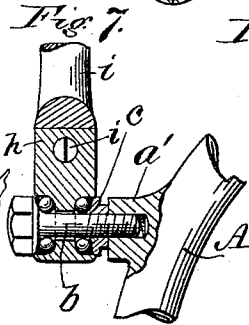
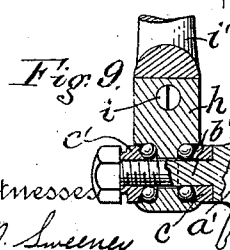
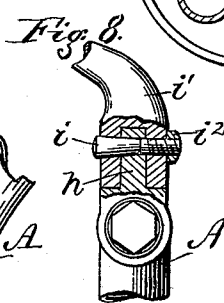
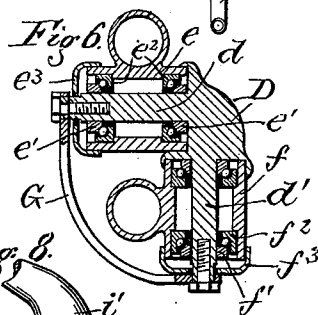
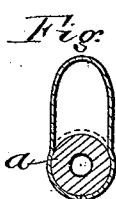
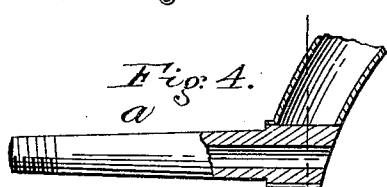
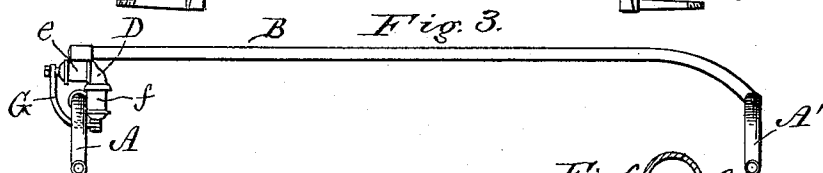
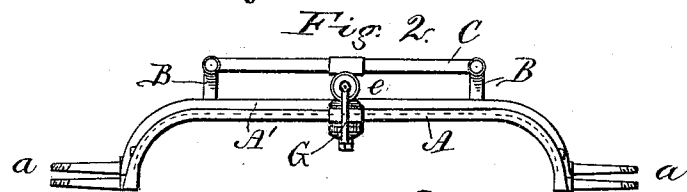
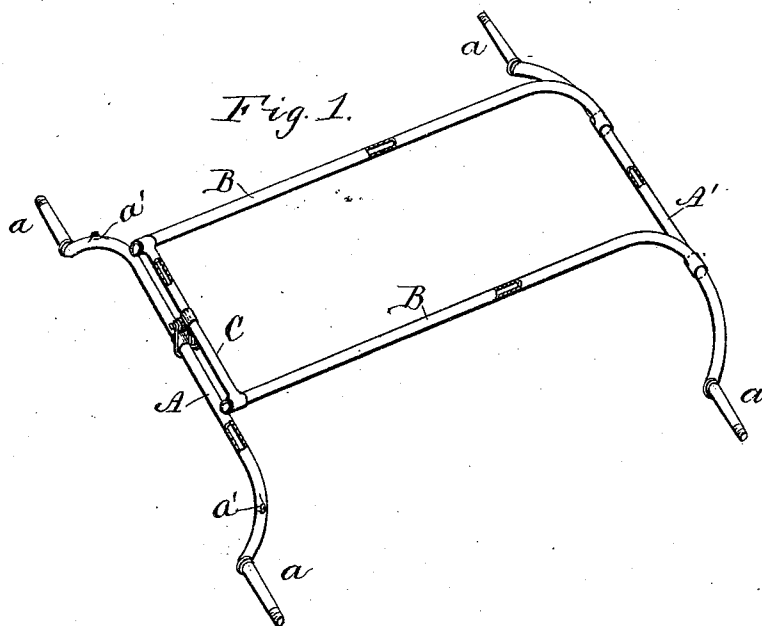


R. S. CRAWFORD.  
RUNNING GEAR FOR VEHICLES.

Patented Dec. 10, 1895.



Witnesses  
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# UNITED STATES PATENT OFFICE.

ROBERT S. CRAWFORD, OF HAGERSTOWN, MARYLAND.

## RUNNING-GEAR FOR VEHICLES.

SPECIFICATION forming part of Letters Patent No. 551,202, dated December 10, 1895.

Application filed December 14, 1894. Serial No. 531,774. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT S. CRAWFORD, a citizen of the United States, residing at Hagerstown, in the county of Washington and State of Maryland, have invented certain new and useful Improvements in Running-Gears for Vehicles, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention has for its object to provide a running-gear frame for a four-wheeled vehicle which will be of simple construction, so that it may be cheaply manufactured, and which in its structure will be such that clips and other parts liable to become loose may be entirely dispensed with, while at the same time the structure of the frame is such that it need not comprise springs, but can still accommodate itself to lateral inequalities of the road or surface over which the vehicle is to run.

Another object of my invention is to combine with a running-gear frame having the advantages just mentioned the greatest possible lightness consistent with proper strength.

To secure the results just stated my improved running-gear frame comprises in its preferred form front and back axles, side bars rigidly and directly connected to the back axle at their rear ends, a bolster rigidly joining the front end of said side bars, and horizontal and vertical joints between said bolster and said front axle, said horizontal and vertical joints providing a universal-joint swivel connection between the said front axle and the said bolster, which will permit the front axle to be turned horizontally relative to the running-gear frame, as does the ordinary fifth-wheel of a wagon, and which will also permit the outer ends of the front axle to move vertically in accommodating themselves to inequalities of the road without imparting lateral rocking motion to the running-gear frame, while at the same time the said horizontal joint permits of more or less lateral rocking motion of the running-gear frame, incidental to such vertical movements as may be imparted to the rear wheels by any roughness in the road without disturbing the front axle, this structure, as will be seen, con-

tributing to an easy-riding vehicle without necessitating the use of springs in the construction of the running-gear.

In the accompanying drawings, Figure 1 is a perspective view of a running-gear frame constructed in accordance with my invention. Fig. 2 is a front end view, and Fig. 3 a side view, of the same. Figs. 4 and 5 are detail views illustrating the manner in which the axle-spindles are preferably joined to the axles. Fig. 6 is a detail view of the universal-joint connection between the bolster and front axle, said connection comprising vertical and horizontal joints. Figs. 7 and 8 are detail views illustrating the joint between the front axle and the shaft or pole connection, and Fig. 9 shows a modification of the same.

In the drawings, A denotes the front axle and A' the rear axle, said axles being provided with spindles *a*.

B B are the side bars of the frame, and C a bolster rigidly connecting the forward end of said side bars together, the rear ends of said side bars being preferably directly and rigidly attached to the rear axle A' by suitable brazed joints. The axles, side bars, and bolster referred to are all preferably of metal tubes, thus providing a metal frame of the least possible weight consistent with the greatest strength, and as the side bars have brazed connections with the rear axle and with the front bolster, all clips and similar separate and loose parts by which running-gear frames are usually joined together may be dispensed with. The axle-spindles are preferably bored out for lightness, as shown in Figs. 4 and 5, and are connected directly to the tubes constituting the axles by a joint which is formed by splitting the tubes and lapping the ends thereof around the axle-spindles and brazing them thereto, as will be understood by reference to said Figs. 4 and 5.

To provide a running-gear frame which will be easy riding, without necessitating the use of springs in its construction, I have devised a novel connection between the said frame and the front axle, which connection comprises a horizontal joint or pivot. This horizontal joint or pivot permits of vertical movements of the wheels running on the spindles

of the front axles, and which vertical movements will give rocking movements to the said front axle, but without imparting rocking movement to the vehicle-frame, the said horizontal pivot also permitting the frame to rock slightly, more or less, incidental to vertical movements of the rear wheels on a rough road, without disturbing the front axle. Furthermore this horizontal joint so far relieves the running-gear frame from strain that the superstructure of the vehicle may be made much lighter than heretofore with safety. Fig. 6 illustrates the preferred form of the horizontal joint referred to and which is also preferably connected with the vertical joint or pivot constituting the fifth-wheel, which permits the turning of the front axle relative to the vehicle-frame. In this preferred form of my combined horizontal and vertical joints, D denotes a forging provided with a horizontal spindle  $d$  and a vertical spindle  $d'$ . The horizontal spindle  $d$  is inclosed within a casing  $e$ , which has a brazed connection with the bolster C and which is preferably provided with cones  $e'$ , between which and collars  $e^2$  are interposed balls forming a ball-bearing between these parts, the ball-bearing being protected and inclosed by a cap  $e^3$ . The vertical spindle  $d'$  is also preferably inclosed within a casing  $f$ , having a brazed connection with the tubular front axle D', said spindle being also preferably provided with cones  $f'$ , between which and collars  $f^2$  are interposed balls, thus making a ball-bearing fifth-wheel joint between the said front axle and said bolster, said ball-bearing being also protected by a cap  $f^3$ . The spindles  $d$  and  $d'$  are preferably joined by a brace G, which steadies the same and holds them rigid with relation to each other.

To provide for an antifricition and antirattling joint between the front axle and the shaft or pole connections the said front axle is provided with lugs  $a'$ , which, as herein shown, are bored for the reception of screw pins or bolts  $b$ , the shanks of which form studs on which are placed cones  $c$  which will be screwed tightly against said lugs  $a'$ . The bolts  $b$  are also formed with conical portions below their heads, and between the conical portions of the said bolts and the said cones  $c$  and ears  $h$  which surround the bolts are interposed balls to form ball-bearing joints. The ears  $h$  are each rigidly connected by a bolt  $i$ , preferably formed tapering, as shown, to the forked portion of the pole or shaft connection  $i'$ , said bolt being provided with a set-nut  $i^2$  by which it may be drawn up tight. This construction forms a convenient detachable connection between the pole or shafts and the axle without disturbing the ball-bearings.

From the foregoing it will be apparent that I am able to provide a vehicle running-gear of very simple construction in which no clips, springs, or a reach will be necessary, and which at the same time will provide an easy-riding

vehicle-frame which will be of the greatest possible strength with the least possible weight.

My improved running-gear frame is more particularly designed for use in connection with pneumatic wheels, and when furnished with the same will provide a very light, as well as light-running and easy-riding vehicle. Furthermore, my improved running-gear, while very light, is so rigid longitudinally that the driver of a fast horse will always be in the same position relative to the horse, and thus any jerking on the horse's mouth through the reins incidental to longitudinal vibration of the vehicle, is avoided.

I do not wish to be understood as limiting my invention to the details herein shown, as I believe that I am the first to construct a running-gear for a four-wheeled vehicle in which there is a horizontal and vertical joint connection between the front axle and a bolster above the same, providing a universal-joint swivel connection between these parts. While I have shown the rear ends of the side bars as rigidly and directly connected to the rear axle I do not wish to be understood as limiting my invention to this construction, as, if desired, springs may be interposed between the rear ends of the said side bars and said rear axle. Furthermore, although I prefer to construct the parts of my improved running-gear frame of metal tubes, as above described, I do not wish to be understood as limiting myself to metal tubes, as the double-joint connection between the bolster and front axle might be used in connection with a frame of wood, or a metal frame the parts of which were not of tubes, without departing from the spirit of my invention.

Fig. 9 illustrates a slight modification of the pole connection with the front axle, and in this form of my invention the lugs  $a'$  are provided with studs  $b'$ , which are integral therewith or rigidly secured thereto and on which are placed cones  $c$  and  $c'$ , between which and the ears  $h$  are interposed balls to form a ball-bearing.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In a vehicle running gear the combination with the front and rear axles thereof, of side bars connected with said rear axle, a bolster rigidly joining the front end of said side bars, said axles, side bars and bolster being all of metal tubes, and a horizontal and vertical ball-bearing joint connection between the said bolster and said front axle.

2. The combination with the front axle A and the bolster C, of the universal joint connection between said parts comprising the piece D provided with the spindles  $d$  and  $d'$ , the casing  $e$  attached to the said bolster, the casing  $f$  attached to the said front axle, and the brace G connecting said spindles.

3. The combination with the front axle A

and the bolster C, of the universal joint connection between said parts comprising the piece D provided with the spindles *d* and *d'*, the casing *e* attached to the said bolster, the  
5 casing *f* attached to the said front axle, ball bearings in the said casings, and the brace G connecting said spindles.

4. The combination with the front axle provided with the lugs *a* having studs, of the ears

*h* surrounding said studs, the ball bearings 10 between said studs and ears, and the shaft or pole connections attached to said ears.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT S. CRAWFORD.

Witnesses:

HENRY CALVER,  
NATHAN H. ROBBINS.