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BY A. P. C.

E. LATSCHER-LATKA

TURNSPRING

Filed July 12, 1940

Serial No. 345,249

2 Sheets-Sheet 1

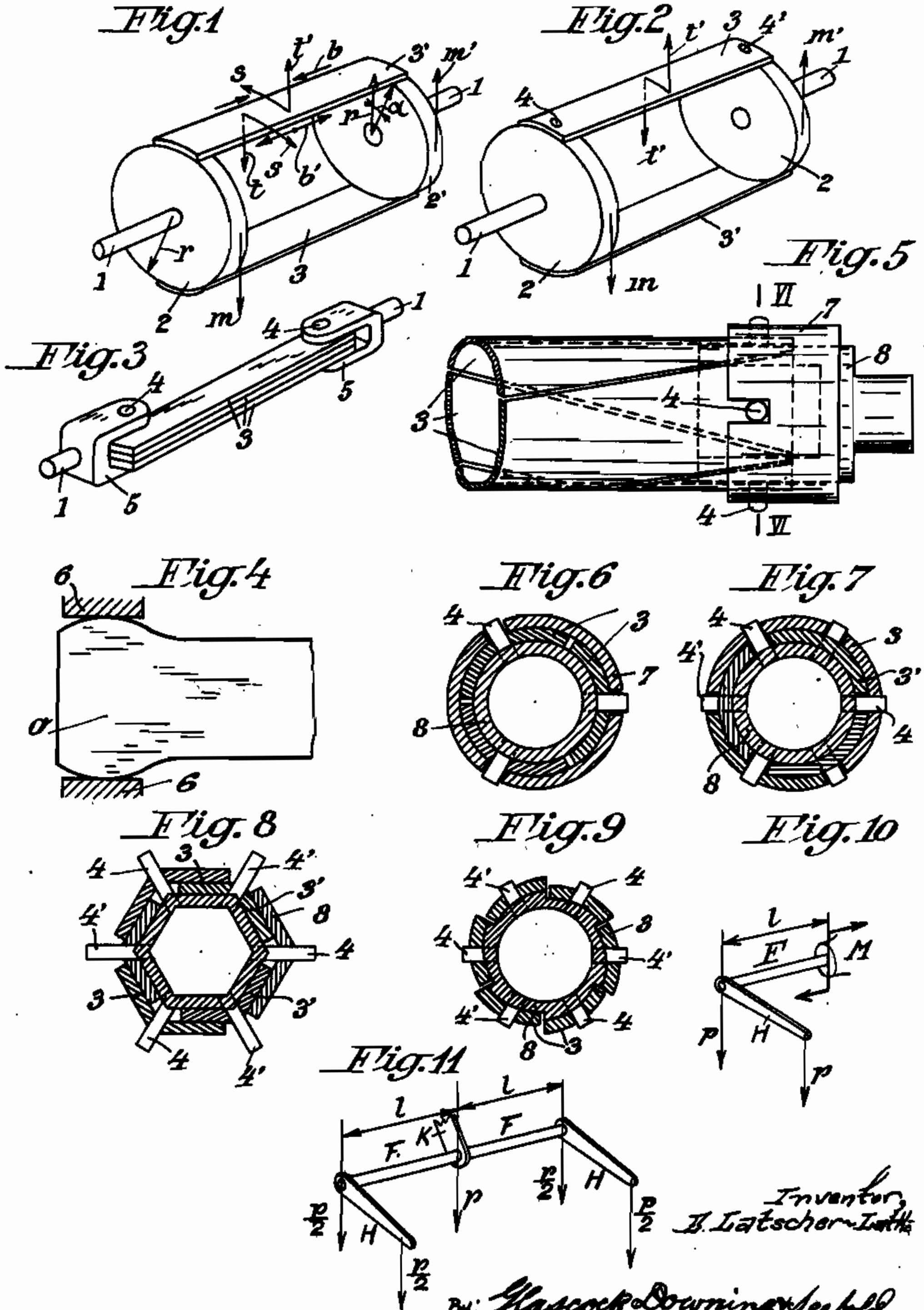

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Fig. 12

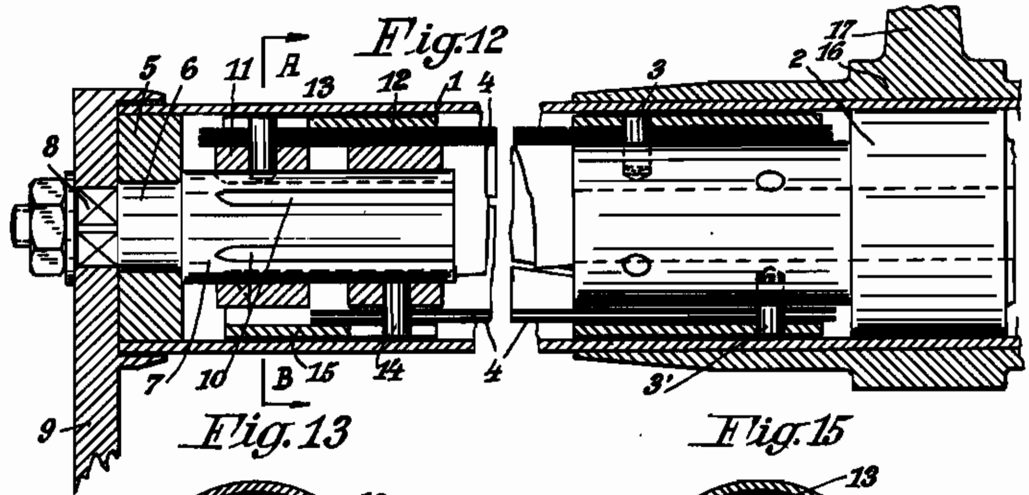


Fig. 13

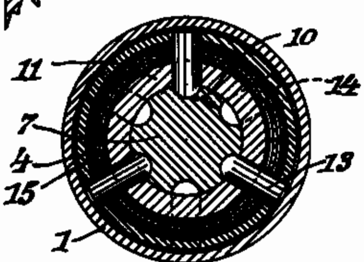


Fig. 15

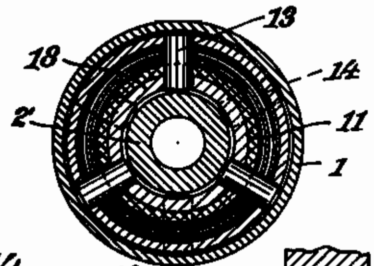


Fig. 14

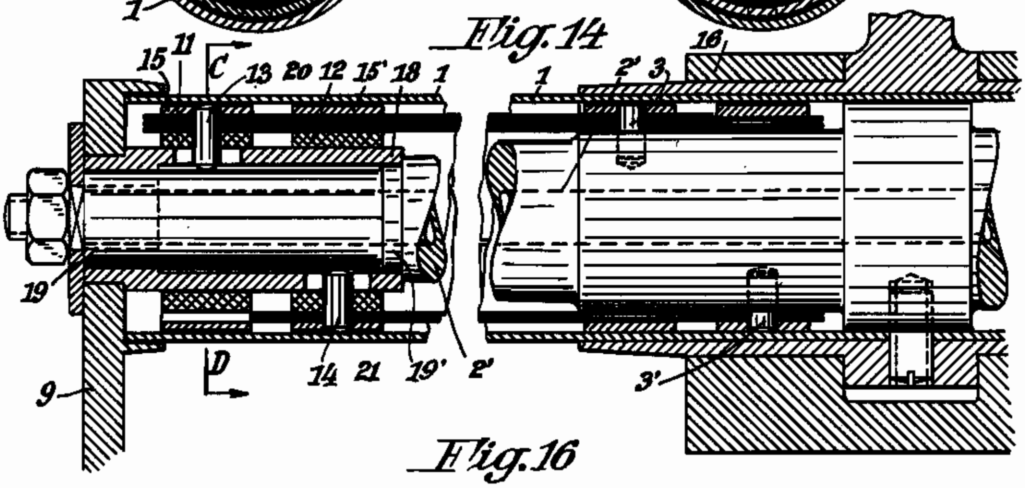
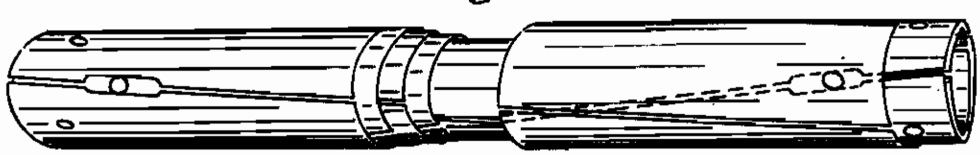


Fig. 16



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ALIEN PROPERTY CUSTODIAN

TURNSPRING

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The rod under strain of turn is being known as the simplest turnspring. But rods, which have to take upon themselves correspondingly big moments will operated hardly in consequence of the mostly restricted length of construction. Quite a number of constructions is known to be destined to rectify this inconvenience such as for instance the use of slit tubes instead of rods. It had been tried, furthermore, to produce the turnspring by putting together around a geometrical or bodily axle single small spring-blades or spring-rods or such like material, which are either essentially under strain of push or flexure or of push and flexure.

With all these turnsprings the angle of distortion produced by a certain moment will be dependent besides upon the length of time for manufacturing, also upon the distance of the elements under strain of turn or rather of flexure, upon their radial distance from the turnaxle. The angle is the smaller, the springs consequently also the harder, the bigger the distance will be of the elements under strain from the turnaxle.

In this most simple case nxa-elements for their arrangement around the turnaxle will require an nxa-times distance from it than a-elements. The hardness of the springs will, therefore, with an nxa-element be n^2-times bigger than with an a-element.

This invention's claim is now to create a turnspring with which independently from the distance of the spring-elements from the axle around which they are arranged the hardness of the spring will essentially grow in a simple relation to the number of elements. It is, therefore, aimed to create for the turnspring approximately the equal conditions as for the parcel of spring-blades under strain of flexure, where essentially there will also be only a simple combined total effect of the single spring-blades.

The basis of the invention now consists in a device of turnsprings with spring-lamellas arranged around a geometrical or material turnaxle parallelly or in a pointed angle to it and with precautionary measures in order to exclude draw tensions by means of a free axial shiftability of the lamellas or their set in means. The invention consists essentially therein that the lamellas are rotatorily arranged in their bearings on both of their final points around the geometrical or material axles, which is essentially radial to the turnaxle so that each lamella operates singly as turnspring without experiencing any practical push or flexure strain in the tangent of the circumference circuit put around the turnaxle by the lamellas.

In the drawing Figs. 1 and 2 serve to illustrate the axiom of the invention, Figs. 3 to 14 show various examples of execution, Figs. 15 and 16 show schematically the axiom of a special execution of a turnspring according to the invention.

Fig. 1 shows two disks **2**, **2'** in bearings, which may be turned and axially shifted with their pivots **1**, **1'** and are connected with the spring-lamellas **3**, **3'**. The latter are again connected with the disks so that they may be regarded as bar-like elements set in at both of their ends. If the disks will be reciprocally turned around an angle α by the moment forces m, m', push tensions s, s' and flexion tensions b, b' will appear in the rods besides the torsion strains brought about by the forces t, t'. The set-back forces created by the push- and flexion-tension effect on the disks **2**, **2'** with a set-back moment which, besides to the turning angle α, is proportional also to the radius r of the disks. Only the torsion moment t, t' of the lamella is independent of the radius and proportional only to the angle α. The set-back moment t, t' is, therefore, independent of the radial distance of the lamelly opposite to the pivots **1**, **1'** and corresponding only to the turning of the lamella in itself. If according to the invention the lamellas **3**, **3'**—as shown in Fig. 2—will be set rotatorily into bearings around radial pivots **4**, **4'**, neither push- nor flexion-tensions may arise, there only remains the setback moment t, t' of the lamelly by its torsion in itself, independently which distance the lamellas may have from the geometrical axle of the pivot **1**, **1'**.

Fig. 3 shows demonstratively a simple form of execution of a turnspring according to the invention. The spring-lamellas **3** are movable around pivots **4**, rest in corresponding bearings with the pivot **1**. The moment necessary for a certain torsion is equal to the sum total of the moments necessary for the torsion of the single lamellas around the same angle, whereby the medium and outer lamellas will show the same strain of torsion. The arrangement is comparable with a leaf-spring, whereby the friction between the lamellas here create a certain oscillation-slackening effect. Instead of around a material pivot **4** the lamellas may, as shown in Fig. 4, be also arranged around an ideal centre of motion o by making their heads in the form of a circular segment and setting them in bearings between guidances **6**.

If the spring lamellas 3, as shown in Fig. 5, are set into bearings about kernels of any form in which the centres of motion of the single lamellas are arranged, on a most favourable space the possibly largest amount of single spring-lamellas may be located and so a strong total spring-efficiency be reached; should the lamellas be not plane but made as cylinder segments, whereby each has a turn pivot 4 and all lamellas are externally clad into a cuff 7, besides the torsion strain yet flexion strains of a most complicated manner will arise as in consequence of the swinging around the pivots 4, the bending of the single lamellas will be flattened in the direction of their circumference. These strains work closely pressing and cramping between the kernel 8 and the cuff 7 and result in slackening effects when the spring swings backwards. According as to the fact of the circumference, a lamella may occupy and whether their edges go parallel the axle or in screw lines, as Fig. 5 shows, there will result a stiffness in torsion within large limits. Fig. 6 shows there will result according to Fig. 5, Figs. 7 and 8 an arrangement of two spring lamella devices, which in one case are arranged about a circular and in the other case about an hexagonal kernel. The lamellas arranged either in double or in several layers one upon the other, by a suitable transplantation of the turn pivots will enable to give some of the lamellas a torsion relay so that the effect of the spring will be different towards both sides. Fig. 9 shows the lamellas arranged around a kernel having the form of a circular saw-blade. In this case the single lamella turn-axles are not radial, but only approximately radial towards the spring-axle. The effect of the spring working differently towards both sides cannot only be reached by relaying the single lamellas or by the layer of the lamellas, but also by the lamella's form, i. e. by the arrangement of their centre of motion. According to a spring as shown for instance in Fig. 6 or 9, the lamellas formed liked a screw or not central to the centres of motion, have the additional strain of flexion, which will slacken the backswing of the spring different towards both directions. A relay to single lamellas may with a simple position of the lamellas also be imparted by transplanting the pivot 4.

Figs. 10 and 11 on the one and 12 to 14 on the other side show arrangements of springs, where the centres of motion of the lamellas, as was already shown in fig. 5, are on both ends of the springs set in circle towards one another so the edges of the lamellas run in steep screw lines. At the here shown springs the lamellas are arranged in several concentric layers, whereby the various layers of lamellas single or in groups possess an opposite gradient. Hereby the number of layers of lamellas of one group in relation to the number of layers of lamellas of the other group with an opposite gradient may be different. Since when twisting the spring the lamellas will vault stronger with the gradient turning in the sense of the turn, the lamellas with the opposite sense of turn, however, will slope down, frictional pressures will result between the lamellas lying together, which will slacken the vibration to a special extent. Axially going spring-lamellas may also be combined with those going screw-shaped. Since the turnsprings with screw-shaped running spring-lamellas in the turn sense of the screw-drive will effect softer than in the opposite sense by electing the number of lamellas passing in one or the other sense the capacity of the spring may far-reachingly be influenced.

The peculiar manner of construction of the turn-springs according to figs. 10 and 11, respectively 12 and 13 is elucidated in its effect by means of figs. 15 and 16. In fig. 10 the turn-spring F is fitted with the leverarm H on the end of which works the to be springed force p its effect. The same force works at the end of the spring and demands at the spot of insertion a moment $M=p\times 1$, which must be taken up by means of a rigid frame or such like contrivance. According to the invention as fig. 16 will show, the arrangement is made thus that in a middle body K the springs F, F' are fixed like axles, on the levers H, H' of which $p/2$ each works so that the total sum of moments

$$2\times\frac{pH}{2}$$

is the same as in fig. 15. Since the forces $p/2$, catching in at the ends of the springs, exercise opposite moments on the body K, no moment of turn will be executed in the body, but only the force p so that this body K may only be brought out as an element to receive this force, for intance likewise as levelarm. The turnspring contrivance can, therefore, be used even as turn-joint, which takes up into itself all moments. The fundamental construction of a turnspring according to the invention composes itself out of an element, which is flexure-proof and combined with the middle part K, with which are coupled the levers H, and of the proper turn-spring contrivance, working between the middle part K and the levers H.

Fig. 10 shows a turnspring according to the invention in an axle-section, where the flexion moment

$$\frac{p\times 1}{2}$$

is taken up by a flexion-proof casing. Fig. 11 shows the section according to A—B of fig. 10. In the flexion-proof tube 1, used as casing for the springs is set in the middle part 2 in the length-middle, which bears the radial pivots 3, 3' set into the axial direction, upon which the for the time being inner ends of the right- and left-going lamellas 4 are set up with drills. At the ends the tube is closed by bearing parts 5, in which by means of the bearings 8 the jointing body 7 is rotatorily fitted in. On the outward the swinging levers 9 are fitted upon the squares 8. The jointing bodies 7 are as a rule cylindric and fitted with longitudinal grooves 10. On the body 7 two rings 11 and 12 are slidingly fixed. In these rings circularly inserted there are two radial bolts 13, respectively 14, which encroach with their inner ends into the grooves 10. Upon the outer ends of the bolts 13 there are fitted, for instance, the right-going spring lamellas with drills, on the bolts 14 the left-going lamellas.

Since by twisting the pointing body 7 the spring lamellas of the one system will lengthen themselves and shorten those of the other system, the rings 11 and 12 will shift themselves alternately so that the lamellas will experience no strain of cracking at all. The longitudinally sliding rings may naturally be fitted also on the inner ends of the spring turned towards one another. One ring only can also slidingly be fitted on the outer, the other on the inner end. This will have the effect that with the longitudinal compensation the spring lamellas will shift themselves reciprocally according to their lengths and thus, in consequence of the arising friction, will bring about an increased slackening of swinging of the lamellas. Instead of the sliding rings, with more simple executions, longitudinal slits may also be provided for in the spring lamellas in order to compensate the lengths. Over the lamellas the slit swinging ring 15 is mounted, fitted with spaces to receive the pivots 13, 14, whereby a tube case 1 will prevent the ring to get loose so that the end of the lamellas, when twisted will vault, respectively flatten more strongly may, therefore, move only with a certain pressure of friction and, consequently, experience a swinging-slackening braking, which will increase with the extent of the distorsion. In proportion as to the intended hardness of the springs more or fewer layers of spring lamellas may at all events be adapted in different strength, for instance alternatively layers of left- and right-going lamellas, that is to say about three layers of left-going and two layers of right-going lamellas. Since the lamellas, when distorted in the sense of their screw-drive, are softer than in the opposite sense, by means of a different number of left- and right-going lamellas springs may be composed, which from the zero-position in the one sense of turn will effect softer than in the other sense of turn therefore, for instance, in one sense as proper turnspring, in the other sense of turn as shock-damper.

The cover-tube 1 may in any case, for instance by welding, be attached to the cardan. In the present example of execution it is fitted in the ring 16 which, for instance, also carries a swing-lever 17 so that the spring as such forms a link between two swing-lever systems 9 and 16.

The example of execution according to figs. 12 and 13 differs as compared with the described one by the fact that it is not the cover-tube which carries, but the middle part is worked out into a turnproof axle by being lengthened on both sides to bodies 2' of an equal resistance of distorsion. To reduce weight the axle may be made hollow. There are liners 18 on the axle-ends, turnable on the bearing planes 19 and 19' and fixed on lever 9. These liners have slits 20 and 21, through which the pivots 13, respectively 14 encroach similar to the first example of execution through the sliding rings 11 and 12 and on the other ends of them the spring lamellas are mounted, which are clasped by the split spring rings 15, 15'. An outer gasket tube 1 allows to put the spring, same as with the first example, into a lubricant oil. The middle part 2 is set into bearings not rotatorily in a bearing-jack 16 of the like.

Fig. 14 shows demonstratively several bearings of alternatively right- and left-going spring lamellasystems. Also axle-parallel lamellasystems with right- or left-going lamellasystems may be combined. In the simplest case several layers of parallel springs may be arranged and set in a circle around the turnaxle. This kind of construction must be preferred, where a smaller slackening of springs will be desired.

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