and each one of the locking mechanisms locks another one of the lock arms (11, 13, 15).



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## Bicycle lock

### Field of the invention

The present invention relates to a lock for a bicycle. The present invention relates in particular to a bicycle lock having multiple lock arms for  
5 simultaneously locking multiple parts of a bicycle, for example for locking both wheels of the bicycle as well as securing the bicycle to an external stationary object such as a pole, a railing, etc.

### Background of the invention

Most conventional bicycle locks belong to one of the following categories:  
10 shackle locks, cable locks and chain locks.

Shackle locks are also commonly known as U-locks, C-locks or D-locks because of their specific shape when viewed in either an engaged or disengaged position. Shackle locks therefore usually rely on a solid U, D or C metal frame which is completed by a cross member on which a locking  
15 mechanism is mounted. The locking mechanism can usually be released by a key or comprises a combination lock-release system.

Cable locks on the other hand utilize a system of cables often enclosed in a flexible material allowing for the contortion of the lock's arm to flexibly fit around fixed objects. Such locks are thus characterized by the use of a cabling  
20 system which is enclosed in a protective layer of flexible plastic or other synthetic polymer based substances.

Chain locks utilize a system of solid links which are connected to create a single elongated lock arm which for example has a lock mechanism on one end, and a lock head on the other end. Chain locks are also often locked by  
25 means of a regular padlock, which secures both ends of the chain around a frame member and a wheel of the bicycle, or around an external stationary object and a wheel.

Conventional U-locks, cable locks and chain locks, however, only provide users with a single locking mechanism with which to secure a single frame member to an independent stationary object, or to tether a single frame member of the bicycle along with a single wheel together with an independent stationary object. As a result, conventional bicycle locks are not very effective in securing bicycles, because they are easily defeated if the locking mechanism is itself defeated.

With hundreds of millions of bicycles in use the world over, and over 130 million bicycles, or twice the number of cars produced in 2007 according to the Earth Policy Institute, the bicycle is on track to becoming the leading mode of transportation per capita globally. Unfortunately, approximately 4 million bicycles are stolen in China each year, another 400'000 in France, 400'000 in Germany, and 440'000 in the UK, while the Netherlands suffers a further 700'000 in stolen bicycles, as well as bicycle theft amounting to US\$ 50 million in the USA every year. Thus, the failure of many existing locks to effectively secure bicycles and their component parts has not only resulted in criminals cheating bicycle owners out of hundreds of millions of dollars in stolen bicycles each year, but has shown that bicycle theft is becoming increasingly unabated by the existing technologies which are available for their security.

Too often one passes by the front wheel of a bicycle, which is securely fastened to a pole or railing, without any sign of the rest of the bicycle in sight, or observes that the bicycle frame remains in place, but one of the wheels is missing, or the bicycle is stolen in its entirety.

#### Summary of the invention

An aim of the invention is thus to provide an effective bicycle lock providing maximum security to bicycles and their parts.

Another aim of the invention is to provide a secure bicycle lock allowing for the simultaneous locking of multiple parts of a given bicycle and/or locking a part of the bicycle with an external stationary object such as a fence, a railing, a lamp-post or a bicycle parking station.

These aims are achieved by a bicycle lock comprising the features of independent claim 1.

These aims are achieved in particular by a bicycle lock comprising a centrepiece, at least two lock arms extending from the centrepiece for each  
5 engaging one or more parts of a bicycle and/or an external element, at least two lock mechanisms for locking the lock arms around or with the corresponding one or more parts of a bicycle and/or the external element, wherein the lock mechanisms are independent from each other and each one of the locking mechanisms locks another lock arm.

10 The bicycle lock of the invention ensures that not only will there be less risk of losing a bicycle wheel to theft, but also of the loss of the bicycle itself, in one simple and effective way. That is, by securing at least two of the relevant points of concern, namely a first wheel and the second wheel and/or the bicycle frame altogether using a single bicycle lock. The bicycle lock of the invention  
15 thus provides a solution to the previously unavoidable security risk exposure by offering the user a minimum of two, preferably three, distinct independent locking mechanisms comprised in a single lock, so as to secure a bicycle using any of the preferred characterizations of the lock system.

#### Brief description of the drawings

20 The invention will be better understood with the help of the following description, illustrated by the figures where:

Figure 1 shows a preferred embodiment of the bicycle lock of the invention;

Figure 2 illustrates the internal structure of the bicycle lock of figure 1;

25 Figure 3 shows another embodiment of the bicycle lock of the invention;

Figure 4 illustrates the internal structure of the bicycle lock of figure 3;

Figure 5 shows the bicycle lock of Figure 3 in use on a bicycle and between the bicycle and an external stationary object.

Detailed description of the invention

According to a preferred embodiment of the invention illustrated in Figure 1, the bicycle lock of the invention comprises a centrepiece 1 and three rigid and elongated lock arms 11, 13, 15 extending from the centrepiece 1. The other  
5 extremity of each lock arm 11, 13, 15 comprises a lock, for example a U-lock, for engaging one or more parts of a bicycle, for example a wheel, and/or an external element such as a pole, a fence, etc. Each lock comprises an independent lock mechanism (not represented in the figures) for independently  
locking and unlocking said lock.

10 The lock mechanisms are for example key lock mechanisms that can be actuated with a key through a corresponding key hole 5, 6, 7. Preferably, the lock mechanisms of the bicycle lock of the invention are all differently encoded. However, in order to facilitate the use of the bicycle lock, all lock mechanisms can preferably be actuated with a single master key. Other lock mechanisms  
15 are possible within the frame of the invention. In particular, in a variant embodiment, one or more lock mechanisms are number combination lock mechanisms.

The lock arms 11, 13, 15 are preferably each independently rotatable around the centrepiece 1. The centrepiece 1 comprises for example three  
20 portions 101, 102, 103 that are rotatably attached to each other along a rotation axis 100, each lock arm 11, 13, 15 extending from another one of these portions 101, 102, 103. Each lock arm 11, 13 or 15 can thus be oriented in any direction perpendicular to the rotation axis 100 for its engagement with one or more parts of the bicycle, for example with a wheel and/or a part of the bicycle frame,  
25 and/or with an external element such as a pole, a fence, etc.

Preferably, each portion 101, 102, 103 and at least a part of the lock arm 11, 13, 15, respectively, extending from it are made of a single piece, for example of a single casted metallic element.

In a preferred embodiment, the lock arms 11, 13, 15 are retractable  
30 arms, for example telescopic arms. The length of each lock arm 11, 13, 15 can

thus be adjusted independently and adapted to the distance between the centrepiece 1 and the one or more parts of the bicycle and/or the external element to be engaged by the corresponding lock. Furthermore one or more locks at the extremities of the lock arms 11, 13, 15 can be flexible locks, for example such as cable locks, which can be easily adapted to the shape of the bicycle parts and/or external elements to be engaged.

Figure 2 illustrate the internal structure of the bicycle lock of Figure 1. According to this preferred embodiment, a coiled cable runs inside each telescopic lock arm 11, 13, 15 along its entire length and terminates at the lock mechanism, for example at both ends of the corresponding U-lock, such that when the corresponding lock is closed, the coiled cable is firmly attached to the lock mechanism. The coiled cables are for example made of interwoven metallic fibres. The coiled cables extending in each lock arm 11, 13, 15 are preferably joined to each other inside the centrepiece 1, thus forming a single cabling structure connecting all three locks of the bicycle lock of the invention. Due to their coiled configuration, the cables easily extend inside the lock arms when the latter are extended, and easily fold when they are retracted.

According to another embodiment illustrated in Figure 3, the bicycle lock of the invention comprises a centrepiece 1 comprising three lock housings 2, 3 and 4, each housing an independent lock mechanism (not visible on the figures). Each lock housing 2, 3, 4 further comprises a lock receptacle 10, 9, 8 respectively, and a key hole 5, 6, 7 through which the corresponding lock mechanism can be opened with the help of a key. The three independent lock mechanisms are thus further securely fastened together inside the centrepiece 1 so as to ensure the inseparability of the system. Other lock mechanisms are possible within the frame of the invention. In particular, in a variant embodiment, one or more lock mechanisms are number combination lock mechanisms. The bicycle lock further comprises three, preferably flexible, lock arms 11, 13, 15 extending from the centrepiece 1, with a lock insert 12, 14, 16 resting on their extremity. The flexible lock arms 11, 13, 15 can all be of the same length, or they can be of variable lengths. For example, one flexible lock arm can be

significantly longer than the other ones in order for it to be easily engaged around large external elements such as poles, trees, etc.

Figure 4 is a partial cut of the bicycle lock of Figure 3, illustrating by way of example a possible internal configuration of the lock arms in order to deliver  
5 an effective security level. According to this example, the lock arms comprise two flexible cables 17, 19. Both cables 17, 19 are firmly attached at a first end to a lock insert and approximately in their middle to the centrepiece, thus forming the structure of two lock arms. The remaining part of the two cables 17, 19 are combined together, preferably interlaced into each other, in order to form the  
10 third lock arm. The lock insert of the third arm is then attached to the loose end of the interlaced cabling 18. The cables 17, 19 shown in figure 2 thus run the entire course of the bicycle lock, starting at the end-points of two of the three lock arms, intersecting at the lock's centrepiece, where they are preferably bolted to the encasing of the centrepiece itself. After the intersection of the two  
15 lock cables 17, 19 at the centrepiece, the cables are further combined, for example interlaced or intertwined, in order to form an even stronger interlaced cabling 18, contained in the third lock arm. The cables 17, 19 as well as the interlaced cabling 18 are preferably covered by one or more protective layers, for example of flexible plastic or other synthetic polymer based substance (not  
20 represented in Figure 4).

In a variant embodiment, the three lock arms are built by a single cable that runs from the end-point of a first lock arm, through the centrepiece, is interlaced or intertwined on itself in order to form the middle lock arm, and ends at the end-point of the third lock arm.

25 According to the embodiment of the invention illustrated in Figure 3, the centrepiece 1 is a solid metal encasing which houses the lock mechanisms and allows the cabling for the locks to be funnelled through, and be securely fastened to the inner part of the centrepiece 1, for example by means of a secure bolt or other means.

The lock housings 2, 3 and 4 separate and protect each of the three lock mechanisms and preferably serve as the direct entry or exit point for the cables contained in the three lock arms 11, 13, 15.

5 The key holes 5, 6 and 7 allow the activation and deactivation of the lock mechanisms contained in the three lock housings 2, 3 and 4 on the centrepiece 1.

10 Preferably, the lock inserts 12, 14, 16 have ridged heads such that when they are inserted into the lock receptacles 8, 9, 10 they become engaged by displacing a ratchet pawl mechanism inside each of the lock mechanisms and are then secured in place until a key is inserted into the corresponding key hole 5, 6 or 7 connected to the corresponding lock mechanism and releases the corresponding ratchet pawl.

15 The lock receptacles 8, 9, 10 are essentially the external portions of the lock housing 2, 3, 4 containing the lock mechanisms allowing for the engagement of the lock mechanisms.

20 The cables 17, 19 shown in Figure 4 consist for example of a system of thin individual metal fibres that are bonded together by interlacing or weaving together each individual strand to form a single solid piece of wiring, but which is flexible enough to allow for it to be flexed or bended, preferably to at least a 45 degree angle.

The cables 17, 19 are then preferably combined, for example interlaced or interwoven together a second time, for creating a more impenetrable, but equally flexible, interlaced cabling 18 inside the third lock arm that is formed.

25 According to this embodiment, the bicycle lock of the invention thus comprises a centrepiece 1 in which are set three lock mechanisms, each contained in a lock housing 2, 3, 4. The three lock arms 11, 13, 15 extend outwards, each from one end and preferably of the same side of the lock housings 2, 3, 4, allowing the lock inserts 12, 14, 16 installed at the end of each lock arm 11, 13, 15 to be coiled for example around a frame member of a  
30 bicycle and through the spokes of a bicycle wheel and finally inserted into the



lock receptacles 8, 9, 10 for their engagement with each of the three independent lock mechanisms. The centrepiece 1 also has three independent key holes 5, 6, 7 which allow a key, for example a flat master key, preferably an encoded master key, to engage and disengage the lock mechanisms by  
5 accessing the lock housing 2, 3, 4 from the top part.

Other embodiments are possible within the frame of the invention. According to the invention, the bicycle lock comprises at least two, preferably three, interconnected lock arms, each associated with a locking mechanism such as, for example, a coded lock which utilizes a flat encoded key or a  
10 number combination lock. The lock arms can be of different nature. They can for example form with the corresponding lock mechanism, a U-lock, a cable lock or a chain lock. The lock arms are each attached to a single centrepiece, which may be fixed or may comprise rotatable elements. The lock arms extend outward from the centrepiece and preferably allow each lock to simultaneously  
15 engage a frame member of the bicycle frame, preferably together with a bicycle wheel and/or with an external stationary object.

As illustrated in Figure 5, the bicycle lock 20 of the invention is intended to completely immobilize a bicycle 30 by preventing its motion at any two or three desired points. Preferably, it prevents motion in both the forward and rear  
20 wheels simultaneously, while ensuring that if any one of these locks is defeated, the other remains intact to prevent the bicycle from being ridden away. The bicycle lock of the invention simultaneously prevents the bicycle from being removed from its desired stationary position by allowing a third lock arm to secure the bicycle to an independent stationary object which, if it is itself  
25 defeated, will leave in place two separate and independent locking means which will secure both wheels of the bicycle and prevent it from being ridden or pushed away.

The bicycle lock of the invention achieves its security objective for example by first engaging the central downward sloping frame member and the  
30 rear wheel of a bicycle 30 with a first lock arm 11, the thus formed lock being locked around these elements.

Another lock arm 15 then engages the forward sloping front frame member and the front bicycle wheel of the bicycle 30, while a third lock arm 13 preferably engages with an independent stationary object, for example, a fence, railing, lamp-post or a bicycle parking station.

- 5        Also, due to the retractable or flexible nature of its lock arms, the bicycle lock of the invention can thus be easily folded into a compact shape, thus facilitating its storage and its transport when riding the bicycle.

**Claims**

1. Bicycle lock (20) comprising:  
a centrepiece (1);  
at least two lock arms (11, 13, 15) extending from said  
5 centrepiece (1) for each engaging one or more parts of a bicycle and/or an  
external element;  
at least two lock mechanisms for locking said at least two lock  
arms (11, 13, 15) around or with said one or more parts of a bicycle and/or  
external element;  
10 wherein said at least two lock mechanisms are independent  
from each other and each one of said at least two locking mechanisms locks  
another one of said at least two lock arms (11, 13, 15).
2. Bicycle lock (20) according to the preceding claim, said  
centrepiece (1) comprising at least two portions (101, 102, 102) that are  
15 rotatably attached to each other, each of said at least two lock arms (11, 13, 15)  
extending from another one of said at least two portions (101, 102, 102).
3. Bicycle lock according to one of the preceding claims, wherein  
said at least two lock arms (11, 13, 15) are retractable arms.
4. Bicycle lock (20) according to the preceding claim, wherein  
20 each of said at least two lock arms comprises one of said at least two lock  
mechanisms on its end.
5. Bicycle lock according to claim 1, wherein said at least two lock  
arms (11, 13, 15) are flexible arms.
6. Bicycle lock according to the preceding claim, wherein said at  
25 least two lock mechanisms are fastened to each other inside said centrepiece  
(1).

7. Bicycle lock according to one of the preceding claims, further comprising cables (17, 18, 19) inside each of said at least two lock arms (11, 13, 15), said cables being attached to each other inside said centrepiece (1) on one end and to a part of one of said at least two lock mechanisms on the other  
5 end when said at least two lock arms are locked.

8. Bicycle lock according to the preceding claim, wherein said cables (17, 18, 19) are flexible metallic cables.

9. Bicycle lock according to the preceding claim, wherein said cables (17, 18, 19) are made of a single cable running from one end of a first  
10 one of said at least two lock arms (11), through said centrepiece (1) and ending at one end of a second one of said at least two lock arms (15).

10. Bicycle lock according to the preceding claim, comprising a third lock arm (13), wherein said single cable is interlaced or interwoven with itself inside said a third lock arm (13).

15 11. Bicycle lock according to claim 8, comprising three lock arms (11, 13, 15) and two cables (17, 19), wherein a first one of said two cables (17, 19) runs from an end of a first one of said three two lock arms (11), through said centrepiece (1) and ends at an end of a third one of said three lock arms (13), a second one of said two cables (17, 19) runs from an end of a second one of  
20 said three two lock arms (11), through said centrepiece (1) and ends at an end of said third one of said three lock arms (13).

12. Bicycle lock according to the preceding claim, wherein said two cables (17, 19) are interlaced or interwoven together inside said third one of said three lock arms (13).

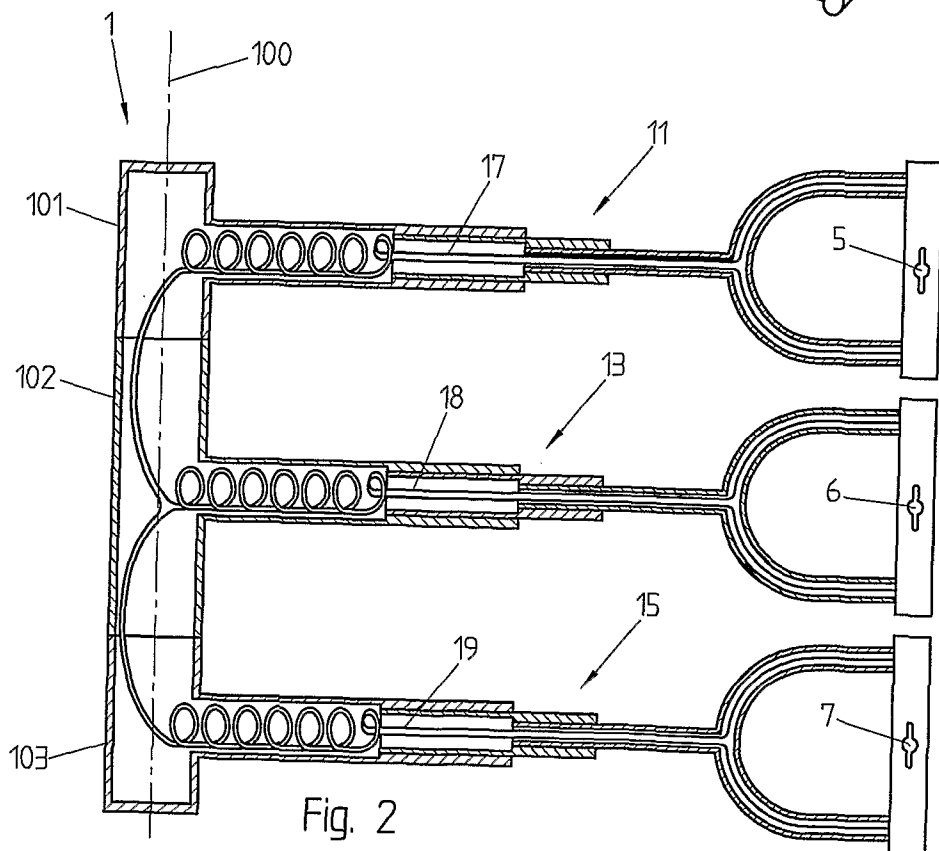
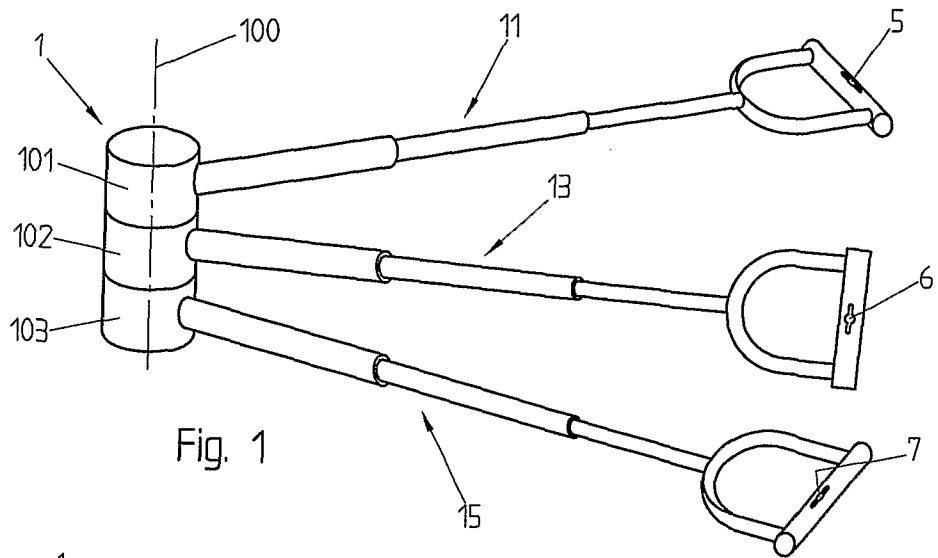
25 13. Bicycle lock according to one of the claims 8 to 12, wherein said at least two lock arms (11, 13, 15) are retractable lock arms and said cables (17, 18, 19) are at least partly coiled inside said at least two lock arms (11, 13, 15).

14. Bicycle lock according to one of the preceding claims, wherein said at least two lock mechanisms are key lock mechanisms differently encoded from each other.

15. Bicycle lock according to the preceding claim, wherein said at  
5 least two lock mechanisms can be actuated by a single master key.

16. Bicycle lock according to one of the preceding claims, comprising three lock arms (11, 13, 15) and three lock mechanisms, wherein said three lock mechanisms are independent from each other.

1/4



2/4

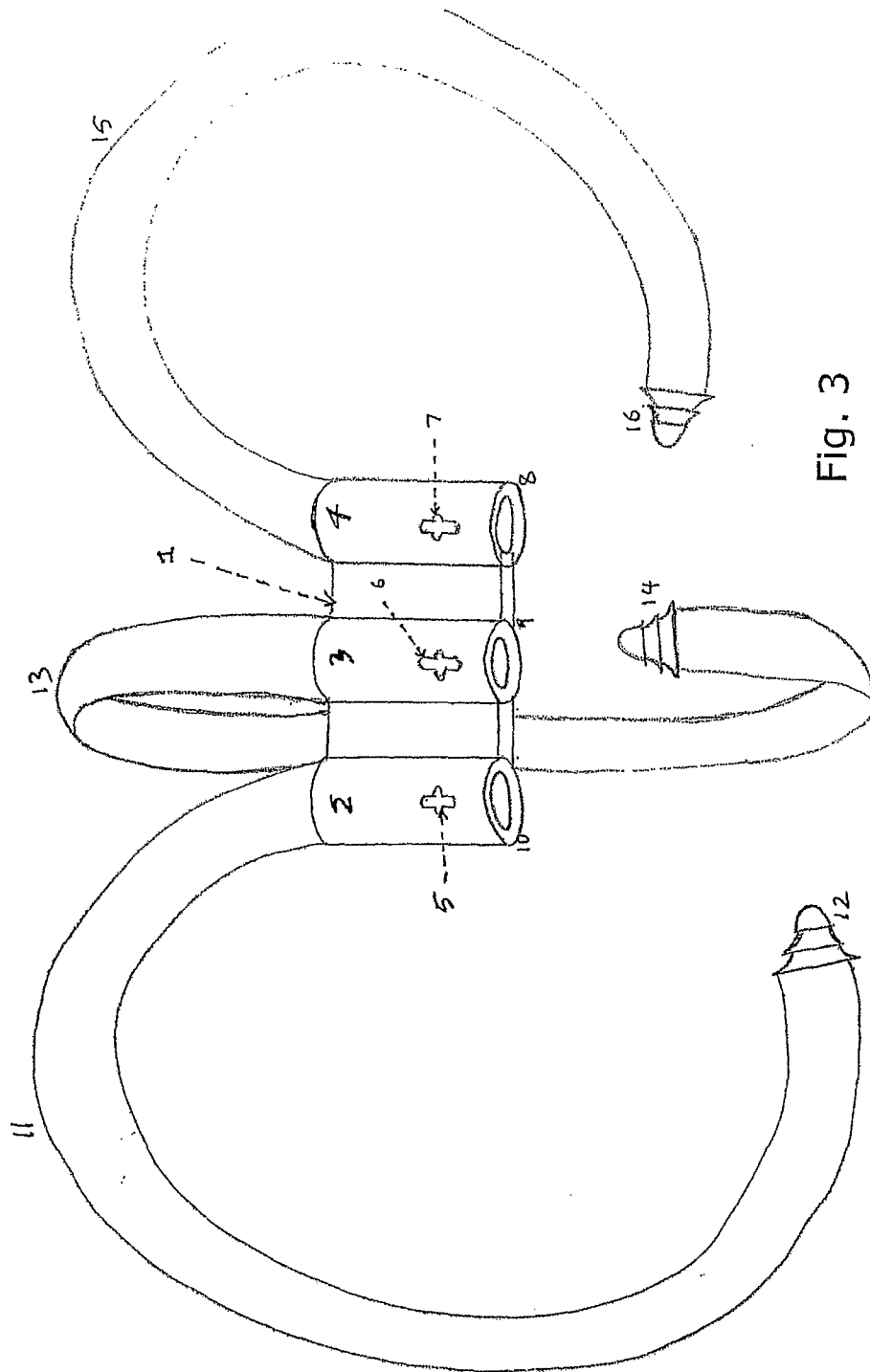


Fig. 3

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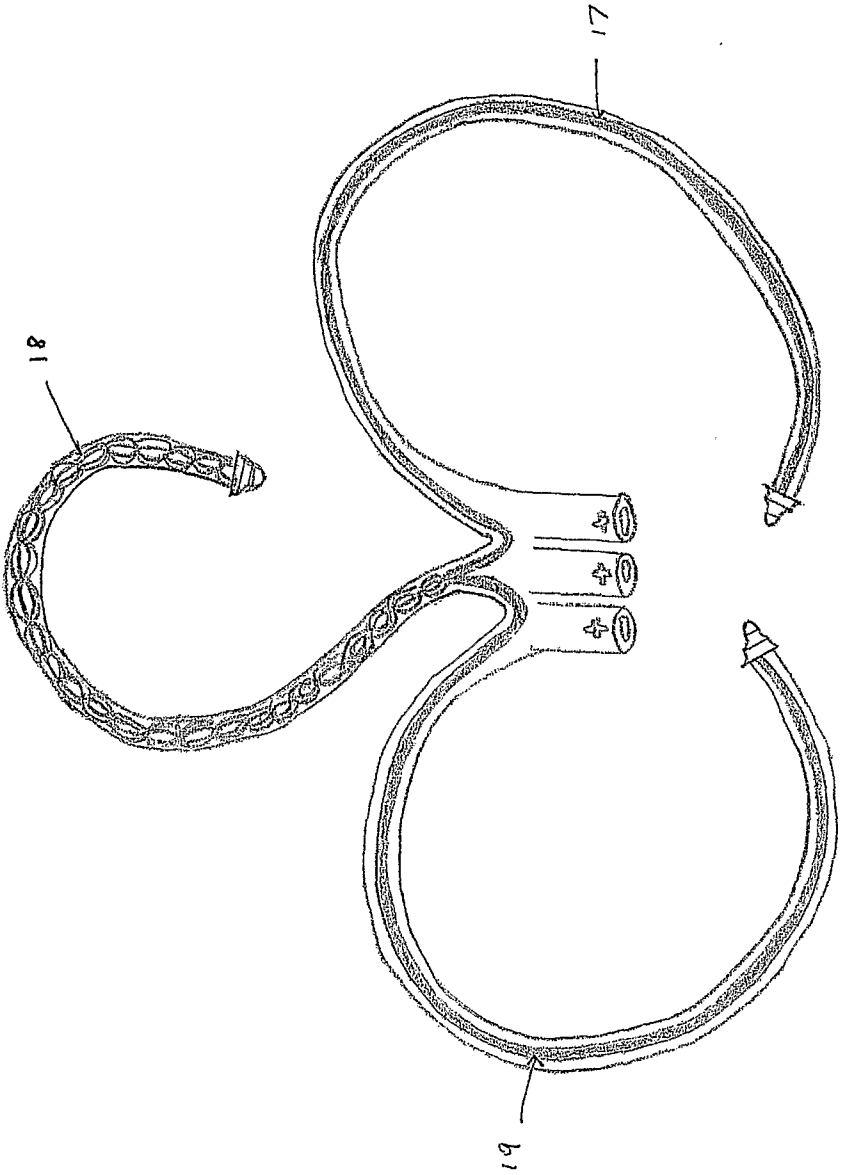


Fig. 4



4/4

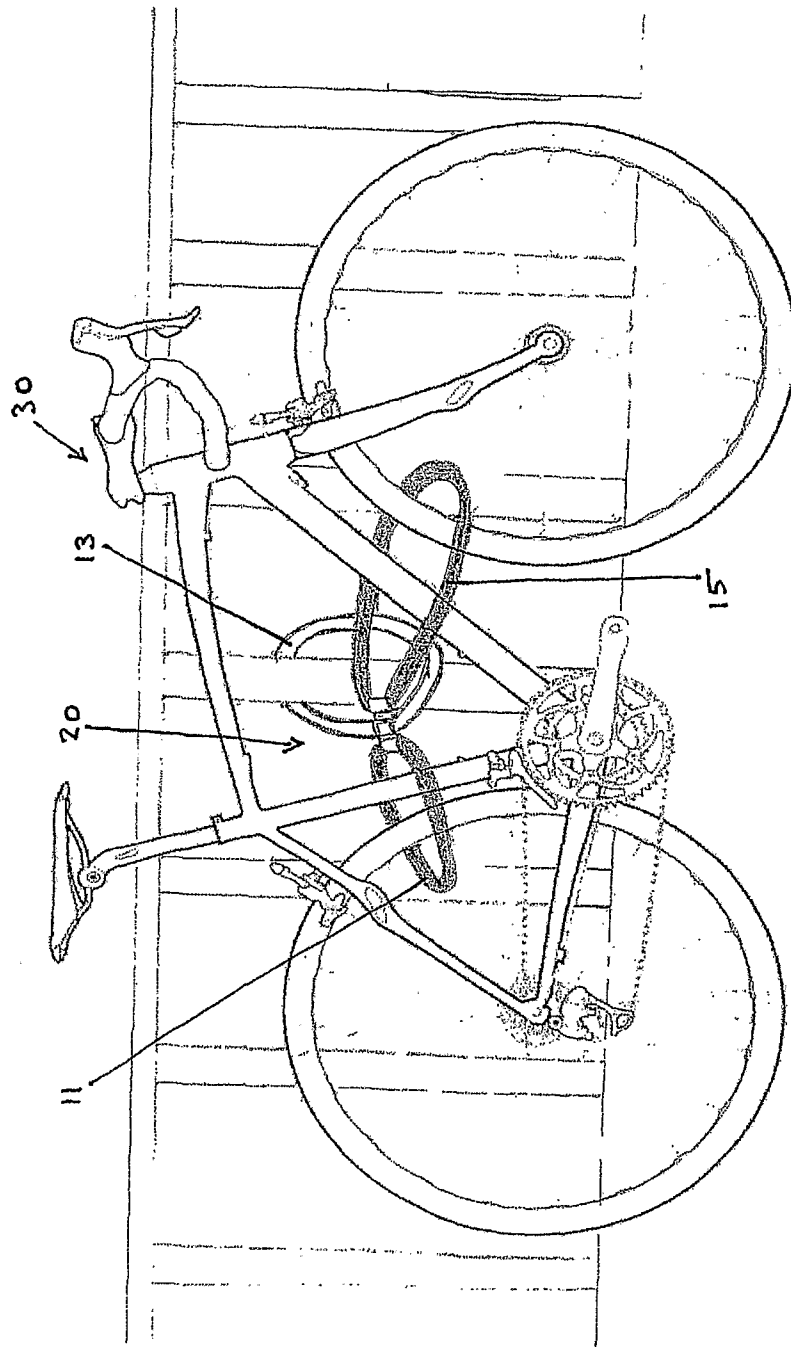


Fig. 5