E. CLIFF.

Elliptic Springs.

No. 152,606. Patented June 30, 1874.

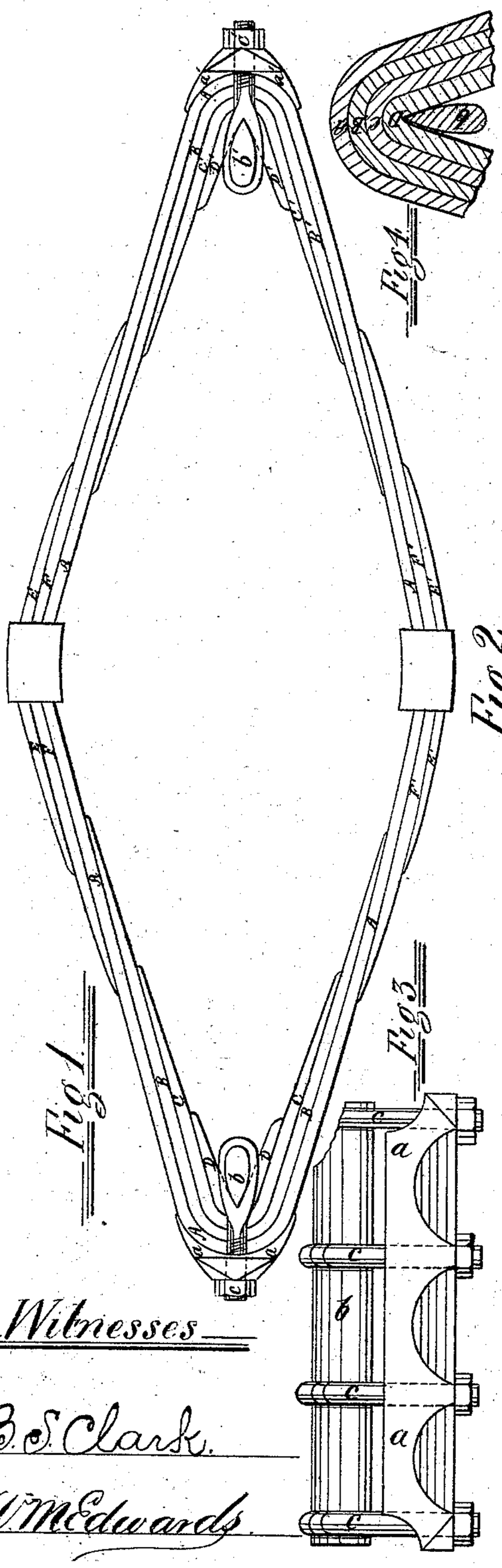

Fig 1.

Fig 4.

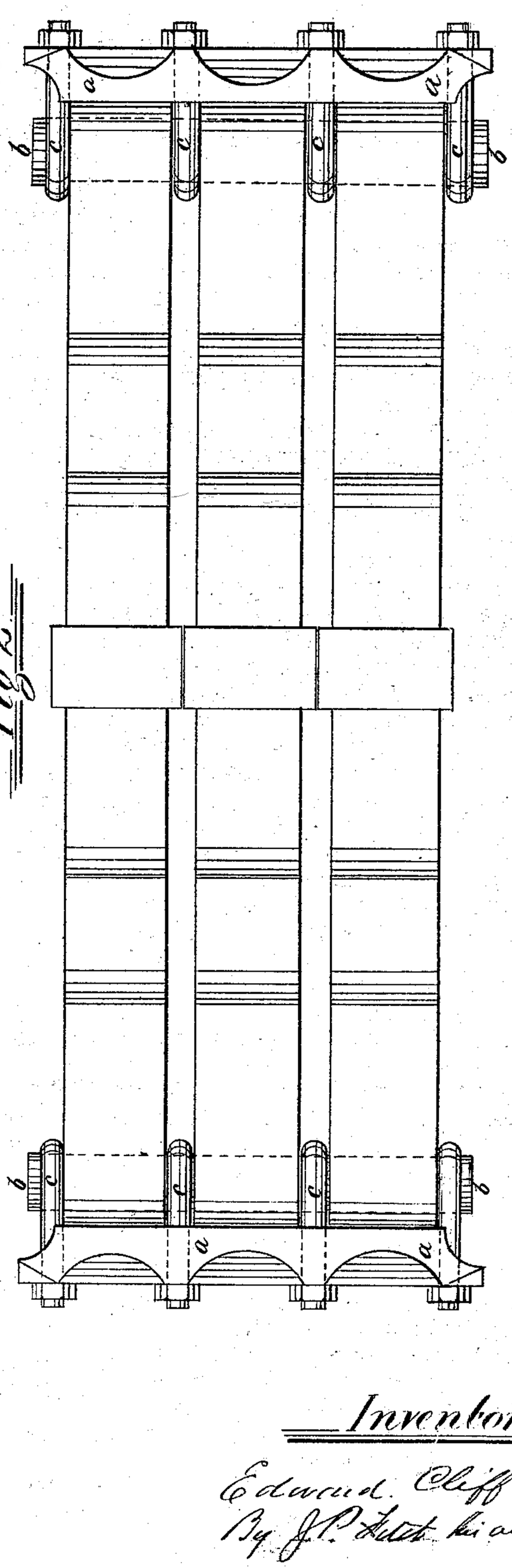

Fig 2.

Fig 3.

Witnesses

B. S. Clark.

W. McEdwards.

Inventor

Edward Cliff

By J. P. Lott his atty

UNITED STATES PATENT OFFICE.

EDWARD CLIFF, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND RICHARD VOSE, OF SAME PLACE.

IMPROVEMENT IN ELLIPTIC SPRINGS.

Specification forming part of Letters Patent No. **152,606**, dated June 30, 1874; application filed June 16, 1874.

To all whom it may concern:

Be it known that I, EDWARD CLIFF, of the city of New York, county and State of New York, have invented Improvement in Elliptic Springs, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation of an elliptic spring embodying my improvements; Fig. 2 is a plan or top view of three of my springs connected together to form a railway-car spring; Fig. 3 is a side view of the devices, consisting of a binding-bar, the clip-bolts, and the clamp-plates by which the several leaves are held together at the ends of the spring; and Fig. 4 is a detailed edge view of the several leaves forming the ends of the spring, and a cross-section of the binding-bar.

My invention relates to an elliptic spring, composed of an entire or endless elliptical hoop, with auxiliary V or U shaped leaves placed interiorly at the ends of the ellipse, and there secured by suitable clamping devices, either with or without auxiliary leaves arranged exteriorly, midway between the ends; also, to a provision against the breaking of such interior auxiliary leaves, by the peculiar form (hereinafter particularly described) given to the interior surface of said leaves at their central bend or angle, and a corresponding form given to the binding-bar, which fits into such angle or bend.

A is a single bar of steel bent into an elliptical form, as represented, the two ends of the bar being welded together. It is preferably made by bending the bar in the center, such bend being made to form one end of the ellipse, and welding the ends of the bar at the opposite end of the ellipse. B, C, and D, and B′, C′, and D′, are auxiliary V or U shaped leaves, formed of bars of steel of different lengths, bent to fit into each other, as shown, and preferably diminishing in thickness from the central bend to the ends. These are placed interiorly at the ends of the principal spring A, and clamped firmly to the latter, as represented. Preferably, auxiliary leaves E F, one or more, are placed centrally on the exterior of the spring A, and clamped in the ordinary manner. The several leaves, with the principal spring A, are bound firmly together at the ends of the ellipse by the exterior concave clamp-plate *a*, the binding-bar *b*, and the clip-bolts *c*. In their general construction these clamping devices do not differ from those heretofore employed in ends of a certain class of elliptical springs.

I have found, however, by practice, that when the interior surface of the auxiliary leaf D has the circular form in the center, giving it the U shape instead of an angular or V form, and then a round binding bolt or bar arranged in the bend is employed to clamp the leaves together, this interior leaf is very liable to be broken by any considerable compression of the spring. To obviate this result, I give to this inner leaf the form shown plainly at Fig. 4. As will be seen, the interior surface approaches very nearly to an acute angle, while the exterior surface is a circular curve. This form permits the use of the elliptical-shaped binding-bar, to be presently described, fitted into the interior angle of the said leaf, while the exterior surface of said leaf corresponds to the curved interior surface of the next exterior leaf C.

The form of the binding-bar *b* is plainly shown in Fig. 4. As will be seen, its cross-section presents the form of a wedge, with slightly-curved sides united to half of a circle. The wedge is formed to fit into the interior angle of the leaf D, but does not quite fill the space between the opposite sides of the leaf. Now, it is evident that when this leaf is compressed, its two arms, from the center of bend to their extremities, will act as levers, the bar *b* being the fulcrum and the point of weight being the center of the bend, the fulcrum-line shifting away from the point of weight in proportion as the levers are caused to approach. It is further evident that the next exterior leaf, fitting closely over the leaf D, acts to resist the strain exerted at the center of the bend in the leaf D, tending to brake or separate the same at that point, and that the effectiveness of this resistance of

the exterior leaf to prevent the breaking of the leaf D increases in proportion as the fulcrum-line recedes from the inner edge of the bar *b* by the compression of the spring, the length of the short arm of the levers increasing as the spring is compressed and the strain being augmented, while the binding action of the external leaf C remains the same, and continues to be exerted at the same point. Although it is not essential, it is advisable to make the outer edge of the binding-bar *b* round, as shown, to fit correspondingly-shaped eyes in the clip-bolts *d*, as with this form they have greater strength and are more conveniently made than with any other form.

Fig. 2 represents three of my springs, placed side by side and clamped together at the ends, the clamping-plate *a* and the binding-bar *b* extending across and embracing the whole. Two, three, or more of these springs may thus be combined together to be used upon railway-cars, or elsewhere where great bearing power is needed.

An elliptical spring constructed as described has more combined bearing power and elasticity, and greater elasticity, than the same steel will yield in any form of elliptical spring with which I am acquainted.

What I claim is—

1. An elliptical spring composed of the endless bar A and auxiliary V or U shaped leaf or leaves, placed interiorly at each end of the spring, bound together by clamping devices, all combined to operate as and for the purpose specified.

2. An elliptical spring composed of the endless bar A and V or U shaped leaf or leaves at each end of the spring, with the center auxiliary leaves E F E′ F′ bound together by clamping devices, all combined to operate as and for the purpose specified.

3. The combination in an elliptical spring, with the endless bar A, of the leaves D and D′, and the wedge-shaped binding-bar *b*, the interior surface of the said leaves being formed to fit and act upon the said bar *b*, as and for the purpose described.

Witness my hand this 15th day of June, 1874.

EDWARD CLIFF.

Witnesses:

B. S. CLARK,

JOS. D. MACKENZIE.