J. J. ADGATE & F. HICKMAN.

CARRIAGE SPRINGS.

No. 185,275. Patented Dec. 12, 1876.

Fig. 1.

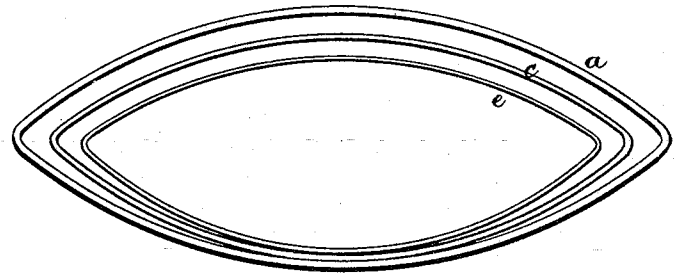
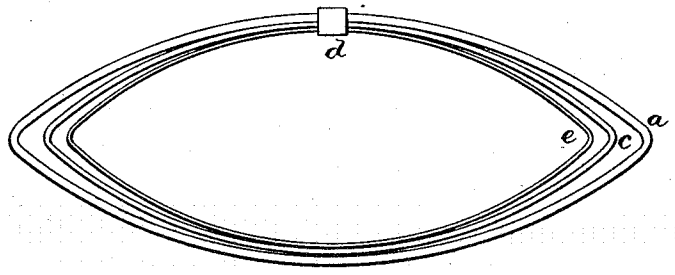


Fig. 2.



WITNESSES

Henry N. Miller

Frances L. Durand

INVENTOR

J. J. Adgate.

Francis Hickman.

By Munn & Thacher

Attorneys

UNITED STATES PATENT OFFICE.

JOSEPH J. ADGATE, OF NEW YORK, N. Y., AND FRANCIS HICKMAN, OF READING, PENNSYLVANIA.

IMPROVEMENT IN CARRIAGE-SPRINGS.

Specification forming part of Letters Patent No. **185,275**, dated December 12, 1876; application filed April 15, 1876.

To all whom it may concern:

Be it known that we, JOSEPH J. ADGATE, of New York, N. Y., and FRANCIS HICKMAN, of Reading, in the county of Berks and in the State of Pennsylvania, have invented certain new and useful Improvements in Carriage-Springs; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon, making a part of this specification.

The nature of our invention consists in the construction of springs for vehicles elliptical in form, the ellipse being unbroken, and the several ellipses of which the spring is composed being graduated in thickness, as will be hereinafter set forth.

In the accompanying drawings, making part of this specification, both Figures 1 and 2 represent side views of the spring, the several leaves being bound together in one instance, but not in the other.

In the figures, *a* represents an elliptic spring, which is made entire, or without a joint. The thickness of this spring, taken together with the length of its major axis as well as its minor axis, will determine the thickness of the inner springs, as well as the length of their axes, as they are, as a general thing, to have proportionate dimensions. *c* and *e* represent smaller elliptic springs, and similar to the outer spring, except that *c* is made thinner than *a*, and *e* is made thinner than *c*, and they have proportionately shorter axes.

If the outer spring should be made one-fourth of an inch in thickness, each supplemental spring should be reduced about two-sixty-fourths, and so continued as the springs grow shorter or more are used.

It is evident that, with this arrangement, if a long and flexible spring is desired, one or more of the inner ones may be removed, or, if a shorter and stiffer one is needed, the outer one can be removed and several smaller ones can be added on the inside.

This combination of separate springs is admirably adapted to light wagons, which are liable to pass quickly over short deep ruts, as they protect each other in the upward movement, and prevent breakage of each other.

By forming the elliptic springs of a single piece, the end connections between the semi-ellipses are avoided, and there is no liability of one part of the semi-ellipse springing from or becoming detached from the end connection, as is common in cases where carriage-springs are made in semi-elliptic form and connected together at the ends.

Having thus fully described our invention, what we claim is—

A carriage-spring composed of two or more endless elliptical springs, *a c e*, of unequal thickness, and placed one within the other, substantially as and for the purposes herein set forth.

In testimony that we claim the foregoing we have hereunto set our hands this 22d day of March, 1876.

JOSEPH J. ADGATE.
FRANCIS HICKMAN.

Witnesses:
JOHN L. JENNING,
ISRAEL C. BECKER.