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(54) **A pulling tackle.**

(57) In a tackle comprising tackle blocks (10, 11) with sheaves or pulleys (12,13) and a tackle fall (15) passed over the pulleys, both end portions (16, 17) of the fall are releasably fastened to one (10) of the tackle blocks by means of a locking device (23). This means that the user may operate the tackle either by pulling one of the tackle end portions and thereby obtain a mechanical advantage which is normal for a tackle of that type, or pull both of the tackle end portions (16, 17) simultaneously, and thereby obtain a mechanical advantage which is only half of that normally obtained.

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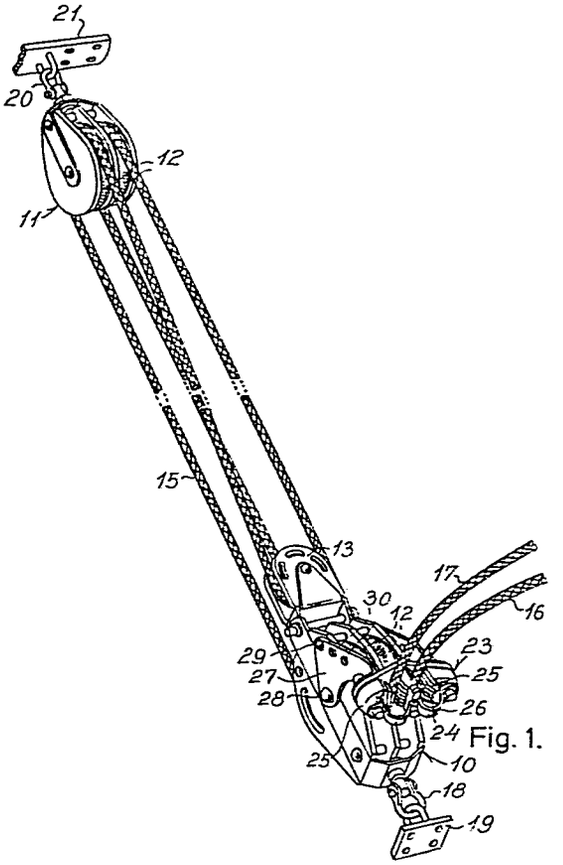

Fig. 1.

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A PULLING TACKLE

The present invention relates to a pulling tackle comprising at least two blocks, each having a number of pulleys, a tackle fall having two end portions and extending between the blocks and being passed over the pulleys thereof, and a releasable locking device associated with one of the blocks for releasably locking the fall in relation thereto.

Such pulling tackles are used for example on board in sailing boats or ships, in hoists, as wire stretchers, or, more generally, in cases where a manually or possibly mechanically generated pulling force is to be augmented a certain number of times. In the known pulling tackle one end portion of the tackle fall - the so-called standing part - is fixed to one of the blocks, while the other end portion of the tackle fall - the so-called hauling part - is to that which the manual or mechanical pulling force is applied. In principle, both tackle blocks may be moveably or loosely arranged. However, normally the block from which the free end of the hauling part extends, is fixed, while the other block is moveable or loose. As mentioned above, tackles of the above type may be used on board in sailing ships, for example for stretching ropes and wires, for moving the boom, etc. In this connection it is known to provide the fixed block with a releasable locking device for releasably locking the end of the hauling part. This known locking fastening device comprises a channel for receiving the hauling part and defined between a pair of swingably mounted locking members or excentrics allowing movement of the hauling part along the channel in the direction of a pulling force applied to the free end of the hauling part, but preventing movement of the hauling part in the opposite direction. When it is desired to ease off or slack the hauling part, the hauling part may be moved out of the channel defined between the locking members while a pulling force is applied to the hauling part.

The known locking device described makes it possible to lock the hauling part and thereby maintain a desired total length of the tackle also when the tackle blocks are exposed to oppositely directed pulling forces. Furthermore, it is possible to make a quick adjustment of the tackle length either by pulling the hauling part of the tackle fall in order to reduce the length of the tackle, or by releasing the hauling part from the locking device and slacking the hauling part so as to increase the length of the tackle.

The mechanical advantage of the tackle, which means the ratio between the manual or mechanical pulling force applied to the hauling part of the tackle fall, and the pulling force provided by the moveable or loose tackle block, is dependent on the number of pulleys in the blocks. Thus, the mechanical advantage obtainable by means of a certain tackle cannot be changed rightaway. This is rather disadvantageous, because the resistance or force to be overcome by means of the tackle may vary substantially, for example because it is desired to use the tackle as a hoist for lifting loads of rather different weights, or the tackle is used for moving the boom of a sailing ship. In the last mentioned case the wind resistance which must be overcome in order to move the boom may vary rather substantially, and, furthermore the resistive force which must be overcome by the tackle for a given wind force, may vary during the swinging movements of the boom due to variations of the vertical distances between the forces and the rotational axis.

Therefore, when tackles of the above known type are used it is necessary to select a tackle having a mechanical advantage which is sufficient to secure that the user of the tackle will be able to apply a sufficient pulling force to the free end of the hauling part of the tackle fall when the tackle is exposed to a maximum load. However, a big mechanical advantage of the tackle also means that a relatively long length of the hauling part has to be hauled in in order to obtain a desired reduction of the the tackle length or a desired movement of the tackle blocks towards each other. Thus, for example, a doubling of the mechanical advantage of the tackle means a doubling of the length of the hauling part to be hauled in for obtaining a certain

movement of the tackle blocks towards each other. This means, that the time which is necessary for obtaining a certain reduction of the length of the tackle will be disproportionate for smaller tackle loads, and correspondingly, the time necessary for obtaining a desired increase of the tackle length by releasing the hauling part of the tackle fall will be relatively long. When tackles are used for maneuvring sailing boats the prolongation of the "reaction time" is, of course, especially disadvantageous.

The present invention provides a tackle of the type described above, which makes it possible to halve the "reaction time" or the time it takes to operate the tackle, when the tackle load is equal to or smaller than half the estimated maximum load of the tackle.

The tackle according to the invention is characterized in that the releaseable locking device is adapted to lock both end portions of the fall and to selectively release any of these end portions.

When the tackle according to the invention is used for overcoming a load exceeding half the predetermined maximum load, the tackle may be shortened like a conventional tackle by applying a pulling force to one of the end portions of the tackle fall, while the other end portion is maintained in a locked position by the locking device. However, if the force to be overcome by the tackle is about half the estimated maximum load or less, a pulling force may simultaneously be applied to both of the end portions of the fall. The pulling force to be applied by the user is then the double of that necessary when only one of the end portions is hauled, but the length of the free end portions to be hauled in is simultaneously halved, whereby the operating time will be reduced. If it is desired to slacken the fall and increase the distance between the tackle blocks, both end portions of the fall may be released simultaneously irrespective of the tackle load condition. The tackle may then be extended at least double as quickly as if only one end portion had been released, because the pulleys in one of the blocks need not rotate, whereby the frictional resistance is reduced.

The said locking device may be constructed in any suitable manner allowing a quick, selective locking and release of any of the end portions of the tackle fall. As an example, the locking device may comprise a spring biased clamping device combined with an easily operatable actuating mechanism, which may, for example, be of an electromagnetic type. As a tackle is able to transfer pulling forces only, in its locking position the locking device is preferably adapted to allow movement of each of the fall end portions in relation to the locking device in a direction tending to reduce the length of the tackle and to prevent movement of the end portions in the opposite direction. The length of the tackle may then be reduced even when the locking device is in its locking position, by hauling in one or both of the fall end portions.

In its preferred embodiment the locking device defines a pair of adjacent channels for receiving a respective one of the fall end portions therein, at least one of the opposite wall portions of each channel including a fall engaging surface part formed on a locking member mounted moveably so as to prevent movement of the respective fall end portion in relation to the channel in a direction towards the associated block and so as to allow movement of said end portion in the opposite direction. As explained above, any of the fall end portions may be hauled in so as to reduce the length of the tackle while the end portions remain in their respective channel. However, when the user releases his hold of the end portion or portions so that the respective fall end portion tends to move in the channel towards the associated block, the frictional forces generated between the fall end portion and the engaging surface part of the locking member cause the locking member to move so as to wedge the fall end portion in the channel. If it is desired to slacken the fall so as to obtain a quick extension of the tackle, one and preferably both of the fall end portions are pulled out from the channel or channels and released.

The said end portions of the tackle fall may be in the form of separated free end portions. However, the free ends of the fall end portions are preferably interconnected so as to form an endless tackle fall. Thereby it may be obtained that the tackle fall is displaced in relation

to the locking device during repeated uses of the tackle so that the wear of the fall caused by the locking device will not always take place at the same location of the fall.

The locking device may be mounted stiffly in relation to the associated block. Thus, the tackle block and the locking device may be fastened to the same body such as the hull of a ship or boat. Alternatively, the locking device may form part of or be fastened directly to the associated tackle block which may then be swingably or otherwise moveably mounted on the hull of a ship or another supporting structure or body, if desired. In that case the relative position between the locking device and the associated tackle block cannot change during use of the tackle.

However, in certain cases it may be desirable to allow a certain mutual movement of the locking device and the corresponding tackle block. This may, for example, be the case when a person operating the tackle wants to remain at the same position, even if the position of the free or loose tackle block and, consequently, also the direction in which the tackle extends, is changed during use. As an example, the situation occurs when the tackle is used for moving the boom or other moveable parts of a sailing boat or ship. In order to allow such a limited relative movement the locking device and the associated block may be interconnected by resilient connection means.

It should be understood, however, that although normally not preferred, the locking device and the associated block may be even more freely moveable in relation to each other. Thus, for example, the locking device may be fastened to the hull of a ship or another supporting structure while the associated tackle block is connected to that structure only by means of the tackle fall.

The invention will now be further described with reference to the drawings, wherein

Figs. 1 and 2 are perspective view showing tackles according to the invention with different mechanical advantages,

Fig. 3 is a tackle corresponding to that shown in Fig. 1 and operated by hauling one of the end portions of the tackle fall,
Fig. 4 is a tackle with a bigger mechanical advantage being operated by hauling both of the fall end portions simultaneously, and
Fig. 5 is a further embodiment of the tackle according to the invention with a mechanical advantage corresponding to that of the tackle in Fig. 1.

All of the embodiments of the tackle according to the invention shown in Fig. 1-4 comprise a fixed tackle block 10 and a loose or free tackle block 11. Each of the tackle blocks comprises one or more rotatably mounted pulleys or sheaves 12,13, and 14, and a so-called fall 15 is passed over these pulleys or sheaves so that free end portions 16 and 17 thereof extend out from the fixed tackle block 10.

The fixed tackle block 10 may comprise an eye 18 which may be swingably connected to a mounting member 19 (Fig. 1) which may be fastened to a stationary object or structure such as the deck of a boat or ship. Similarly, the loose or free tackle block 11 may comprise an eye 20 swingably connected to a mounting member 21, which may be fastened to a moveable part, such as a boom of a sailing boat or ship. The free block 11 of the embodiments shown in Figs. 2-4 may in a corresponding manner be fastened to a moveable part by means of an eye 20, while the fixed block 10 may be stationarily fastened by means of a joint 22 or another device allowing a certain restricted movement of the block.

In the embodiment shown in Figs.1-4 a locking device 23 for releaseably locking the free end portions 16 and 17 of the fall is mounted on the fixed block. The fastening device defines a pair of channels for receiving a respective one of the end portions 16 and 17, and these channels are defined between a stationary central part 24 and a pair of swingably mounted eccentrics 25, vide Figs. 1 and 5. The opposite side surfaces of the central part 24 as well as the inner surfaces of the eccentrics 25 are serrated so as to increase friction, and the eccentrics 25 are formed and mounted so that the end portions 16 and 17 of the fall may simultaneously or separately be pulled outwardly as

indicated by arrows and as illustrated in Figs. 3 and 4. However, the end portions cannot be moved in the opposite direction, because such movement will cause the respective eccentric to be moved so as to wedge the end portion between the serrated surface part of the eccentric and the opposite serrated surface part of the central part 24. When it is desired to release one or both of the fall end portions 16 and 17 this may be obtained by pulling the end portion or portions outwardly and simultaneously in a direction towards U-shaped bridging members 26 bridging the channels so as to pull the end portion or portions out of engagement with the eccentrics 25. Provided that the tackle is exposed to tension, the tackle may be extended by easing off or completely releasing one or both of the fall end portions. When the tackle has obtained the desired length the end portion or portions of the fall may be reintroduced into the channel or channels and brought into engagement with the central part 24 and the eccentrics 26 so as to be locked automatically.

In the embodiments shown in Figs.1-4 the locking device 23 is mounted on the tackle block 10 by means of a pair of arms 27 allowing adjustment of the position of the locking device 23 in relation to the block 10. Thus, the arms 27 may be swung about a pin 28 and locked in a desired position by inserting a locking pin 29 into one of a plurality of holes 30 formed in the arms 27.

In the embodiment shown in Fig. 1 the fixed tackle block 10 is provided with three sheaves or pulleys of which two pulleys 12 are arranged coaxially, while the third pulley 13 is arranged at the inner end of the block and in a plane forming right angles with the plane defined by the pulleys 12. However, the free tackle block 11 is provided with only two coaxial pulleys 12, and, consequently, the tackle is a double luff. If a pulling force is applied to only one of the end portions 16 and 17 of the fall the ratio between the pulling force applied to the end portion and the force generated by the tackle will be 1:4. This means that the tackle increases the normally manual pulling force applied to one of the end portions 16 and 17 fourfold. In return, the length of the tackle is reduced only by 1/4 of the length of the fall being hauled through the channel of the locking

device 23. If, alternatively, a pulling force is simultaneously applied to both of the end portions 16 and 17 of the fall, the mechanical advantage of the tackle will be 1:2, which means that the tackle will only double the total pulling force applied to the two end portions of the fall. In return, the length of the tackle will be reduced by half the length of the fall end portion being hauled through the channel of the locking device 23. It is understood that one and the same tackle allows for choosing between two different mechanical advantages, because it is possible to pull either one of the fall end portions or both of the fall end portions simultaneously. Thus, it is possible to choose the mechanical advantage being the most preferred in a certain situation in view of the force which is to be overcome by means of the tackle.

In the embodiment shown in Fig. 2 the free tackle block 11 comprises only a single sheave or pulley 13, while the fixed tackle block 10 comprises two coaxially arranged pulleys 12. If only one of the fall end portions 16 and 17 of this embodiment is pulled, the tackle will double the pulling force applied to the end portion, and if both end portions are pulled simultaneously, the mechanical advantage will be 1:1, which means that the pulling force supplied to the fall end portions will not be increased by the tackle.

The tackle shown in Fig. 3 is a double luff like that shown in Fig. 1, and in Fig. 3 it is illustrated how one of the fall end portions 16 may be pulled, whereby the tackle will multiply the pulling force applied to the fall end portion by four.

In the embodiment shown in Fig. 4 the free tackle block 11 comprises two coaxially arranged sheaves or pulleys 12 and a sheave or pulley 13 arranged at the end of the block just like the fixed block 10 shown in Fig. 1, and in Fig. 4 the fixed block 10 is provided with four sheaves or pulleys 12, which are coaxially mounted in pairs and rotatably about parallel axes. Thus, the tackle shown in Fig. 4 is a threefold tackle. If only one of the fall end portions is pulled, the tackle will multiply the pulling force applied to the end portion by six. If, however, both of the fall end portions 16 and 17 are pulled

simultaneously as illustrated in Fig. 4, the pulling force applied to the fall end portions will be multiplied only by three.

The tackle shown in Fig. 5 is a double luff just like that in Fig. 1. However, the tackle shown in Fig. 5 comprises in addition to the fixed tackle block 10 with the coaxial sheaves or pulleys 12 a further fixed tackle block 31, which has only one sheave or pulley, and which is fastened to a fixed rail 32. The fall 15 is passed over a pair of coaxial sheaves or pulleys mounted in a further tackle block 33 which is fastened to a moveable part, such as a boom 35 by means of a mounting member 34. The fixed tackle block 10 may then be mounted on the hull or deck (not shown) of a sailing boat or ship, while the rail 32 may, for example, be arranged on the roof on the deckhouse, and the tackle block 31 may be arranged displaceably along the rail 32, if desired. The locking device 23 is mounted on an arm 36 swingable around a vertical stud to the upper end of which the fixed tackle block 10 is moveably connected, for example by means of a universal joint. The tackle block 10 is biased in an upward direction and is maintained in an upright position by a coil spring 37, which is arranged between the arm 36 and the block, and which surrounds the stud, so as to allow a certain relative movement between the locking device 23 and the tackle block 10. When one of the fall end portions 16 and 17 is pulled, the boom 35 will be influenced by a pulling force which is four times the force applied to the fall end portion. If both of the fall end portions 16 and 17 are pulled simultaneously, the force applied to the fall end portion is only doubled.

The tackle block 10 in Fig. 5 may be a so-called ratchet block having sheaves or pulleys which may rotate only in the direction in which the fall end portions are pulled in order to reduce the length of the tackle. Consequently, the frictional resistance between the fall and these pulleys are substantially increased when the fall end portions are pulled in the opposite direction after having been released from the locking device 23. If desired, the ratchet block may be changed to function as a normal block by operation a change-over member 38.

While the tackle according to the invention is especially being described in connection with its use on board in a boat or ship it should be understood that the tackle according to the invention may advantageously be used also within other fields, where tackles are normally used, for example in hoists, as wire stretchers, etc. It should also be noted that the pulling force applied to the end portions 16 and 17 of the fall need not necessarily be provided manually, but may also be provided mechanically. Furthermore, the locking device 23 shown in the drawing may be replaced by any other type of locking device allowing an easily releasable and selective locking of one or both of the end portions of the fall. Even though the fall end portions are shown as free end portions in the drawing, it may in some cases be desirable to interconnect the free ends of the fall end portions so as to obtain an endless tackle fall.

CLAIMS

1. A pulling tackle comprising at least two blocks (10,11,33), each having a number of pulleys (12-14), a tackle fall having two end portions (16,17) and extending between the blocks and being passed over the pulleys thereof, and a releasable locking device (23) associated with one of the blocks for releasably locking the fall in relation thereto,
characterized in that the releasable locking device (25) is adapted to lock both end portions (16,17) of the fall and to selectively release any of these end portions.

2. A tackle according to claim 1,
characterized in that in its locking position the locking device is adapted to allow movement of each of the fall end portions (16,17) in relation to the locking device in a direction tending to reduce the length of the tackle and to prevent movement of the end portions in the opposite direction.

3. A tackle according to claim 2,
characterized in that the locking device (23) defines a pair of adjacent channels for receiving a respective one of the fall end portions (16,17) therein, at least one of opposite wall portions of each channel including a fall engaging surface part formed on a locking member (25) mounted moveably so as to prevent movement of the respective fall end portion (16 or 17) in relation to the channel in a direction towards the associated block (10), and so as to allow movement of the said end portion in the opposite direction.

4. A tackle according to claim 3,
characterized in that the moveably mounted locking member (25) is swingable about an axis eccentrically positioned in relation to the fall engaging surface part thereof.

5. A tackle according to any of the claims 1-4,
characterized in that the free ends of the fall end portions (16,17) are interconnected so as to form an endless tackle fall (15).

6. A tackle according to any of the claims 1-5, characterized in that the locking device (23) is mounted stiffly in relation to the associated block (10).

7. A tackle according to any of the claims 1-6, characterized in that the locking device (23) and the associated block (10) are interconnected by resilient connecting means (37).

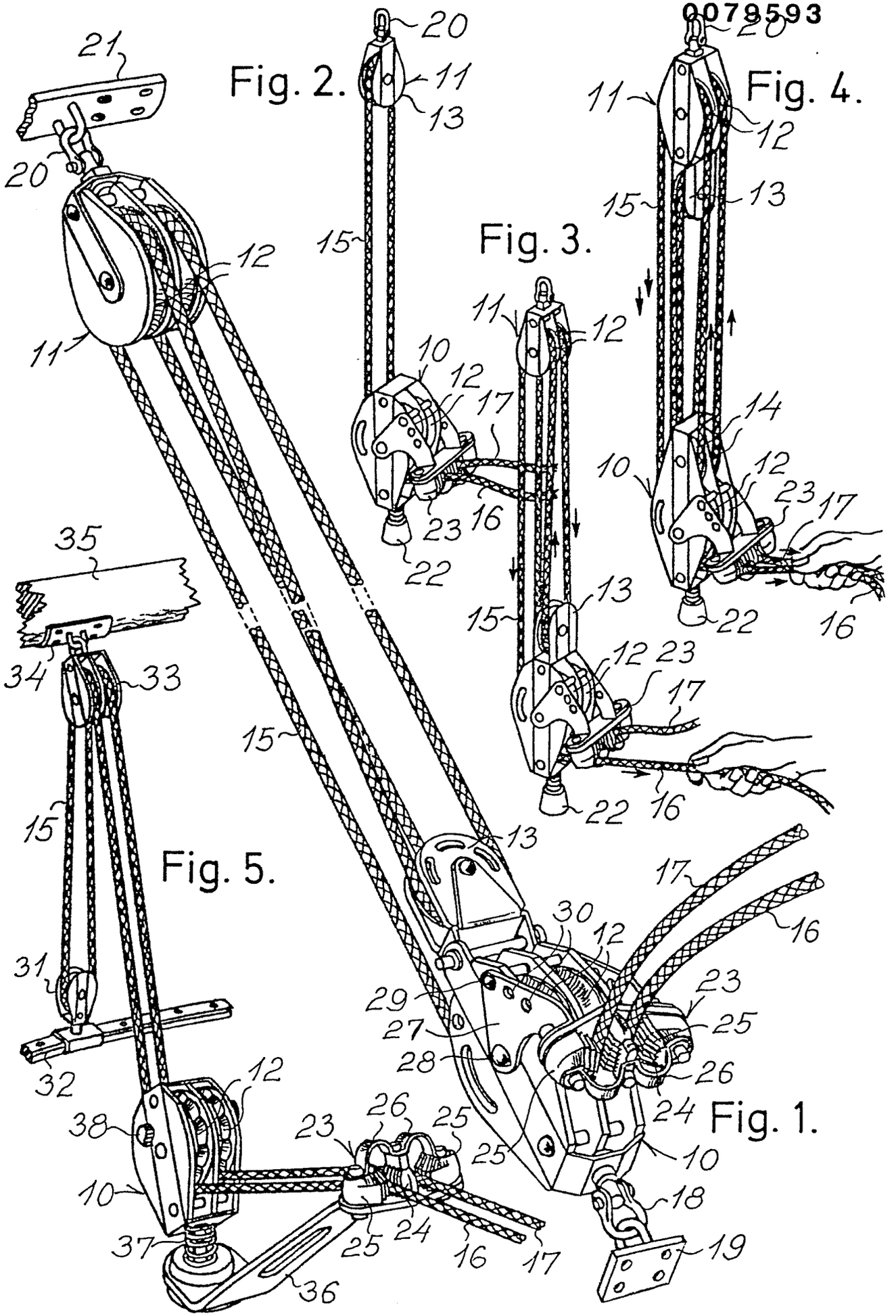

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.