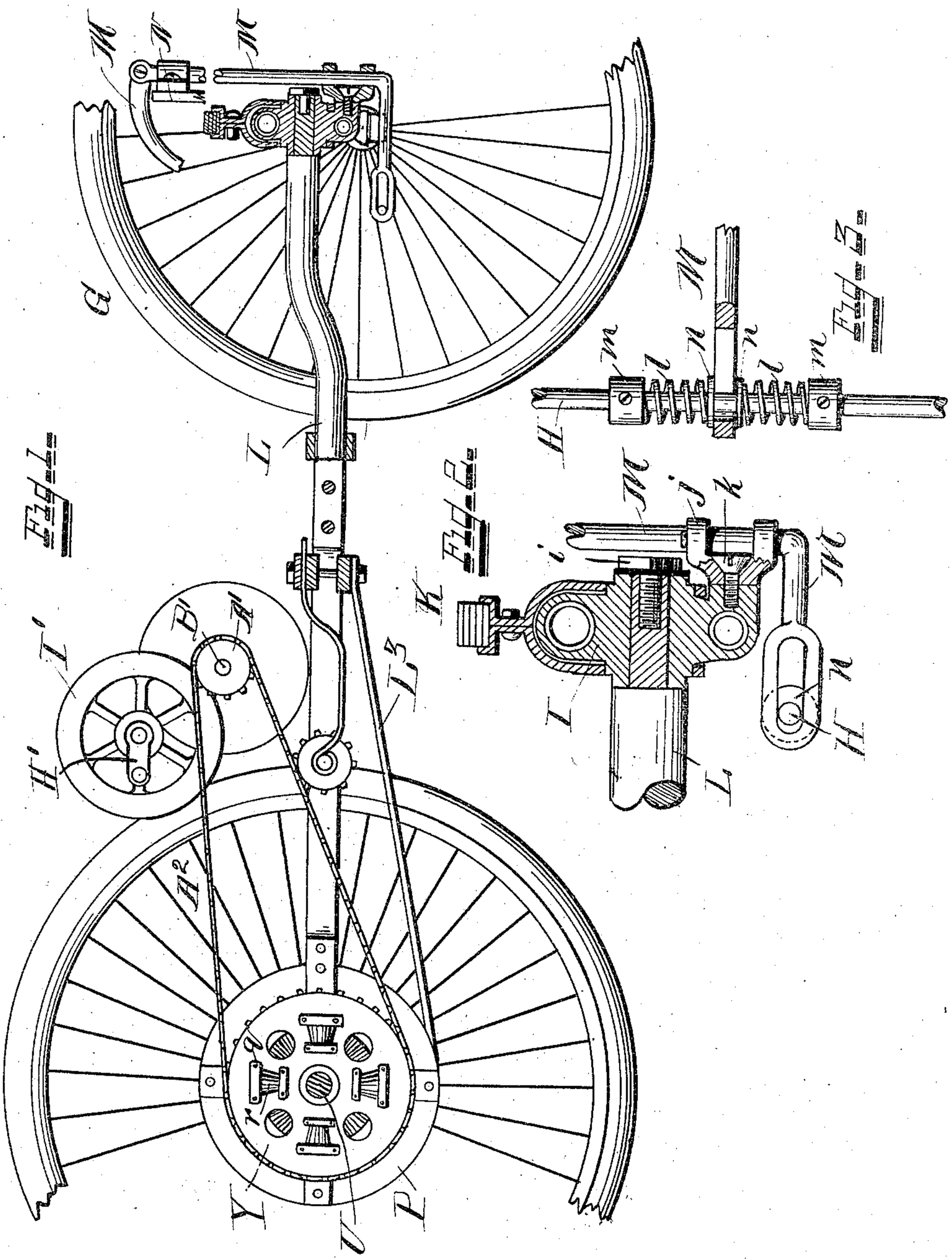
No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 1.



Witnesses.
Wm. J. Peck.
Gerlinde E. Phillips.

Inventor
Ernest P. Gray
by Chamberlain
his Attorney.

No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 2.

Fig. 4.

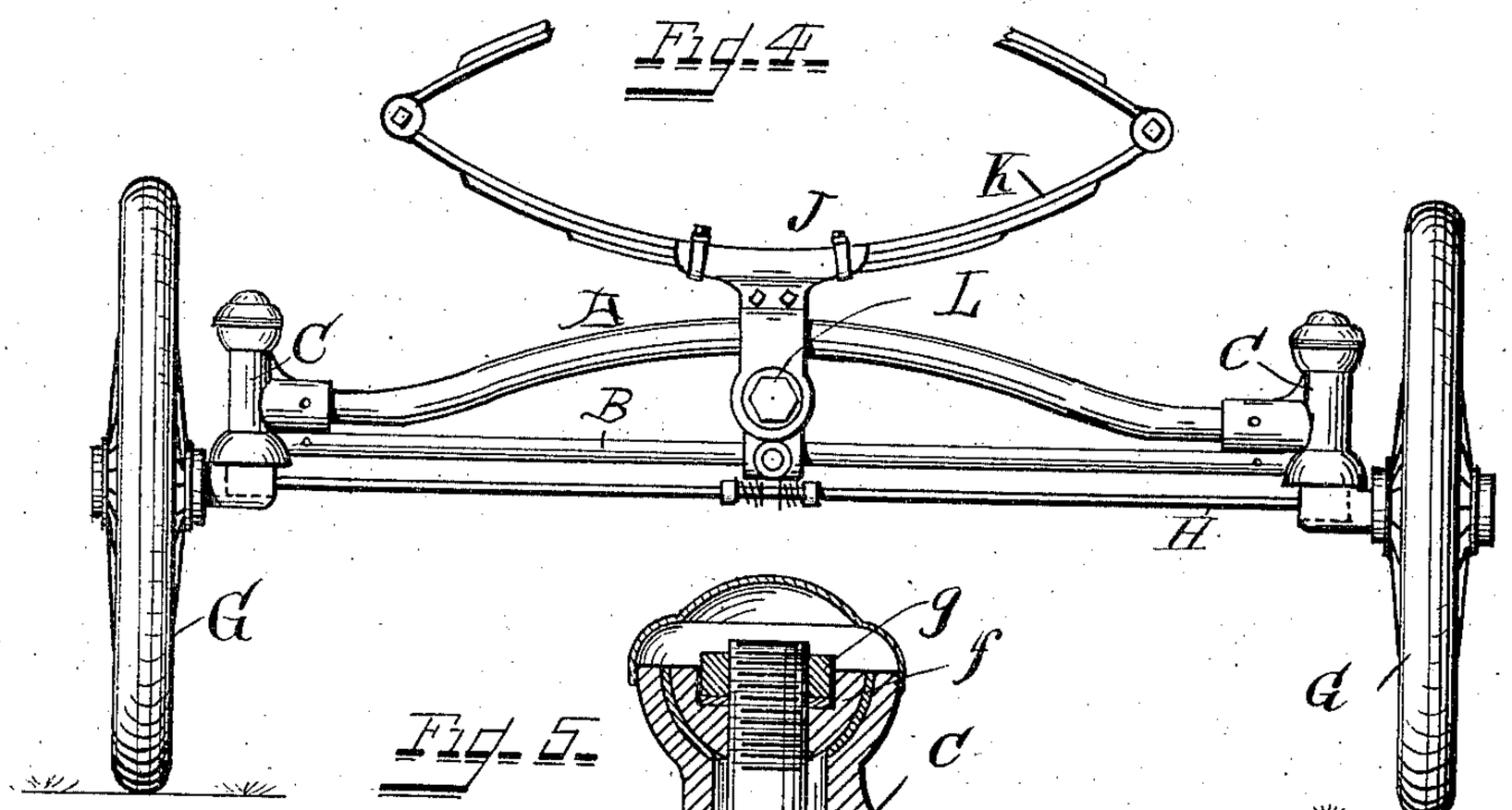


Fig. 5.

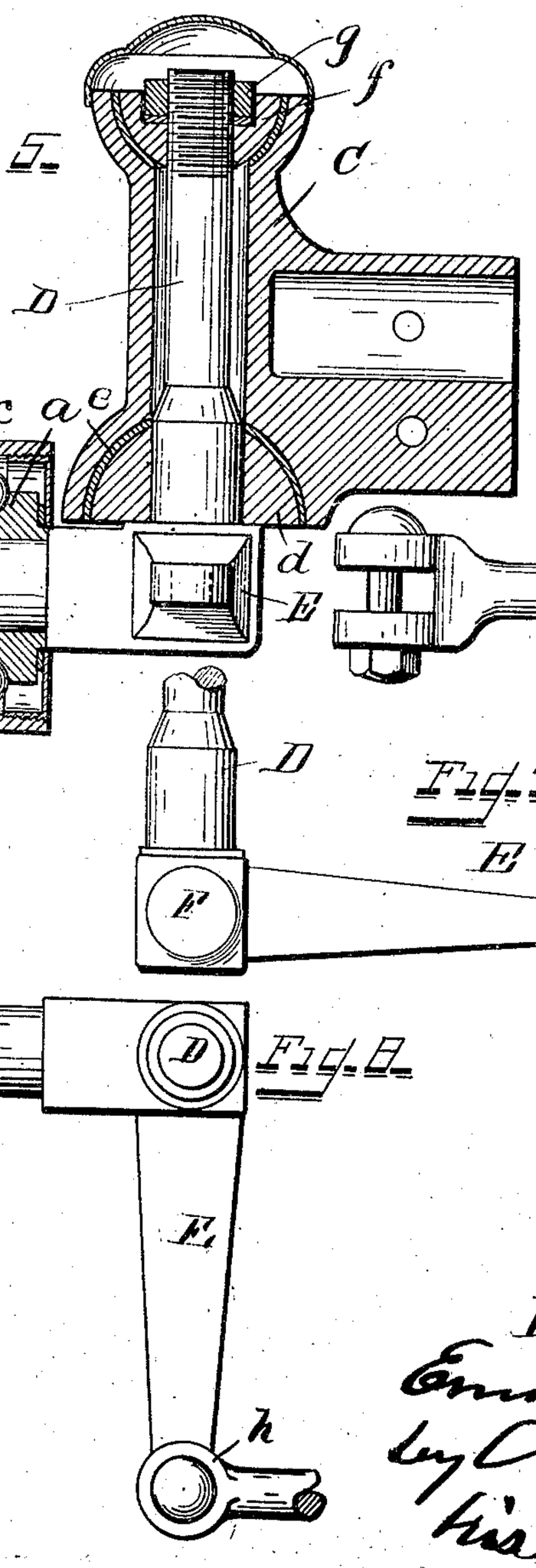


Fig. 6.

Fig. 9.

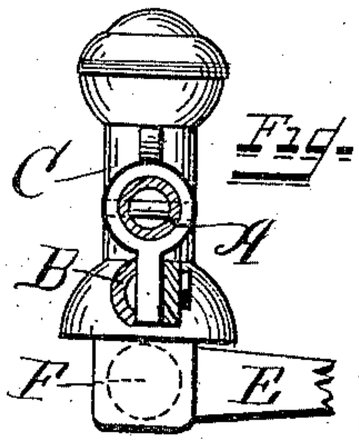


Fig. 7.

Fig. 8.

Witnesses.
Wm. J. Peet.
Gertrude E. Phillips.

Inventor.
Emmet P. Gray
by Chas. M. Bloch
his Attorney.

No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 3.

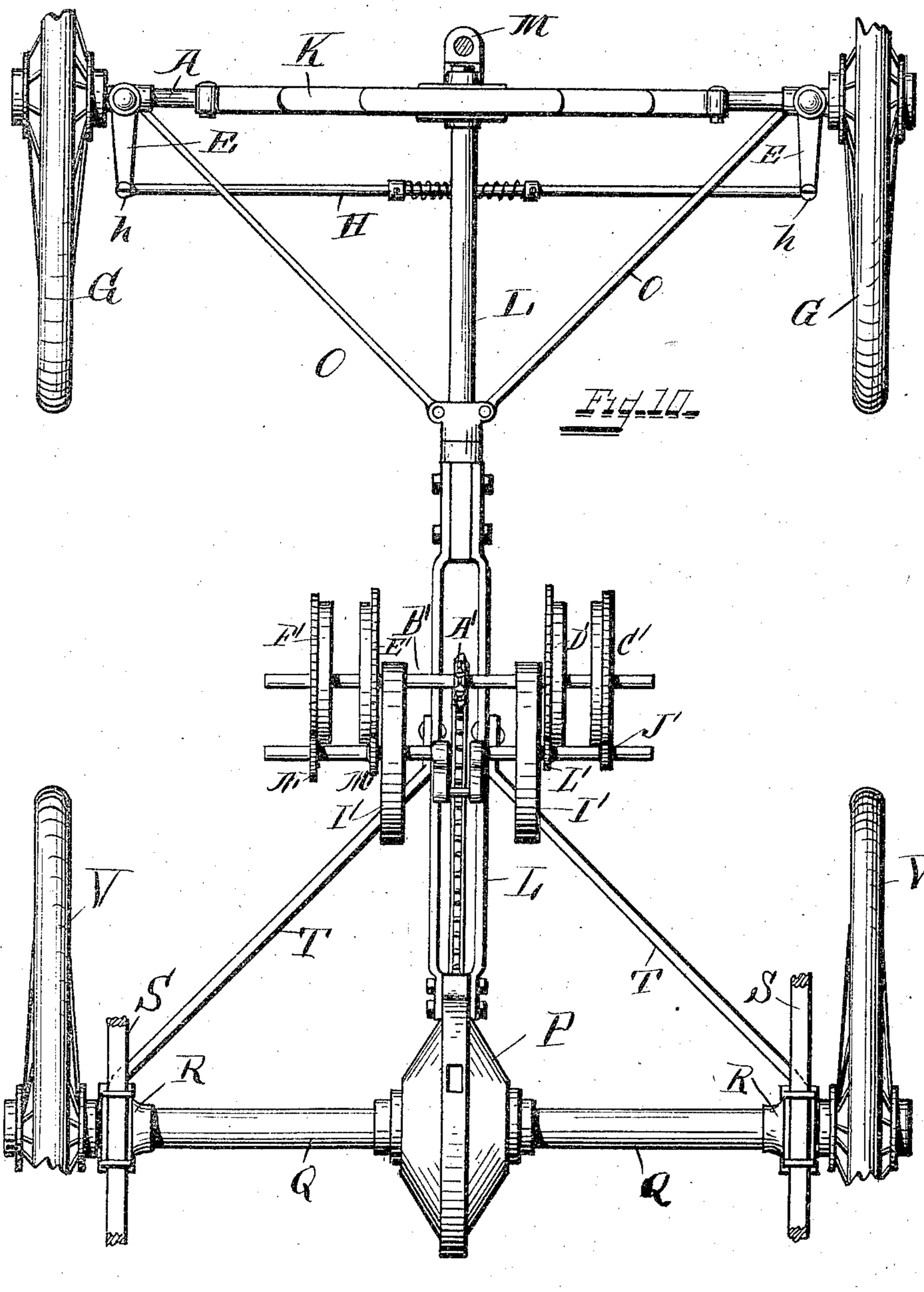


Fig. 10.

Witnesses.
Wm. J. Peck.
Gertrude E. Phillips

Inventor.
Emmet P. Gray
by Chas. J. Peck
his Attorney.

No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 4.

Fig. 11.

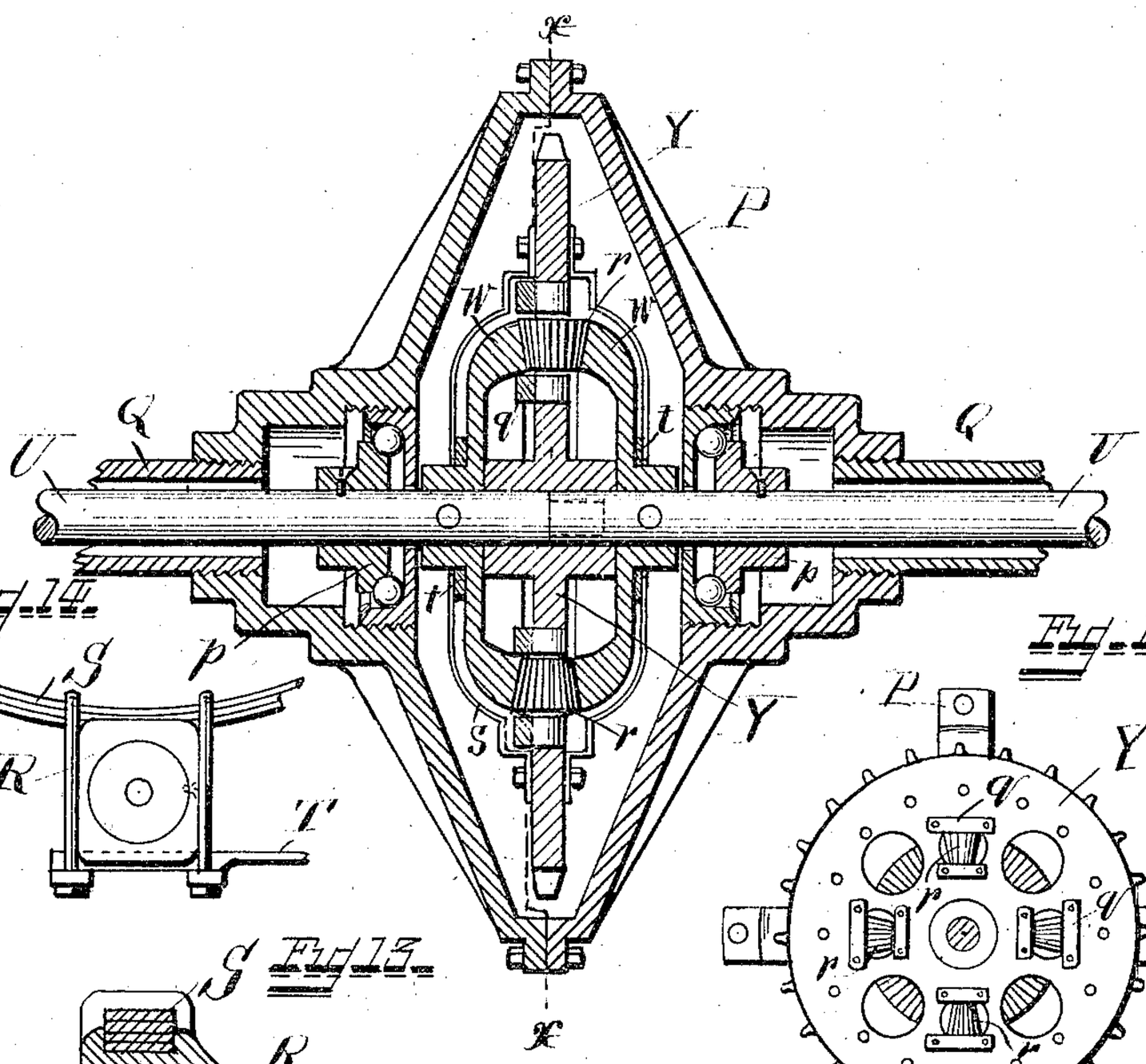
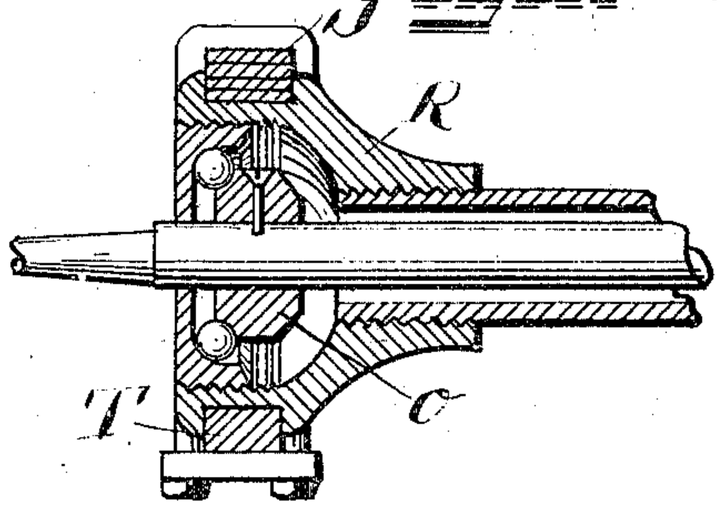


Fig. 14.

Fig. 12.

Fig. 13.



Witnesses.
Wm. J. Peb.
Gertrude E. Phillips

Inventor.
Edmund P. Gray
by Chas. J. Peb
his Attorney.

No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 5.

Fig. 15.

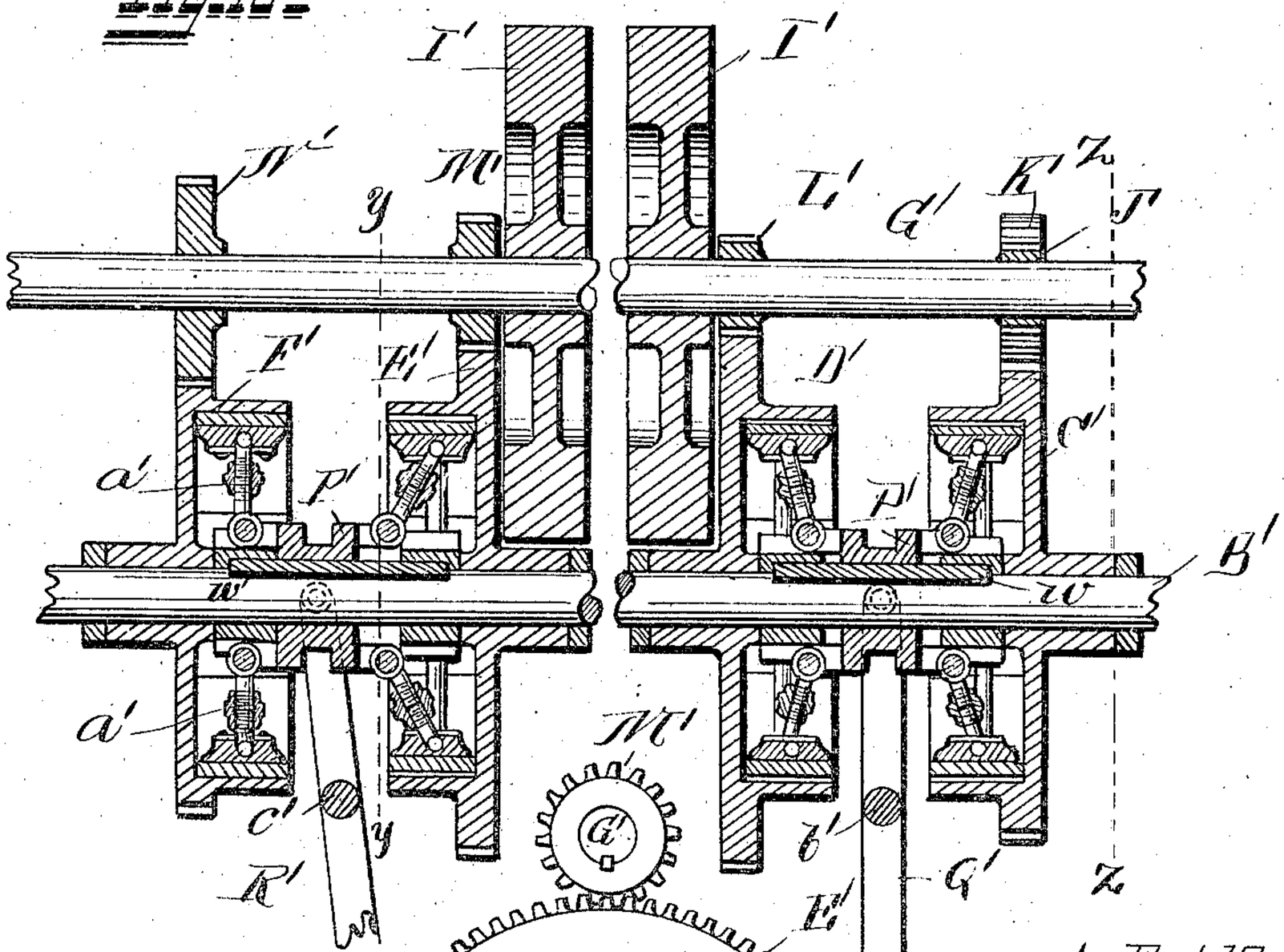


Fig. 16.

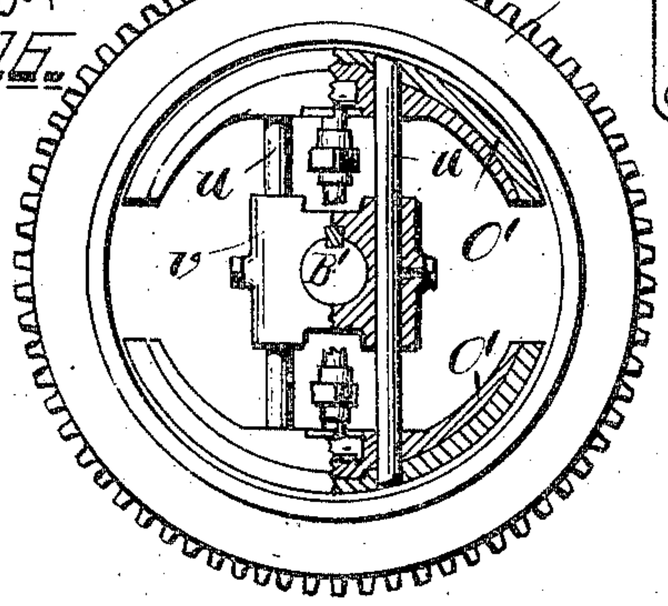


Fig. 17.

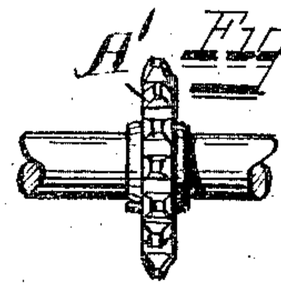
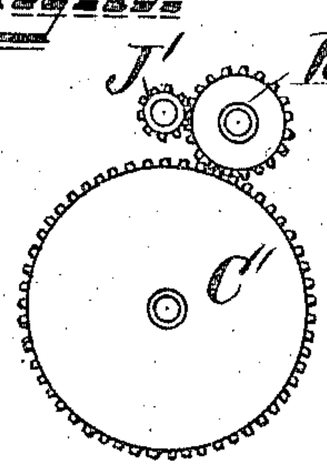


Fig. 18.



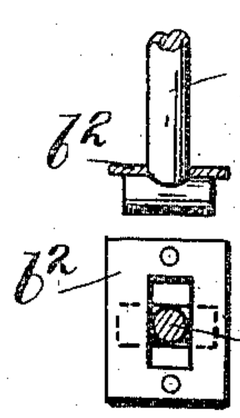


Fig. 19.

Witnesses.
Thos. J. Peck.
Gertrude E. Phillips.

Inventor.
Emmet P. Gray
by Chas. Thornbrook
his Attorney.

No. 641,204. Patented Jan. 9, 1900.

E. P. GRAY.

GEARING FOR HORSELESS CARRIAGES.

(Application filed Aug. 24, 1899.)

(No Model.) 6 Sheets—Sheet 6.

Fig. 21.

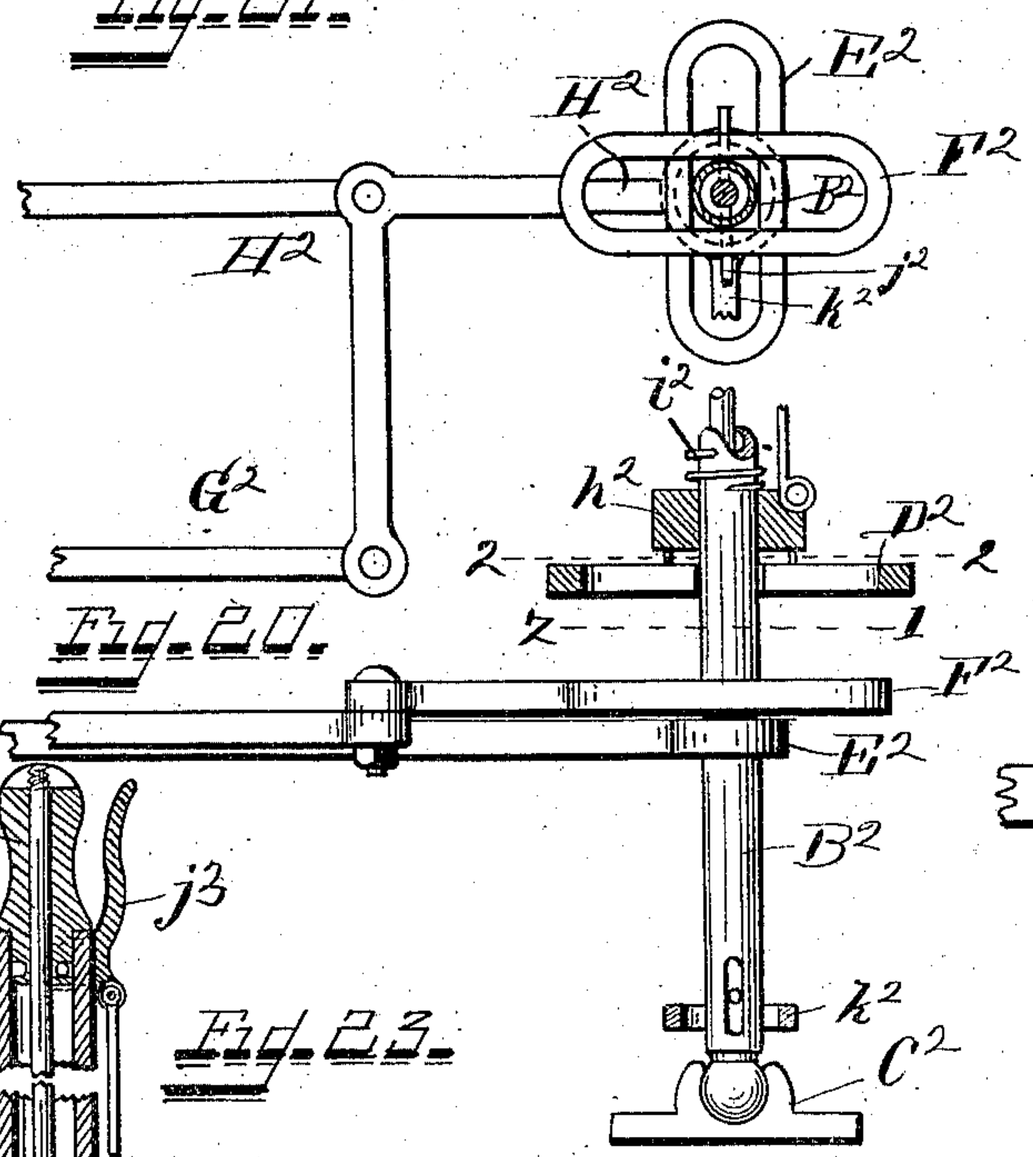


Fig. 20.

Fig. 22.

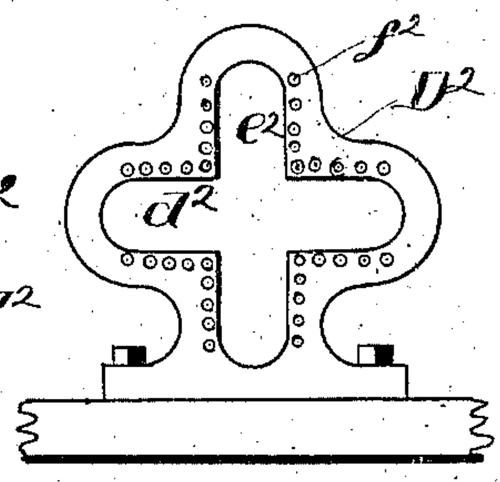


Fig. 24.

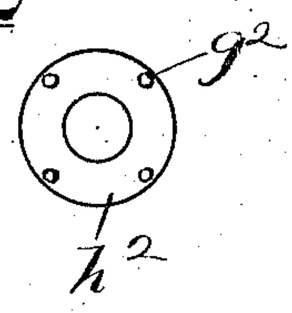


Fig. 23.

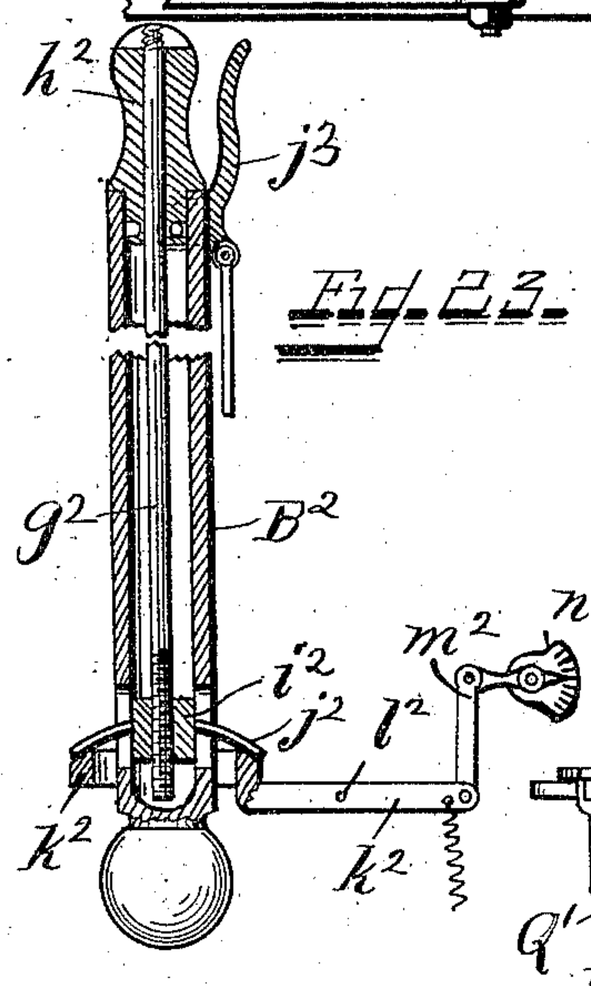


Fig. 26.

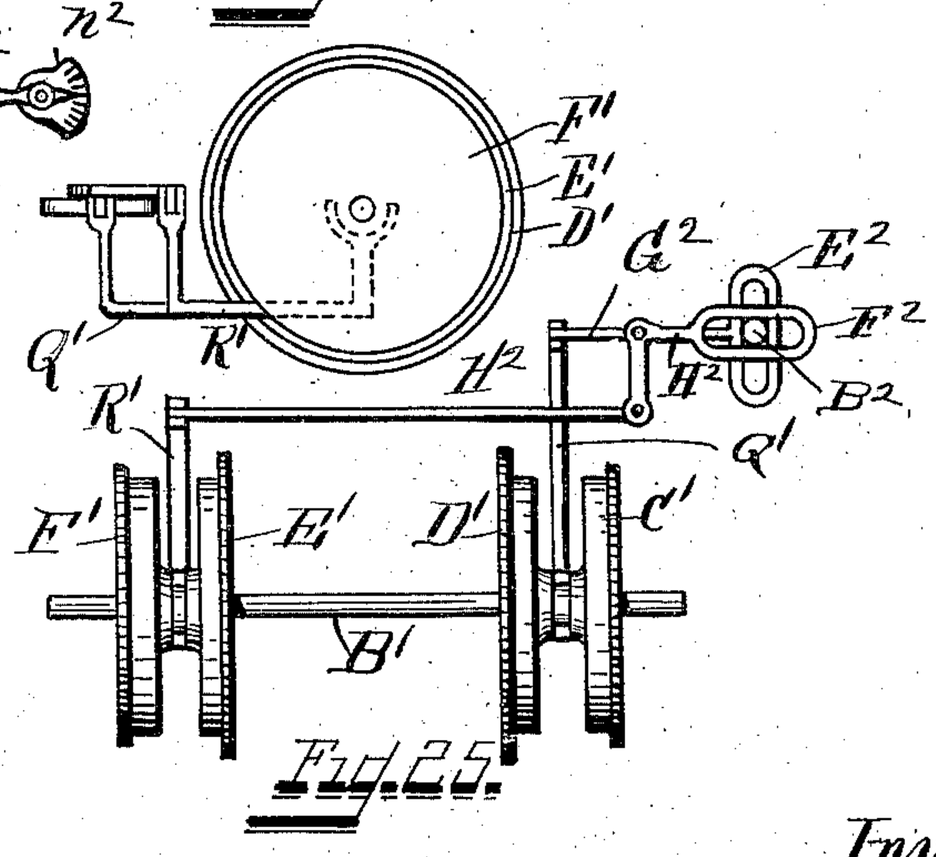


Fig. 25.

Witnesses.
Wm. J. Peck.
Gertrude E. Phillips.

Inventor.
Emmet P. Gray
by Chamberlain
his Attorney.

UNITED STATES PATENT OFFICE.

EMMET P. GRAY, OF CINCINNATI, OHIO, ASSIGNOR OF TWO-THIRDS TO OTTO ARMLEDER AND LOUIS B. SAWYER, OF SAME PLACE.

GEARING FOR HORSELESS CARRIAGES.

SPECIFICATION forming part of Letters Patent No. 641,204, dated January 9, 1900.

Application filed August 24, 1899. Serial No. 728,268. (No model.)

To all whom it may concern:

Be it known that I, EMMET P. GRAY, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Gearing for Horseless Carriages, of which the following is a full, clear, and exact description, reference being had to the accompanying drav ings, forming part of this specification.

My invention relates to that class of vehicles known as "horseless carriages," "automobiles," or, in short, any vehicle which is supplied with a self-contained motor for operating it, whether electrically operated or oporated by gas, gasolene, steam, or compressed air.

It has for its object the improved construction of the driving and guiding mechanism, as well as the improved construction of the vehicle throughout, whereby its strength lightness of construction, and efficiency of action are greatly increased.

In the accompanying drawings, Figure 1, Sheet 1, is a central sectional side elevation of so much of the vehicle as is necessary to illustrate certain parts of my invention. Fig. 2, Sheet 1, is an enlarged sectional side elevation of the coupling between the reach and front axle with associated parts. Fig. 3, Sheet 1, is an enlarged detail plan view of the connection between the steering-arm and front-wheel-guiding rod. Fig. 4, Sheet 2, is a front elevation of the forward axle, wheels, and their connections with the steering-arm omitted. Fig. 5, Sheet 2, is an enlarged sectional rear elevation of the wheel and axle connections of the right-hand wheel of Fig. 4. Fig. 6, Sheet 2, is an enlarged detail view of the end of the steering-rod in juxtaposition to its attachment to Fig. 5. Fig. 7, Sheet 2, is a side elevation of the lower part of the bell-crank mechanism of Fig. 5, showing the steering-rod connected. Fig. 8, Sheet 2, is a plan view of Fig. 7. Fig. 9, Sheet 2, is a sectional end elevation, looking to the left of Fig. 4, of the axle and wheel connections. Fig. 10, Sheet 3, is a plan view of the running and driving gear, some of the parts being broken and others being omitted for clearness of illustration. Fig. 11, Sheet 4, is an enlarged central sectional elevation of the differential driving-gear and its associated mechanism. Fig. 12, Sheet 4, is a diminished side elevation on the dotted line $x\,x$ of Fig. 11 looking to the right with the dust-proof and oil casing removed. Fig. 13, Sheet 4, is a detail central sectional elevation of the outer bearing of the rear axle, showing the manner of connecting the spring and brace-rods. Fig. 14, Sheet 4, is a diminished end elevation of Fig. 13 looking to the right. Fig. 15, Sheet 5, is a sectional transverse elevation of the driving and clutch operating mechanisms and their associated parts. Fig. 16, Sheet 5, is a side elevation, partly in section, of one of the clutch mechanisms on the dotted line $y\,y$ of Fig. 15 looking to the right. Fig. 17, Sheet 5, is a detail elevation of the driving-sprocket of Fig. 10. Fig. 18, Sheet 5, is a diminished side elevation on the line $z\,z$ of Fig. 15 looking to the left. Fig. 19, Sheet 5, is a sectional detail of one of the toggle-arm joints and connections. Fig. 20, Sheet 6, is an enlarged sectional detail in elevation of the combined clutch-shifting and motor-regulating mechanisms. Fig. 21, Sheet 6, is a plan view of Fig. 20 on the dotted line 1 1. Fig. 22, Sheet 6, is a plan view of the slotted locking-plate on the dotted line 2 2 of Fig. 20. Fig. 23, Sheet 6, is a central sectional elevation of the clutch-shifting and motor-regulating lever. Fig. 24, Sheet 6, is a plan view on the dotted line 2 2 of Fig. 20 looking upward. Fig. 25 is a diminished diagrammatic plan of the clutch operating and controlling mechanism. Fig. 26, Sheet 6, is an end view of Fig. 25 looking to the right.

The same letters are used to indicate identical parts in all the figures.

I will first describe the novel features of the framework of my improved gearing, reference being had to Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, and 14. As seen in Figs. 4 to 10, inclusive, there is a front axle composed of an upper curved tubular bar A and beneath this a straight tubular bar B. Both of these bars have their ends secured to a vertical socket-piece C, Fig. 5, in which is journaled the vertical member D of a bell-crank, having a rearwardly extension E and an outwardly-extending stub-spindle F. The stub-spindle F has a collar a with a recess on its

outer end to receive the balls *b*, held in place by the bearing-cup *c* of the hub of the wheel G, which preferably has a rubber or pneumatic tire, as in vehicles of the class described. The upper spindle of the bell-crank has a bearing through a hemispherical washer *d*, confined in a recess in the socket C and having its bearing against a steel lining *e* in said bearing. Its upper end passes through a similar hemispherical washer *f* in a lined recess in the upper end of the pocket and is held in place by a nut *g* upon the upper threaded end of the spindle. By this means not only is the spindle given an easy bearing upon its axis, but it is rendered easy of lubrication and all wear can be easily taken up.

The rear ends of the members E have pivoted to them, as at *h*, the ends of a steering-rod H in rear of and parallel with the axis, the construction of the parts so far described being such that by moving the rod H longitudinally both spindles D are simultaneously turned on their axes, and both stub-spindles F are thereby simultaneously thrown through the arc of a circle to change the angle of the wheels G relatively to the ground, and thereby steer the vehicle to the right or left.

Surrounding the tubular portions A B of the forward axle is a block I, Figs. 1, 2, and 4, carrying the forward bolster J, whose lower forked end straddles and embraces the block I and is journaled upon bosses upon the front and rear sides of the block I, as seen in Figs. 1 and 2, and to which bolster elliptical springs K for supporting the front portion of the body of the vehicle are secured. This block I also affords a bearing for the forward ends of the perch L, which is socketed into it and held by a set-screw *i*, and also for a forked perforated bracket *j*, in which the lower end of the steering arm M is journaled, and which bracket is pivoted to the block I by a set-screw *k* to permit the turning of the bracket should one of the wheels G be raised higher than the other, as in passing an obstruction. The lower end of the steering-arm M is extended rearwardly and is slotted, so as to embrace the steering-rod H, Fig. 3, between two coiled springs *l* on the rod H, and whose ends are engaged by collars *m*, fast on the rod H, and washers *n* against the slotted sides of the rear end of the arm M, so as to form a yielding connection between the arm M and the rod H. The upper end of the steering-arm M passes up over the dash (indicated at N) and is thence curved backward in reach of the person on the seat controlling the steering of the vehicle, as seen in Fig. 1. If desired, this rearwardly-curved part of the steering-arm may be pivoted to the vertical part journaled in front of the dash.

As seen in Fig. 10, brace-rods O extend rearwardly from the socket-pieces C to the perch L, to both of which members they may be united in any suitable or convenient manner.

I will now describe the construction of the rear axle, its shaft, and means of connection to the running-gear and body of the vehicle. I employ a two-part housing P, Figs. 10 and 11, connected to the opposite sides of which by being screwed therein, if desired, as seen in Fig. 11, are the inner ends of a two-part tubular shaft Q, whose outer ends have upon them, as seen in Figs. 13 and 14, flaring bearing-caps R, with socketed upper sides to receive the helical springs S, which receive and support the rear part of the body of the vehicle and whose lower ends are recessed to receive the rear ends of brace-rods T, which extend diagonally forward and are connected in any suitable manner to the perch L. As seen in Fig. 10, the perch L from a point just in rear of the brace-rods O to its connection with the housing P is in two separated parts, with a space between them, for a purpose to be hereinafter explained. Through the tubular shaft Q and housing P extends the axle U for the rear wheels V. This axle has ball-bearing collars *o* in the caps R and ball-bearing collars *p* in the hubs of the housing P, whereby the shaft U is held in sure alinement with the shafts Q and the least amount of friction is produced. The wheels V are secured in the usual or any suitable manner upon the outer projecting ends of the shaft U. I have thus described the running-gear, framework, and guiding mechanism of a vehicle embodying my invention, the body being omitted, as its form may be varied and as it constitutes no part of my present invention.

I will now proceed to describe the driving mechanism for the vehicle thus embodying my invention.

Referring to Figs. 11 and 12, it will be seen that the shaft U at the middle of the housing P is in two parts, with its abutting ends interengaged, so as not to prevent independent rotation, but so as to prevent an endwise movement. Within the housing P and fast to the two adjacent ends of the shaft U are the two larger members W of a differential gearing, and between these members and loose on the shaft U is a large sprocket-wheel Y, having openings through it at which are brackets *q*, in which are journaled in this instance four beveled gears *r*, meshing with both of the larger gears W. A casing *s*, snugly surrounding the hubs of the gears W, with interposed washers *t*, is bolted to the sprocket Y just outside of the smaller beveled gears *r* and serves to form a surrounding chamber to the gears W *r* to be constantly filled with oil inserted through any convenient capped orifice and to exclude dust.

As seen in Figs. 1 and 10, a drive-chain A^2 passes through openings in the housing P, around the sprocket-wheel Y, and thence around a smaller sprocket-wheel A′, fast on a shaft B′, suitably journaled upon the framework of the machine. This shaft B′ has loose upon it, as seen in Fig. 15, four internal clutch-pinions C′, D′, E′, and F′. Parallel to and adjacent to the shaft B′ is the motor-shaft G′, in this instance shown as having a driving-crank H′ and two fly-wheels I′, though

the motor mechanism that drives the shaft G′ is immaterial and may be of any suitable construction. Fast on the shaft G′ over the clutch-pinion C′ is a small pinion J′, constantly meshing with an idle pinion K′, journaled in a suitable bracket and meshing with the pinion C′. Likewise fast upon the shaft G′ is a small pinion L′, constantly meshing with the clutch-pinion D′. Likewise fast upon the shaft G′ is a pinion M′, larger than the pinion L′, constantly meshing with the pinion of the friction-clutch E′, which is smaller than the pinion of the friction-clutch D′, and likewise fast upon the shaft G′ is a pinion N′, larger than the pinion M′, and constantly meshing with the pinion of the friction-clutch F′, which is smaller than the pinion of the friction-clutch E′. It will thus be observed that there is a pair of friction-clutches C′ D′ adjacent to each other and an another pair of friction-clutches E′ F′ adjacent to each other. The particular mechanism of these friction-clutches forms no part of my present invention, except as they are coupled to the operating mechanism of the machine. Within each clutch-rim is a pair of oppositely-set clutching-segments O′, guided by rods *u*, passing through hubs *v*, which are keyed or otherwise fast upon the shaft B′ within the friction-rings. A pair of circumferentially-grooved collars P′ are feathered by means of keys *w* upon the shaft B′ between each pair of friction-rings, and each of these collars has a lateral extension, to which is pivoted a pair of toggle-arms *a′*, extending to the segments O′, with which they engage. There is a lever Q′ fulcrumed at *b′*, with a fork engaging the circumferential groove of the collar P′ between the friction-disks C′ D′, and a similar lever R′ fulcrumed at *c′*, with a fork engaging the circumferential groove of the collar P′ between the clutch-disks E′ F′. When the lever R′ is in the position shown in Fig. 15, the pinion F′ is clutched to the shaft B′, and the vehicle thereby receives its highest speed from the motor-shaft G′. When the lever R′ is shifted to unclutch the rim F′ and to clutch the rim E′, the vehicle receives its next highest speed from the motor-shaft. When the lever R′ is in the position of the lever Q′ or at right angles to the shaft B′, all of the clutches are disengaged and the vehicle comes to a stop, although the motor may be running. When the lever Q′ is shifted to throw the clutch into engagement with the rim D′, the vehicle receives its lowest rate of speed, and when the lever Q′ is shifted to throw the clutch into engagement with the rim C′ the vehicle is reversed or travels backward by reason of the intermediate pinion K′, Fig. 18.

The manner of connecting the lower ends of the toggle-arms *a′* to their base-plate b^2 is by forming trunnions on their lower ends and passing the same through slots in the plates b^2 and then giving them a half-turn, as seen in Fig. 19.

Referring now to Figs. 21 to 26, inclusive, I will proceed to describe the mechanism for operating the clutches, as well as the mechanism for regulating the extent of the motive power employed. For this purpose I employ a single operating-handle composed of a vertical tubular shaft B^2, stepped by a ball-and-socket joint into a piece C^2, secured to the frame of the machine. This shaft B^2 passes up through a plate D^2, Figs. 20 and 22, having through it two bisecting slots $d^2 e^2$ at right angles to each other. The diameter of the shaft just fits the width of these slots, and their margins on the upper surface are provided with perforations f^2 to receive pins g^2 on the under side of a sliding block h^2 on the shaft B^2 and normally held down to lock the shaft B^2 to the plate D^2 by a coiled spring i^2. Beneath the plate D^2 and surrounding the shaft B^2 are two links E^2 F^2, the former of which, as seen in Fig. 25, is connected by a link H^2 with the lever R′, while the latter is connected by a link G^2 with the lever Q′, the arrangement being such that when the shaft B^2 stands vertical and in the convergence of the slots d^2 and e^2 the links G^2 H^2 hold the levers Q′ R′ at right angles to the shaft B′ and all of the clutches are out of engagement. Upon shifting the lever or shaft B^2 to the right in the slot d^2 the link E^2 would be drawn to the right and, acting through the lever H^2, would shift the lever R′, so as to reverse the machine, as before described, and so in like manner by shifting the lever B^2 in the proper direction in either of the slots D^2 E^2 the proper clutch would be engaged to increase or diminish the speed of the vehicle. Passing down through the shaft B^2 is a stem g^2, having on its upper end a turning handle or button h^2, while the lower end of said stem is threaded through a block i^2 at the lower end of the shaft B^2, having fingers j^2 extending through slots in the shaft B^2 and bearing upon a collar k^2, surrounding the shaft and forming part of a lever fulcrumed at l^2 and connected by a link m^2 with an index n^2, and regulating mechanism (not shown) for increasing or diminishing the extent of power from whatever source derived to the motor that drives the vehicle.

As will be seen from Fig. 1, I provide a spring chain-tightener which may be fastened in any suitable manner to the perch, so as to be adjustable. The object of this device is to provide means for taking up any slack in the chain caused by wear or by the vibration of the carriage.

As a further means of strengthening the construction I provide a brace L^3, (seen in Fig. 1,) which extends from the gear-casing P forward and upward to the perch L, thereby stiffening the perch and preventing the gear-casing from turning in either direction. The forward end of the brace L^3 is coupled to the perch by having a bolt passed up through it and having on its upper end a clamping-plate which serves to clamp both the brace and the chain-tightener.

Having thus fully described my invention, I claim—

1. In horseless-carriage construction of the character described, the combination with a front axle composed of an arched piece and a straight piece below said arched piece and a bearing for the perch in the center of said axle and having at each end antifriction-bearings for carrying stub-axles with bell-cranks attached thereto, of a steering-rod attached to the said bell-cranks having a pair of springs thereon on either side of a looped steering-lever to form a yielding connection between said rod and said lever, substantially as described.

2. In horseless-carriage construction, the combination with a front axle composed of a hollow arched piece and a hollow straight piece connected at their middle by a block having a central transverse opening forming a bearing for the perch allowing free movement of the axle vertically to allow the wheels to pass over obstructions, of a yoke or saddle for the forward spring composed of a pair of plates so bent as to form a rest for the spring and to pass over the central block and hinge upon it so as to allow it to swing with the bed, of a pair of vertical bearings at either end of said axle composed of a casing having a cup-shaped opening in the top and bottom thereof, and a stub-axle having an upward extension passing through the vertical bearing and carrying a pair of hemispheres within the cup-shaped openings in said bearing and a pair of steel cups interposed between said members with means for taking up wear, a steering-rod attached to rearward extensions on said stub-axle and having yielding connection with a steering-lever, substantially as described.

3. In a vehicle of the character described, the combination with a motor-shaft carrying thereon pinions meshing with pinions on the periphery of friction-disks loosely mounted on a counter-shaft carrying a sprocket-wheel centrally arranged, of lever mechanism so constructed that no two of the clutches may be thrown into connection at the same time, of a differential gear composed of a sprocket-wheel carrying a series of miter-wheels meshing with miter-wheels fast on the ends of the rear axle, substantially as described.

4. In a vehicle of the character described, the combination with a motor-shaft carrying pinions meshing with pinions on the periphery of friction-disks loosely mounted on a counter-shaft having the other members of the friction-clutches fast thereon with means for throwing the clutches into or out of connection with the friction-disks, and means whereby no two of the clutches may be thrown into gear at the same time consisting of lever mechanism consisting of a pair of slotted arms set at right angles to each other and having an operating-lever passed through them at the point of bisection in such manner that when the lever is moved forward or backward it will affect only one of the slotted arms to throw in or out of connection one of a pair of the clutches and when the said operating-lever is moved to either side it will throw in or out one of another pair of friction-clutches and means for locking the operating-lever in any of its positions for holding the clutches in gear, of a sprocket-wheel fast on the counter-shaft and connected to a differential gear mounted on the rear axle of the vehicle consisting of a sprocket-wheel driven by the before-mentioned sprocket-wheel and carrying a set of miter-wheels meshing constantly with a pair of miter-wheels fast on the ends of the rear axles so as to allow one rear wheel of the vehicle to turn faster than the other in turning a curve, of the coupling-pole connecting the front and rear axles and split toward the rear to allow the driving-chain to pass therethrough, of a chain-tightening wheel mounted on a spring adjustably mounted on the coupling-pole, and a brace extending from the lower part of the differential casing forward and upward to the coupling-pole and connected thereto by the same bolt that holds the adjustable chain-tightener for the purpose of preventing any rotary movement of the differential-gear case and for stiffening the construction of the vehicle, of a pair of braces extending from the vertical bearing of the front axle rearward and connected to the coupling-pole by a rocking member so as to provide for the rise and fall of the front axle in passing over an obstruction and to prevent lateral movement of the said front axle, and another pair of braces extending from the outer ends of the rear axle forward to the coupling-pole to prevent lateral movement of the rear axle, substantially as described.

5. In a vehicle of the character described, the combination with the rear axle composed of a pair of stub-axles splined into each other carrying on their inner ends miter-wheels fast thereon and contained in a pipe fast within the differential-gear case at the middle and fast to the outer bearings, of a pair of outer bearings to which the rear brace-rods are connected and having recesses at the top and bottom thereof to receive the springs of the vehicle and the brace-rods respectively, and the springs and brace-rods connected to the said outer bearings by having clips slipped over both of the said springs and brace-rods and having clip-ties to secure the same in place, substantially as described.

EMMET P. GRAY.

Witnesses:
WM. J. PECK,
GERTRUDE E. PHILLIPS.