L. L. B. DENIS.

METAL SPRING.

APPLICATION FILED FEB. 3, 1909.

1,008,794. Patented Nov. 14, 1911.

Fig. 1.

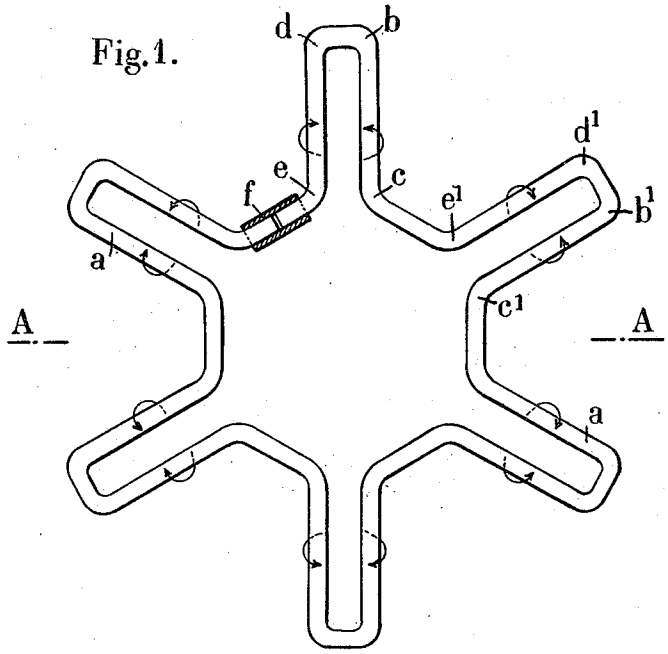


Fig. 2.

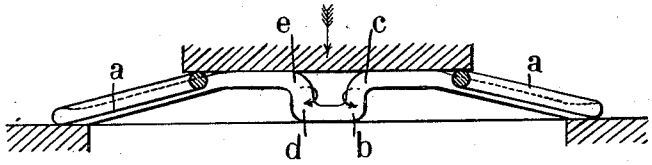
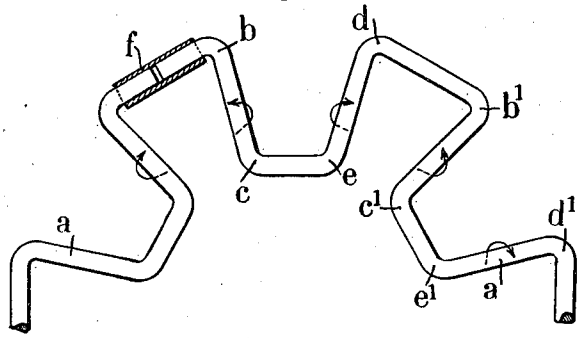


Fig. 3.



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METAL SPRING.

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To all whom it may concern:

Be it known that I, LUC LÉON BASILE DENIS, of 135 Boulevard de Ménilmontant, in the city of Paris, Republic of France, have invented an Improved Metal Spring, of which the following is a full, clear, and exact description.

The present invention relates to a spring which by reason of its special construction possesses great elastic power for a minimum quantity of material.

This spring is formed from wire or metal rod of any convenient cross-section bent on a flat or conical surface to form the outline of a conventional star, the radiating arms of which are subjected to torsional stresses when the exterior and interior supporting planes are moving together or apart.

By way of example, the present invention is illustrated in the accompanying drawing in which:

Figure 1 is a plan of a spring made in accordance with the present invention. Fig. 2 is a vertical section taken on the line A—A, Fig. 1. Fig. 3 shows a modified form hereinafter referred to.

As shown in the drawing (Fig. 1) my improved spring is formed from wire or metal rod *a* of any suitable cross-section, bent in such a manner that in its entirety it has the contour of a star-shaped figure with double arms. This star-shaped figure may be formed on a flat surface or, preferably, on a conical surface as shown in Fig. 2 of the drawing, so that a loading pressure exerted on the interior circumference and a supporting reaction exerted on the exterior circumference, produce a deflection or yielding of the interior parts of the conical star-shaped figure until the latter is flattened out or inverted.

The elastic force of the spring results from the symmetrical torsion, in the direction indicated in the drawing by arrows, of the consecutive members *b*, *c* and *d*, *e*; b^1, c^1 and d^1, e^1; etc., which form the arms of the star. It follows that the transverse members *b*, *d*; *c*, e^1; etc., serve as connecting or tie-pieces uniting in pairs the extremities of the radiating members forming the arms of the star.

The point of junction of the two extremities of the wire or metal rod *a* forming the spring is arranged in one of these interior or exterior transverse members. The two extremities of the wire or rod are supported in alinement by means of a sleeve *f* or by any other convenient means. In the arrangement shown in Fig. 1, this union is made in one of the interior transverse members. The modified arrangement illustrated in Fig. 3 shows this point of junction in one of the exterior transverse members of a pair of arms.

In order to take account of the multiplicity of forces and of the dimensions of the improved spring, it will be useful to set out its geometrical properties the principal of which are as follows: 1. For the same exterior and interior diameters, and for the same deflection (or movement in the direction of the axis of the spring), the angle through which each active member *b*, *c*; *d*, *e*; etc., is bent is smaller as the number of the said members is increased, or inversely, the deflection, for a given force, increases with the number of the said active members. 2. The limiting angle of torsion before deformation or breaking of the spring increases with the length of the active members *b*, *c*; *d*, *e*; etc. 3. The strain which can possibly be obtained before such deformation or rupture depends solely on the diameter of the wire or metal rod and on the length of the active members; it is independent of their number.

From the above it will be understood that by selecting and combining in a suitable manner the diameter of the wire or metal rod *a*, and the length and the number of the arms of the star-shaped form, numerous types of springs can be produced which can be put to many and diverse uses. Moreover the improved spring which in use is subjected to torsional stresses, possesses, as do coiled springs similarly subjected to torsional stresses, a very great resiliency or elastic power in proportion to the weight of material employed. The inert parts *d*, *b*; *c*, e^1, etc., in practice can be reduced to a minimum with respect to the active members, so as to obtain maximum utilization of the elastic material.

The improved spring as has been stated hereinabove can be put to numerous uses. It can for example be applied to lateral reaction elastic wheels, and used in cases where elasticity over a large surface is necessary.

The arrangements hereinabove set forth are given only by way of example, the forms, dimensions, and details of arrangement can be varied to meet the needs of particular applications, without departing from the principle of my present invention.

Claims—

1. A spring formed from a rod of metal bent into star-shape with double arms, the side members of which are straight and incline upwardly and inwardly, whereby a conical torsional spring is produced.

2. A spring formed of a single piece of wire bent into star-shape with double arms having its ends united in one of the connecting portions of said arms, the side members of the arms being straight and inclined upwardly and inwardly.

The foregoing specification of my improved metal spring signed by me this 22nd day of January 1909.

LUC LÉON BASILE DENIS.

Witnesses:
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