(No Model.) 3 Sheets—Sheet 1.

C. E. LUFBERY.

MOTOR VEHICLE.

No. 601,731. Patented Apr. 5, 1898.

FIG-1-

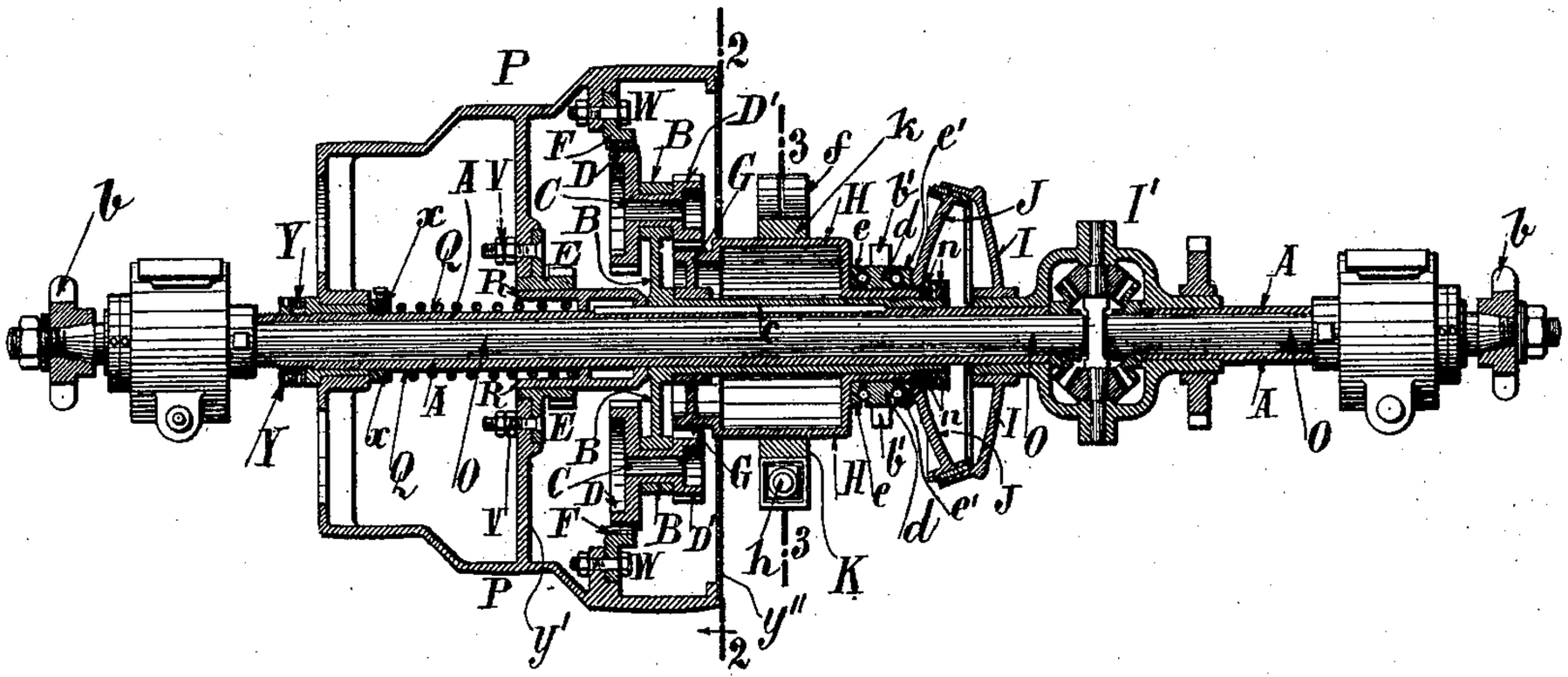


FIG-4-

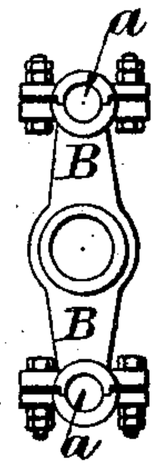


FIG-3-

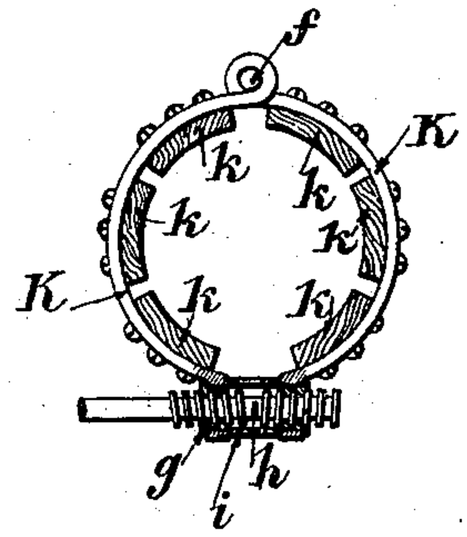
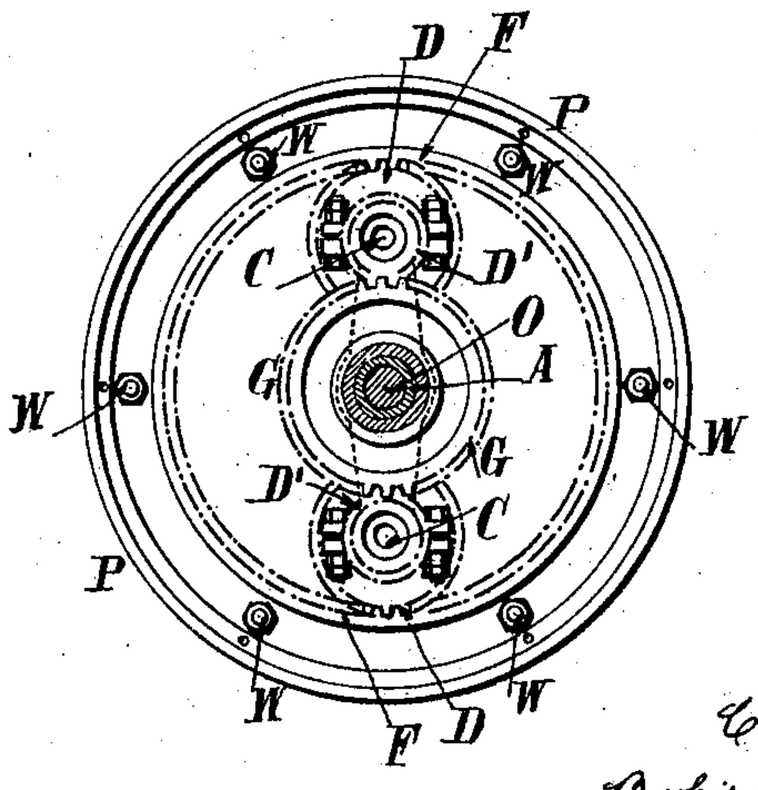


FIG-2-



WITNESSES.

Fred White

Thomas F. Wallace

INVENTOR:

Charles Edouard Lufbery,

By his Attorneys

Atkinson & Fraser & Co.

(No Model.) 3 Sheets—Sheet 2.

C. E. LUFBERY.

MOTOR VEHICLE.

No. 601,731. Patented Apr. 5, 1898.

FIG-5-

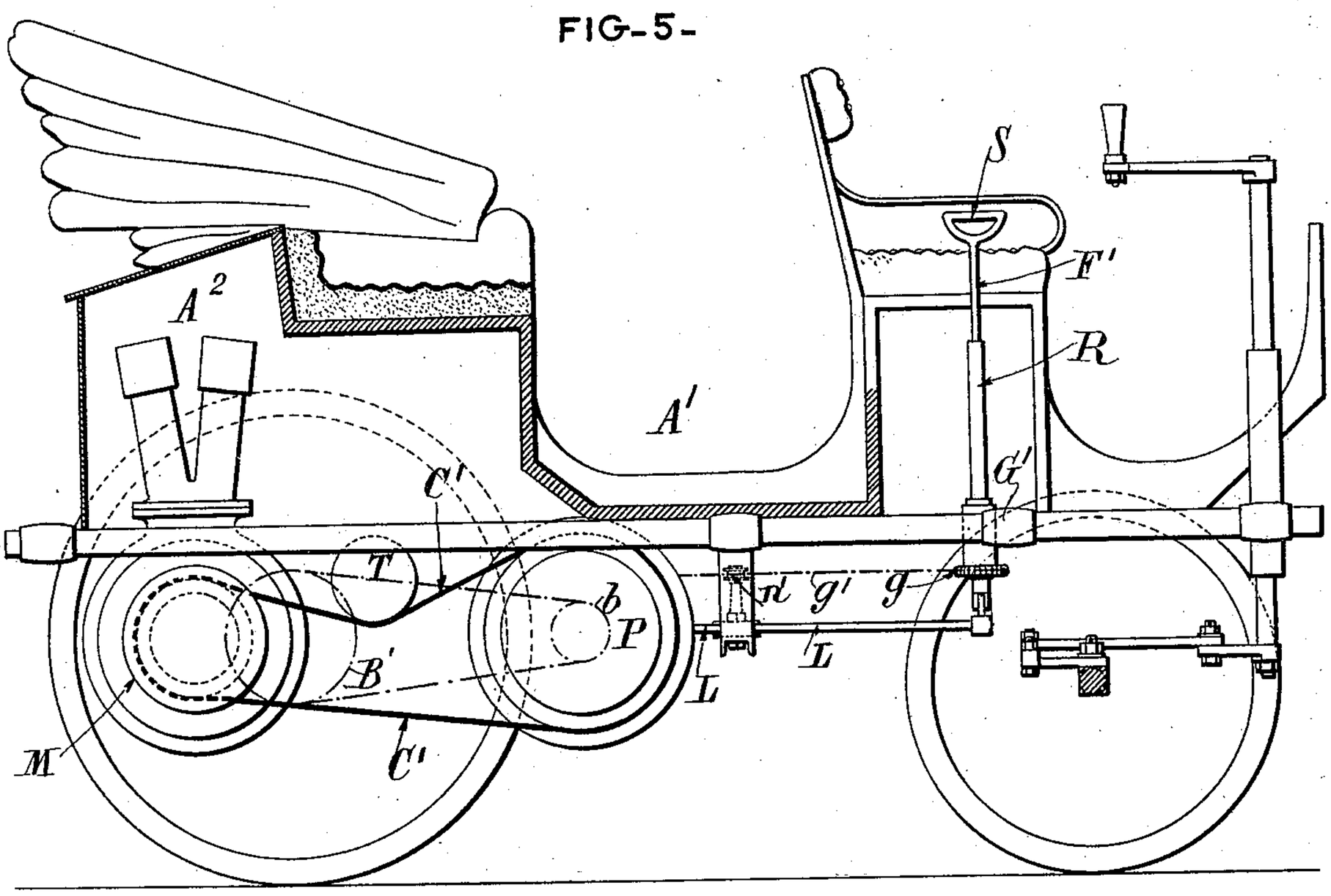
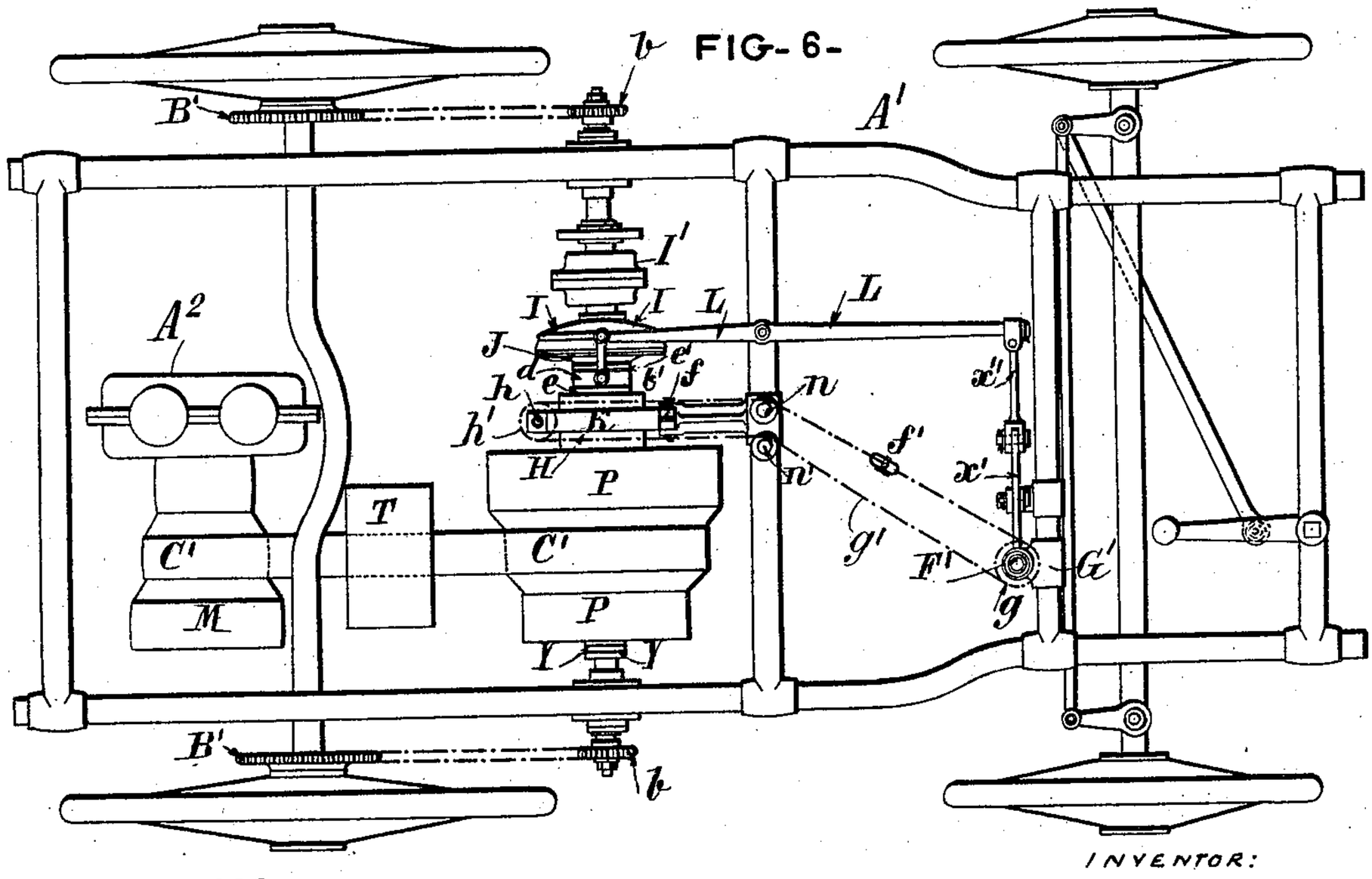


FIG-6-



WITNESSES:

Fred Whitey

Thomas F. Wallace

INVENTOR:

Charles Edouard Lufbery,

By his Attorneys:

Wilkinson & Frazer & Co

(No Model.) 3 Sheets—Sheet 3.

C. E. LUFBÉRY.

MOTOR VEHICLE.

No. 601,731. Patented Apr. 5, 1898.

FIG-8-

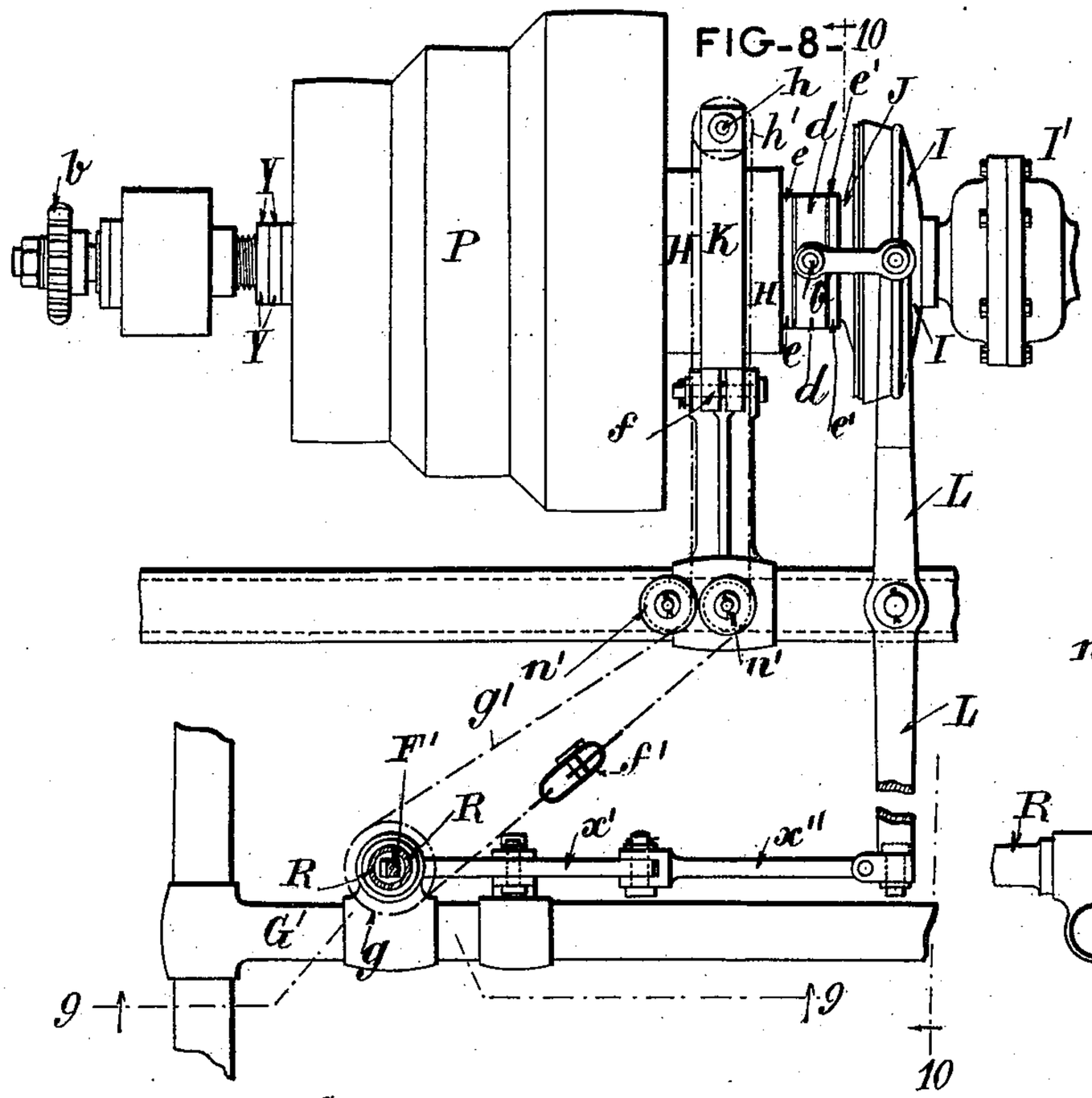


FIG-10-

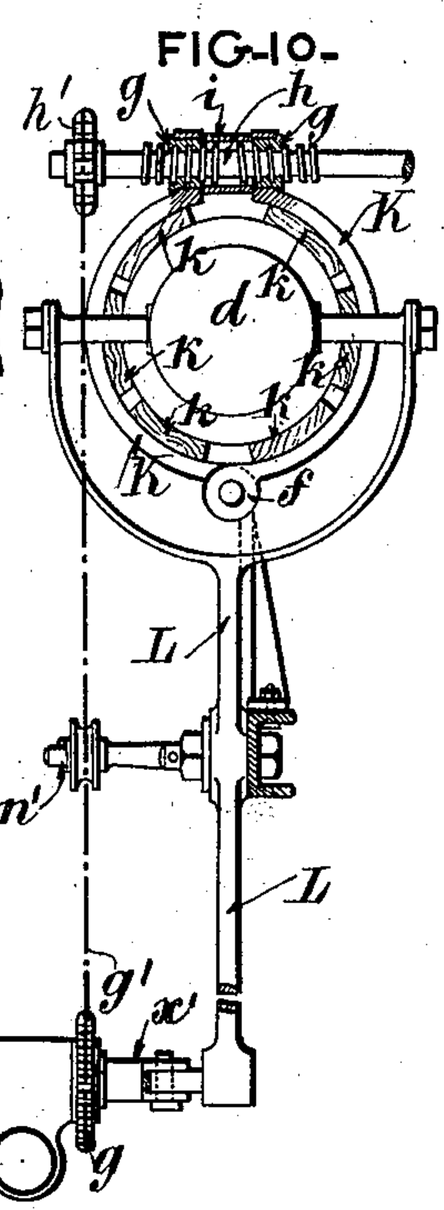


FIG-9-

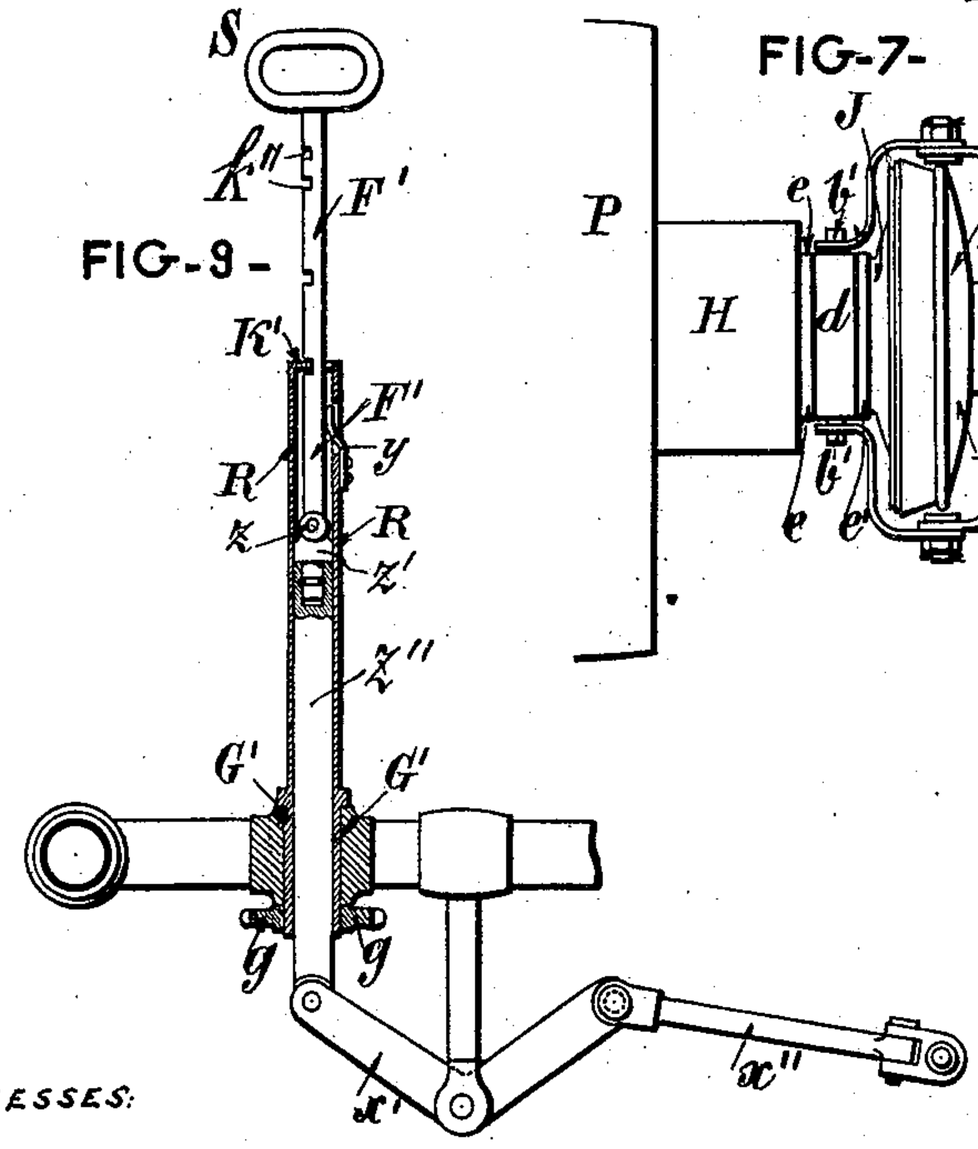


FIG-7-

WITNESSES:

Fred Whitey

Thomas F. Wallace

INVENTOR:

Charles Edouard Lufbery,

By his Attorneys:

Arthur C. Fraser & Co.

UNITED STATES PATENT OFFICE.

CHARLES EDOUARD LUFBERY, OF CHAUNY, FRANCE.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 601,731, dated April 5, 1898.

Application filed August 28, 1897. Serial No. 649,812. (No model.)

To all whom it may concern:

Be it known that I, CHARLES EDOUARD LUFBERY, a citizen of the United States, residing in Chauny, (Aisne,) France, have invented certain new and useful improvements in apparatus for transmitting motion with variable speed and for reversing the motion, applicable to motor-cars and to other purposes, of which the following is a specification.

This invention relates to apparatus for transmitting motion with variable speed and for reversing motion, especially applicable for motor-cars, and aims to provide an improved apparatus which shall be noiseless in operation and which is capable of driving at a number of different speeds—such, for example, as six, nine, twelve, eighteen, and twenty-four kilometers per hour for the forward motion and six, nine, and twelve kilometers per hour for the backward motion—when applied to motor-cars, which application of my invention is shown in the accompanying drawings, in which—

Figure 1 is a vertical axial section of the preferred form of my improved mechanism applied to the driving-shaft of a motor-carriage, the shaft and its bearings being shown in side elevation. Fig. 2 is a vertical cross-section cut on the line 2 2 and looking in the direction of the arrow, the dust-plate of the stepped pulley being removed. Fig. 3 is a fragmentary cross-section on the line 3 3, showing the brake-strap. Fig. 4 is a side elevation of the pinion-carrier B within the stepped pulley. Fig. 5 is a fragmentary vertical longitudinal section of a motor-carriage furnished with my improvements. Fig. 6 is a fragmentary plan view of the frame and driving mechanism thereof. Fig. 7 is a fragmentary front elevation of the driving mechanism, showing the connection of the reversing-lever. Fig. 8 is a fragmentary plan view thereof. Fig. 9 is a fragmentary vertical section showing the operating-handle for the variable and reversible speed mechanism, the view being cut on the line 9 9 of Fig. 8 and looking in the direction of the arrow; and Fig. 10 is a fragmentary side elevation of such mechanism cut on the line 10 10 of Fig. 8.

In carrying out my invention I provide a belt-driven stepped pulley having within it two spur-gears, the one an externally and the other an internally toothed gear, disposed in different planes, and I provide pairs of differential pinions, one of which meshes alternately with either of said spur-gears, according to whether forward or reversed motion is desired, and I provide a carrier for the pinions, movable axially therewith to bring the pinions into mesh with the proper spur-gear of the pulley, a driven gear meshing with one of the pinions, a brake controlling revolution of this driven gear, and a shifter for throwing the parts from one to another position, together with a single handle for operating both the brake and shifter, and I provide various other features of improvement, all of which will be hereinafter fully set forth in detail in their preferred form with reference to the accompanying drawings.

In the drawings, A′ represents a motor-carriage or other vehicle; A^2, the motor-engine thereof; M, the stepped pulley of this engine; P, the reversely-stepped pulley; C′, a belt driving the pulley P; T, a belt tightener and holder for the belt C′; A, an intermediate shaft for the pulley P; O, a cross-shaft within and carrying the shaft A; *b*, sprocket-pinions on the cross-shaft, and B′ sprocket-gears on the road-wheels of the car driven by chains from the pinions.

The motor-engine may be of any suitable or known kind capable of running at a high speed, such as seven hundred revolutions per minute. The belt is shifted in any suitable manner to different steps of the pulleys to vary the speed, to permit which it is a loose belt kept taut by the cylindrical weight T. In the construction shown the diameters of the two stepped pulleys and sprocket pinions and gears are designed to permit variations of speed from twelve to eighteen or twenty-four kilometers per hour by mere shifting of the belt from one step to another. A suitable forked lever may be employed for shifting the belt, and suitable means for raising the weight to permit such shifting can be provided, these parts not being shown, since they are too well known to require illustration, and their details are immaterial to my improvements.

The mechanism contained within the interior of the pulley P is actuated by a lever L and acts as follows: first, to reduce the speed of the shaft A to one-half of that of the pul-

ley, in which case the driving speed of the car will be six, nine, or twelve kilometers per hour, according to the position of the belt; second, to reverse the direction of rotation of the shaft A and also reduce its speed to one-half of that of the pulley—that is to say, to make the shaft turn within the pulley, but in opposite direction thereto. This last result is accomplished by the same lever L and permits driving of the car rearwardly at a speed of six, nine, or twelve kilometers, according to the position of the belt.

It will be understood that the speeds mentioned are taken merely as examples, for which any other relative speeds may be substituted by a proper proportioning of the parts.

The mechanism which permits of obtaining the results described consists of a three-stepped pulley P, of cast-iron or aluminium, mounted loosely on a cross-shaft A, which is tubular and is traversed by a differential shaft O. The pulley is held laterally by fixed rings *x* and Y on the shaft A. Within the pulley and rigidly fixed thereto by bolts V and W are two concentric spur-gears of phosphor-bronze, the one, E, having external teeth and the other, F, disposed outwardly thereof, of greater diameter and having internal teeth. The teeth of these gears are opposed to each other, but the two gears are displaced in relation to each other in the direction of the length of the shaft.

On the shaft A is feathered by a spline *c* a carrier B, consisting of two steel arms, (best seen in Fig. 4,) which arms terminate at their extremities in bearings or eyes *a*, in which turn the axles of the shafts C of pinions D D′, the pinions being arranged in pairs differing in diameter and shown as formed integrally with their shafts. The arms can slide longitudinally on the shaft to bring the pinions D into engagement either with the gear F or the gear E. The hub-piece B is elongated at one side and supports a brake-cylinder H, which carries at one end a spur-gear G, with which the pinions D′ constantly mesh. The spur-gear G and cylinder H are shown as integral and rotatively secured on the hub of the carrier B. The carrier and brake-cylinder are adapted to be moved axially by the lever L through the medium of pins *b*′, which project solidly from a ring *d*, maintained between two rings *e e*′ with ball-bearings interposed between them, which rings are fixed to the cylinder H.

The cylinder H can turn freely on the hub of the carrier B, but is maintained against axial movement thereon by the collars *n*, to the end that the carrier and cylinder shall move together and always maintain the same relative positions axially of the shaft.

The cylinder H carries at its end opposite the gear G a bronze friction-cone J, faced with copper. This cone is able to engage in a reciprocal cone I, mounted on the casing of the differential movement I′ and fixed to the cross-shaft A.

The carrier B, which supports the cylinder H, is constantly pressed against the cone I by a spring Q, wound around the arbor A, which spring reacts against the ring *x* and against a steel sleeve R, maintained non-rotatively on the shaft A by the spline *c*, but able to slide on this shaft longitudinally and passing through and closing the interior of the gear E. This spring exerts a constant pressure against the piece B, which is displaced, together with the cylinder H and the cone J, which it carries, causing the latter to engage in the cone I and thereby coupling the cylinder H and shaft A together against independent rotation.

Around the cylinder H is arranged a brake, which is best seen in Fig. 3. The brake is composed of two half-collars K, connected by a pin *f* and having nuts *g*, receiving a reversely-threaded screw *h*. The collars K are provided internally with wooden blocks or shoes *k*. By turning the screw *h* in one direction or another one can apply or release the brake at will. A rubber tube *i*, surrounding the screw *h* between the nuts, forces the collars to open when the screw is unscrewed.

The operation of this system is easy to comprehend. It varies according to the position occupied by the pinions D, which can be moved along the shaft and maintained where desired by the lever L, acting through the pins *b*′ and collar *d*, the connection of which is best shown in Fig. 7. Supposing the pinions D to be meshing with the gear F, the friction-cones J and I separated only some millimeters, and the brake K being applied to prevent rotation of the drum H, the rotation of the pulley P is transmitted by the gear F to the pinions D. As the pinions D′ cannot revolve the gear G, which is held immovable by the brake, they roll on this gear, and it is the carrier-arms B which are revolved. These in their turn revolve the cross-shaft A, on which they are splined. In this case the number of revolutions of the shaft A is equal to one-half of the revolutions of the pulley P, giving the speeds of six, nine, or twelve kilometers. If it is desired to augment the speed of the shaft A, one releases the brake K, thus freeing the drum H, which on becoming liberated is displaced axially with the carrier-arms B because of the pressure exerted against them by the spring Q. This displacement, which one can aid by the lever L and collar *d*, produces a clutching of the friction-cones J and I, which engage with each other and gradually render the drum completely immovable rotatively relatively to the shaft, to the end that the drum is rotated by the shaft. All internal revolution between the pulley, pinions, and drum becomes impossible when the drum is thus clutched, and the pulley then revolves with the shaft A and carrier B, to which the shaft is splined, and the drum also revolves with these parts, to which it is

clutched by the cones. As the drum is in such a case revolving with the shaft and is still within the interior of the brake, one can, if desired, then employ the brake to check movement of the shaft. In this position the pinions D and the drum H correspond to the speeds of twelve, eighteen, or twenty-four kilometers. The drawings represent the apparatus in this position.

It will be seen that for engaging the cones J and I the pinions D, which are meshing always during such engagement with the gear F, are slightly displaced to the right from their true position in engagement with this gear, the teeth being not exactly in position; but this slight displacement is of no importance, because in this position as the cones J and I are in engagement the pinions D do not roll on the gear F, but serve merely to lock the pulley to the shaft. In displacing the drum H in the opposite direction the pinions D will be disengaged from the gear F and brought into mesh with the gear E. If the brake is then applied, the rotation of the shaft A will take place in the reverse direction and its speed of rotation will be equal to one-half the number of revolutions of the pulley P, giving the speeds of six, nine, or twelve kilometers.

A complete disengagement or uncoupling between the pulley and the shaft is obtained by shifting the drum so that the pinions D are in a position intermediate between the gears E and F, when the pulley is free to turn on the shaft.

The two movements for shifting the drum and for applying and releasing the brake are controlled by a single handle. (Best seen in Figs. 8, 9, and 10.) In these a handle S, adapted to be manipulated by the right hand of the operator of the car, permits the latter to drive the car forward at a small or a great speed, to arrest it, and to drive it to the rear. These operations are effected during the progress of the car.

The controlling apparatus consists of a vertical tube R, rotatably supported in the frame of the car by a bearing G′, which tube in its upper part rises near the seat of the operator at his right side. At the lower end of the tube it has keyed to it a sprocket-wheel *g*. This wheel receives a chain *g′*, which is carried by idlers *n′* to a sprocket-wheel *h′* on the end of the screw *h*. A turnbuckle *f′* serves to tighten the chain. Thus by turning the handle S, with which the tube R and wheel *g* must turn, the brake K can be applied or released at will.

The tube R is traversed throughout its length by a notched rod F′, surmounted by the handle S. This rod can be raised and lowered in the tube and has at one side four notches *k″* at predetermined points. The lower end of the rod is pivoted at *z* to a block *z′*, which in turn is swiveled to a rod *z″*, the latter being connected by an elbow-lever *x′* and link *x″* to the lever L. The joint between the rods F′ and *z″* permits raising and lowering of the rods without turning the tube and permits turning of the tube R without vertical movement of the rods. In the tube R is located a disk K′, having a rectangular hole through which passes the rod F′. The disk K′ is fixed to the tube, and its hole fits the rectangular cross-section of the rod F′, thereby causing the tube and rod to turn together, while its edge receives the notches in the rod and thereby holds the latter against vertical movement. A spring *y* within the tube R acts against the rod F′ to hold its notches in engagement with the disk K′. To adjust the rod vertically, it is tilted against the spring until its notch is free from the disk, and is then raised or lowered until the notch corresponding to the position desired for the rod is opposite the disk, when the spring is allowed to force the rod into engagement with the disk and hold it there until the position of the rod is to be again changed.

Turning the rod applies and releases the brake and raising and lowering the rod shifts the drum H axially through the medium of the lever L. The drum can be thus moved to and held at any of the four positions corresponding to the notches k^2. The position for the uppermost notch corresponds to the position of the parts shown in Fig. 1, in which the drum is clutched to the shaft A, so that the pulley and shaft must rotate together at either of the speeds twelve, eighteen, or twenty-four kilometers, the brake K being released. For the second notch the position of the parts corresponds to the speeds six, nine, and twelve kilometers, the speed of the shaft being half that of the pulley P, the clutch in this position being disengaged, the pinions D and F being in mesh, the brake being applied, and the carrying-arms being revolved by the rolling of the pinions D′ around the spur-gear G, the revolution of the arms being transmitted by the spline *c* to the shaft A. In going to this position the handle S is elevated until the second notch engages the disk K′, and is rotated until the brake is applied to the drum. The third notch corresponds to the position of complete uncoupling of the pulley P, so that it turns freely on the shaft A, the pinion D being then in a position intermediate of the gears F and E and out of mesh with either. The fourth notch corresponds to the position for reversing the rotation of the shaft relatively to the pulley for driving a car backward. In this position the pinion D meshes with the spur-gear E, the brake K is applied, and the pinions D and D′ are turned in the opposite direction, thus carrying the carrier-arms B around in reverse direction, which arms through the spline *c* revolve the shaft A backward, which allows of driving the car rearwardly at a speed of six, nine, or twelve kilometers per hour, according to the step of the pulley on which the belt is running.

The improved apparatus involves by the

combination of a belt and spur-gears a convenient arrangement for obtaining with but one belt a number of different speeds, a passive point, reversal of direction, and different rearward speeds. It avoids the necessity for two belts, reduces the mechanism to comparative simplicity, and attains a construction which is practically noiseless in operation.

This apparatus presents the following advantages:

First. The mechanical parts are hermetically inclosed against entrance of dust and escape of noise, the partition y' within the pulley, the collar R, fitting the gear E and shaft A, and the cover y'', fitting the drum H and closing the end of the pulley P, constituting an inclosing case for the mechanism within which the lubricant for the parts can be preserved against escape and kept clean.

Second. The teeth of the gears can be kept running in oil within this case.

Third. The stops, reversals, and changes of speed can be accomplished by a single movement and without difficulty and are progressive or gradual with the changing of the belt and the application of the brake, which latter is always slightly lubricated, so as to be graduated in its action.

Fourth. The movements at the reduced speeds are almost noiseless and at the greatest speeds are absolutely noiseless, because in the latter case the gears do not run at all, the pulley being then directly coupled to the shaft, so that the latter is essentially a belt-shaft.

Fifth. The arrangement and dimensions of the apparatus are such that the utmost compactness is attained and they require but little space. Thus for the transmission of a power of three and one-half horse power the apparatus weighs from thirty-five to fifty kilograms, according to the speed of the motor employed.

It will be understood that my invention is not limited to the particular details of construction and arrangement set forth as constituting its preferred form, nor to the particular use described, since the invention can be availed of in whole or in part according to such modifications, and with such equivalents of the structural features shown as circumstances or the judgment of those skilled in the art may dictate, without departing from the spirit of the invention.

What I claim is—

1. In variable-speed apparatus, the combination with a stepped pulley, of a speed-changing mechanism, and a speed-reversing mechanism operatively connected thereto, and means for operating both the speed-changing and the speed-reversing mechanisms.

2. In variable gearing, the combination with internal and external gears revolving together, of a pinion for meshing with either of said gears, said pinion and gears relatively movable, and constituting the one a driving and the other a driven part, and means for moving the movable part for alternately engaging the pinion with the different gears, and thereby reversing the motion of the driven part.

3. The combination with a shaft, of a wheel loosely mounted thereon and having two gear-wheels connected to and revolving with it in its interior, a pinion for meshing alternately with said gears, a differential pinion driven by said first pinion, a carrier for said pinions movable axially to bring said first pinion into mesh with either of said gears, and a third gear-wheel meshing with said second pinion.

4. The combination with a driving-pulley having a spur-gear, of a pinion meshing with said gear, a carrier for said pinion, a second pinion driven by said first pinion, a second gear meshing with said second pinion, a brake controlling rotation of said second gear, a shaft carrying said pulley-carrier and second gear, and a clutch for clutching said second gear to said shaft, whereby said second gear can be clutched to said shaft and then will cause the shaft and pulley to revolve together, and can be held immovable by said brake, and then will cause said pulley and carrier to revolve at different speeds.

5. The combination with a variable-speed apparatus, of a shaft having one member of a clutch, a speed-changing mechanism having a reciprocal member of a clutch, a pulley in operative connection with said mechanism, and a spring tending to engage the members of said clutch and thereby lock said pulley and mechanism together.

6. The combination with a variable and reversible speed mechanism, of a controlling mechanism therefor to be operated by the operator of the car, having two movements, and movable to a plurality of positions, said controlling mechanism when in one position disengaging said speed mechanism to arrest the car, when in another position throwing said mechanism into engagement for driving a car forward at a relatively great speed, when in another position engaging said speed mechanism for driving a car forward at a lesser speed, and when in another position engaging said mechanism for driving a car to the rear, and a car carrying said speed and controlling mechanisms.

7. For a variable and reversible speed mechanism, an operating-handle comprising a rod having both a reciprocatory and a rotary motion, a pinion on the rod, a brake for controlling a speed mechanism having brake-straps and oppositely-threaded nuts in their adjacent ends, a reversely-threaded screw engaging said nuts and having a pinion, and a connection between the pinions of said rod and screw driving the latter with the former, a shifter for reversing said mechanism, and a connection between said shifter and said rod for operating the former with the reciprocatory motion of the latter.

8. In variable-speed mechanism, a shaft, a

wheel loosely mounted thereon, two gears fixed on said wheel, the one an internal and the other an external gear at different positions longitudinally of the shaft, a pinion for meshing with said gears, movable axially to engage with either and to a neutral position relatively to both, a second pinion of different diameter to the first and revolving therewith, a carrier for said pinions keyed to the shaft, a third gear meshing with said second pinion and rotative on said shaft, a clutch having one member fixed to the shaft and the other member fixedly connected to said third gear for clutching the latter to rotate with and freeing it from the shaft, means for operating said clutch, and means for moving said pinions axially, substantially as and for the purpose set forth.

9. In variable-speed mechanism, a shaft, a wheel loosely mounted thereon, two gears fixed on said wheel, the one an internal and the other an external gear at different positions longitudinally of the shaft, a pinion for meshing with said gears, movable axially to engage with either and to a neutral position relatively to both, a second pinion of different diameter to the first and revolving therewith, a carrier for said pinions keyed to the shaft, a third gear meshing with said second pinion and rotative on said shaft, a clutch having one member fixed to the shaft and the other member fixedly connected to said third gear for clutching the latter to rotate with and freeing it from the shaft, means for operating said clutch, means for moving said pinions axially, a brake for controlling rotation of said third gear, and means for operating said brake, substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES EDOUARD LUFBERY.

Witnesses:

EDWARD P. MACLEAN,

DAVID T. S. FULLER.