(No Model.) 2 Sheets—Sheet 1.

N. E. SPAULDING.

SPRING.

No. 352,013. Patented Nov. 2, 1886.

FIG. 1.

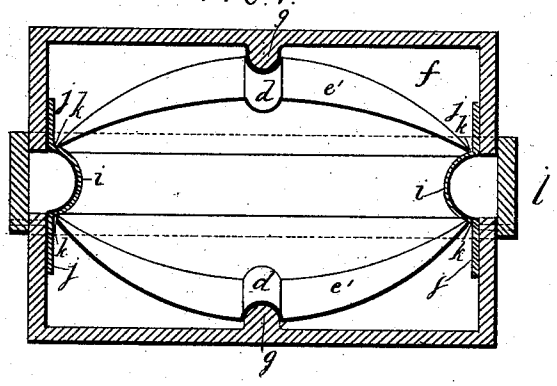


FIG. 2.

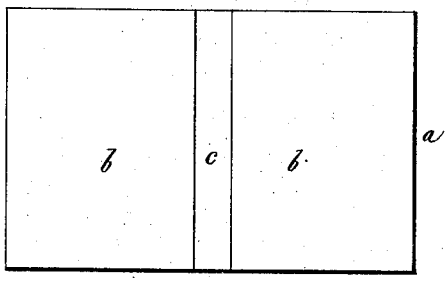


FIG. 3.

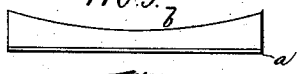


FIG. 4.

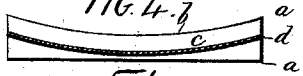
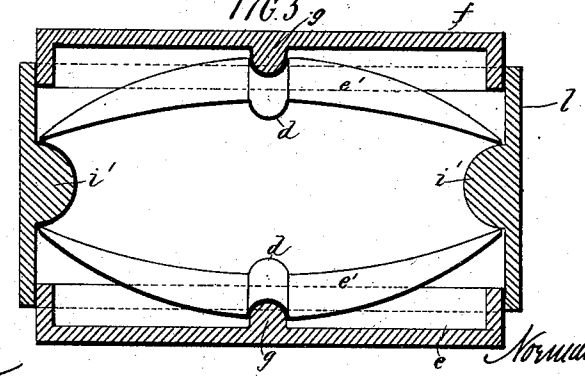


FIG. 5.



Witnesses:
W. J. Morgan
S. N. Morgan

Norman E. Spaulding,
Inventor.
By A. P. Thayer
Attorney.

N. PETERS. Photo-Lithographer. Washington, D. C.

(No Model.)

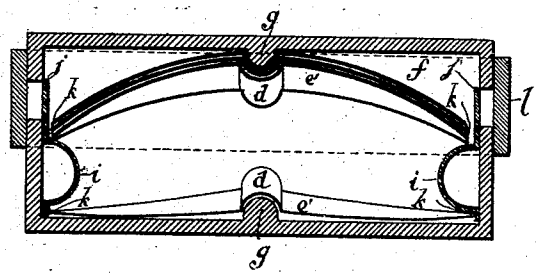
2 Sheets—Sheet 2.

N. E. SPAULDING.

SPRING.

No. 352,013. Patented Nov. 2, 1886.

Fig 6



WITNESSES=
O. J. Morgan
A. H. Morgan

INVENTOR
Norman E. Spaulding
By A. P. Thayer
atty

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

NORMAN E. SPAULDING, OF BROOKLYN, NEW YORK.

SPRING.

SPECIFICATION forming part of Letters Patent No. 352,013, dated November 2, 1886.

Application filed December 1, 1883. Serial No. 113,356. (No model.)

To all whom it may concern:

Be it known that I, NORMAN E. SPAULDING, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Springs, of which the following is a specification.

My invention consists of a spring made of one or more flat steel plates of much shorter and somewhat wider dimensions than the springs commonly made of steel plates, and being so contrived that a single plate may be used alone as a semi-elliptic spring, or two or more may be used together in the same form or as a complete elliptic spring, said plates being merely placed in a box or case loosely, in which they are confined by a rib of the box, to which they are fitted without being fastened together or to the box or case, so that whenever it is desirable to make the spring stronger or weaker it may be done by adding more plates or removing some from the box or case; also, if a plate breaks it may be removed and a new one replaced without disturbing the others and without any refitting, and the spring may be readily graduated by placing more of the plates or thicker ones on one side than the other, so that one side will be adapted for a light load and the other side for a heavy load. The case is so constructed as to hold the plates of an elliptic or semi-elliptic spring in position one above the other without the use of bolts or bands. The case also keeps two or more springs in position parallel with each other—that is, side by side—and forms a joint or pivot at each end of the spring without the aid of bolts.

My invention also consists of a novel contrivance of the form of the plates, whereby springs of great power and considerable range are obtained from short and very thin plates.

The object is more particularly to provide simple, light, and cheap springs for freight-cars; but my improved spring may be applied to other cars or vehicles, and may be used for other purposes, all as hereinafter fully described, reference being made to the accompanying drawings, in which—

Figure 1 is a side elevation of an elliptic spring constructed according to my invention, and sectional elevation of the box to hold it. Fig. 2 is a plan view of one of the plates. Fig. 3 is an end elevation of said plate. Fig. 4 is a transverse section of the plate on the line *x x* of Fig. 2. Fig. 5 is a sectional elevation of a modified form of the device for confining the spring. Fig. 6 is a section showing the graduated spring of greater strength on one side than the other.

For freight-car springs I take steel plates *a*, about one foot long, eight inches wide, and an eighth of an inch thick, but varying the proportions as may be required, and strike them up in the dies as spring-plates are usually formed, the dies being constructed to produce the semi-elliptic form represented in Figs. 1 and 5, also the transverse concave *b*, and also the transverse groove *c* in the back or crowning side with the corresponding transverse convexity, *e*, and also the rib *d* of the under or inner side of the plates, the concavo-convex form being greatest at the crown of the plate where it is crossed by the groove *c*, and diminishing therefrom to and vanishing at the ends which are straight across from edge to edge of the plates. While a spring-plate concave transversely on the crowning side of the longitudinal curve is the best form for strength, because the tension is sustained by the middle web of the transversely convex side and the edges of the plate are subject to compression only, yet the plates must be comparatively long and narrow to obtain much range of motion in the springs, for the tendency of the edges of the plate to buckle is such that in a plate of much width the conflicting forces of tension of the middle web and compression of the edges will rend the edges unless relieved by corresponding length. By means of the transverse groove or depression *c*, which I make in the concave side and the corresponding rib, *d*, of the other side resulting therefrom, the necessary relief of the edges of the plate is afforded by the transverse contraction and expansion of the rib to allow the desired range of motion of the spring with plates of half or less than half the length that must be used without such depression and rib and the plate is materially strengthened thereby. By the graduation of the transverse concavo-convex form of the plate from said depression to the ends the plates are rendered uniformly elastic from the middle to the ends, and thus

the effect of the load is equally distributed over the plate and all parts contribute alike to the support of the load without over-strain of any part. The groove *c* also serves for an excellent means of connecting the spring to the car-body, axle-box, or bolster, or to the bottom or top of a box, *e f*, in which it is preferred to arrange the spring as here shown, in which box or on the car-body, axle-box, or bolster a suitable rib, *g*, is made to fit the groove or depression, so that the plate will rest on and be confined by its groove and said rib *g*.

In case a single plate is used, the ends will rest on any suitable bearings connected with the axle box or boxes, and the bolster will rest on the plate, with its rib *g* in the depression of the spring; but when two plates are used in the elliptic form the plates will preferably have some kind of bearer between them at the ends, unless the plates are made with sufficient curve to allow the necessary spring motion when bearing on each other, and they will preferably be arranged in a box, as here shown, the said bearers preferably being made of a thin steel plate having a half-round bend, *i*, between the short end sections, *j*, which end sections lie in one and the same plane and form angles at *k*, in which the ends of the plate rest, which said bearers are supported by the ends of the box against the end thrusts of the plates, and the said bearers rise and fall with the motions of the springs. The bends *i* also act as springs to some extent, and thus enlarge the range and increase the elasticity of the spring in some measure; but the bearers may be dispensed with and the plates may rest on each other, instead as above stated. The bearers may consist, however, of solid oval ribs *i'*, formed on the end bars of the band *l*, and projecting through the ends of the box, as represented in Fig. 5, the band in that case being disconnected from both parts of the box and free to play independently of either part; but in Fig. 1 said band is represented as attached to the bottom part, *e*, of the box, to form an overlapping flange to the upper part, *f*, which plays up and down within the band for its keeper. The edges of the two parts of the box are to close together, and the spring-plates are to be supported by contact with the bottom and top of the box, respectively, when the spring has closed to the limit of its range.

To increase the power of the spring by additional plates requires only to add other plates by placing them on those already in place, which added plates will be secured the same as the others without being connected or attached in any way, as in other elliptic springs, the ribs of the added plates resting in the groove of the others.

It will be seen that springs of this improved construction may be made much shorter than other elliptic springs of the same power and range, although a little wider; but that is not objectionable. In case it may be required to use springs of greater power than may be practically made of plates placed one upon another, duplicate springs may be placed side by side, said springs being arranged in suitably widened boxes or other means of holding them; and to make springs adapted for both light and heavy loads, I propose to arrange more plates on one side than the other, as in Fig. 6, or plates of different thicknesses, so that the weak side will serve for the light load, and when a heavier load is on the weak side will, when sprung down to a proper limit, be sustained by the box or other object carrying the spring, and the stronger side of the spring will then become operative.

What I claim, and desire to secure by Letters Patent, is—

1. The improved semi-elliptic spring-plate herein described, said plate being bent longitudinally convex and transversely concave on the outer side and having the transverse groove at the middle of the plate and in the concave and crowning side of the longitudinal bend, substantially as described.

2. The improved spring-plate herein described, said plate being bent longitudinally and concaved transversely on the crowning side of the longitudinal bend, and also being grooved across the middle of the concave and crowning side, said concave being greatest at the middle and vanishing at the ends of the plate, substantially as herein set forth.

3. The combination, with a longitudinally-curved spring-plate transversely concaved on the crowning side and having a transverse groove across the middle of the crowning side, of a rest or bearing for the same, having a convex rib, *g*, adapted for fitting the groove across the concavity of the plate, substantially as described.

4. The curved bearer *i*, having end sections, *j*, forming bearing-angles *k* for the ends of the spring-plates *a*, in combination with said plates and the box *e f*, or equivalent supporting-band, substantially as described.

5. The improvement in graduated elliptic springs, consisting of plates bent longitudinally, concaved transversely, and grooved across the middle of the crowning side and arranged in greater number or with thicker plates on one side than the other, and with a support for the weaker side when compressed to its limit, substantially as described.

In witness whereof I have hereunto signed my name in presence of two subscribing witnesses.

NORMAN E. SPAULDING.

Witnesses:
W. J. MORGAN,
S. H. MORGAN.