# PATENT SPECIFICATION

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Complete Accepted : Jan. 7, 1927.

COMPLETE SPECIFICATION.

## Improvements in Elastic Links or the like.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to loop or bow shaped plate or strap springs, each side of the loop or bow being formed of curved plates secured together at their ends. Such springs have been proposed for various purposes as elastic links adapted to be stressed by collinear forces applied at the ends, for example, in chains and spring balances. The object of this invention is to obtain in compact form a device capable of storing a large amount of elastic energy and of acting also as a resilient stop when the load exceeds a given limit without creating excessive stresses in the material used. The invention is intended mainly for use as a stabilizing spring link for my power converter, such as is described in my British Specifications Nos. 206,204, 217,271, 217,684, 218,406, 220,706 and 229,357, but it has numerous other applications, such as to elastic coupling rods generally, to motor car and vehicle springs, as coupling springs, to cranes or other machines for lifting weights, and to chains generally. In the application to these and similar cases the link combines the functions of an extensible spring and a stop, since as the tension increases the leaves tend to straighten, the rate of deformation tending progressively to zero as a limit.

According to my invention each side of the loop or bow is built up of a number of plates or laminæ bent into approximately sine curve form. The plates are assembled so that when under no load each of them touches the adjacent plates at or near the points of inflexion, that is, where the curvature is zero, but are separated elsewhere, this separation being effected by thickening the ends of the plates or by interposing distance pieces between them. The plates or laminæ are securely fastened together at the places where the ends of the bow or loop meet, but if they are bent into a number of waves it is not necessary for them to be fastened together at intermediate points where they meet or approach.

In the annexed drawings, which show practical embodiments and applications of my invention, Figure 1 shows in elevation and plan a single bow spring each side of which is composed of several leaves, Figure 2 shows on a greatly exaggerated scale a part of one side of the spring shown in Figure 1, Figures 3, 4 and 5, show alternative means for connecting the leaves together, Figure 6 shows an elastic tension rod comprising several bows, each side consisting of a plurality of leaves, Figure 7 shows the application to my power converter, Figure 8 shows the application to a vehicle as a shock-absorber, Figure 9 shows the application to a chain flexible in one plane only, Figure 10 shows the application to a chain flexible universally, and Figure 11 shows the application to a crane.

It will be understood that as regards the plates, Figures 1 and 3 to 11 inclusive are diagrammatic only in that they do not show a separation between the leaves and in some cases show only one leaf. The construction shown in Figure 2 applies to them all, and in every case the sides of the bows or loops consist of a plurality of leaves.

Figure 1 shows a bow in plan and elevation each side consisting of four leaves, two of which are referred to by the numeral 4. The leaves form sine curves and their ends are secured together by plates 5 and rivets 6. 7 are pins passing

through holes in the leaves by which the spring is secured to an adjacent object.

Figure 2 shows on an exaggerated scale parts of two adjacent leaves of the arrangement shown in Figure 1. The figure shows two leaves shaped so that in their unstrained state the medial lines 10*a* of their longitudinal sections form equal sine curves. The object is to ensure that each leaf may bend or straighten freely without frictional or other interference from the adjacent ones. The feature to be noted is that the two leaves 8 and 9 are separated at their ends by an interval *d*. This avoids frictional or other interference between the leaves which when assembled touch at their points of inflexion while unstrained, as shown at 10 in the figure. When tension is applied to the ends of a spring so built up the leaves tend to separate and no frictional or rubbing effect arises between them. The diagram is as stated very much exaggerated. For example, if the dimension *b* is 120 m/m and *f* 30 m/m, *a* will be about 1 m/m and *d* about .1 m/m. An approximate dimension is given by $d=a/10$ if $b=4f$. It will therefore be sufficient in general to coat the ends of the leaves with paint, or still better with tin, or to galvanize with a coating of metal $\frac{1}{20}$ m/m thick in the above example, or to insert layers of paper or metal before riveting the ends.

According to another method each leaf may be made of thicker section at its ends. This may be effected by stretching the leaves when softened by heat, the ends being firmly held.

Figure 3 shows another mode of assembly in which two plates 12 are riveted outside the leaves, securing holes 13 being bored in the plates 12.

Figure 4 shows a similar method, in which a single plate 12 is used.

Figure 5 shows a method of assembly in which the leaves are secured together by eyelets or sleeves 14 which are riveted over as shown.

Figure 6 shows an elastic tension rod consisting of plates or leaves bent so as to form a number of bows. Each side 15 and 16 consists of several leaves as in the case of a single bow. The leaves are fastened together at the ends only. There is no occasion to fasten them together at the intermediate points 17.

Figure 7 shows the application to a rotary power converter such as is described in my prior specifications above referred to. 18 is a shaft to which unidirectional motion is communicated by ratchets or the like 19 which are linked to a common pivot 20. It may be necessary to stabilize or limit the motion of this pivot which is reciprocated in the direction of the arrows by means described in the said prior specifications. In the form shown this stabilization or limitation is effected by a pair of bow or loop springs 21 such as are described above which are connected to the pivot 20 and to fixed supports 22 about which they can turn. In a modification one bow or loop only, such as 21, is used, the other being an ordinary link. In this case the pivot 20 will describe a circular arc instead of a straight line. For reasons already explained the linkage acts as a stop.

Figure 8 shows the application to a vehicle shock absorber. Two springs 29 such as described above are flexibly jointed to brackets 30 on the vehicle body 31 and are also flexibly jointed to a block 32 which carries the axle 33. The dotted portion of the figure shows the limit of possible displacement and indicates clearly how springs of this kind can act as stops. They may be used alone as shown or in combination with ordinary springs.

Figure 9 shows a succession of spring bows such as are described above made up into a chain which can be bent in one plane. The plates of each bow are directly connected to those of the next as shown at 34, and the extreme ends may be provided with shackles or the like 35.

Figure 10 shows a chain in which the planes of the bows are alternately at right angles to one another, each bow being connected to the next by a coupling 36 which permits universal flexibility.

Figure 11 shows by way of example the application to crane mechanism for the purpose of avoiding shocks. The crane hook 37 is connected to the article to be lifted by a spring bow 38 of the character above described. The invention is also applicable to connecting and coupling rods, the body of the rod being formed wholly or in part of one or more spring bows or loops constructed as above described.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An elastic link or the like adapted to be extended by collinear forces applied at the ends consisting of metal plates or laminæ of sinusoidal formation assembled so as to form a symmetrical loop or bow, the plates being secured together at their ends, where they are separated by distance pieces, by thickening or by other means, and assembled so that when

under no stress each plate or lamina touches its neighbour at or near the points of inflexion only, substantially as described.

2. An elastic link or the like consisting of a succession of loops or bows as claimed in Claim 1, substantially as described.

3. The application of elastic links as claimed in either of the preceding claims to a power converter, as stabilizing means combining the functions of a spring and a stop, substantially as described with reference to Figure 7 of the accompanying drawings.

4. The application of elastic links as claimed in either of the first two claims to shock absorbers for vehicles, substantially as described with reference to Figure 8 of the accompanying drawings.

5. The application of elastic links as claimed in either of the first two claims to elastic rods, to chains or to coupling means for cranes, substantially as described.

6. The application of elastic links as claimed in either of the first two claims to connecting or coupling rods, substantially as described.

7. Elastic links or the like together with their applications substantially as described with reference to the accompanying drawings.

Dated the 6th day of October, 1925.

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W.C. 2.

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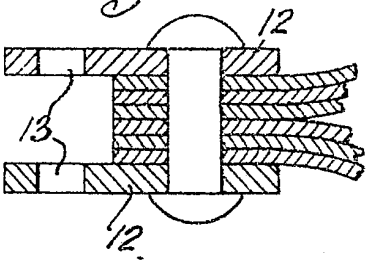
SHEET 1

Fig. 3.



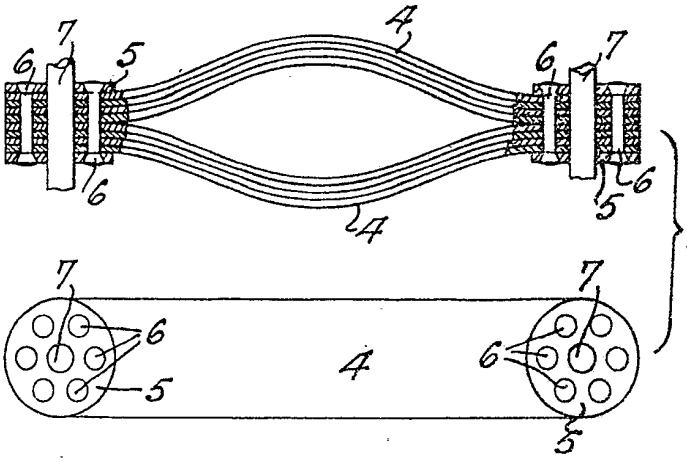




Fig. 1.

Fig. 2.

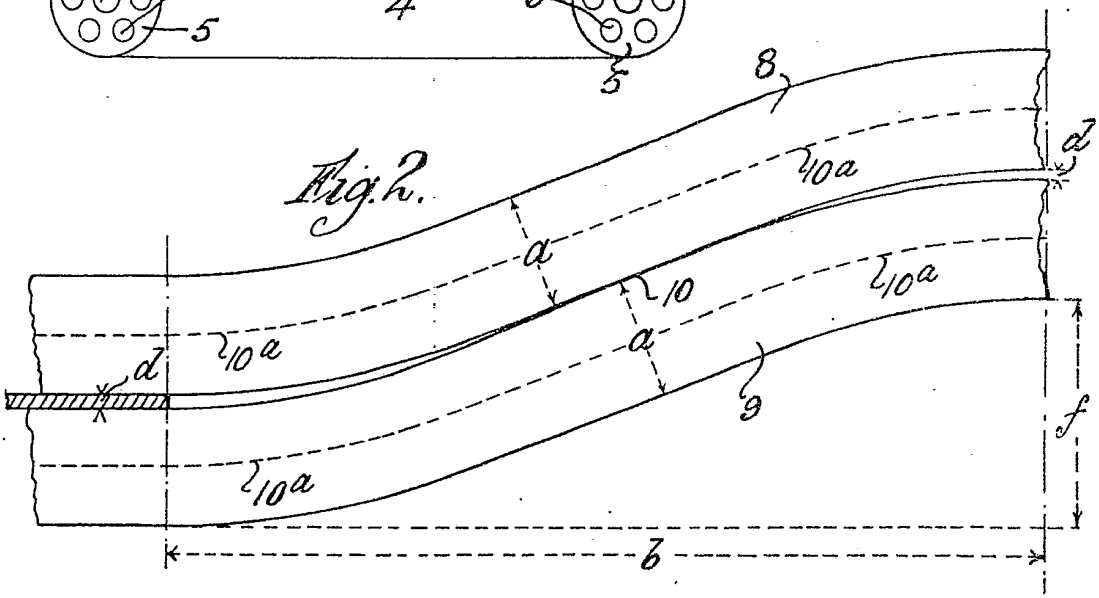



Fig. 4.

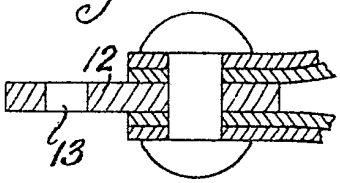



Fig. 5.

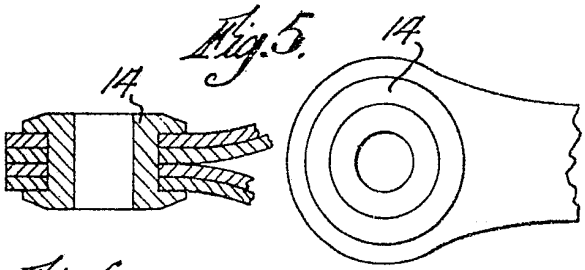
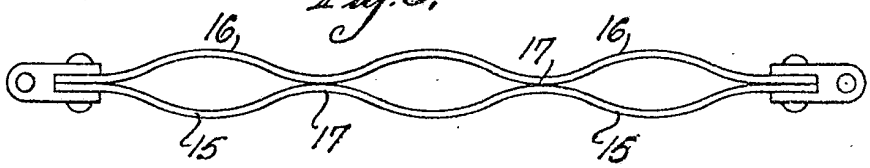
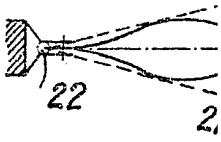
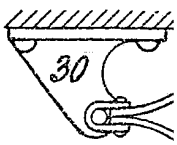


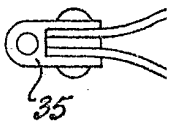

Fig. 6.

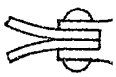


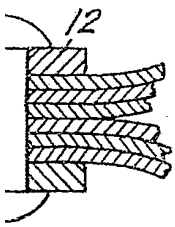


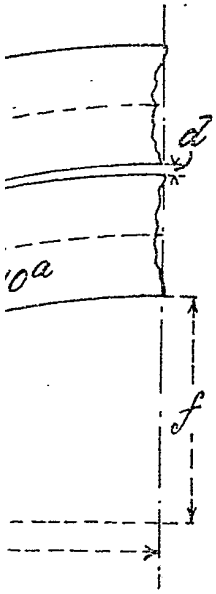


SHEET 1




2 SHEETS
SHEET 2

Fig. 7.

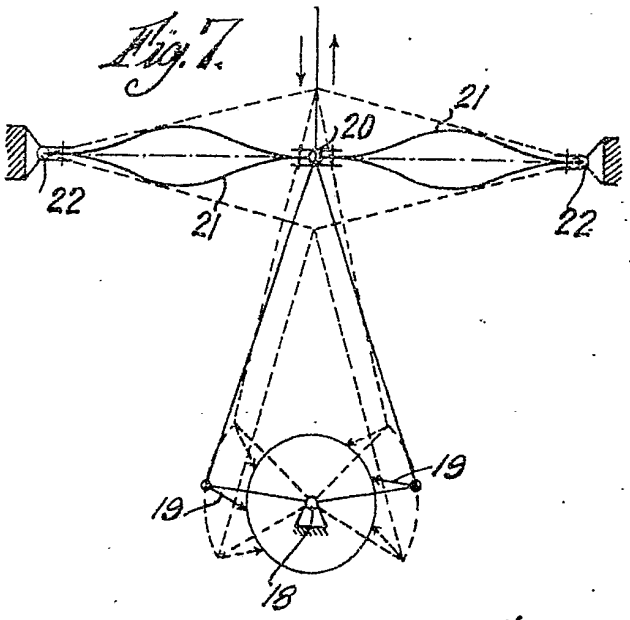



Fig. 8.

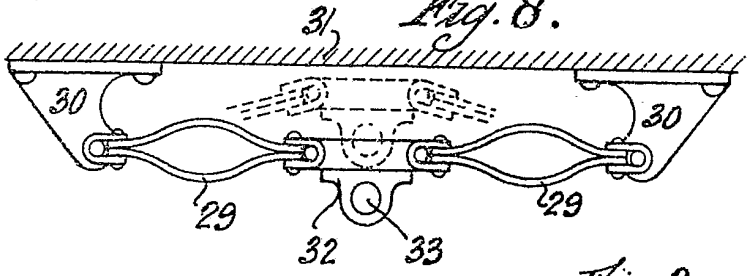



Fig. 9.

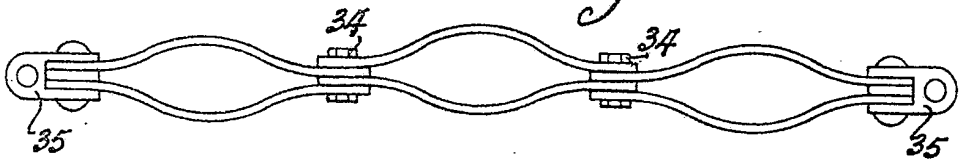



Fig. 10.

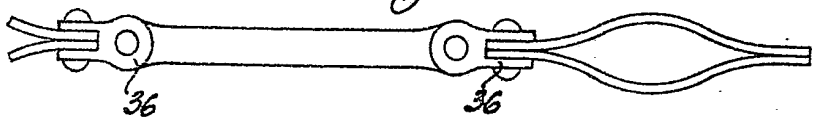



Fig. 11.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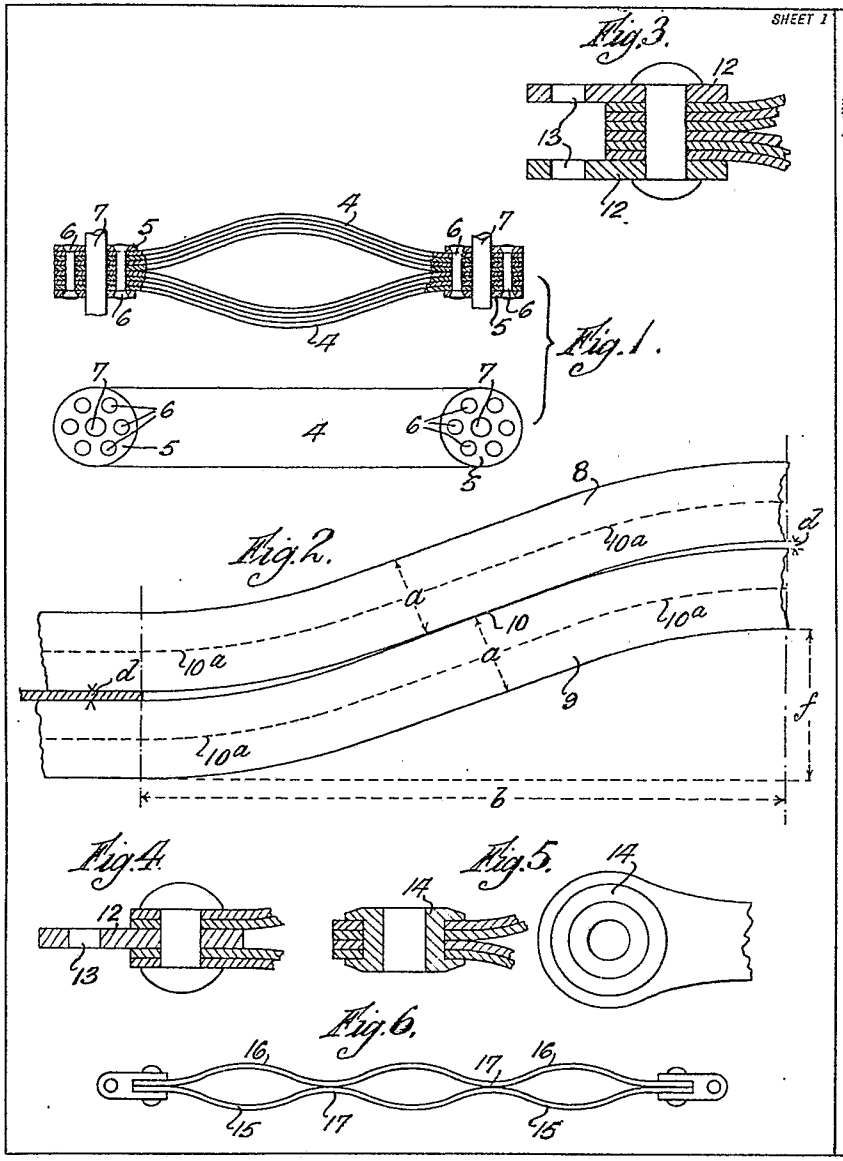


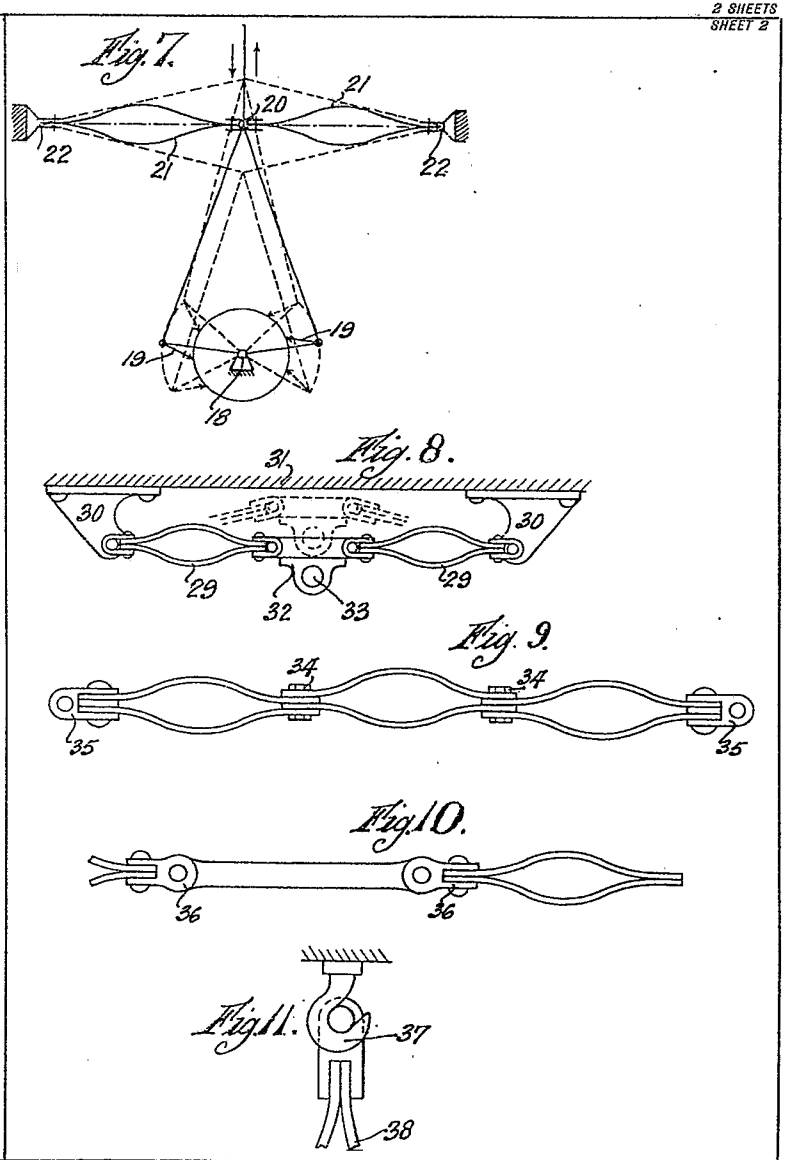


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