(No Model.)

2 Sheets—Sheet 1

F. WHITE.

TRICYCLE.

No. 336,968. Patented Mar. 2, 1886.

Fig: 4.

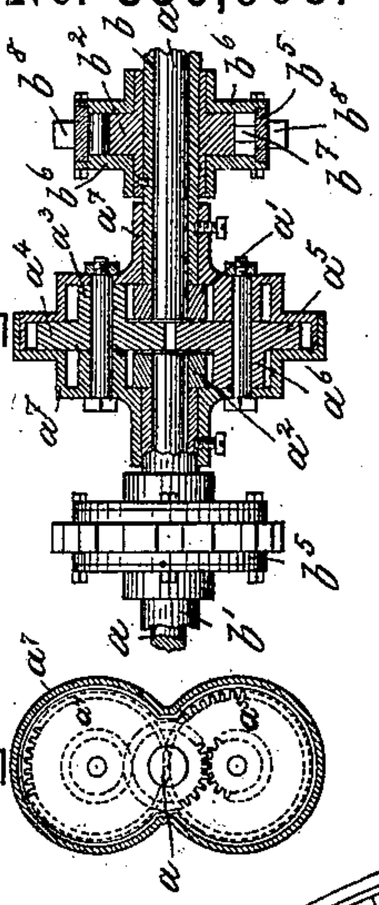


Fig: 3.

Fig: 6.

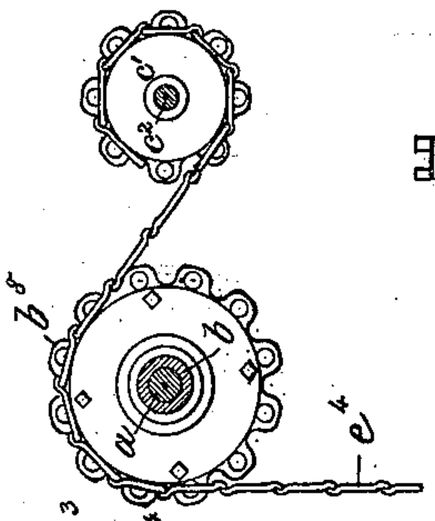


Fig: 5.

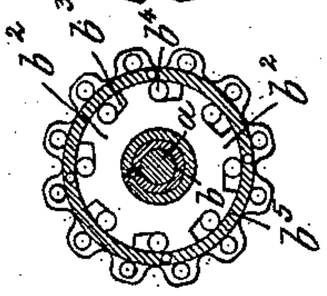


Fig: 7.

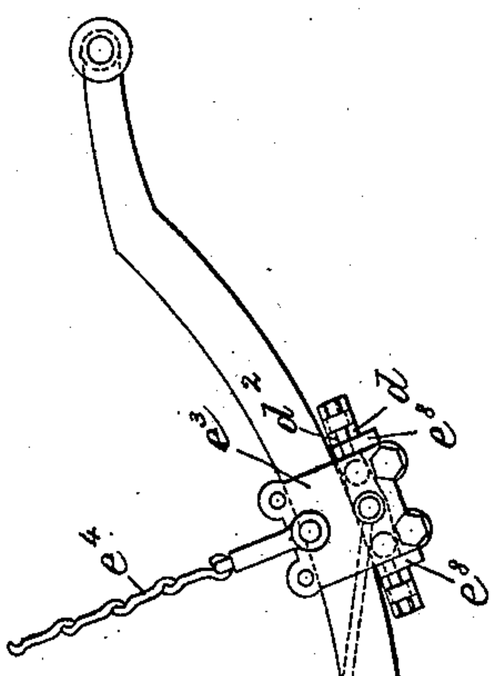


Fig: 1.

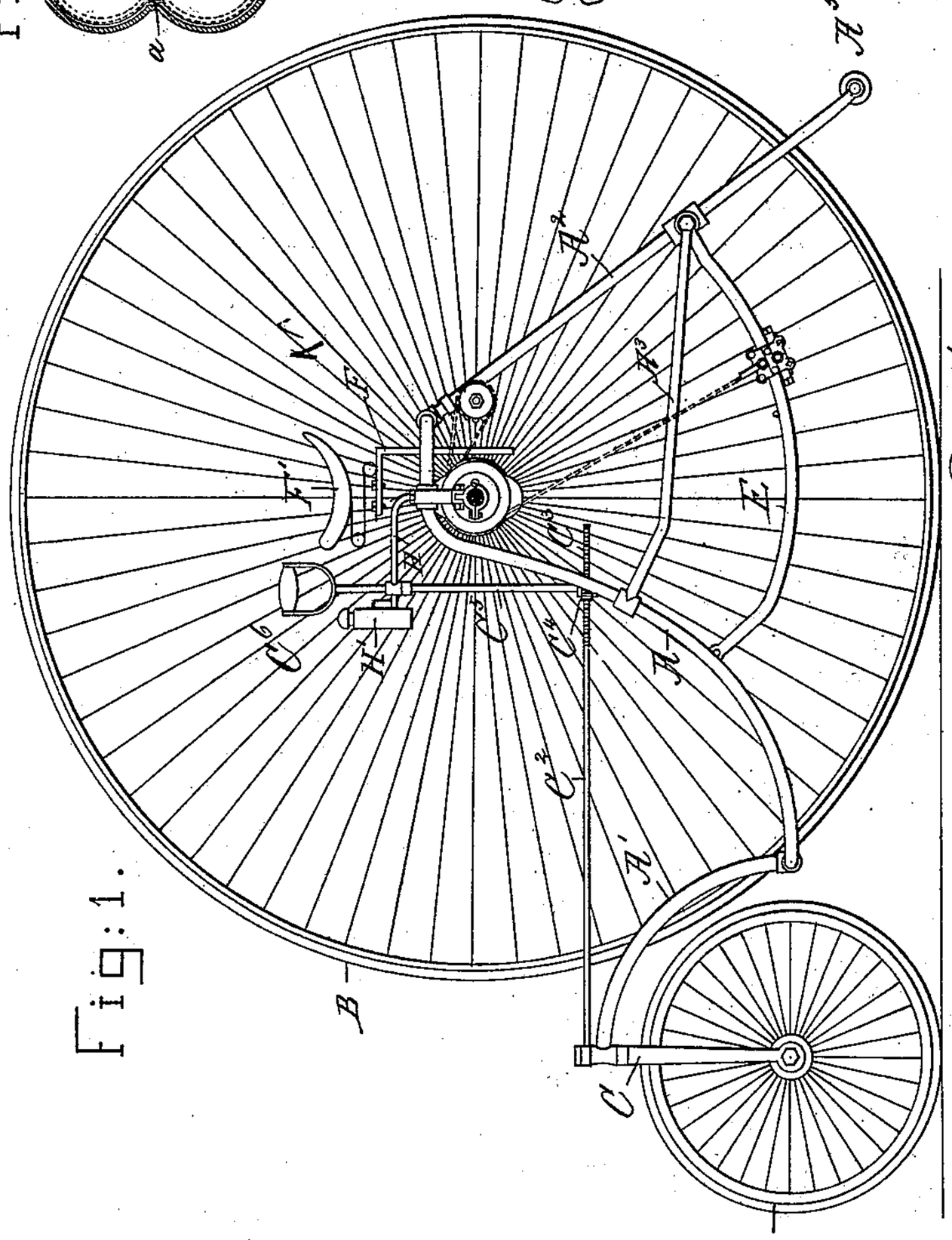


Fig: 15.

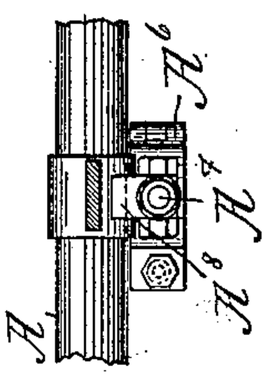
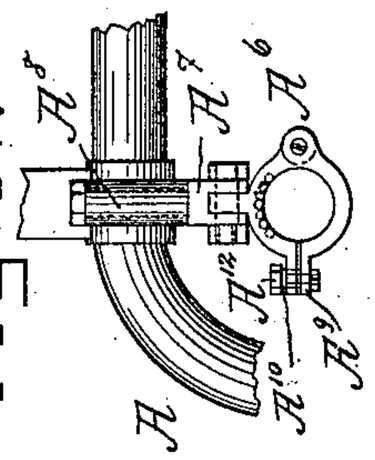


Fig: 14.



Witnesses.

Arthur Lippincott.

John P. C. Prentice

Inventor.

Frederick White.

By Crosby & Gregory Attys.

(No Model.) 2 Sheets—Sheet 2.

F. WHITE.

TRICYCLE.

No. 336,968. Patented Mar. 2, 1886.

Fig: 8.

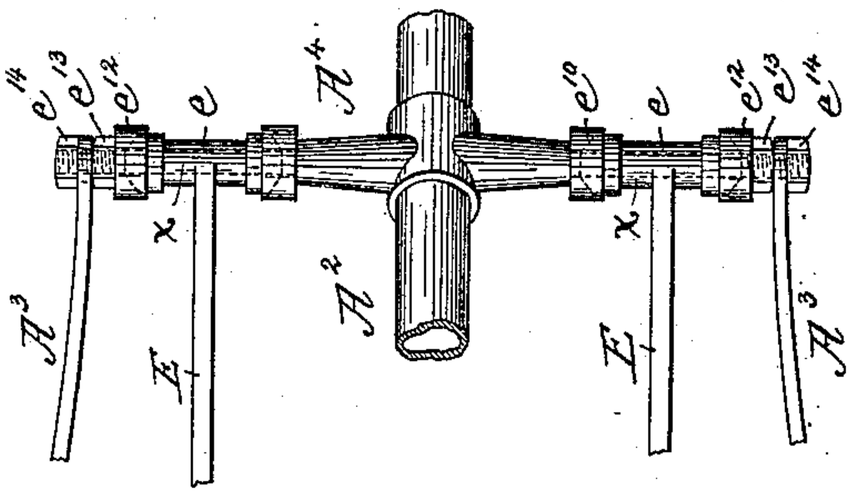


Fig: 11.

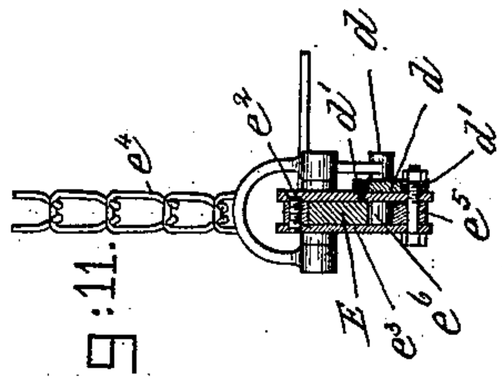


Fig: 10.

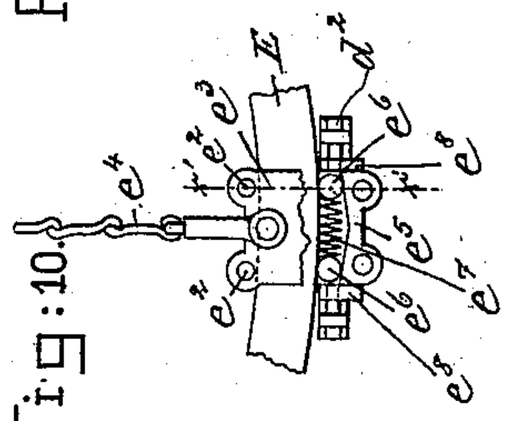


Fig: 2.

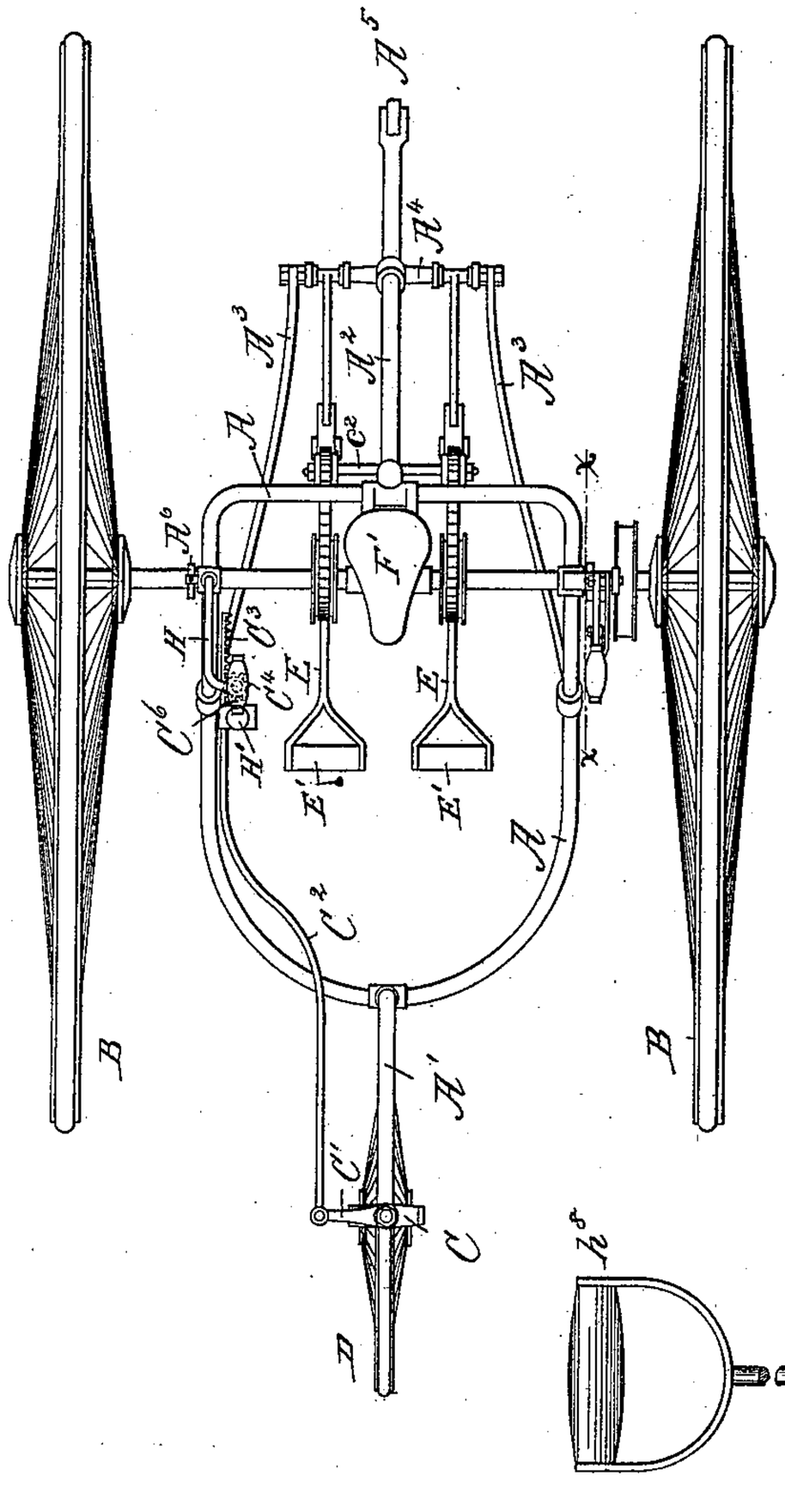


Fig: 9.

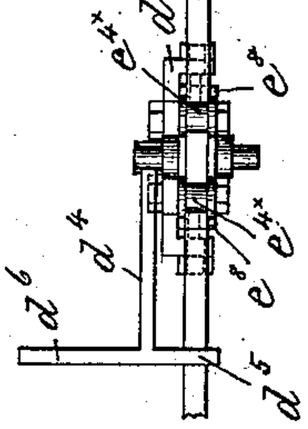


Fig: 12.

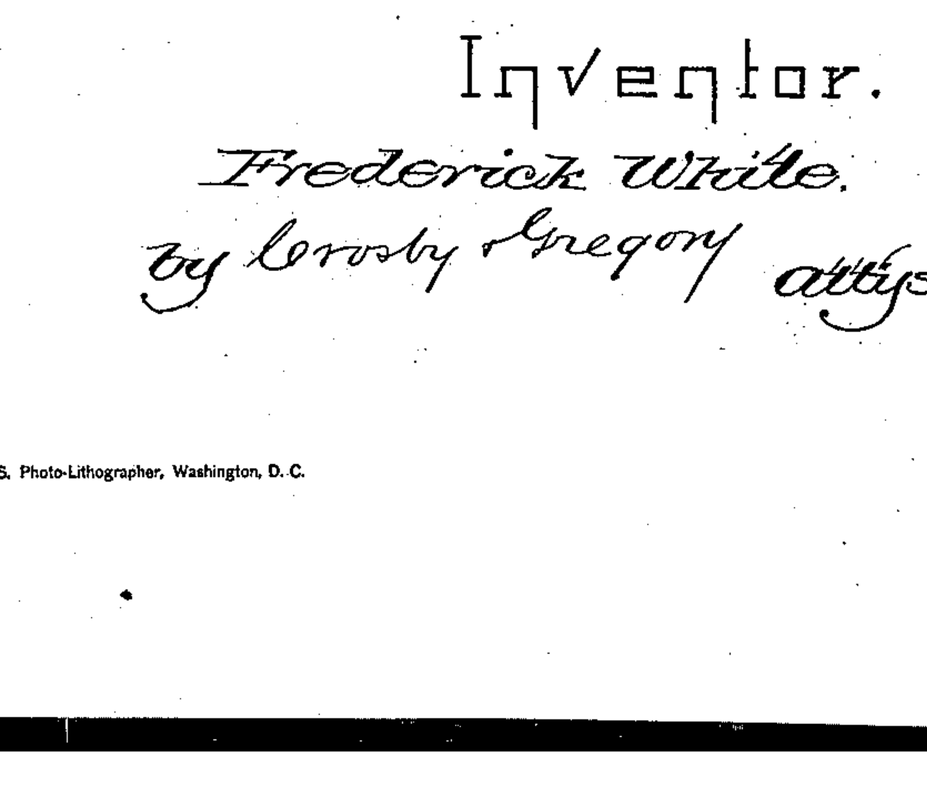


Fig: 13.

Witnesses.

Arthur Lispenard.

John F. C. Printkerk

Inventor.

Frederick White.

by Crosby & Gregory attys.

UNITED STATES PATENT OFFICE.

FREDERICK WHITE, OF WESTBOROUGH, MASSACHUSETTS, ASSIGNOR TO THE BOSTON WHEEL COMPANY, OF BANGOR, MAINE.

TRICYCLE.

SPECIFICATION forming part of Letters Patent No. 336,968, dated March 2, 1886.

Application filed April 6, 1885. Serial No. 161,316. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK WHITE, of Westborough, county of Worcester, State of Massachusetts, have invented an Improvement in Tricycles, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention, relating to tricycles, has for one of its objects to provide convenient and effectual mechanism for varying and adjusting the relation between the power and resistance while the vehicle is in motion, so that the power may be applied advantageously for propelling upgrades or over soft or rough roads, or for producing a great speed when the road is favorable.

The invention consists in various details of construction hereinafter described.

Figure 1 is a vertical section in line *x x*, Fig. 2, of a tricycle embodying this invention; Fig. 2, a plan view thereof; Figs. 3 to 6, inclusive, details of the mechanism for transmitting the power from the actuating levers or treadles to the driving-wheels; Fig. 7, a side elevation of one of the actuating levers or treadles; Fig. 8, a plan view, partly in section, of a portion of the frame-work and actuating levers, showing the pivots of the latter. Figs. 9, 10, 11, details of the devices for varying the relative lengths of the arms of the actuating-levers, or the point of application of the load or resistance on the said levers; Figs. 12 and 13, details of the brake or retarding apparatus. Figs. 14 and 15, details of a portion of the frame-work on a larger scale, and Fig. 16 a detail to be referred to.

The main frame A, supported on the shaft *a* (see Figs. 3 to 6) of the main or driving wheels B, is provided with a forward extension or branch, A′, resting on a fork, C, for the steering-wheel D, and a rearward extension, A^2, connected by braces A^3 with the main frame-work, the said rearward extension A^2 also having a cross-piece, A^4, forming a support for the actuating-levers E, provided with suitable foot pieces or pedals, E′. The rearward part, A^2, of the frame-work has a roller, A^5, to prevent the tricycle from tipping over backward.

The main frame-work A has secured to it the saddle-support F, vertically adjustable in order to place the saddle F′ at the proper distance above the foot pieces or pedals E′ to suit the rider.

The fork C of the steering-wheel D is provided with an arm, C′, connected by a rod, C^2, with a rack, C^3, engaged by a pinion, C^4, fixed on a shaft, C^5, provided with a handle, C^6, by which it may be rotated to turn the steering-wheel D in either direction, these parts constituting the steering apparatus and not differing materially from that found in tricycles now in use. The upper bearing for the shaft C^5 is on an arm or bracket, H, which also serves as a support for a lantern, H′.

The actuating pedal-levers E have pivotal bearing portions *e*, working on bearing pins or arms, as shown in dotted lines, Fig. 8, extending from the portion A^4 of the frame-work and constituting the fulcra of the said levers. The bearing portions *e* of the pedals are made conical at their ends, as shown, and enter correspondingly-tapered sockets in hubs or bosses e^{10} e^{12} on the arms *x*, the said bosses e^{10} e^{12} being adjustable and held in proper engagement with the bearing portions *e* by nuts e^{13} e^{14}, between which the brace-pieces A^3 of the frame-work are also secured. By the proper adjustment of the bosses the pedals will have a suitable bearing without looseness, the bosses being moved up from time to time as the bearing-surfaces wear away.

The portion E^2 of the treadle-lever near the fulcrum *e*, which portion may be called the "weight" or "resistance" arm of the levers, is curved at its under side, as shown in Figs. 1 and 7, to form a seat or support of an attaching device, e^3, connected with a flexible band, strap, or chain, e^4, by which the power is transmitted to the axle *a* and driving-wheels B, as hereinafter described.

The attaching device e^3 (shown in plan view in Fig. 9, in side elevation in Fig. 10, and in vertical section on line x' x' of Fig. 10 in Fig. 11) consists of two plates, which receive the pedal-lever E between them, the said plates being connected above the lever by bolts or screws e^2, preferably provided with rollers or sheaves $e^{4\times}$, which rest on the upper surface of the lever E. The plates of the attaching device extend below the under surface of the lever

E, as best shown in Figs. 10 and 11, the lower portion of the nearer plate being broken away in Fig. 10, and the said plates have fastened between them at their lower ends a piece, e^5, having its upper surface inclined in opposite directions toward the middle thereof, as shown in Figs. 10 and 11, thus forming two wedge-shaped spaces between the under surface of the lever E and the upper surface of the inclined or wedge piece e^5. The said wedge-shaped spaces contain rollers or balls e^6, the diameters of which are greater than the narrowest end of the wedge-shaped spaces, but less than the wider portion of the said spaces. A spring, e^7, tends to force both the rollers into the narrower portion of the spaces, as best shown in Fig. 10, thus locking the attaching device e^3 and preventing it from sliding on the lever E, as any tendency to move in either direction will wedge the locking device or cylinder e^6 more tightly into the space on the side from which the movements or pressure takes place.

The place at which the attaching device e^3 is left on the lever E constitutes the point of application of the resistance, and its distance from the pivoted end of the lever determines the ratio of the lower arms, so that by moving or placing said attaching device nearer the fulcrum e the mechanical advantage of the power applied at the pedals E′ is increased, and by moving the said attaching device away from the said fulcrum the mechanical advantage of the power applied at the pedals is diminished, but the amount of movement imparted to the chain e^4, relative to the movement of the pedals E′, is increased, so that a greater speed is imparted to the vehicle for the same movement of the pedals E′ than when the attaching device is nearer the fulcrum.

In order to enable the ratio of the lever-arms at the point of application of the resistance or load to be readily changed by the operator without stopping or dismounting from the vehicle, so that the power may be employed advantageously to produce higher speed, if the road be smooth and level, or greater propelling force, in case the road is difficult or uphill, means are provided for sliding the attaching device e^3 along the lever E to any desired point. It is necessary, in order to thus slide the attaching devices on the levers, that the locking-cylinder e^6, on the side from which the movement takes place, should be pushed out from between the inclined surfaces, or toward the middle of the attaching device e^3. The cylinder e^6 is thus disengaged, and the attaching device subsequently moved on the lever in one or the other direction by a shifting device consisting of a slide-piece, d, working between guides d' (see Fig. 11) on one side of the attaching device. The said shifting device or slide d is provided with pins d^2, which pass through openings in the flanges e^8 at the ends of the wedge-piece e^5, in position to strike one or the other of the cylinders e^6, according as the said slide-piece d is moved in one or the other direction with relation to the attaching device. The said slide-piece d is provided with a stud, d^3, upon which is pivoted an arm, d^4, provided with a projection, d^5, resting on the upper side of the lever E, and having a projection, d^6, extending toward the opposite lever E.

The projections d^6 on both levers E extend near enough to one another to enable both to be engaged simultaneously by one foot of the operator, who, when it is desired that the position of the point of attachment of the chain e^4 with the actuating-lever E should be varied, merely pushes the projections d^6 in whichever direction the point of attachment is to be moved. For example, if an increase in speed is desired, the projection d^6 will be moved away from the fulcrum end e of the lever, or toward the pedals, and in this movement the slide d will first move a short distance on the attaching device e^3, in which movement the pin d^2, near the fulcrum end of the lever, engages the adjacent cylinder e^6, moving it toward the middle of the attaching device, and thereby releasing or unlocking the latter, which will then move freely with the shifting device d as far as the operator may desire, the cylinder e^6 at the other end readily relieving itself in this movement. When the attaching device has been placed in a proper position and the foot removed from the projection d^6, the spring e^7 will throw the locking-cylinder e^6 into the tapering spaces, locking the attaching device, and preventing any movement thereof, except when the shifting device is again operated, the said shifting device, in operating, first unlocking and then moving the attaching device.

The levers E are curved, as best shown in Fig. 7, for the greater portion of their length, so that the distance between the lever and the point of application of the power at the other end of the chain e^4 is maintained substantially constant for all positions of the attaching device e^3, so that the relation of the levers E to the saddle is not varied when the attaching device is shifted to vary the ratio of the lever-arms.

The shaft a, upon which the driving-wheels B are fixed, is divided at the middle, as shown in Fig. 4, the two parts each having fixed thereon a pinion, a' and a^2, the former meshing with a pinion, a^3, connected with a gear, a^4, meshing with a gear, a^5, provided with a pinion, a^6, that meshes with the pinion a^2 on the portion of the shaft connected with the other driving-wheel. The gears a^4 a^5 and connected pinions a^3 a^6 have bearings in a box, a^7, rigidly connected with the sleeve b b', loose on the shaft a, and it will be seen that the train of gearing described will transmit from the sleeve b b', and box a^7 an equal movement in the same direction to both parts of the shaft a, provided that both parts offer an equal resistance to such movement, as when the vehicle is progressing in a straight line. When, however, one of the

driving-wheels B moves more slowly than the other, as when the vehicle is turning around a curve, the pinion a' or a^2 connected with the said driving-wheel is also retarded and operates through the train of gearing to drive the other pinion at a speed as much greater than that of the sleeve $b\,b'$ and box a^7 as the speed of the retarded pinion is less than that of the said box, thus enabling the two driving-wheels B to turn independently, or at different speeds, although the propelling power is applied to both of them.

The box a^7 is made in two parts for convenience in putting together, and forms a rigid connection between the two parts of the sleeve $b\,b'$, which turns in the bearings A^6 of the frame A.

The sleeve $b\,b'$ has fixed upon it two hubs, b^2, each having around its periphery a series of recesses, b^3, containing cylinders or rollers b^4, the under faces of the said recesses being slightly eccentric to the axis of the hub, and the deepest portion of the recesses being curved at the sides, as shown, to fit the cylinders b^4 when in the said deepest portion. The said hubs b^2 have loose upon them rings or collars b^5, secured between the plates b^6, which also turn freely on the hubs b^2. The inner surface of the ring b^5 is adapted to turn smoothly on the outer portion of the periphery of the hubs, and when the motion of said rings with relation to the hub is toward the deepest portion of the recesses b^3 it will tend to carry the rollers b^4 into the said deepest portion of the said recesses, and the rings will turn freely on the hubs without affecting the movement of the latter. When, however, the movement of the rings is toward the shallow portion of the recesses b^3, one or more of the roliers b^4 will drop into the narrow portion of the recesses and will become wedged between the inner surface of the rings and the bottom of the recess, thus locking the ring and hub together, so that the hub will be caused to accompany the ring in the movement of the latter, derived from the actuating-lever E through the chain e^4. This device constitutes what may be called a "friction" ratchet-clutch, similar in its nature to what has been previously employed to produce rotary movement in one direction from an oscillating or to-and-fro rotary movement.

It has been found in practice that when the hubs b^2 are solid between their recesses b^3 the cylinders b^4 are likely to be retained in the deeper portion of the recesses by the suction or adhesion derived from the oil, and consequently fail to operate to lock the hub and ring together. This defect has been obviated in the present invention by grooving the entire periphery of the hub b^2, as shown at b^7, Figs. 4 and 16, said grooves, together with the recesses b^3, thus forming a channel which permits free circulation of oil around the rotating hub, thereby preventing the oil from accumulating in the deeper portion of the recesses.

The ring b^5 is provided with sprocket projections b^8, which receive the links of the drive-chain e^4. One of the ratchet friction-clutches is shown in longitudinal section in Fig. 4 and the other in elevation.

Each pedal lever is raised or retracted alternately and the corresponding ring b^5 moved backward into position to make a new propelling-stroke by means of the chain e^4 of the opposite lever. Each of the said chains e^4, after passing over the ring b^5, winds around an intermediate pulley, c', fixed on a shaft, c^2, there being two of the intermediate pulleys c', one corresponding to each pedal, and the chain e^4 from one of the said levers passes over the upper side of the corresponding pulley, while the other chain passes over the under side of its pulley, thus rotating the other pulley in the direction to wind up the chain and raise the other pedal-lever, so that the two pedal-levers are caused to move alternately in opposite directions.

The brake mechanism (best shown in Figs. 12 and 13) consists, essentially, of a friction-wheel, h, fixed upon the sleeve b', and having wound about its periphery a strap, h^2, the ends of which are connected with a straining device, h^3, pivoted at 4 and provided with an arm, h^4, forked to embrace a shaft, h^6, provided with a notched shank, h^7, and a handle, h^8, the said arm h^4 being engaged by a shoulder, h^5, and a collar or projection, h^{50}, on the said shaft. The shank h^7 is cylindrical, and when in the position shown in Figs. 12 and 13 the notches are parallel with and receive a locking device, h^9, which prevents a longitudinal movement of the said shaft; but by a quarter-rotation of the said shaft the notched portion will be disengaged from the said locking device to permit the longitudinal movement of the shaft, and by depressing the same the straining device h^3 will be caused to draw on both ends of the strap h^2, increasing its pressure against the periphery of the brake-wheel h, and thus retarding the vehicle.

By turning the handle h^8 back the shaft may be engaged at any desired point, retaining the brake applied with any desired pressure without further attention on the part of the rider.

The bearings A^6 are hinged upon swivel-pieces A^7, (see Figs. 14 and 15,) which turn or swivel in sockets A^8, connected with the main frame-work A, thus accommodating the slight movement or twist in the frame-work without causing the bearings to bind. The bearings A^6 consist of two half-rings hinged together at one side, as shown in Fig. 14, and provided with internal grooves to receive anti-friction balls. The half-rings opposite the hinge are provided with lugs A^9, one of which has a threaded opening, which receives a bushing, A^{10}, which may be screwed into the said opening a greater or less distance, so as to engage the opposite lug, and thus determine the distance that the said lugs approach one another for the purpose of adjusting the fit of the ring upon the axle or sleeve turning within it. When properly adjusted, the two

parts of the ring are fastened together by a bolt, A^{12}, passing through the bushing and the lugs, and it will be seen that the bolt may be applied or removed, for the purpose of closing or opening the bearing, without changing the adjustment of the bushing, and consequent adjustment of the bearing.

Some of the parts and devices hereinbefore referred to are applicable to bicycles and other wheeled carriages adapted to be operated by power.

I claim—

1. The driving-wheels and divided shaft having one portion connected with each wheel and the pinions $a' a^2$, connected with two portions of the shaft, combined with the intermediate gearing, $a^3 a^4 a^5 a^6$, between the said pinions, the box inclosing the said pinions, and gearing having bearings for the said gears a^4 a^5 and their connected pinions, and actuating mechanism for the said box, substantially as described.

2. The main shaft and hubs b^2 carried thereby, each hub provided with an annular groove around its periphery, the said groove being intersected by transverse recesses, and rollers placed in the said recesses, combined with rings surrounding the said hubs and rollers, drive-chains or bands to engage and operate the said rings and connected with the actuating-levers E^4, the annular groove of each hub affording space for the circulation of oil from one to the other of the said recesses as the hub rotates, substantially as described.

3. The main shaft and hubs b^2 carried thereby, each hub provided with an annular groove around its periphery, the said groove being intersected by transverse recesses, the under faces of which are made eccentric to the axis of the hub, and rollers placed in the said recesses, combined with rings surrounding the said hubs and rollers, drive chains or bands to engage and operate the said rings and connected with the actuating-levers E^4, the annular groove of each hub affording space for the circulation of oil from one to the other of the said recesses as the hub rotates, substantially as described.

4. The levers and drive-chains actuated thereby and the attaching device and frictional locking device for holding it from movement on the said levers, combined with a shifting device, substantially as described, co-operating with the locking and attaching devices, whereby the latter may be first released from engagement and then shifted along the lever, and be again locked in any position thereon, where it may be left, substantially as described.

5. The brake or retarding mechanism consisting of a friction wheel and band and straining device therefor, combined with the longitudinally-movable notched shaft engaging the said straining device, and the locking device for engaging the notches of the said shaft, operated by the rotary movement thereof, substantially as described.

6. The actuating-lever and attaching device movable thereon, provided with inclined surfaces, combined with the locking-rollers and spring co-operating therewith, and the shifting device movable with relation to the said attaching device and provided with projections to engage the said rollers, substantially as and for the purpose described.

7. The combination, with the frame-work, of a bearing for the axle comprising two half-rings hinged together at one side, provided with lugs at the opposite side, and a bushing screwed into one of the said lugs and projecting therefrom and bearing against the other lug to prevent contact of the two lugs, and a bolt passing through the said bushing and lug fastening two half-rings together, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK WHITE.

Witnesses:

G. W. GREGORY,

F. CUTTER.