(No Model.) 2 Sheets—Sheet 1.

E. F. MORSE.

VEHICLE SPRING AND GEAR.

No. 383,974. Patented June 5, 1888.

Fig 14

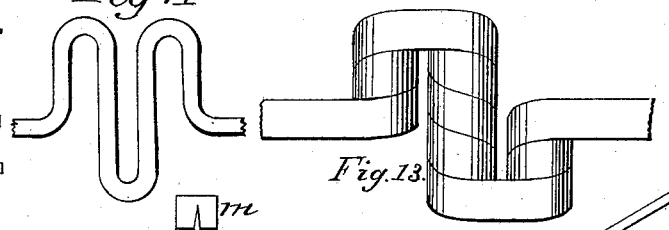


Fig. 13.

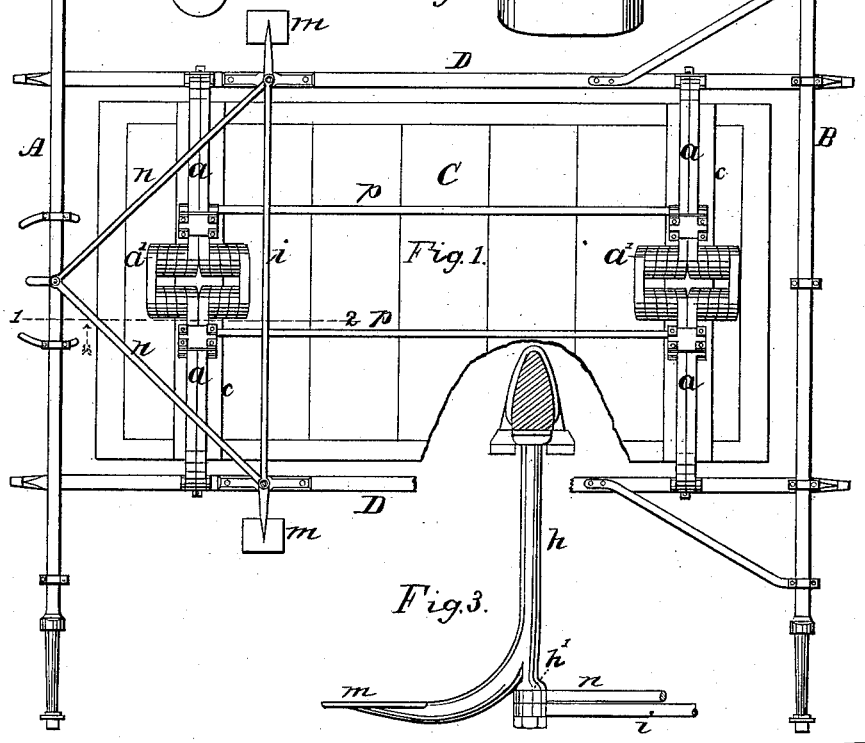


Fig. 3.

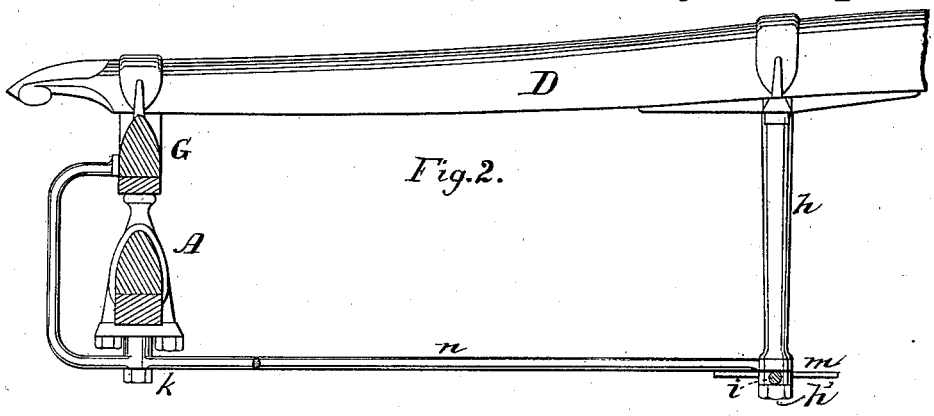


Fig. 2.

WITNESSES:

Sanford C. Goode.

Wm L. Ostrom

INVENTOR:

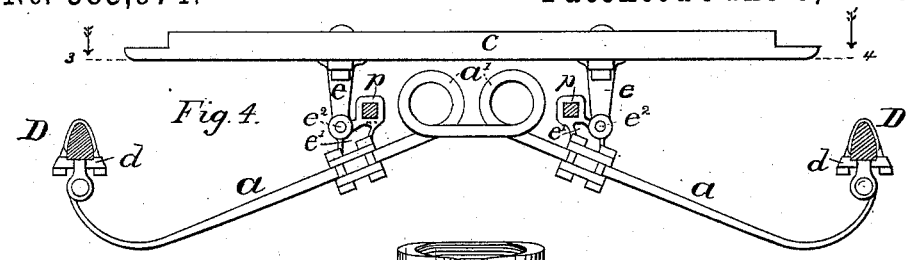
Everett F. Morse.

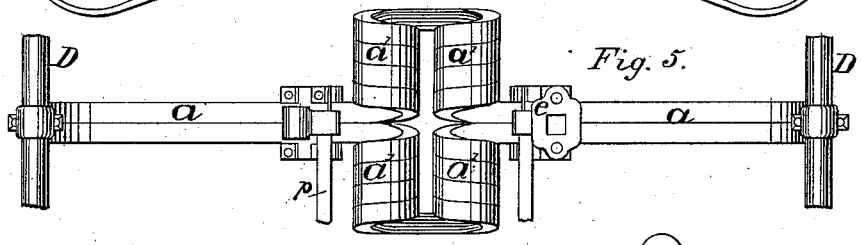
(No Model.) 2 Sheets—Sheet 2.

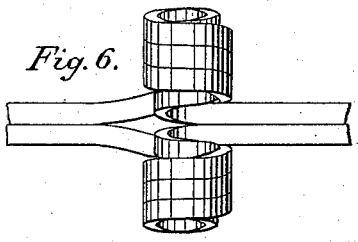
E. F. MORSE.

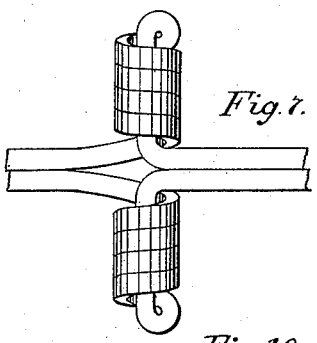
VEHICLE SPRING AND GEAR.

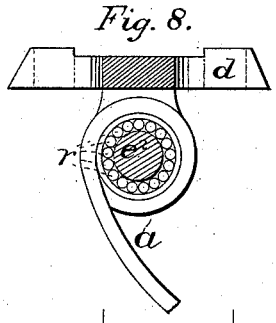
No. 383,974. Patented June 5, 1888.

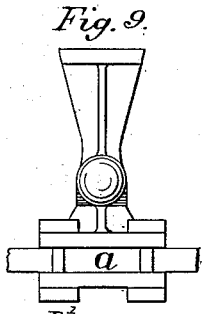


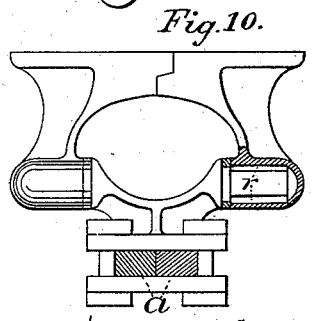


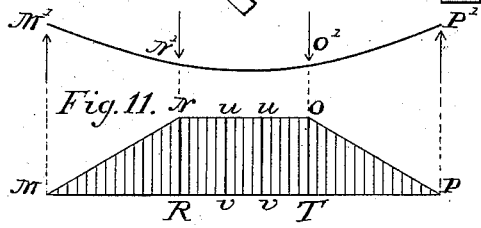


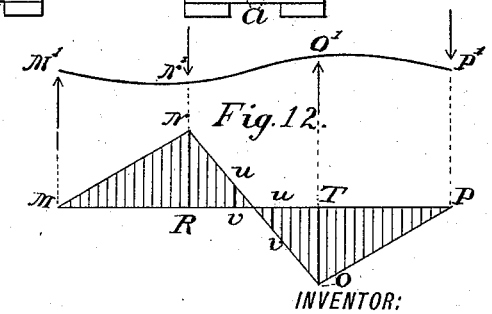












WITNESSES:

Sanford C. Conde.

Wm L. Ostrom

INVENTOR:

Everett F. Morse.

UNITED STATES PATENT OFFICE.

EVERETT F. MORSE, OF ITHACA, NEW YORK.

VEHICLE SPRING AND GEAR.

SPECIFICATION forming part of Letters Patent No. 383,974, dated June 5, 1888.

Application filed July 3, 1886. Serial No. 207,029. (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 certain new and useful Improvements in Vehicle Springs and Gears, of which the following is a specification.

My invention relates to improvements in vehicle springs and gears, and has for its objects to provide a spring that may yield much flexibility to even depression, and, at the same time as little flexibility to rocking or pitching as may be desired, and, further, to provide an improved bearing or joint for vehicle-springs by which the usual sliding friction is replaced by rolling friction, and, further, to provide an improved means for restraining the front axle from tipping either forward or backward. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a bottom view of a vehicle-gear with my improvements, and having a portion broken away to make room for Fig. 3. Fig. 2 is a vertical longitudinal section of my gear on the line 1 2 of Fig. 1, showing my improved way of securing the lower end of the king-bolt. Fig. 3 is a detail view of the step and a portion of the connecting-rods. Fig. 4 is an elevation of my spring; Fig. 5, a plan view of the same with the bar *c* and one of the hangers *e* removed. Figs. 6 and 7 show modified forms of the central part of my spring. Fig. 8 is a detail sectional view of one of my improved bearings or joints. Figs. 9 and 10 are two projections of a modified form of the hangers to my spring. Figs. 11 and 12 are diagrams illustrating the mechanics of my spring, Figs. 13 and 14 are views of modified forms of the portion of my spring extending between the central bearings.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings, A and B represent the front and rear axles, respectively; G, the bolster; D D, the side bars, which are connected with the rear axle and front bolster in the usual manner.

C is the box or body of the carriage, and is supported by the similar springs *a a*, which in the present case extend from one side bar to the other. Each of these springs acts between its ends and two intermediate points, being supported pivotally at its ends by the shackles *d*, which are securely attached to either side bar, and supporting the body at two points on opposite sides of the longitudinal central line of the body by the hangers *e e*, and consists of the oppositely-extending supporting-arms *a* and two or more nearly or quite horizontal parallel torsional branches, *a'*, arranged between the axes of the pivotal connections of the spring with the body and extending transversely to the supporting-arms. When two in number, as shown in Figs. 5, 6, and 7, these torsional branches are rigidly connected to the supporting-arms at one end and with each other at their opposite ends, thus permitting the ends connected with the arms to spring together or apart and follow the circular paths about the central bearings when the springs are worked. Although these torsional branches may consist simply of straight parts of the elastic rods, I prefer generally to form the parts of the rods composing the torsional branches into coils *a'*, thereby locating a larger portion of the elastic rods into them.

When the torsional branches *a' a'* extend wholly to one side of the plane of the spring-arms, two similarly-formed rods may be clamped together, as shown in Figs. 1 and 5, by suitable clamps, the upper halves, *e'*, of which are adapted to be pivotally connected with hangers *e*, which are securely attached to and support the body. The clamps *e'* are also adapted to receive and securely hold the ends of the equalizing-rods *p p*, which connect the front and rear springs, as shown in Fig 1, and which, by their torsional action, tend to make these two springs depress alike and thus reduce the pitching of the body.

When my springs are used in combination with the equalizing-rods *p p*, these rods restrain them from tipping either forward or backward; but when these rods are not used I design the central bearings, as shown in Figs. 9 and 10, so that they will prevent the springs tipping relatively to the body.

It is very desirable that the joints of a vehicle-spring should be as quiet, durable, and have need of as little lubricant as possible. To accomplish this end I insert a series of small

cylindrical rollers, *r*, Fig. 8, between the two bearing-surfaces and parallel to the axis of the joint or bearing, so that when one of these surfaces moves relatively to the other the small rollers will roll between them, and thus replace the usual sliding friction by rolling friction. When the outer bearing surface is one of the eyes at the ends of the spring, a sleeve can be inserted, as shown in Fig. 8, to insure a continuous surface for the small cylinders *r* to roll upon.

My device for securely restraining the front axle from tipping either forward or backward has reference to staying the lower end of the vertical axis about which this axle turns, the upper end of this axis being secured in the usual manner to the bolster G; and it consists of the arms *h*, which have their upper ends rigidly attached to the side bars, D, and the rods or bars *n n* and *i*, which directly connect the lower ends of arms *h* to the lower end of the king-bolt *k* and to each other, respectively. The arms *h* may also have securely attached to their lower ends the steps *m*, as shown in Fig. 3, and thereby be utilized for a double purpose. The various members of the triangular bracing *n n* and *i* act, in combination with arms *h* and side bars, D, to restrain the front axle from tipping, as follows: Any effort of the axle to tip forward is resisted by a pull, and to tip backward by a thrust, in rods *n n*, which in turn tend to throw arms *h* in the direction of the respective rods *n*, to which they are attached, either toward or from the king-bolt *k*. On account of the vertical transverse stiffness of the side bars, to which they are attached, these arms are well adapted to effectively resist the components of these forces, which are parallel to the side bars; but, on account of the torsional flexibility of the side bars, the arm *h* might yield too readily to the components of these forces, which are perpendicular to the side bars, were these components not otherwise resisted. However, as these latter components always act in opposite directions, they are made to act against and thus neutralize each other by the rod *i*, which connects the lower ends of the arms *h*, and resists a thrust when the rods *n n* are subjected to a pull, and conversely resists a pull when the latter rods are subjected to a thrust.

Among the many ways of locating a large amount of elastic material between the central points of action, three are shown in Figs. 6, 7, and 13. The same end may be attained by forming this part of the spring into deep transverse corrugations, as shown in Fig. 14. It may be observed that my spring is reversible—*i. e.*, that the spring may be supported at the central bearings either by having these bearings connected with the axle, bolster, or otherwise, and support the side bars or body at the ends.

In operation the portion of the spring extending between the bearings *e e* acts as an equalizer to the depression of the parts of the body supported by these bearings by being simultaneously subjected to the moments of both supporting-arms. When the spring is evenly loaded, these independent moments tend to deflect the central part of the spring in the same way, and in combination form uniform moments throughout the central part of the spring, as shown by the equal vertical ordinates of moment, (diagram of Fig. 11;) but when the spring is subjected to rolling action—*i. e.*, when the terminal forces act in opposite directions—the independent moments tend to deflect the central part of the spring in opposite directions, and so partially neutralize each other, and in combination form the variable moments shown in moment diagram of Fig. 12. The practical effect of this is to cause the central part of the spring to yield much more flexibility to even depression than to rolling action. The relative flexibility of the coils *a' a'*, Fig. 5, to these two motions is shown by the relative lengths of the ordinates *u v* in the two moment diagrams.

As the rocking motion of the body is the most objectionable accompaniment of very flexible springs, the equalizing-spring should connect arms supporting opposite sides of the body, so that it will limit this particular motion to the desired amount.

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

1. A vehicle-spring consisting of two oppositely-extending supporting-arms supported at their remote ends and pivotally connected to the body on opposite sides of its central line at their adjacent ends, and an elastic rod or bar which is either a continuation of or has its ends rigidly attached to and extends continuously and freely between the butt-ends of said arms, said rods being formed into two or more nearly or quite parallel horizontal torsional branches arranged between the axes of said central pivotal connections and extending transversely to said arms, substantially as described.

2. A vehicle-spring consisting of two oppositely-extending arms supported at their remote ends and pivotally connected to the body on opposite sides of its central line at their adjacent ends, and an elastic rod or bar which is either a continuation of or has its ends rigidly attached to and extends continuously and freely between the butt-ends of said arms, said rods being formed into two or more nearly or quite parallel horizontal coils arranged between the axes of said central pivotal connections and extending transversely to said arms, substantially as described.

3. A vehicle-spring consisting of two elastic rods or bars having their ends pivotally connected to the side bars of a side-bar wagon, their central portions formed into oppositely-extending torsional branches, and the portions extending outward from said branches similarly formed, clamped together, and pivotally connected to the body on opposite sides of said branches, substantially as described.

4. A vehicle-spring consisting of two elastic

rods or bars having their ends pivotally connected to the side bars of a side-bar wagon and their central portions formed into similar coils a' a', and the portions extending outward from these coils similarly formed and closely clamped together by clamps e' e', adapted to pivotally connect said rods to the body at two points on opposite sides of the longitudinal central line of the body, said coils lying between the axes of the central bearings and being free to yield to the moments of both arms, substantially as and for the purpose described.

5. The combination, with a vehicle spring bearing or joint, of a series of small cylindrical rollers inserted between the bearing-surfaces of said joint and parallel to its axis, whereby as one of said surfaces moves relatively to the other said small cylinders are adapted to roll between them, substantially as described.

6. The combination, with the axles and side bars of a side-bar wagon, of dependent arms having their upper ends rigidly attached to said side bars, steps m, securely affixed to the lower ends thereof, and rods or bars securely attached to and extending between the lower ends of said arms and the lower end of the axis about which the front axle turns, substantially as described.

7. The combination, with the side bars and axles of a side-bar wagon, of dependent arms extending from and having their upper ends securely attached to said side bars, and a horizontal truss consisting of members diverging from its opposite ends, which are connected with and supported by the lower ends of said arms, the central part of said truss being connected to and staying the lower end of the axis about which the front axle turns, substantially as described.

8. The combination, with the side bars and axles of a side-bar wagon, of dependent arms having their upper ends securely attached to said side bars, rods diverging in two branches from and securely attached to the lower ends of said arms, the one branch extending to and pivotally connected with the lower end of the axis about which the front axle turns, the other extending between and connecting said arms, substantially as described.

9. The combination, with the axles and side bars of a side-bar wagon, of arms h, having their upper ends securely attached to said side bars, and steps m, affixed to their lower ends, rods n n, securely attached to and extending between the lower ends of said arms and the lower end of the axis about which the front axle turns, and rod i securely attached to and extending directly between the lower ends of said arms, substantially as described.

EVERETT F. MORSE.

Witnesses:
SANFORD C. CONDE,
W. L. OSTROM.