3 Sheets—Sheet 1

J. B. ROOT.

Road-Locomotive.

No. 205,212. Patented June 25, 1878.

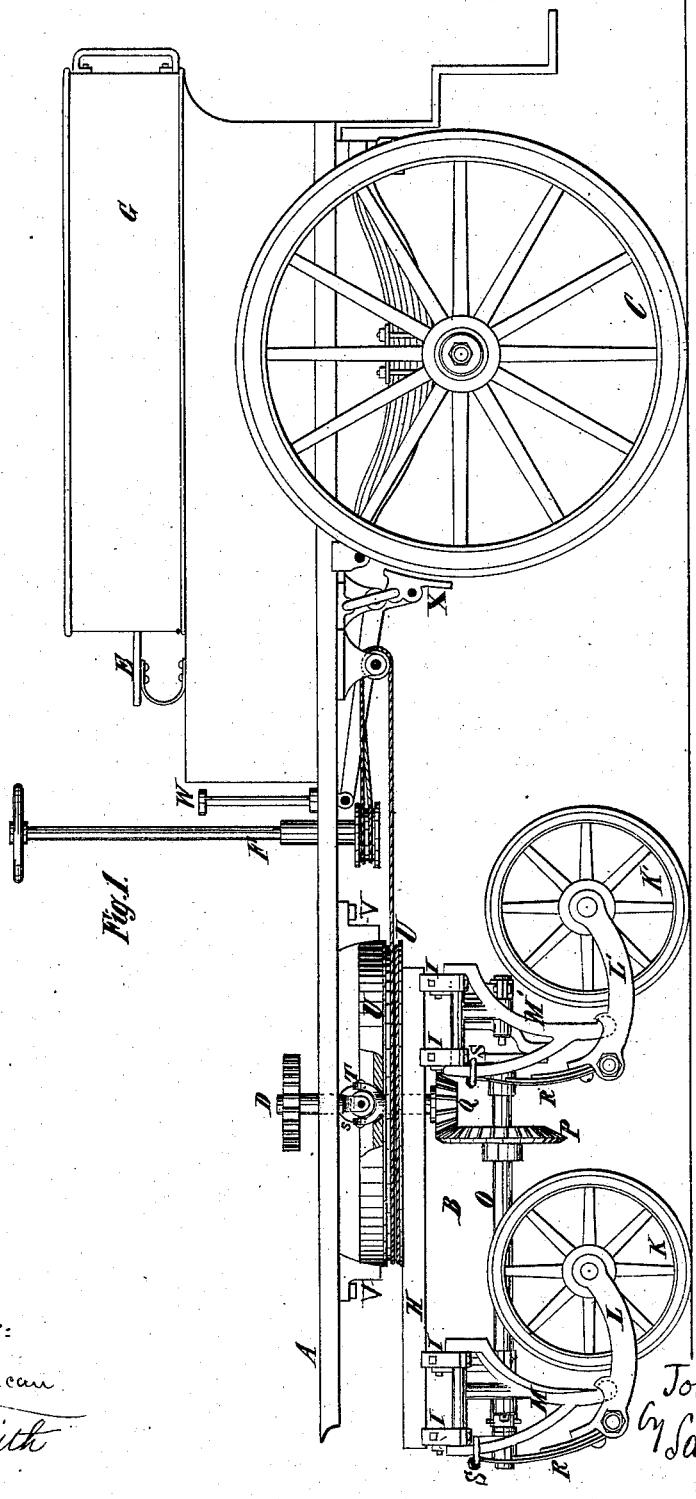

Fig. 1.

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3 Sheets—Sheet 2.

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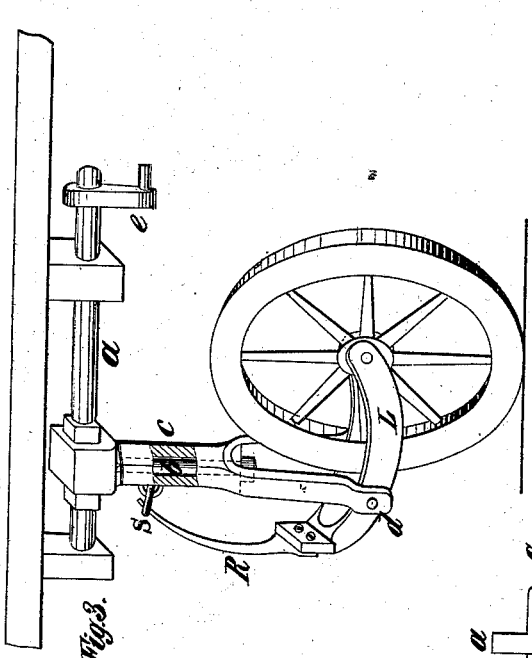

Fig. 3.

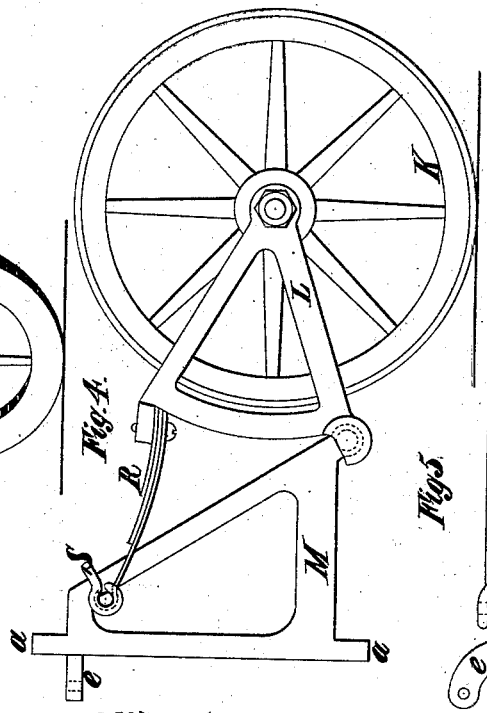

Fig. 4.

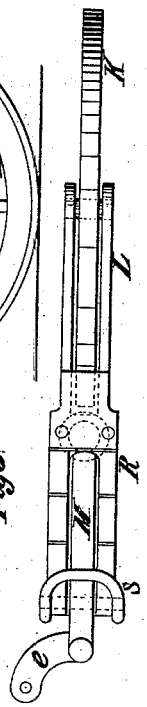

Fig. 5.

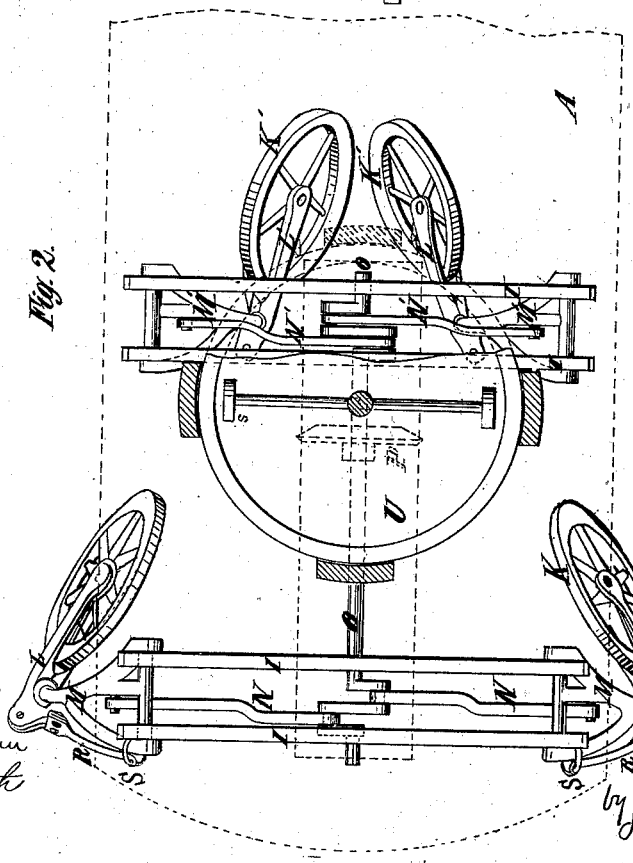

Fig. 2.

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3 Sheets—Sheet 3.

J. B. ROOT.

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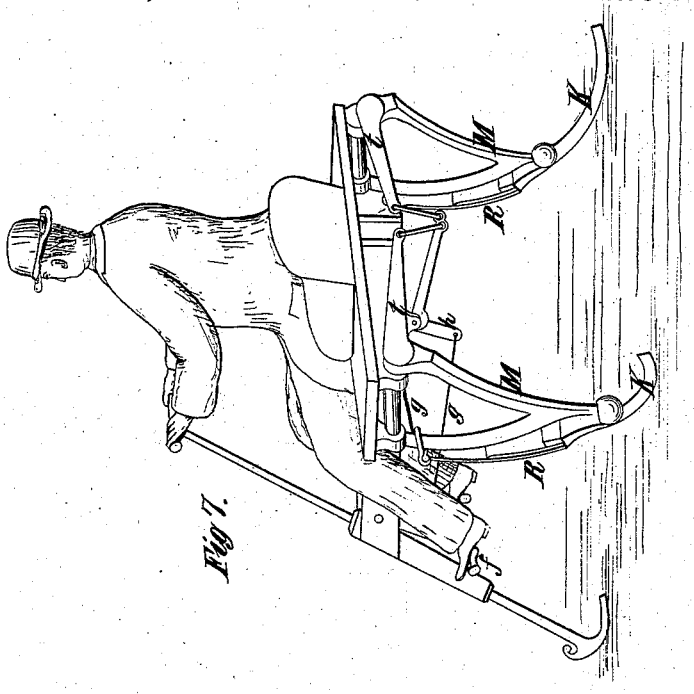

Fig 7.

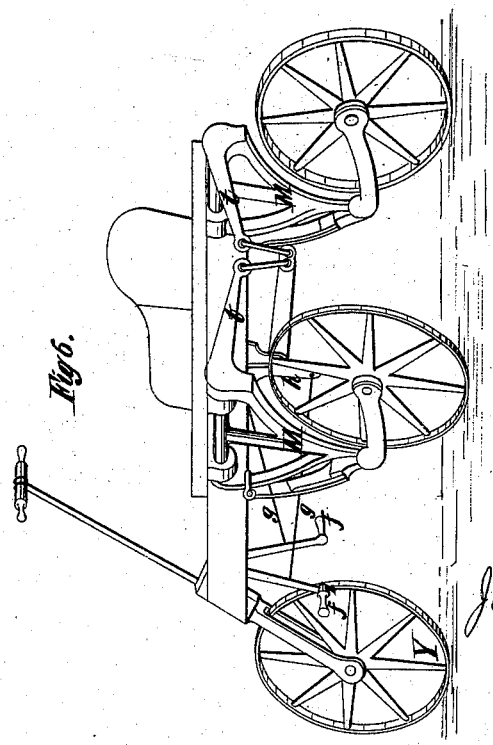

Fig 6.

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UNITED STATES PATENT OFFICE.

JOHN B. ROOT, OF NEW YORK, N. Y.

IMPROVEMENT IN ROAD-LOCOMOTIVES.

Specification forming part of Letters Patent No. **205,212**, dated June 25, 1878; application filed October 27, 1877.

To all whom it may concern:

Be it known that I, JOHN B. ROOT, of the city, county, and State of New York, have invented a new and useful Improvement in Road-Locomotives, of which the following is a specification:

In road-locomotives, or, as they are otherwise called, "traction-engines," as generally heretofore constructed, the traction-wheels have been mounted upon axles that maintained a fixed relation to the line of direction along which the machine moved. Various disadvantages attend this construction, among them the circumstance that wheels thus mounted, when encountering obstructions or coming upon soft ground, are liable, by their continued revolution on the same spot, to dig down into the surface of the road, and thus embed themselves and wholly arrest the advance of the engine.

The present invention is based upon an entirely different principle of construction, the propelling-wheels being mounted, so as to move in and out with reference to the path of the machine, assuming a diagonal position relatively to such path as they perform their vibrations. The action of the parts which follows from this construction is somewhat akin to that which attends the movements of a skater on the ice or an oarsman propelling a boat through the water by sculling, except in the present apparatus, by reason of the medium upon which it moves, the wheel becomes an important element.

The invention is fully illustrated in the accompanying drawings, (three sheets,) in which—

Figure 1 is a side elevation of the machine. Fig. 2 is a plan of the truck, certain parts being represented in dotted lines, in order to show more distinctly the parts below. Fig. 3 shows a modified plan of mounting the traction-wheels. Figs. 4 and 5 are, respectively, an elevation and plan of a method of mounting the wheels to swing from a vertical axis. Fig. 6 shows a convenient application of the principle to a carriage to be operated by treadles. Fig. 7 shows the application of the principle to a carriage to be propelled upon a surface of ice, runners or blades of metal being in this instance substituted for the wheels used when the carriage is to be propelled over the ground.

Referring to Figs. 1 and 2, A is the main carrying frame or platform. The forward end of this frame is supported on the truck B, and the rear end by the carrying-wheels C C. Upon this platform may be mounted any suitable engine for driving the main vertical shaft D; also, a conductor's seat, E, a part, F, of the steering apparatus, and, if desired, seats G for the accommodation of passengers.

The truck B consists of a main longitudinal beam, H, and several transverse beams, I I, supported on two pairs of caster-wheels, K K K′ K′. These wheels are mounted in the frames L L L′ L′, and these frames, in turn, are connected by ball-and-socket joint with hanging arms M M M′ M′, which are pivoted to the frame of the truck in such a way as to swing in and out relatively to the path of the machine, their lateral movements being controlled by the connecting-rods N N N′ N′, which are operated by the cranks on the counter-shaft O. This counter-shaft is driven by the bevel-wheel P, meshing with the bevel-pinion Q on the lower end of the driving-shaft.

The frames which support the caster-wheels have each an arm projecting forward of the ball-and-socket joint, and to this arm there is attached a spring, R, the upper end of which is secured to one branch of the swinging arm near its pivot by means of a loose ring, S. This mode of attachment, while supporting the forward end of the wheel-frame, permits such frame to turn on the ball-and-socket joint, within certain limits, with freedom.

The cranks of the forward pair of wheels are set in opposite directions, while those of the rear pair are, preferably, set at an angle of ninety degrees with those first named. This arrangement of cranks enables the one pair of wheels to be in full action while the other is changing direction.

The driving-shaft D is made in two parts, and these are coupled together with a universal joint at T. The object of this is to provide a joint around which the truck may rock, as the vibrating arms L L′ swing in and out, without too much disturbing the level of the platform above, and this joint should be as near

as may be at a point midway between the forward wheels and the rear wheels when the vibrating arms stand vertical.

The operation of the machine is as follows: The revolution of the crank-shaft swings the arms L L L′ L′ alternately out and in; but the wheels, by reason of their swivel-connection with these arms and their contact with the ground, instead of moving directly at right angles to the crank-shaft, are caused to run always in directions diagonal thereto, changing alternately to the right and left of the vertical plane of the axis on which the swinging arms move. It is by the repeated diagonal movements of these wheels that the truck and all the parts mounted thereon or connected therewith are carried forward.

It will be observed that during a portion of each outward or inward vibration of the wheels they will be inclined from their normal perpendicular position, and when thus inclined will not only be running forward diagonally to the path of the machine, but will actually be pushing against the ground; and it will also be observed that during a portion of each vibration of the wheels the center of gravity of the corresponding end of the truck will be raised, but only to descend during the remaining part. Both of these last-named features combine with the diagonal movements of the wheels to aid in moving the machine forward.

It should be remarked that the driving-shaft D, instead of being made in two parts, as shown in the drawing, may be made rigid throughout; and in that case the tendency of either end of the truck to rise as the vibrating arms swing from their extreme positions to the perpendicular position will be compensated by the play of the spring R and the joint which connects the vibrating arms with their respective wheel-frames. This, of course, requires that the spring be made of a strength corresponding to the work thus put upon it.

The object of arranging the wheels in pairs is to keep the machine steady in its forward course, and thus prevent the lateral oscillation that would attend the use of a single wheel centrally located. A single wheel, doubtless, might be used for driving a vehicle provided with proper carrying-wheels, were it not for the constant tendency to veer to the right and the left with every change in the direction of the wheel, which makes the arrangement in pairs very desirable.

The springs R R serve largely to relieve the apparatus from the shock that otherwise would come from the contact of the wheels with the inequalities of the surface. These springs also, to no inconsiderable extent, cause the wheels to hug the ground, notwithstanding its inequalities.

The engine is guided by changing the direction of the truck. This is accomplished by means of a guide-pulley, U, mounted on the truck and operated by an endless cord or chain passing around the smaller pulley on the lower end of the shaft F. This shaft may be operated by the hand-wheel on its upper end. The guide-pulley U is provided with friction-rolls *s s*, designed to bear against the under side of the main platform, and these rolls are arranged on that diameter of the pulley which is at right angles to the direction of the truck.

The guide-pulley, in order to insure greater steadiness, is made to work against curved bearing-blocks, V V.

In order to permit the turning of the truck, as above described, the main shaft D is made to turn freely in its bearings.

W is a treadle placed near the conductor's seat for operating the brake X.

In the construction shown in Fig. 3 the swinging arm consists of a rock-shaft and the round bolt *b*. This bolt enters a tubular socket in the standard *c*, which is pivoted at *d* to the frame which immediately supports the wheel. The rock-shaft *a* is operated by the crank *e*, to which a connecting-rod from the counter-shaft is to be attached. By this construction the joint between the wheel and the swinging arm may be carried farther back toward the axle and within the periphery of the wheel, and thereby a greater leverage secured than when the joint is wholly outside and in advance of the rim of the wheel. As shown in the drawing, Fig. 3, the rod *b* and standard *c* are in a perpendicular position, which arrangement will serve on a machine adapted for a level surface; but on a machine intended for ascending inclines or running in an uneven country these parts are, preferably, to be inclined rearwardly, which will give greater leverage.

In Figs. 4 and 5 there are shown the details of a construction in which the driving-wheel is attached to an arm which swings around a vertical axis or pivot, *a* being the rock-shaft which constitutes the pivot and *e* the arm to which the connecting-rod leading from the counter-shaft is attached. The other parts are designated as in Figs. 1 and 2. For certain purposes this mode of mounting and driving the wheel may be found desirable, especially if a single wheel be used.

In Fig. 6 a single pair of driving-wheels is shown, and these are operated by means of treadles *f f*, from which connecting-rods *g g* run to the double bell-crank lever *h*, the rear arm of which is linked to arms *t t* on the swinging frames M M.

The vehicle is guided by means of the wheel Y, which can be turned freely in any direction.

The vehicle shown in Fig. 7 is arranged similarly to that last described, except that curved blades or runners of metal are substituted for wheels. This apparatus is designed for traveling on ice.

One important element of advantage connected with the various forms of apparatus above described is that the leverage of the drivers will change with every change of grade or resistance which the machine encounters in its progress, the leverage increas-

ing with every increase of upward grade or of load.

It will be readily understood that the invention is not limited to the use of the ball-and-socket joint or the strap-spring for connecting the driving devices to the vibrating arms. Any joint that permits the proper degree of swiveling may be used, and any spring that permits the proper play of the wheel-frame may be used instead of the spring R.

What is claimed as new is—

1. In combination with a vehicle or traction-engine, a propelling-wheel or other device mounted upon a vibrating arm, so as to run upon the ground in directions diagonal to the general path of the machine, and changing alternately to the right and left, substantially as described.

2. In combination with a vehicle or traction-engine, a pair of propelling-wheels or other devices mounted upon vibrating arms, so as to run on the ground in directions diagonal to the general path of the machine, and to act against each other to steady the machine, substantially as described.

3. In combination with the propelling-wheels or other devices of the traction engine or vehicle, the swivel-joint and spring by which they are attached to the vibrating arms, substantially as and for the purpose described.

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