No. 729,501. PATENTED MAY 26, 1903.

R. MATHOT.

VARIABLE SPEED AND REVERSING GEAR.

APPLICATION FILED JUNE 16, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

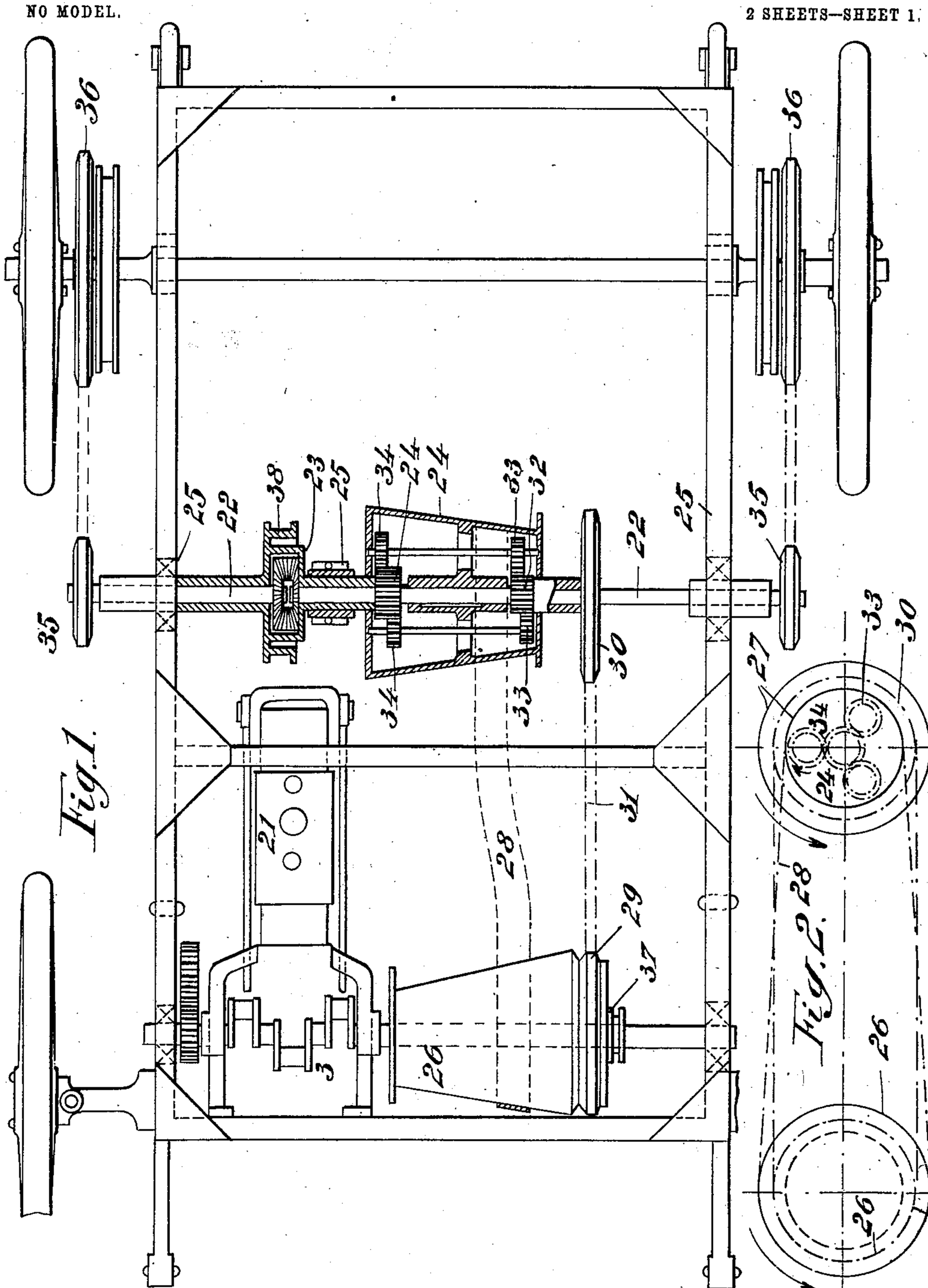

Fig. 1.

Fig. 2.

Witnesses.
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NO MODEL. 2 SHEETS—SHEET 2.

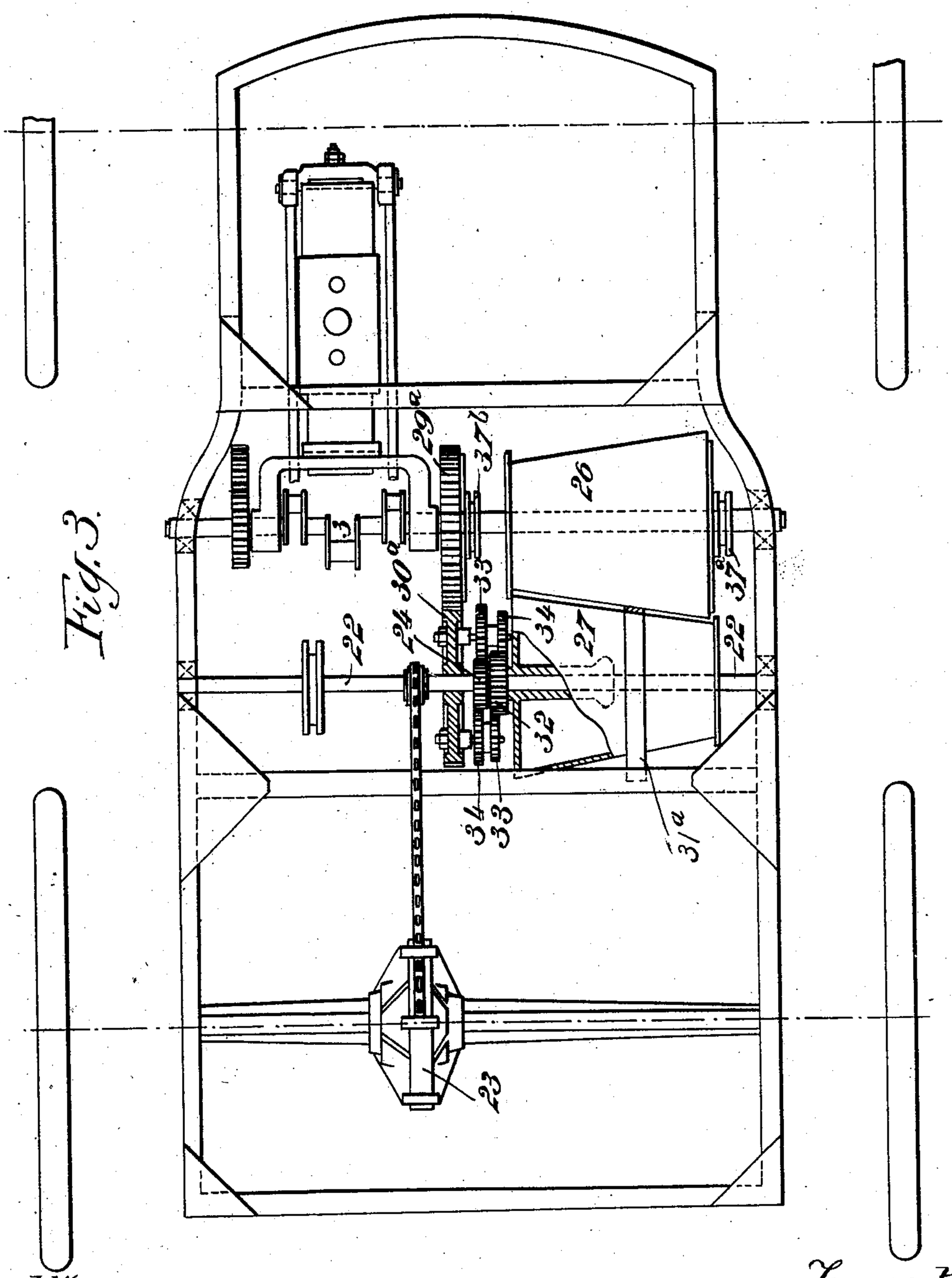

Fig. 3.

Witnesses.
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No. 729,501. Patented May 26, 1903.

UNITED STATES PATENT OFFICE.

RODOLPHE MATHOT, OF BRUSSELS, BELGIUM.

VARIABLE-SPEED AND REVERSING GEAR.

SPECIFICATION forming part of Letters Patent No. 729,501, dated May 26, 1903.

Original application filed March 26, 1902, Serial No. 100,109. Divided and this application filed June 16, 1902. Serial No. 112,002. (No model.)

To all whom it may concern:

Be it known that I, RODOLPHE MATHOT, a subject of the King of Belgium, and a resident of Brussels, Belgium, have invented certain new and useful Improvements in Variable-Speed and Reversing Gear, of which the following is a specification, this application being a division of my prior and pending application filed March 26, 1902, under Serial No. 100,109.

This invention relates to automobile vehicles, and my objects are to provide the same with a novel system of transmission with a view to obviate various defects inherent in automobiles as heretofore constructed and as pointed out in the following, viz:

The mechanisms hitherto employed for the transmission of the movements either by belts or by satellite-gear and other similar gear have the serious objection that for passing from one speed to another it is usually required to disengage a belt or a gear-wheel first and then the motor, so that in most cases the operation is rendered rather complicated and becomes frequently a source for mistakes, while in passing to a higher speed sudden shocks are produced which are detrimental to the mechanical parts and unpleasant to the travelers.

Often when the prearranged speed is calculated for certain districts it will be found too high for other districts and renders the traveling dangerous. The changing of speed necessitates an advance of the ignition, so as to permit the motor to correct its speed to that of the change-gear. This expedient is empirical, irrational, and expensive as regards consumption for the reason that every explosion-motor must be calculated to run at a constant number of revolutions corresponding to its maximum useful effect. The aforesaid objection leads to the conclusion that steam and also electrically driven vehicles are superior with reference to regularity of working, simplicity of the mechanism for the transmission, and of manipulation. In this class of vehicles the motor-couple, whether it is a steam-engine or an electric motor, is designed for variable speeds and reversible in the direction of rotation, and thus with a steam-motor it is only required to vary the admission, or with an electric motor to vary the motive current, while for reversing the travel of the vehicle the steam or the current need only be inverted. Moreover, the alterations in the speed are effected without shocks by passing through an infinite number of intermediate speeds by the simple operation of a lever or a handle, which also in a similar way produces the reversing of the direction. Now I attain all these advantages by the arrangement of parts, motors, and transmission which form my present invention, and which I have shown in the annexed drawings in the form of practical execution, and in which—

Figure 1 is a plan of the vehicle with parts shown in section; Fig. 2, a diagram of the speed-gear in elevation; and Fig. 3, a plan of an automatic vehicle, showing a slight modification in the disposition of the variable-speed gear.

The mechanism for the transmission of the motion of a motor onto the wheels is shown in Fig. 1 mounted upon the frame of a vehicle, the motor being mounted at the front part thereof, although it may also be mounted at the rear in a horizontal or inclined position and in a casing, if desired. The shaft 3 of the motor 21 carries two separate devices 26 and 29 for operating the intermediate or counter shaft 22, and said two devices are coupled to act as one by means of a clutch 37, or they may be cast in a single piece. The intermediate shaft 22 carries chain-pinions 35 for operating the chain-wheels 36 on the hubs of the rear traction-wheels, and, further, also the well-known epicyclic train 23, for example, the box or casing of which latter is formed with a sleeve for carrying the driving-gear 24. The shaft is supported in bearings 25, fixed to the frame of the vehicle. The first controlling mechanism between the motor-shaft and the intermediate shaft comprises two reversely-set cone-pulleys 26 27, connected by a belt or band 28 so arranged that their respective speed changes according to the position of the belt. The pulley 27 is mounted loosely on the intermediate shaft. The second controlling mechanism comprises two chain-wheels 29 30 on said respective shafts, connected by chain 31. The pulley 26 may be fixed upon the motor-shaft, as in

Fig. 1, or connected thereto by clutch 37ª, as in Fig. 3, in which latter case wheel 29 may be connected to said motor-shaft by clutch 37ᵇ, as shown in Fig. 3, where such clutch is applied to the wheel 29ª. The wheel 30 is loose on the intermediate shaft and is cast in one with a pinion 32. The cone-pulley 27 is fitted with a number of internal spindles carrying pinions 33 34, which gear, respectively, with the spur-gear 32, cast in one with the wheel 30, and with the gear 24 of the epicyclic box.

The rotation of the wheel 30 in a definite direction (see Fig. 2) acts to rotate the gear 24 in the same direction through the intervention of the satellites 32, 33, and 34, and the speed of gear 24 is a function of the proportions of the said gear and pinions. The rotation of the pulley 27 in the same direction as 30 causes the pinion 24 to turn in the opposite direction with a speed depending on the function of the same proportions of the gear-wheels and pinions aforesaid. Thus it it will be understood that the parts 30 and 27 may have simultaneously equal speeds, but in the opposite direction to that of the pinion 24. When the belt 28 that drives the pulley 27 is so shifted as to produce such equal speed, the pinion 24 will become stationary and the vehicle will stop.

If the belt is shifted on the cone-pulley 27 in one or other direction, the pinion 24 will turn in one or other direction with a speed increasing with the distance of the belt from the aforesaid position.

It will thus be readily seen what advantages may be obtained from this system during the travel of the vehicle in a definite direction, viz: first, the immobility of the intermediate shaft, if the speeds of the cone-pulley 27 and the chain-wheel 30 annul each other; second, the forward motion, if the speed of the wheel 30 is greater than that of the other; third, the rearward motion, if the former is less than the other and in accordance with the part upon which the satellite movement is mounted. All these movements are obtained by the simple displacement of a belt upon the cone-pulley, the conicity of which may be simplified according to the proportions adopted for the pinions of the system. Further, the gear-wheel and pinions are constantly in gear and require no longitudinal displacement. The result, therefore, is that the variations in speed forward and rearward are entirely graduated from "0" upward in a uniform continuous manner, either in one or other direction, until the maximum speed is attained.

The movement may be disengaged by operating the clutch mechanism on the motor-shaft.

All the gear-wheels used in the mechanism are spur-wheels, and can therefore be made strong and of easy design.

The system or arrangement of transmission may be inverted so as to have, for example, the satellite-pinions (shown in Fig. 1) as mounted in the interior of the cone-pulley, connected with the wheel on the intermediate or counter shaft adjacent to the cone-pulley thereon, (see Fig. 3,) the spur-gear 43 being in this case fixed to a hub of the cone-pulley and the spur-gear 24 being fast to the intermediate or counter shaft. Again, the belt and the chain shown in the previous diagram may be replaced by the system shown in Fig. 3, wherein the cone-pulleys are arranged in almost direct contact, and a shiftable band 31ª, of greater thickness than the intervening space and loosely encircling one of said pulleys, is introduced between them, so as to frictionally connect the driver to the driven. In this case the chain-wheels may be replaced by spur-wheels 29ª 30, and the motor 21 will then necessarily be disposed near the intermediate shaft 22.

The said system is equally applicable to the control of driving-wheels with a single chain, as shown in Fig. 3. The epicyclic train 23 is then mounted upon the divided axle of the driving-wheels, while the intermediate shaft is made in one piece and is directly fitted with the driven pinion 24 of the system.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination to form a variable-speed reversing-gear, of a motor-shaft, a cone-pulley connected thereto to turn therewith, a wheel upon the motor-shaft, a clutch to operatively connect it with the pulley, a counter-shaft, a loosely-running reversely-set cone-pulley thereon, a loose wheel coaxial with and adjacent to the pulley, a spur-gear fast with one of said two members, shafts equidistant from the axis of said pinion, carried by the other member, two sets of satellite-pinions carried at the respective ends of said shafts, one set of which meshes with said spur-pinion, a second spur-pinion meshing with and driven by the second set, an epicyclic train closing a gap between two shaft-sections, a connection between said latter spur-wheel and said train, and a shiftable band frictionally connecting the two cone-pulleys.

2. The combination in apparatus of the nature set forth, of a motor-shaft, a cone-pulley connected thereto to turn therewith, a chain-wheel upon the motor-shaft, a clutch to operatively connect it with the pulley, a divided counter-shaft, a loosely-running reversely-set cone-pulley thereon, a shiftable driving-belt connecting the two pulleys, a chain-wheel loosely mounted on said counter-shaft, a gearing-chain connecting the two chain-wheels, a spur-wheel fast to the hub of the second chain-wheel, shafts carried by the adjacent cone-pulley equidistant from the axis of said pinion, two sets of satellite-wheels carried by said shafts, one set of which meshes with the said spur-pinion, an epicy-

clic train connecting the two sections of the counter-shaft, a revoluble box for said train, and a spur-gear fast to the hub of said box and engaged by the second set of satellite-pinions.

3. The combination of the divided shaft, driven cone-pulley, the two sets of satellite-pinions carried thereby, the pinions of each set being out of plane with each other, the loosely-running gear-wheel on said shaft, the elongated spur-gear 24 fast therewith and engaging one set of said satellites, the epicyclic train connecting the two sections of the shaft, the train-box having an elongated hub embracing the section upon which the pulley is mounted, the elongated gear-wheel fixed to said hub and engaged by the second set of satellites, the reversely-set driving cone-pulley on the motor-shaft, and a driving-gear connected with the first named gear, also upon said motor-shaft and rotating with said pulley.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

RODOLPHE MATHOT.

Witnesses:

CHARLES DE HERBERT DE CHUN.

O. FISCHER.