(No Model.)

3 Sheets—Sheet 1.

A. M. ALLEN.

ROAD VEHICLE.

No. 533,405. Patented Jan. 29, 1895.

Fig. 7

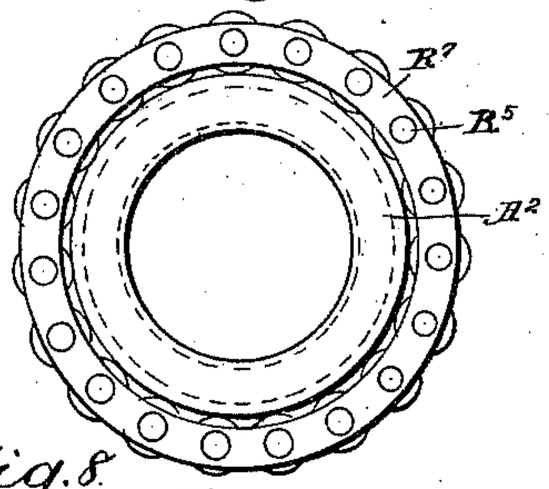


Fig. 8

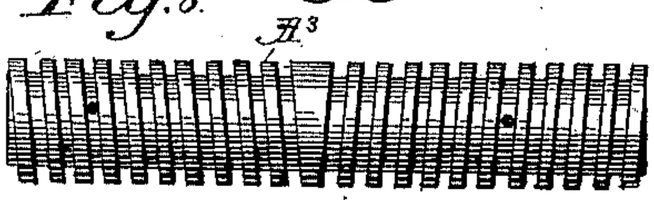


Fig. 9.

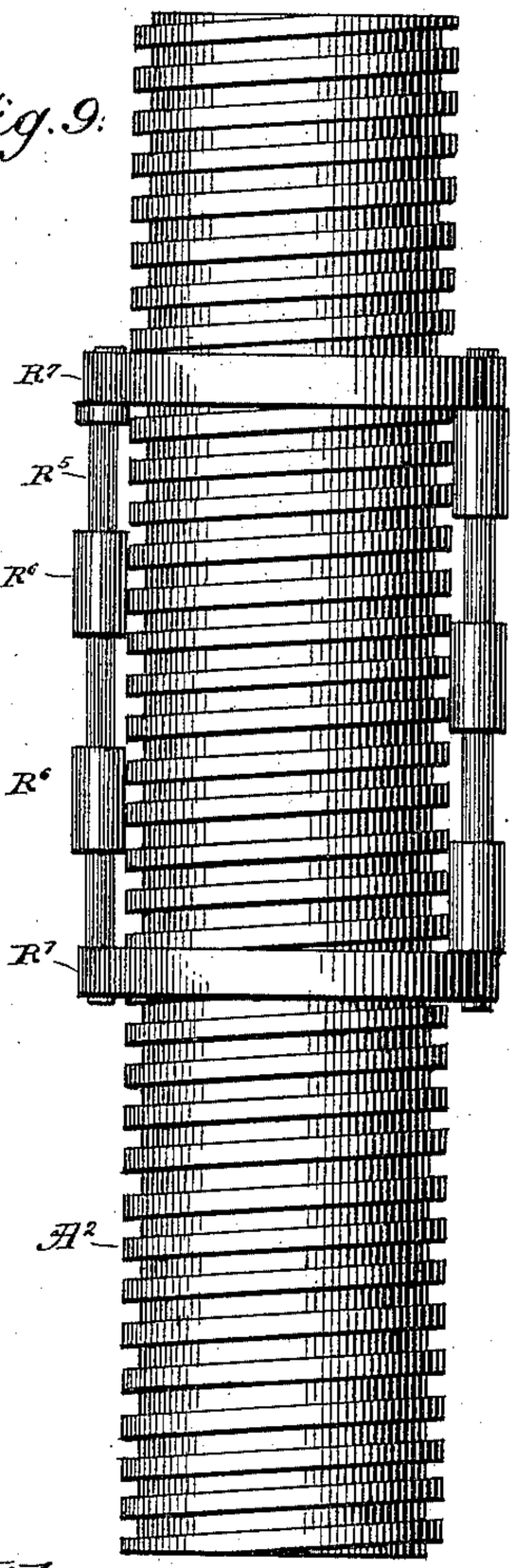


Fig. 3.

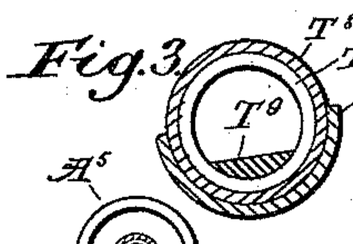


Fig. 4.

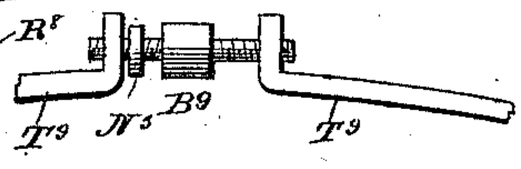


Fig. 2.

Fig. 5.

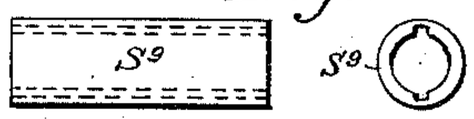


Fig. 6.

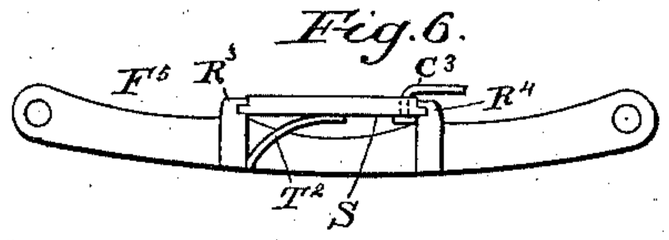
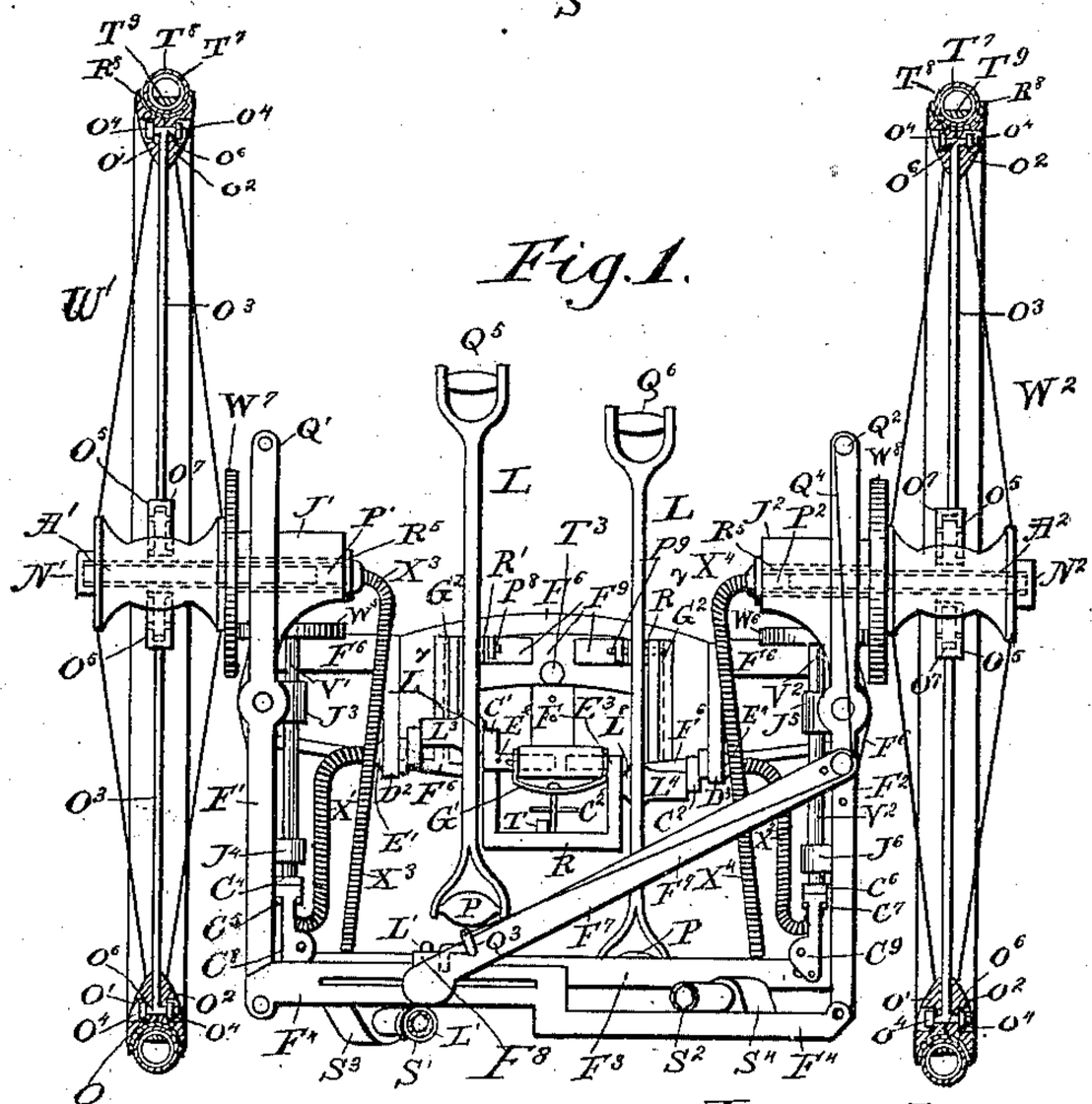


Fig. 1.



Witnesses:
Leonora Ly. Allen.
Helen L. Fox

Inventor:
Arthur M Allen

(No Model.)

3 Sheets—Sheet 2.

A. M. ALLEN.

ROAD VEHICLE.

No. 533,405. Patented Jan. 29, 1895.

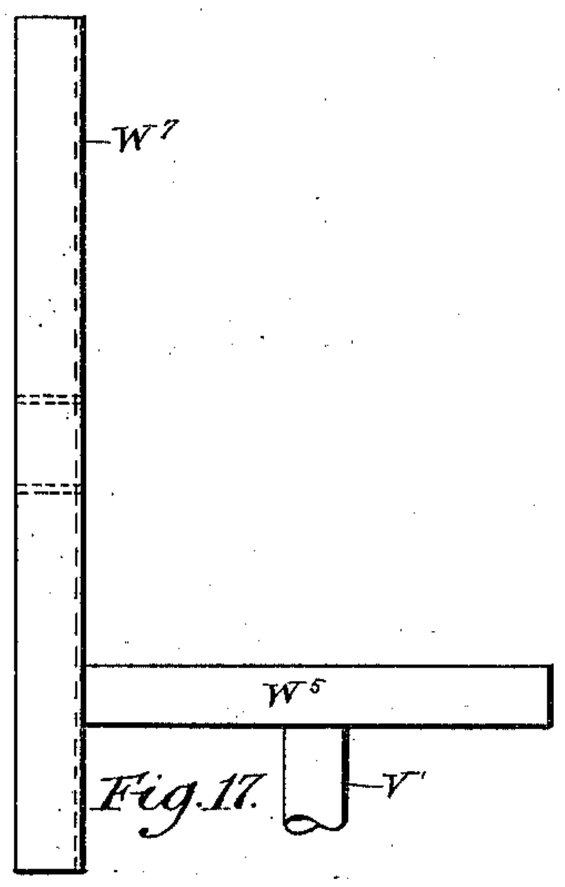


Fig. 17.

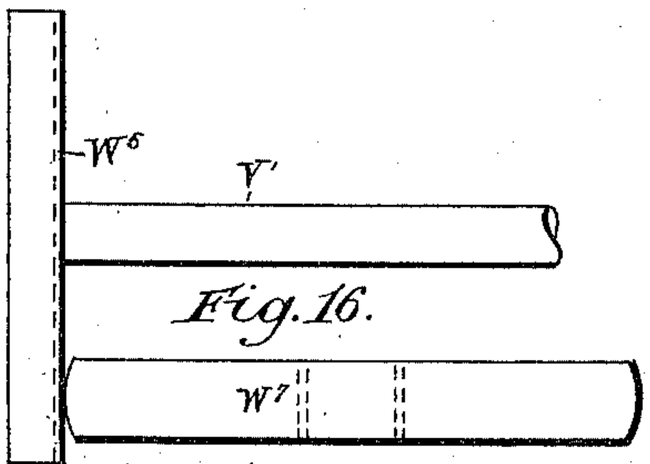


Fig. 16.

Fig. 15. Fig. 14.

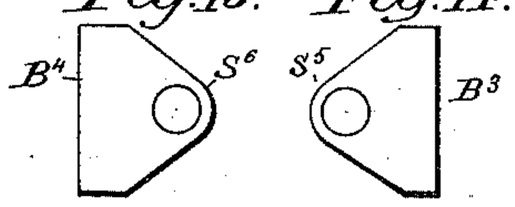
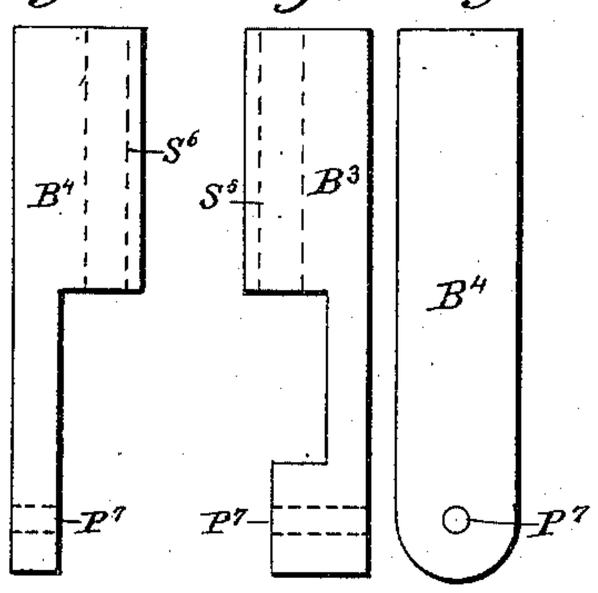


Fig. 13. Fig. 12. Fig. 11.



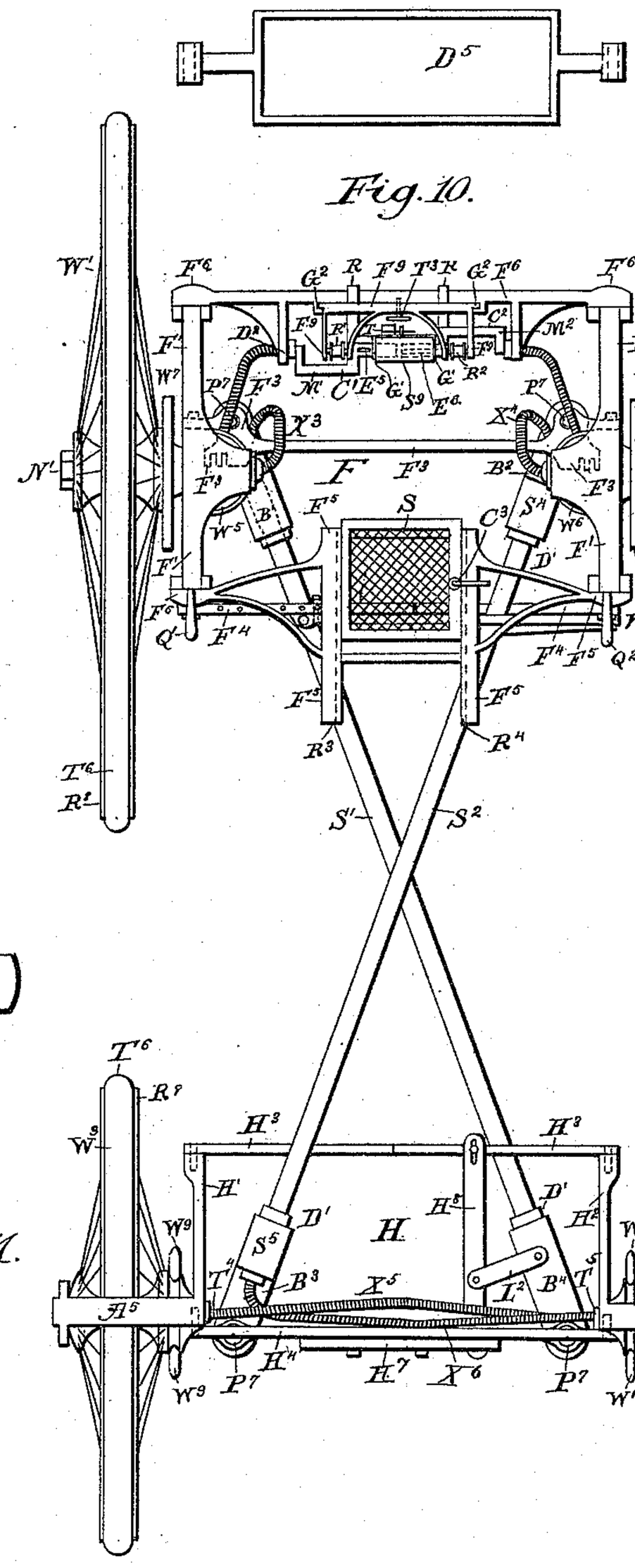


Fig. 10.

Witnesses:
Leonora L. Allen
Helen L. Fox.

Inventor:
Arthur M. Allen

(No Model.) 3 Sheets—Sheet 3.

A. M. ALLEN.

ROAD VEHICLE.

No. 533,405. Patented Jan. 29, 1895.

Witnesses:

Leonora L. Allen

Helen L. Fox.

Inventor:

Arthur M. Allen

UNITED STATES PATENT OFFICE.

ARTHUR M. ALLEN, OF NEW YORK, N. Y.

ROAD-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 533,405, dated January 29, 1895.

Application filed November 7, 1884. Serial No. 147,340. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR M. ALLEN, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Road-Vehicles, of which the following is a specification.

This invention relates to the means necessary to make a road vehicle of such simple and enduring construction, that when operated by a suitable motor, it will transport over ordinary roads with convenience, economy and dispatch, riders, baggage, and its own propelling power, for which purpose are required, first, great economy in applying power; second, variety of muscular action; third, two or more points in the driving gear, to which power may be simultaneously applied; fourth, power variable, and adjustable when under way; fifth, all wheels should propel, steer without slipping, be stable on curves, resist centrifugal strain at high speed, have minimum friction on the road and axle, but maximum road grip, and be easily separated from and replaced on the axles; sixth, smooth operating connection between the driving gear, and steering wheels; seventh, effective and clean lubrication; eighth, the special use of each part to be the guide in construction and all connections to conform thereto; ninth, simple and reliable brake. In this instance hand and foot power, either singly, or combined are used, but any steam, electric, or other motor of light construction, may be used to supply the whole or a part of the required power. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a back view on the line *x x* in Fig. 18 omitting the seat shown in Fig. 6. The wheels are shown in section on the line of the braces O^3. Fig. 2 is a back view on line *o o* in Fig. 18 except the wheels which are shown in vertical section. Fig. 3 is an enlarged section of the elastic tubular tire and rim on the line *a*, *a*, in Fig. 18. Fig. 4 is an enlarged view of the strap ends, and bolt B^9 for securing the tire in the wheel-rim. Fig. 5 shows the side and end of the double splined sleeve S^9. Fig. 6 is a back view of the seat frame and seat. Fig. 7 is an enlarged end view of friction rollers, and the hollow threaded axle. Fig. 8 is an enlarged side view of rear axle A^3 or A^4. Fig. 9 is an enlarged side view of front axle A^2 and the friction roller retaining rings, with two rollers. Fig. 10 is a plan of the vehicle, omitting crank levers L shown in Figs. 1 and 18, and showing diagonal hollow shafts with connections for driving back wheels from front wheels; and the crate frame. Figs. 11, 12, 13, 14, and 15 are enlarged different views of pivot blocks for the ends of diagonal shafts. Figs. 16 and 17 are enlarged views of different positions of friction gears W^5 and W^7. Fig. 18 is a side view of the vehicle, part of the spokes and rims being cut away to show the steering gear. Figs. 19, 20, 21, and 22 represent variations in the construction of the variable crank levers L. Figs. 23 and 24 are detail views of row lock L′ and slide F^8. Fig. 25 shows the construction of the pyramidally pointed contact surface, on the sides of gears W^7, W^8. Fig. 26 represents a single friction roller journal R^5 on which are mounted two sizes of tube sections R^6, R^9.

Similar letters indicate corresponding parts.

Two pairs of road wheels support the vehicle.

Side frames F′ F^2 contain bearings J′ J^2 for axles A′ A^2, bearings J^3 J^4 J^5 J^6 for shafts V′ V^2, and steering handles Q′ Q^2, which are attached to the frames F′ F^2, so that they may turn in their sockets, each on its own horizontal axis. Eight bolts or pivots pass transversely through threaded holes in the ends of cross bars F^3 F^4, seat frame F^5 and crank frame F^6, into threaded holes in the side frames F′ F^2, thus forming the front frame F. Side frames H′ H^2 contain arches A^5 A^6, holes B^5 B^6 B^7 B^8 for axles A^3 A^4 and bearings K′ K^2 for the shafts T^4 T^5 of the friction gears W^9 W^{10}, and are connected by cross bars H^3 H^4 H^5 thus forming the hind frame H. The joints in each frame are threaded pivots, horizontal in this case, and parallel, and are tight in the frames, but loose in the cross connections; whereby the frames can within certain limits, fold like a parallel rule, and the road wheels lean to the inside of the curve traversed by the vehicle, while the rider and driving gear remain nearly upright.

Diagonal cross bars F^7 H^6 are pivoted at their upper ends to the side frames F^2 H′, their lower ends being secured to slide F^8 op-

erating in a horizontal slot in cross bar F^4, and to slotted slide H^7 operating on screw shanks set in cross bar H^4. Slide F^8 is secured in different positions by latch Q^3 and string Q^4, or other suitable detents, operated by the handle Q^2, and is connected to, and operates slide H^7 by diagonal shafts hereinafter described, whereby all the road wheels assist to steer the vehicle, and lean to the inside of the curve as the radius decreases. For higher speeds the diagonal cross bar F^7 is pivoted lower on the side frame F^2 whereby the frame folds more each way.

In cross bars F^3 and H^4 are pivots P^7 on which oscillate pivot blocks B' B^2 B^3 B^4 containing bearings S^3 S^4 S^5 S^6 (with or without friction rollers) for hollow metal diagonal shafts S' S^2, on which are fixed retaining collars D' at the ends of the bearings S^3 S^4 S^5 S^6, and which are connected to flexible shafts X^3 X^4 in front, and to flexible shafts X^5 X^6 behind. These connect the front and hind frames, and by offsets in cross bars F^4 H^3, keep them from swinging. They also with the flexible shaft connect the hind wheels to the driving gear, and are the chief part of the steering and leaning gear. As they revolve in opposite directions they have no friction on each other. Being hollow they may be fixed in their end bearings and rods connecting the flexible shafts passed through them connecting the front and hind wheels.

Flexible shafts X^3 X^4 connect the front ends of diagonal shafts S' S^2 to the inside ends of axles A' A^2 and flexible shafts X^5 X^6 connect the rear ends of said shafts to shafts T^4 T^5 which revolve in bearings K' K^2 in the hind frame, and carry the gears W^9 W^{10}, which engage in grooves in the hubs of the hind road wheels W^3 W^4. The bearings K' K^2 of shafts T^4 T^5 are fixed in side frames H' H^2 and secured by lock nuts N^3 N^4. Flexible shafts X' X^2 connect the driving crank axles to shafts V' V^2, which by friction gears W^5 W^6 W^7 W^8 operate the front road wheels. By these means each front road wheel drives the wheel behind it, and the ratio between the gears W^9 W^{10}, and the hubs of the hind road wheels W^3 W^4, being the same as that between the front and hind road wheels, the same distance is traversed by each wheel in the same time, slipping is avoided, and the size of one wheel does not depend upon the size of the other.

The diagonal shaft S' passes through a rowlock L' in the lower end of front diagonal bar F^7 and near its rear end connects by a link L^2 to a lever H^8, which operates the rear diagonal cross bar H^6 by means of the slide H^7, whereby when handles Q' Q^2 are operated, the front and hind wheels lean and steer in unison.

To lean and steer the vehicle, handles Q' Q^2 are seized by the rider, who pushes one from, and pulls the other sidewise to himself, to steer it, while the propelling is done with the feet alone, it being impossible to operate with hands and feet together, except on straight or circular courses.

In projections from the crank frame F^6 are bearings D^2 D^3 in each of which is mounted one outer axle of the double cranks C' C^2, whose inside axles rest in, and are connected by, a movable sleeve S^9, on whose inside two splines are cut opposite each other, to engage with a long feather E^6 on axle E^3, and a short feather E^5 on axle E^2. When the sleeve is near crank C', both feathers are in the sleeve S^9. By moving the sleeve close to crank C^2, the short feather E^5 is released, and the axles E^2 E^3 are disconnected. Then by revolving crank C^2 till the other spline is opposite the short feather E^5, and moving back the sleeve S^9 to crank C', said axles are reconnected in opposite relative positions. A foot rest R projects from the crank frame F^6, and a swinging sleeve guide G', operated in this case by the foot, is mounted on axles E^2 E^3, and embraces the ends of the sleeve S^9. A stop or catch T keeps the guide in either position after use.

A lever hinged near its middle on the crank pin, one end connected to a stationary fulcrum and the operating end, on the other side of the crank pin, free, is the means by which I purpose to transfer part of the leverage of the return stroke to the live center in use, without lengthening said stroke, and thereby to realize more of the power applied. The means used is called the variable lever L whose advantage to the foot, obtains only during the forward motion of the vehicle.

Upon the pins M' M^2 of cranks C' C^2 are mounted variable levers L, having at one end pedals P for the feet. The other ends of the levers are slotted, and inclose rollers R' R^2 which are mounted on studs P^8 P^9 in the adjustable frame F^9 as fulcra; or they may be plain rods and pass through said studs or blocks mounted thereon. The levers pass to and fro upon the fulcra, and the power is greatest when the crank pins are nearest thereto. Detachable sleeves L^3 L^4 extend from the sides of the levers on the crank pins, for stiffness sidewise. The path of the pedals is substantially straight in the outward thrust and semicircular in the return. The levers when vertical extend beyond the fulcra P^8, P^9, and are provided with handles Q^5 Q^6 to assist the progress of the vehicle when the rider is not steering. The path described by the handles is oval as in rowing. This lever L, I call a variable lever, since the value changes as the driving axle revolves, and its crank pin carries the lever with it, while the fulcrum is fixed. The shape of the lever, or mode of connection to or operation upon the fulcrum is immaterial, but that shown is simplest.

Where eccentrics Fig. 19, or gears Figs. 21 and 22, are to be operated instead of cranks, the bearing L^7 is replaced by an eccentric strap Fig. 19, or internal gear Fig. 21, or external gear Fig. 22 as each case requires.

The fulcra P^8 P^9 are the pivots of the rollers

R′ R², and are mounted in arms extending from frame F⁹, which is fitted in vertical grooves in the crank frame F⁶, and provided with a set screw T³, or other suitable detent, to raise and lower it while the vehicle is moving, which causes the fulcra P⁸ P⁹ to approach to, and recede from, the crank axles E′ E² E³ E⁴, and thereby increases or decreases the power and stroke of both ends of the variable lever at once. The effect of the variable levers thus arranged, being to realize a high percentage of applied power, and to provide for alternate, coincident or independent action of the driving axles when under way, and thereby allowing many variations of muscular action all by one and the same means.

Where variety of muscular action is not desired, both of the handles and pedals may be arranged on one variable lever and its double crank and flexible shafts X′ X² joined to the crank axles E′ E². In each and every case the characteristic of the lever L is its continuous change of value, whereby the power is greatest at one point in the revolution of the driving axle.

Across the seat frame F⁵ are transverse grooves or ridges R³ R⁴ on which the seat S slides. A cam C³ with a handle is arranged as a detent on the side of the seat, to secure it at different distances from the crank frame F⁶, or to allow it to slide back and forth when in action, a limit being provided by the strap T². When the rowing action is desired, the feet are placed on the foot rest R, the fulcra frame F⁹ lowered by the set screw T³ so as to give the longest stroke to the variable levers L, and the seat loosened in the grooves, whereby the complete action of the shell oarsman is obtained, giving the muscles a desirable change when tired.

Bearings J³ J⁴ J⁵ J⁶ in side frames F′ F² contain shafts V′ V² at right angles to axles A′ A², and connected at their lower ends to crank axles E′ E⁴ by flexible shafts X′ X². Shafts V′ V² have fixed upon their upper ends, friction gears W⁵ W⁶, which by contact on the sides or faces (see Figs. 16 and 17) of vertical friction gears W⁷ W⁸ mounted on the axles A′ A², and secured to the road wheels, cause them to revolve and the vehicle to move. The shafts V′ V² are vertical in this case, but that is not essential. One of the surfaces in contact is covered with rubber, leather or other suitable material, and the other is hard and rough, corrugated or covered with fine points, to insure grip while the folding gear causes the face of one friction gear to alternately approach to, and recede from, the center of the other, while the vehicle is in motion, whereby the wheels differ in speed, and the vehicle travels on curves without any change of action of the driving gear. Of course this cannot occur, except when the road wheels revolve. The rubber or leather surface must be periodically renewed.

The fine points on friction gear wheels W⁵, W⁶ or W⁷, W⁸, are produced by planing slant sided grooves close together, along and across the surface, one eighth of an inch deep, and a series of pyramidal points about sixteen to the square inch and similar to a very coarse file but with larger points is the result. See Fig. 25. These points may also be produced by any other ordinary method of metal forming or working, and on wheels having contact surfaces of any desired shape, their essential being a base wider than the height, whereby an effective grip is secured without any possibility of piercing the other contact surface, and the wheel so constructed partakes of the good qualities of both pulley and gear.

The shafts V′ V² have fixed collars C⁴ C⁵ C⁶ C⁷ on their lower ends, and between them loose collars fixed to links C⁸ C⁹, which project downward, and are pivoted to cross bar F³, for the support and control of said shafts, whereby when the frame folds, shafts V′ V² with gears W⁵ W⁶, have alternate vertical motion, and each road wheel W′ or W² maintains its proper speed and inclination on the curve. Many variations of relative position of friction gears W⁵ W⁶ and W⁷ W⁸ may be arranged on the same principle.

Heretofore road wheel axles have been grooved to assist lubrication, and others have been threaded to secure the axle to the frame or wheel, or to adjust the position of parts of the hub, but this axle serves at any part of its length as a journal and oil distributer, and at the same time the part not in the bearing is ready for use with proper nuts, or threads in the frame, wheel or driving gear, to lock any of the parts in position, and is therefore called a combined journal and lockshaft. Axles A′ A² A³ A⁴ are cylinders upon whose entire length are cut flat top threads, the grooves being any shape, but preferably right angled. The thread faces reduce the bearing surface and distribute the lubricator. The thread sides by means of threads in the frame, or by lock nuts, secure the axles to the wheels or frames, and to the driving connection. In this case the front wheels W′ W² are locked to axles which revolve in bearings J′ J² in the frame, and the hind axles A³ A⁴ are stationary, being locked in the ends of the arches A⁵ A⁶ in the hind frame, and the bearings J⁷ J⁸ in the hind road wheels W³ W⁴ are mounted thereon. Caps or shouldered plugs P′ P², for connection to flexible shafts X³ X⁴, are secured to the inside ends of axles A′ A² which are also mounted in the bearings J′ J². The vertical friction gears W⁷ W⁸, whose bores are threaded, are screwed on the outside ends of said axles, and up to the bearings J′ J² leaving clearance for revolution. Road wheels W′ W², the hubs bored to fit the face of the axle thread, are then slipped on, and by nuts N′ N², are locked to the vertical friction gears W⁷ W⁸, whose sides in contact with the road wheels, are roughened to assist the friction. Nuts N′ N² may be integral with the hub.

In adjusting the axles, the vehicle is supposed to move forward; otherwise the oil

would run the wrong way, and soil the wheel and frame. Holes for the oil cups are placed on the tops of bearings J′ J² near the wheels, and for drip cups, on the under sides at the other ends of the bearings. The drip cups may when full be emptied into the oil cups, whereby continuous and effective lubrication is obtained. Axles A³ A⁴ are threaded half right and half left, to keep the oil in the center. Axle A′ has a left thread, and axle A² a right thread, to feed the oil from the oil holes to the drip holes. Those parts of axles A′ A², which are in the bearings J′ J² may also be threaded half right and half left, the locking arrangements not being interfered with thereby. Tapped holes B⁵ B⁸ in outside ends of arches A⁵ A⁶ do not pass through. Holes B⁶ B⁷ through the inside ends of said arches, are smooth. Caps or shouldered plugs are screwed on, or in, the inside ends of axles A³ A⁴. The road wheels W³ W⁴ are adjusted in the arches A⁵ A⁶, bringing the hubs J⁷ J⁸ in line with the holes B⁵ B⁶ B⁷ B⁸. Axles A³ A⁴ are passed through holes B⁶ B⁷ and nuts N⁶ and bearings J⁷ J⁸, and screwed into the holes B⁵ B⁸. The nuts N⁶ are then set up to the side frames, and the axles are locked in position. Threads in holes B⁶ B⁷ may be used instead of nuts N⁶.

The oil holes for the bearings J⁷ J⁸ in wheels W³ W⁴, pass through plugs P³ P⁴ and the hollow axles A³ A⁴ serve as oil cups, transverse holes being made therein at proper distances, for the oil to pass through to the bearing. The arch holes B⁶ B⁷ may be only half depth and tapped, and the axles A³ A⁴ may be sprung in, by bending the arches a little, and all locked up by a pin passed through the hub and one of the oil holes in shaft A³ or A⁴, the oil in that case being supplied by an oil cup screwed into the side of the hub, and no plug or oil canal at the end of the axle being required.

For the further decrease of friction the bearings J′ J² are enlarged, and rollers R⁵ inserted around the axles A′ A². Pieces of standard drawn wire smaller than the space outside the axles, are provided with sections of drawn tubing R⁶, so thick as to fill said space. Such spaces are left between the sections, that in adjoining wires sections are opposite spaces, thereby reducing the bearing surface, and making uniform wear on the axle. Worn sections may be cheaply renewed, the wires being always intact. The wire ends pass through flat rings R⁷, whereby the wires are kept apart, and the friction reduced to a minimum. The rings R⁷ are not necessary when the load is light, because sections R⁶ have little contact, but one more wire is then inserted.

Road wheel rims R⁸ are guttered, and therein are hollow spring tires T⁶ continuous or in sections. In this case such tire is formed of a spiral metal spring T⁷ covered with tubing T⁸ of rubber, leather, or other tough material, and is secured to the rim R⁸ by a strap T⁹, a right and left bolt B⁹ and locknut N⁵. See Fig. 4. The shape of the tire is not essential, but circular is best.

The strap T⁹, spring T⁷, and cover T⁸ are assembled, bent around the rim, one end of the cover turned back, the spring united, the bolt B⁹ set up by a flat wrench inserted between the spring coils, and the cover fastened down by cementing or sewing. The cover may be in sections, or strapped spirally from a flat narrow piece, whereby more surface contact on the road is obtained, and yet less road friction produced, and the vehicle is enabled to use sandy, muddy or rough roads, without slipping, clogging or serious hinderance, and other springs in the vehicle are less needed.

For the purpose of momentum, the front wheel rims are loaded at two opposite points, which are also connected with the hub, and to each other by braces, to preserve the circular form of the wheel at high speed. The weights O are in this case made in two halves O′ O², with recesses inside (to fit the sides of the spoke ends, and the rim R⁸) and transverse holes for the brace heads O⁶, which by nuts O⁴, secure the weights on the rim, and to each other. The brace heads O⁶ are forged to, or passed through holes in, the ends of braces O³. Each brace O³ is a rod having a cross rod O⁶ on its outer end (which is secured in the weights O′ O²) a head or nut O⁷ on its inner end, and a cap O⁵ sliding on the rod and threaded on its lower outside edge, to enter a threaded hole in the hub. Transverse holes in the caps O⁵ allow a rod to be used as a wrench, to screw up the caps and adjust the strain on the braces. The object of the weights is momentum with minimum dead weight. The extra weight in a heavier rim might as well be in the frame.

The size of the road wheels, and the weight at the loaded points, determine that special rate of speed for each vehicle, which requires the least power to maintain, which rate is shown by practice to be increased by the weights. In action the weights describe cycloidal paths through the air, the upper one at twice the speed of the vehicle, while the lower one is for the moment at rest. As they are placed about midway between the cranks, each one stores up part of the power from the crank stroke ahead of it, and acts as an auxiliary crank, till the other crank comes into action. The weights arranged on two road wheels connected abreast, are of further assistance at high speeds, as their momentum overcomes road friction, and if either wheel meets an obstruction and is retarded, then the momentum of the other tends to keep the first one in line, and thereby to assist it over the obstacle. The weights may also be cast into hollow rims, or made integral therein, as metal sections of the fellies in a wooden wheel. They may also be used in the back wheels, but it is better to use larger weights in the front wheels, they only being in accord with

the driving gear, the principle being the concentration of the momentum giving weight at two opposite points which in operation imparts an alternate and successive cycloidal action to each weight.

The braces are necessary to resist the eccentric and elliptical strains, which the weights make on the wheels at high speed, and allow of much faster travel than has heretofore been possible. The eccentric strain necessitates their being secured to the hub, and not directly to each other, as they might be by straps passing the sides of the hub.

The weights in a crude form for use on a single wheel, appear in my Patent No. 103,957, dated June 7, 1870. Those shown and described here with the braces in addition, are the results after much use of the former.

The ordinary strap brake operating on the face of gears W^7 W^8, is used with hand or foot lever.

The crate frame D^5 rests on any desired part of long pivots D^4, and the baggage receptacle is attached.

Seats for riders and another baggage crate may be arranged in the hind frame, and by upright levers and rods connected to the lower ends of crank levers L, each rider may assist to propel.

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

1. A vehicle frame composed of two upright side frames, provided with handles, and pivoted cross connections in combination with a pair of axles, and a pair of road wheels, which thereby may lean inward when traveling on curves.

2. In a wheeled vehicle, a folding frame and handles, in combination with a pivoted diagonal bar and a detent, to retain the frame in different angular positions.

3. In a wheeled vehicle, the combination of folding frame F with diagonal bar F^7, slide F^8, latch Q^3 string Q^4 and handles Q' Q^2.

4. In a wheeled vehicle, the combination of the folding front frame the folding hind frame H and pivoted diagonal bar H^6, with the steering gear of the vehicle, and the connection thereto, to cause the front and hind road wheels to incline in unison.

5. In a quadricycle, two frames each supported by a pair of road wheels abreast, in combination with a pair of crossed tubes vertically pivoted to said frames (which tubes are the only connection between said frames, and through which the driving medium passes to operate the hind wheels) and with steering gear.

6. Road wheels W' W^2, folding frame F, and guide bar F^4, in combination with crossed pivoted bars S' S^2, and road wheels W^3 W^4, folding hind frame H and guide bar H^3, to steady the vehicle.

7. In a quadricycle, a pair of road wheels abreast and axles, a jointed frame and folding gear, and two crossed bars pivoted to the frame and connected to the folding gear, in combination with another jointed frame and its folding gear similarly secured to said crossed bars, and with another pair of road wheels and axles, for the coincident inclination and steering of all four wheels.

8. In a wheeled vehicle, folding frame F handles Q' Q^2, diagonal bar F^7 slide F^8 row lock L', and crossed bars S' S^2 in combination with folding frame H, diagonal bar H^6, slide H^7, connecting lever H^8 and link L^2.

9. In a wheeled vehicle, diagonal shafts S', S^2, in combination with folding frames F and H and means to control their inclination, and with two pairs of road wheels abreast and their axles and driving gear.

10. Diagonal tubes S' S^2 in combination with flexible shafts X^3 X^4, axles A' A^2, road wheels W' W^2, and with flexible shafts X^5 X^6, gears W^9 W^{10}, road wheels W^3 W^4 and the driving gear.

11. In a wheeled vehicle, the pivoted crate frame D^5, arranged upon the bars D^4, in combination with the folding frame F, substantially as shown.

12. In the driving gear of a wheeled vehicle: an active and a passive driving medium the contact surface of one being composed of leather rubber or other tough material, and the contact surface of the other being hard and composed of pyramidal or coarse file like points, said active medium operating said passive medium by said contact surfaces, the points burying in the tough surface and thereby avoiding strain on the shaft bearings, substantially as shown.

13. In the driving gear of a wheeled vehicle, a driving pinion in combination with a driven pinion, the contact surface of one being composed of leather, rubber or other tough material, and the contact surface of the other being hard, and composed of a series of pyramidal points, or similar to a very coarse file, the action of said points being to bury in the tough contact surface without strain on the shaft bearings, substantially as shown.

14. In a wheeled vehicle having two road wheels abreast a pair of friction gears mounted on the axles and fixed to the road wheels, and a pair of friction gears mounted on shafts at right angles to the axles the faces of one pair engaging with the sides of the other pair: in combination with a pair of shaft vibrators, an alternating connecting bar, and driving gear, whereby the vibrators act in opposition and the outside road wheel travels faster on the curve.

15. The road wheels W' W^2, frame F, axles A' A^2, friction gears W^5 W^6 W^7 W^8 and shafts V' V^2, in combination with fixed collars C^4 C^5 C^6 C^7, links C^8 C^9 pivoted to cross bar F^3, and the driving gear, and also with the cross bar F^4.

16. The road wheels W' W^2, frame F, axles A' A^2, friction gears W^5 W^6 W^7 W^8 and shafts V' V^2 in combination with collars C^4 C^5 C^6 C^7,

adjustable links C^8 C^9 pivoted to cross bar F^3, and the driving gear and also with the cross bar F^4.

17. In the driving gear of a wheeled vehicle, two friction gears fixed on shafts at right angles to each other the face of one gear engaging with the side of the other, one of the two engaging surfaces being hard and covered with pyramidal or coarse file like points, and the other of rubber, leather or similar material to insure grip without too much friction.

18. Frame F lever L and crank C′, fulcrum P^8 and axle E′ in combination with flexible shaft X′ shaft V′, friction gears W^5 W^7 and road wheel W′.

19. Frame F cranks C′ C^2, levers L, fulcra P^8 P^9 and axles E′ E^2 E^3 E^4: in combination with adjustable sleeve S^9 flexible shafts X′ X^2, shafts V′ V^2, friction gears W^5 W^6 W^7 W^8 and road wheels W′ W^2.

20. In the driving gear of a wheeled vehicle, axles E^2 E^3: in combination with double splined sleeve S^9, swinging guide G′, and means to change said guide's position.

21. In the driving gear of a wheeled vehicle, axles E^2 E^3 in combination with double splined sleeve S^9, guide G′ with foot piece, and stop T.

22. In a wheeled vehicle, the fulcra frame F^9 and set screw T^3: in combination with the crank frame E^6 and grooves G^2.

23. A pivoted seat frame and a seat: in combination with a folding frame, and a pair of road wheels abreast and their axles, whereby the rider remains nearly upright, when the frame folds.

24. In a wheeled vehicle, the reciprocating seat S and pivoted seat frame F^5: in combination with the folding frame F, axles A′ A^2 and road wheels W′ W^2.

25. In a wheeled vehicle, the reciprocating seat S and detent C^3: in combination with pivoted frame F^5 and folding frame F, to allow the seat to slide or be fixed, as desired.

26. In a road propeller, a stationary fulcrum and a cranked driving axle, mounted in the frame and parallel to each other, in combination with a variable driving lever hinged near its midlength on the crank pin, and having a sliding connection to said fulcrum, whereby the distance between the fulcrum and the crank pin, varies with each stroke of the lever, substantially as shown.

27. In a wheeled vehicle, a fulcrum and a cranked axle mounted in the frame and parallel to each other, in combination with a variable driving lever, having a sliding connection with said fulcrum, said lever being also provided with a pedal, and pivoted on the crank pin at some point between the pedal and the fulcrum, substantially as shown.

28. In a road propeller, a fulcrum and crank axle mounted in the frame, and parallel to each other in combination with a lever pivoted on the crank pin, sliding on the fulcrum, and extended beyond both, and provided at one end with a pedal and at the other end with a handle, to allow a circular motion of the foot and an oval rowing motion of the hand by one and the same means.

29. A fulcrum and a crank axle mounted in a frame and parallel to each other, in combination with a lever pivoted on the crank pin, sliding on the fulcrum, extending beyond both, and provided at one end with one or more handles and at the other with one or more pedals, and in combination with two road wheels abreast and the connection thereto, to allow the use of both hands and both feet on one lever.

30. In a road propeller, a fulcrum and a crank axle mounted in the frame and parallel to each other, in combination with a slotted lever mounted on the fulcrum, and pivoted on the crank pin, and extending beyond the crank pin, and provided at that end with a pedal or handle.

31. The lever L, pedal P, handle Q^5, fulcrum P^8 and crank C′ in combination with axles E′ E^2, flexible shaft X′, vertical shaft V′, friction gears W^7, W^5 and road wheel W′.

32. The slotted levers L, pedals P, handles Q^5 Q^6 and fulcra P^8 P^9 in combination with cranks C′ C^2 axles E′ E^2 E^3 E^4, adjustable sleeve S^9, flexible shafts X′ X^2 vertical shafts V′ V^2, friction gears W^5 W^6 W^7 W^8 and road wheels W′ W^2.

33. In a wheeled vehicle: a stationary fulcrum and a cranked driving axle mounted in the frame and parallel to each other, in combination with a variable driving lever, hinged near its midlength on the crank pin, and having a movable connection with the fulcrum, whereby the distance between the crank and the fulcrum, and between the power and the fulcrum increases and diminishes during each revolution of the crank, substantially as shown.

34. In a road propeller, a threaded axle and lock nuts: in combination with a road wheel whose hub is bored to fit said axle, and with a frame similarly bored, and with driving gear, whereby said axle may either be locked to the wheel and rotated in the frame, or locked in the frame, and the road wheel rotated on said axle.

35. In a road propeller, a road wheel locked on a threaded axle between two nuts, in combination with a frame a journal arranged therein and driving gear, the axle thread being continuous through both journal and wheel.

36. Road wheels W′, axle A′ nut N′ and internally threaded friction gear W^7 in combination with frame F, bearing J horizontal friction gear W^5 and driving gear.

37. In a road propeller, road wheel W′ locked on left-threaded axle A′ by nut N′ and gear W^7, and road wheel W^2 locked on right threaded axle A^2 by nut N^2 and gear W^8 in combination with frame F journals J′ J^2 horizontal friction gears W^5 W^6 and driving gear.

38. In a road propeller, an arch-frame whose

ends contain threaded holes, in combination with a threaded axle screwed therein and a road wheel fitting loosely on said axle.

39. Frame arch A^5, threaded bolt holes B^5 B^6 and nut N^6: in combination with right and left threaded axle A^3 road wheel W^3, and driving gear.

40. In a road propeller, frame arch A^5, threaded bolt holes B^5 B^6 and nut N^6: in combination with transversely bored axle A^3 road wheel W^3 and plug P^3 with the oil canal therein, for lubrication when under way.

41. In a wheeled vehicle, with a hollow frame connecting its front and hind wheel or wheels, a driving medium connecting a front wheel to its hind wheel and passing through inside of said hollow frame, in combination with said front and hind wheel or wheels and foot driving gear operating one of said wheels, to protect the driving medium from exposure and accidents.

42. In a wheeled vehicle with a hollow frame connecting its front and hind wheel or wheels, a driving medium connecting a front wheel to its hind wheel and passing through inside of said hollow frame, in combination with said front and hind wheel or wheels, and hand driving gear operating one of said wheels, substantially as shown.

43. In the driving gear of a wheeled vehicle: a gear whose contact surface is hard and composed of pyramidal points, similar to a very coarse file, substantially as shown.

44. In the driving gear of a wheeled vehicle: a gear whose face and side are at right angles to each other, and whose contact surface is hard and composed of pyramidal or coarse file like points, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 6th day of November, 1884.

ARTHUR M. ALLEN.

Witnesses:
LEONORA L. ALLEN,
HELEN L. FOX.