

(No Model.)

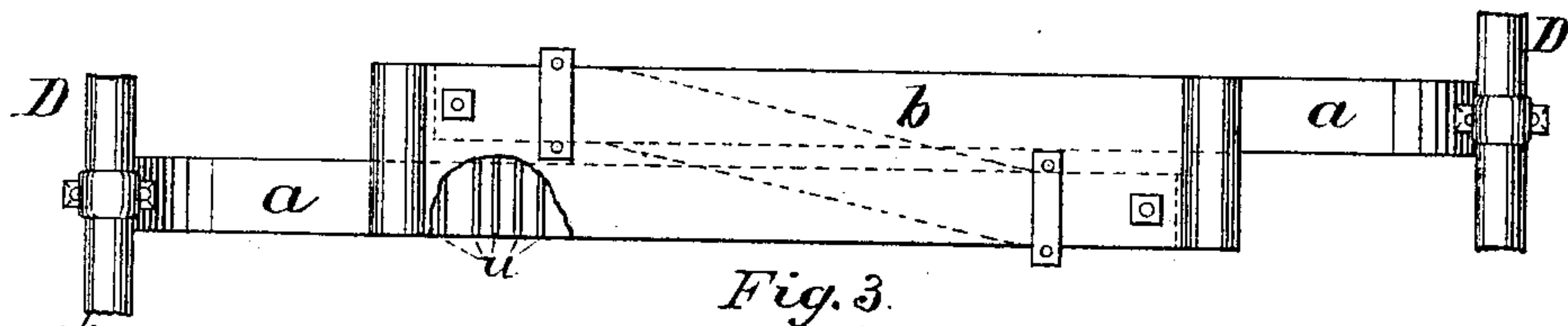
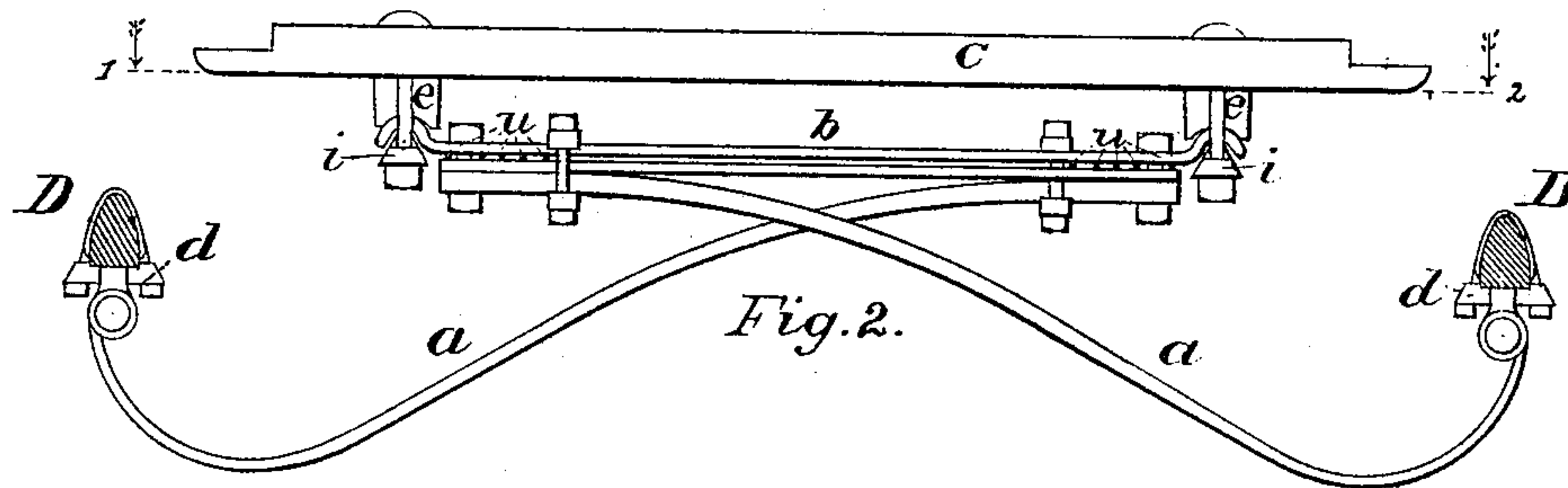
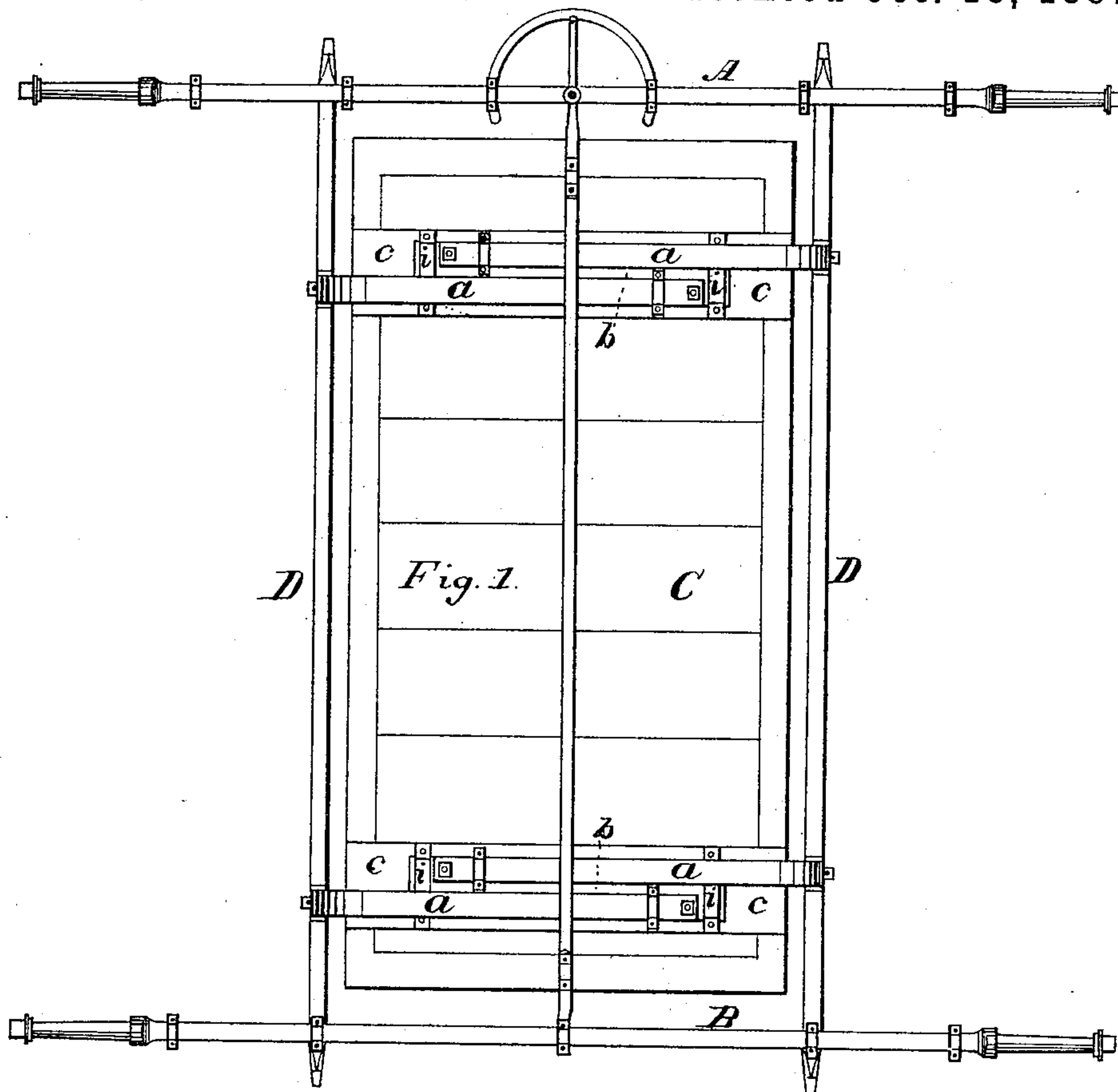
2 Sheets—Sheet 1.

E. F. MORSE.

VEHICLE SPRING.

No. 371,617.

Patented Oct. 18, 1887.



Witnesses:
Sanford F. Pond,
Wm L. Ostrom

Inventor:
E. F. Morse

(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

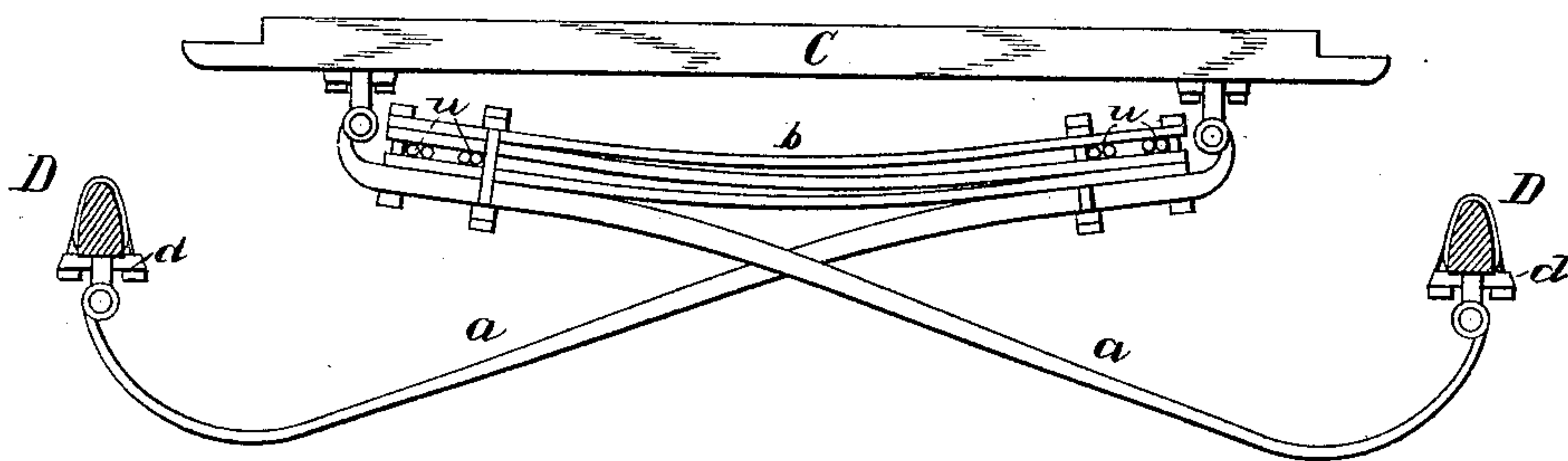


Fig. 5.

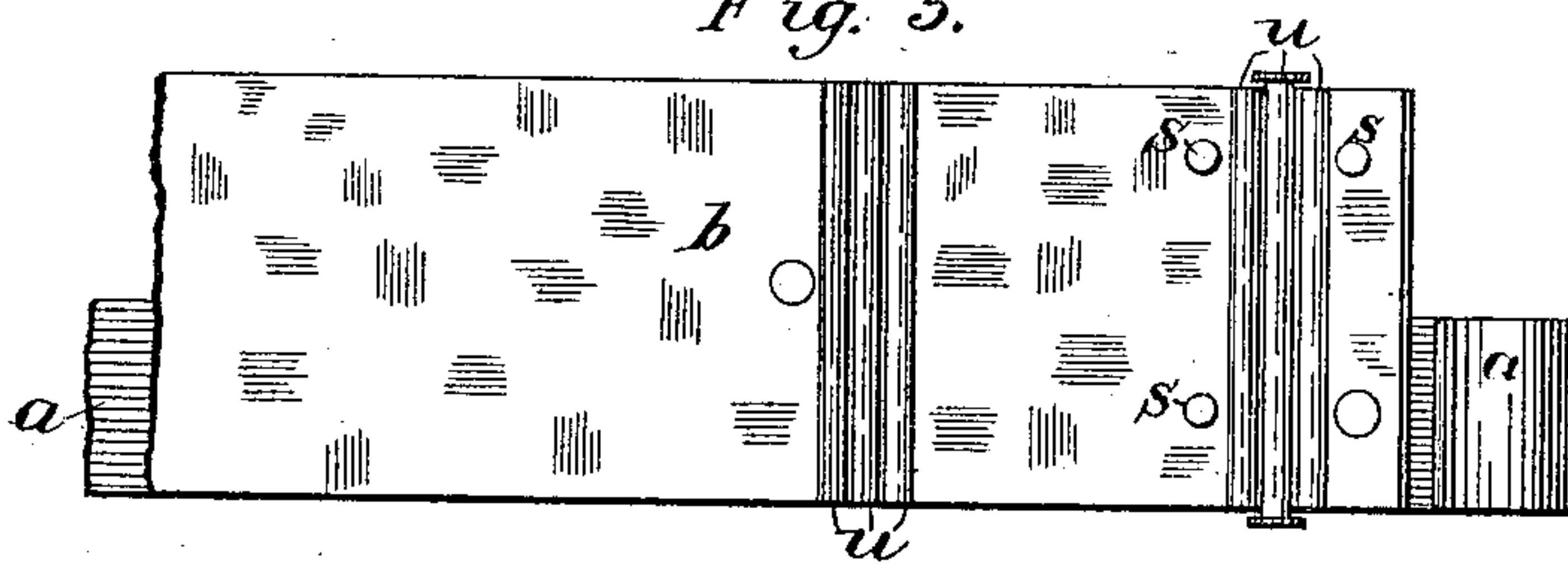
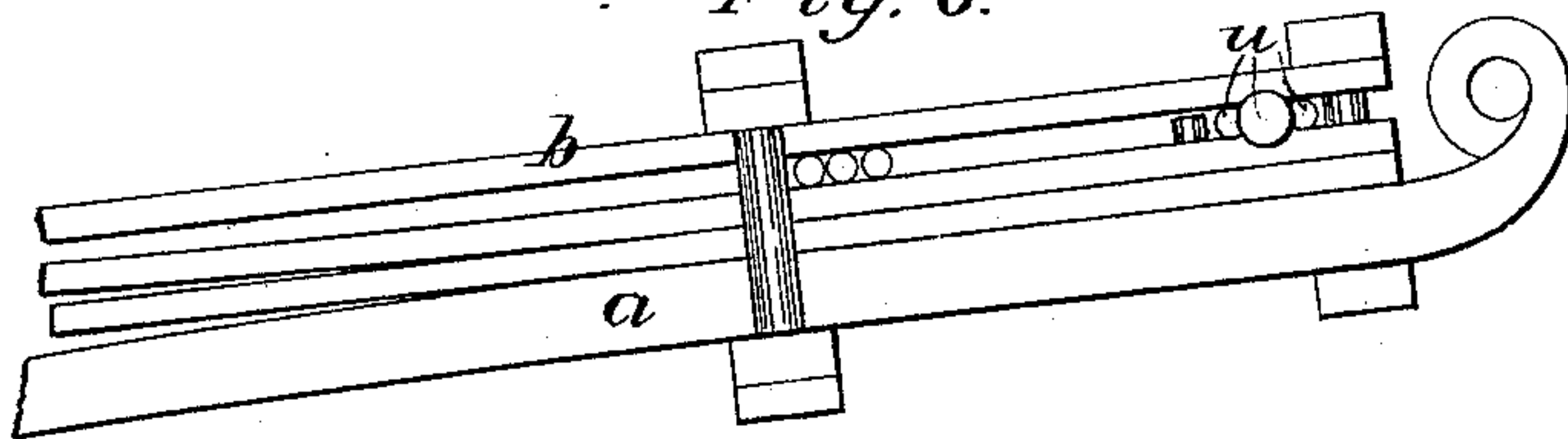


Fig. 6.



WITNESSES:

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UNITED STATES PATENT OFFICE.

EVERETT F. MORSE, OF ITHACA, NEW YORK.

VEHICLE-SPRING.

SPECIFICATION forming part of Letters Patent No. 371,617, dated October 18, 1887.

Application filed July 24, 1886. Serial No. 208,936. (No model.)

To all whom it may concern:

Be it known that I, EVERETT F. MORSE, a citizen of the United States, residing at Ithaca, in the county of Tompkins and State of New York, have invented a new and useful Improvement in Vehicle-Springs, of which the following is a specification.

My invention relates, chiefly, to vehicle-springs in which the oppositely-extending supporting-arms cross each other side by side, and has for its principal object to provide a spring of great flexibility, to even depression, and at the same time of sufficient resistance to rolling action to prevent all objectionable rocking motion to the body. I attain this object and certain improvements in the details of springs by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a bottom view of a gear with my improved springs attached. Fig. 2 is an elevation of one of my springs; Fig. 3, a plan view of the same with the bar *c* and blocks *e e* removed and having a part broken away to show certain details of construction. Fig. 4 is an elevation of a modified form of my spring. Fig. 5 is a plan view of one end of the same, having the top leaf removed to better show the details of construction. Fig. 6 is an elevation of the same.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings, A and B are the front and rear axles, respectively, and D D the side bars, all of which may be connected and constructed in the usual manner.

C is the body, supported by two similar springs, consisting of the equalizing-spring *b* and the oppositely-extending supporting-arms *a a*. The equalizing-spring *b*, extending crosswise of and under the body, has its ends connected to and supports the body near opposite sides and has its middle portion extending free of and a small distance below the bottom of the body in either a straight or curved form, so as to admit of its bending upward as the body is depressed. The connection between my spring and the body should not be rigid, but may be of any design that will admit of a small angular motion to arms *a a*, which, by being rigidly attached to the ends of the equalizing-spring *b*, are indirectly fulcrumed to the body, so that they turn about

these connections as axes when the body is depressed. However, the connection which I deem best adapted to my spring is shown in Fig. 2, and is formed by producing the equalizing-spring slightly beyond the butt-ends of the arms *a a* and bending these ends first upward and then in a semicircular form convexing upward, as shown. Between these ends and the body are inserted the blocks *e e*, which are provided with cylindrical grooves in their lower faces, into which the convex surfaces of the ends of spring *b* are received. These blocks are composed, preferably, of some elastic material—as vulcanized caoutchouc—which by changing its form will provide for the small movement of the ends of spring *b* toward and from each other as the spring is depressed without any sliding friction. The springs are securely restrained to the body by bolts passing through the cross-bars *c* and the triangular clamps *i*, which press against the concave sides of the curved ends of the equalizing-spring, as shown.

Although the spring *b* may consist of a single bar only, it is preferably made of two or more leaves arranged above each other; but when so made the ends of these leaves have a small longitudinal movement relatively to each other when the spring is being depressed. To diminish the resistance of this movement, I insert small anti-friction rollers *u* between and extending crosswise of the leaves, near their ends, where they are clamped together, so that when the two adjacent leaves move relatively to each other these small rollers will roll between them and greatly reduce the resistance to such movement. These rollers are ordinarily retained in their positions between the leaves by the constant pressure of the adjacent leaves upon them, caused by the bolts which secure the leaves together. With this construction the leaves, while free to move endwise relatively to each other a sufficient amount to allow them their maximum flexion, are restrained from an excessive end movement either by the clamping-bolts, as in Fig. 2, or by inserting the rollers between one end only of the adjacent leaves and clamping the opposite ends close together, as shown in Fig. 4. However, in some cases it may be desirable to enlarge the ends of one or more of the rollers, as shown in Fig. 5, to further resist their movement end-

wise, and to limit their rolling motion by stops *s s s*, Fig. 5, attached to one of the adjacent plates.

In the drawings the width of spring *b* is shown to be somewhat greater than the combined widths of the arms *a a*, so that they, in crossing each other side by side, can be easily attached to it. However, if it is desired to make this spring narrower it can be done by bending it, as shown by the dotted lines of Fig. 3.

It is obvious that instead of indirectly fulcruming the arms *a a* to the body, as heretofore described, the spring *b* can have its length limited to the length of the lower plate, and that the butt-ends of arms *a a*, by being produced and suitably formed, can be connected directly with the body, substantially as the ends of spring *b* are shown to be connected, or as shown in Fig. 4. With either construction the action of the spring would be the same.

My springs provide an elastic support to the body through the flexion and angular motion of the supporting-arms *a a*. The angular motions of these arms about their fulcrum-connections to the body are permitted by the flexion of the equalizing-spring *b*, which is bent so as to concave upward as the spring is depressed. In operation the spring *b* is subjected simultaneously to two independent movements which are the separate effects of the forces applied to respective arms, each movement being proportional to the vertical force applied to the pivotal end of the arm *a* imparting it. When the body is evenly depressed, the vertical forces acting at the pivotal ends of arms *a* are equal and act in the same direction; but when the spring is subjected purely to rolling action these forces, while also equal, act in opposite directions. With even depression each of the two independent movements tends to bend the spring *b* upward or in the same direction, and in combination form the uniform bending-movements throughout the portion between the supporting-arms, but with rolling action the two independent movements tend to bend the spring *b* in opposite directions and thus neutralize each other wholly at the center of spring *b* and in less degree toward either supporting-arm. The effect of these independent movements, acting to bend the spring *b* in the same direction when subjected to even depression and in opposite directions when subjected to rolling action, is to subject the spring *b* to double the average bending movement in the former than it does in the latter case, the vertical forces acting at the pivotal ends of arms *a a* being respectively equal in both cases, and as a direct consequence the spring *b* yields double as much flexibility to even depression relatively to its flexibility to rolling action as any other part of the spring.

The equalizing action of spring *b* can also be explained, as follows: If a vertical upward force is applied to the pivotal end of one of the arms *a*, the spring *b* in yielding to this force has the part between the butt-ends of

arms *a* bent upward, and thus allows the arms *a*, to which the force is applied, to turn upward about its fulcrum-connection to the body. The upward bending of spring *b* imparts an angular motion to the opposite arms, causing this arm to turn upward also, although no force is applied to its pivotal end. The equalizing-spring *b* thus connects the oppositely-extending supporting-arms, so that it transmits an angular movement of either arm to the other in such a manner as to reduce the inequality in the depression of the two sides of the body due to uneven loading or other cause, and also forms an elastic support to the body.

I am aware that springs have heretofore been patented with oppositely-extending arms crossing each other side by side and having their butt-ends rigidly attached to a single upper spring-plate; but the various parts have not been arranged and connected with the body in a manner to attain the equalizing effect attained by my present invention. The essential peculiarities of my spring, by which the equalizing effect is attained, are, first, the attachment of the arms *a a* rigidly to the terminal portions of the plate *b*, whereby a larger part of the plate is made to extend freely between said attached parts and supporting-arms; second, the flexible connections between the spring and body, whereby the arms *a a* are freely allowed sufficient angular motion to bend the portion of the plate *b* extending between the arms to its elastic limit and the resistance to the transmission of angular motion from one arm to the other is much reduced. A further desirable arrangement of parts consists of forming the spring *b* of two or more leaves arranged one above another and constructing the arms *a a* of single bars, thereby increasing the flexibility of the former and the stiffness of the latter, and placing the greater part of the resilience of the spring when it offers the greatest flexibility to even depression relatively to its flexibility to rolling action. With this construction the frictional resistance to the working of the spring is much reduced by the anti-friction rollers *u*, inserted between the leaves, as described.

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

1. A vehicle-spring consisting of oppositely-extending supporting-arms extending by or crossing each other, in combination with a spring-plate having its opposite terminal portions rigidly attached to and the intermediate portion extending between the butt-ends of said arms, said spring being hung to the body by flexible connections respectively at or contiguous to the butt-ends of the supporting-arms, substantially as described.

2. A vehicle-spring consisting of oppositely-extending supporting-arms extending by or crossing each other, in combination with two or more elastic plates arranged lengthwise, one above another, and having their opposite terminal portions rigidly attached to and the

intermediate portions extending between the butt-ends of said arms, said spring being hung to the body by flexible connections respectively at or near the butt-ends of the supporting-arms, substantially as and for the purpose described.

3. A vehicle-spring consisting of oppositely-extending supporting-arms formed of single bars extending by or crossing each other, in combination with two or more elastic plates arranged lengthwise, one above another, and having their opposite terminal portions rigidly attached to and the intermediate portions extending between the butt-ends of said arms, said spring being hung to the body by flexible connections respectively at or near the butt-ends of the supporting-arms, substantially as and for the purpose described.

4. A vehicle-spring consisting of oppositely-extending supporting-arms extending by or

crossing each other and two or more elastic plates arranged lengthwise, one above another, and having their opposite terminal portions attached to the butt-ends of said arms, in combination with one or more anti-friction rollers arranged crosswise between the terminal portions of said plates, and means of retaining said rollers in position, substantially as described.

5. In a vehicle-spring having two or more leaves arranged lengthwise, one above another, the combination of one or more anti-friction rollers arranged crosswise between said leaves and suitable means of retaining said rollers in position, substantially as and for the purpose described.

EVERETT F. MORSE.

Witnesses:

SANFORD C. CONDE,
WM. L. OSTROM.

Corrections in Letters Patent No. 371,617.

It is hereby certified that in Letters Patent No. 371,617, granted October 18, 1887, upon the application of Everett F. Morse, of Ithaca, New York, for an improvement in "Vehicle-Springs," errors appear in the printed specification requiring the following corrections: In lines 30, 41, 43-44, 46, and 50, page 2, the word "movements," and in lines 32 and 55, same page, the word "movement," should be stricken out and the words *moments* and *moment* respectively inserted instead; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 22d day of November, A. D. 1887.

[SEAL.]

D. L. HAWKINS,
Acting Secretary of the Interior.

Countersigned:

BENTON J. HALL,
Commissioner of Patents.