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# FASTENERS FOR BUILDING STRUCTURES

## Description

### Technical Field

The present invention relates to a fastener for building structures according to claim 1. The fastener according to the invention is used in the building industry and can be used for the construction of devices made of wood (wood beams, round timber logs) or of other building materials that allow for slight change in shape, linear or spatial displacements, and volume or density changes, depending on time and external environmental influences.

### Prior Art

According to the prior art, a fastener for the construction of wooden structures and devices is already known which contains an angular screw head for a matching wrench, a pin having the thread along the outer cylinder surface, a stop element, and a spring. In the system, the angular head is fixedly connected to the threaded pin, between the head and the thread on the other side of the rod, an upper and a lower stop element with a spring therebetween are coaxially threaded onto the smooth part of the rod, which spring can be displaced axially. (RU 90510 U1). This fastener ensures a substantial reduction of crack formations between the connected parts of the construction, which arise as a result of shrinkage and longitudinal displacements due to the increase in the unit force. However, the use of a cylindrical spring and flat standard protective washers does not seldom lead to loss of attachment stability, to a possible spring slope relative to the common axis, to the loss of the construction quality, and to increasing costs as a result of the replacement of system parts or their exchange.

The defects of this fastener were partially eliminated by a fastening assembly for the connection of wood construction parts using a pin which has a fixed head (RU 180024 U1). A conically-formed spring with the turn of the smallest diameter on the lower surface of the pin head and a stop element beneath it are threaded coaxially onto the upper side of the cylindrical portion of the pin, which stop

element provides the support option for the spring turn with the greatest diameter and which basically is an annular washer with an upright flange on the outer edge, which creates a cavity between the central washer hole and the flange. These two parts can be displaced axially. Instead of the pin with a head, a steel screw can be used, where the outer edges of said screw head can be designed to match a wrench. A series of design solutions for this fastener was directed to the improvement of the fastening and the positioning; for example, the lower cylindrical portion was designed with a smaller diameter than in the upper cylindrical portion, and the coupling region between these two portions is conical in design; and the lower cylindrical portion can be designed with a conical tip.

The use of a conically-formed spring in which each subsequent turn is partially positioned in the preceding turn during compression did not completely solve the problem of the angling of the axis of the fastening system when tightened it in the wood. The design of the lower stop element still does not allows a clear positioning of the spring on the pin axis; the annular upright flange hinders the complete "opening" of the lower spring turn for the purpose of a tighter arrangement of all turns, requires a more accurate dimensional accuracy of the diameter of the lower spring turn and of the washer, and also makes it impossible to increase the number of spring turns when the degree of hardness of the entire element is required. It has also been found that the spring turns, which are by default produced with a right-hand thread, i.e., wound with an increase in diameter in the clockwise direction from the top to the bottom, still become offset relative to one another, radially bulge out, and may protrude over the boundaries of the preceding turn during the winding process and when overloaded, which leads to a spring exchange.

## Presentation of the invention

It is therefore the object of the present invention to eliminate the above-mentioned disadvantages and to provide a fastener which eliminates the increased time and labor effort for the connection of wooden structures to the fastening system, eliminates the lacking possibility of pressing force, and the putative damage of the spring when the assembly is attached, and at the same time increases the connection quality due to the incorrect positioning of the spring relative to the pin axis.

According to the invention, the object is achieved by the fastener according to the invention according to Claim 1, which consists of a cylindrical pin with an angular screw head for a matching wrench located at its upper portion, a conically formed tip at its lower portion, a thread, and a threaded-on conically-formed spring, which abuts the screw head with its smallest turn, and a disc-shaped stop element to which the spring abuts with its greatest turn, wherein the stop element comprises an inner hole for receiving the pin, and having the shape of a plate turned over with the bottom in the direction of the screw head.

The conically-formed spring is wound counterclockwise and, between the angular screw head for a matching wrench and the smallest spring turn, a flat washer with an inner hole can additionally be placed. The lower cylindrical portion of the pin can have a smaller diameter than the upper cylindrical portion. The coupling region between these two portions is conical.

As a technical result of using this design, it is possible to increase the accuracy of the axial positioning of the conically-formed spring and to ensure a possible increase in the pressure force of the spring by using a plate-shaped washer. Additional results are eliminating the offset of spring turns during compression by using a conically-formed spring with a left-hand winding, and ensuring the reduction of frictional forces during screwing in and loading direction along the axis of gravity of the fastening assembly by using an additional flat washer under the hexagonal head. For connecting elements with lower density ratios and for simplifying assembly, a pin can be used in which the lower cylindrical portion of the pin is designed to have a smaller diameter than the upper cylindrical portion. The coupling region between these two portions is conical.

Brief description of the drawings

Further goals, features, advantages and possible applications of the fastener according to the invention emerge from the following description of an embodiment with reference to the drawings.

In the drawings:

Fig. 1 shows the fastener according to the invention in an advantageous embodiment;

Fig. 2 shows a detailed representation of the plate-shaped washer;

Fig. 3 shows different variants of the use of the fastener.

Embodiment of the invention

The cylindrical pin 1 consists of the angular screw head 2 for a matching wrench, the upper portion 3, the lower portion 4, on which the conical tip 5 is designed and the thread 6 is arranged. In the case of a difference in diameter in the portions 3 and 4, the coupling region 7 between these two portions of the pin 1 is conical. The conically-formed spring 9, which is threaded onto the pin 1, abuts the head 2 with the smallest turn 8. The greatest turn 10 abuts against the plate-shaped washer 11, which is threaded onto the pin 1 through the inner hole 13 in the bottom 12, with the bottom 12 up.

The conically-formed spring 9 is shown with a left-hand winding, where the increase in the turn diameter runs counter-clockwise from the upper to the lower turn for the purpose of increasing frictional forces when screwing in the fastener, the outer contact surfaces of the turns 8 and 10 of the conically-formed spring 9 were designed to be flat, for example, by grinding.

If the angular screw head for a matching wrench 2 is designed to be annular without a base, a flat washer 14 with the inner hole 15 is placed between the turn 8 with the smallest diameter and the head 2 of the pin 1.

The fastener is assembled, adjusted and functions as follows: For the purpose of connecting elements 16 and 17, a recess 18 is generally prepared on the element 16 to be connected, in the middle of which a through-hole 19 is formed coaxially with respect to the recess walls, into which through-hole 19 the central pin 1 is set with the flat washer 14 (if required), the conically-formed spring 9 and the washer 11, which are threaded onto said pin in this order. The size of the diameter of the recess 18 should exceed the diameter of the washer 11 for the purpose of

unobstructed opening of the turn 10 of the spring 9 with small tolerance. The through-hole 19 is designed with a diameter corresponding to the total diameter of the upper portion 3 and of the lower fin 4 of the pin 1 or with a small tolerance. In this case, the fixed clamping of the upper portion 3 of the pin 1 by the material of the element 16 to be connected is ruled out, and the pressing force of the conically-formed spring 9 is exerted to the full extent over the entire duration of the connection work. The conical tip 5 facilitates the entry of first turns 6 into the material of the element 17.

In the case of a low density of the material of the elements to be connected and a lower probability of the clamping of the upper portion 3 of the pin 1 by the material, a central pin 1 is used which has an upper portion 3 of greater diameter than the lower portion 4. To simplify the entry of the pin 1 into the material of the element 16 during screwing, the coupling region 7 therebetween is designed to be conical. Such a design of the central pin 1 is manufacturing-friendly and allows the attachment of the fastener without having to prepare a through-hole 19 in the element 17 to be connected.

While the thread 6 is screwed into the material of the element 17 with a tool (screwdriver) which rotates the head 2 of the pin 1, the lower turn 10 opens completely up to the fixed compression of all turns of the conically-formed spring 9, without counteracting obstacles at the edge of the disc-shaped stop element plate 11. In the process, the lower turns of the conically-formed spring 9 are additionally centered on the bottom 12 of the washer 11, since they abut against one another and reproduce the trapezoidal shape of the bottom surface 12 of the washer 11 at its inner surfaces and thus preclude the possibility of offset relative to the axis of the pin 1.

The left-hand winding of the conically-formed spring 9 additionally favors the successive application of the turns when the pin 1 is rotated clockwise, since the direction of rotation does neither affect the radial offset nor the “ejection” of fins, but their centering on the axis of the pin 1.

If the hexagonal head 2 of the pin 1 is designed without an annular base, the use of a flat washer 14, especially in combination with the contacting, polished surface of the upper turn 8 of the conically-formed spring 9, will promote the orientation of the load on the axis and facilitate the sliding of the head 2 during assembly of the fastener.

Such design solutions on the fastener, such as the embodiment of the special washer 11 in the form of a plate with its bottom turned upward, and the left-hand winding of the conically-formed spring 9, increase the installation quality by positioning the assembly on the axis, exclude the scrapping of a spring, enable the increase of contact pressure of the assembly by increasing the number of turns and the reduction of the working effort during installation. The different design of the pin 1 enable the use of the fastener for connecting elements of different densities.

List of reference signs

| | |
|---|---|
| 1 | Cylindrical pin |
| 2 | Angular screw head |
| 3 | Upper portion of the pin |
| 4 | Lower portion of the pin |
| 5 | Conical of the pin |
| 6 | Thread |
| 7 | Coupling region |
| 8 | Smallest turn |
| 9 | Conically formed spring |
| 10 | Largest turn |
| 11 | Disc-shaped stop element |
| 12 | Bottom |
| 13 | Inner hole |
| 14 | Flat washer |
| 15 | Inner hole on the flat washer |
| 16, 17 | Elements |
| 18 | Recess |
| 19 | Through-hole |

PATENTKRAV

1. Fastgørelseselement til bygningskonstruktioner, hvilket fastgørelseselement består af en cylindrisk stift (1) med et kantet skruehoved (2) på den øvre del (3), og som passer til en egnet skruenøgle, og en konisk spids (5) på den nedre del (4), et gevind (6) og en konisk dannet fjeder (9), der er viklet deromkring, og som med den mindste vinding (8) ligger an mod skruehovedet (2), og et skiveformet anslagselement (11), mod hvilket fjederen (9) ligger an med den største vinding (10), idet anslagselementet (11) omfatter et inderhul (13) til modtagelse af stiften (1) og har form af en tallerken med bunden (12) vendt på hovedet i retning af skruehovedet (2), **kendetegnet ved, at** fjederen (9) har en venstreskåret vinding.

2. Fastgørelseselement (1) ifølge krav 1,

**kendetegnet ved, at**

skruehovedet (2) omfatter en ringformet underdel.

3. Fastgørelseselement (1) ifølge krav 1,

**kendetegnet ved, at**

en flad skive (14) med et inderhul (15) desuden er fastgjort til den cylindriske stift (1) mellem det kantede skruehoved (2) til en passende skruenøgle og den mindste vinding (8) på den koniske fjeder (9).

4. Fastgørelseselement (1) ifølge et af de foregående krav,

**kendetegnet ved, at**

den nedre cylindriske del (4) af stiften (1) er udført med en mindre diameter end den øvre cylindriske del (3), idet koblingsområdet (7) mellem de to dele (3, 4) er dannet konisk.

Fig. 1

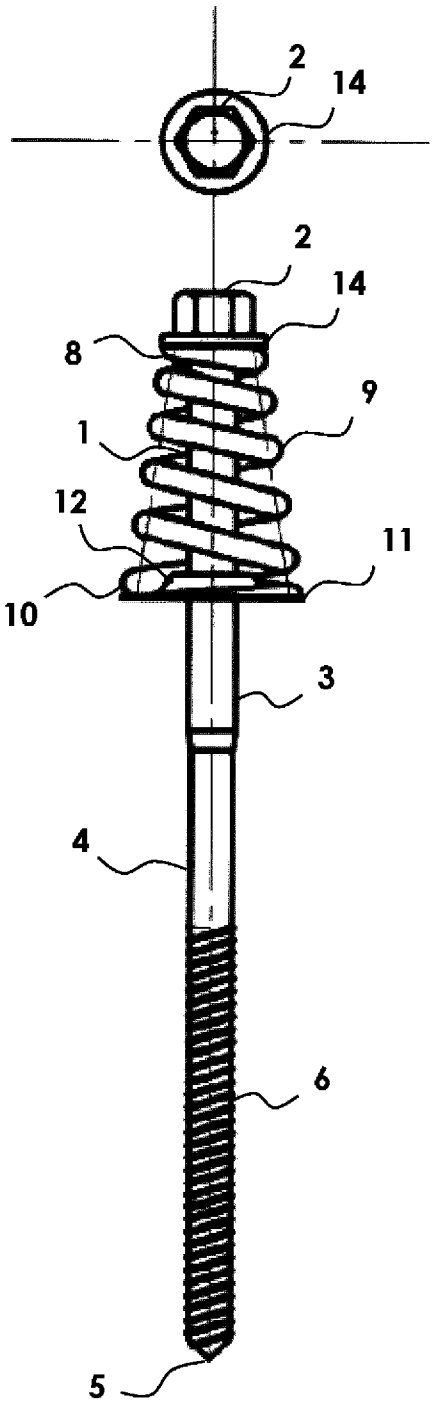

Fig. 2

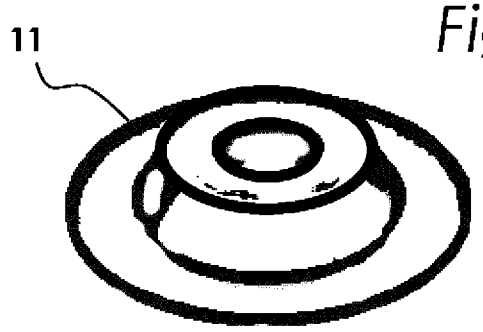


Fig. 3