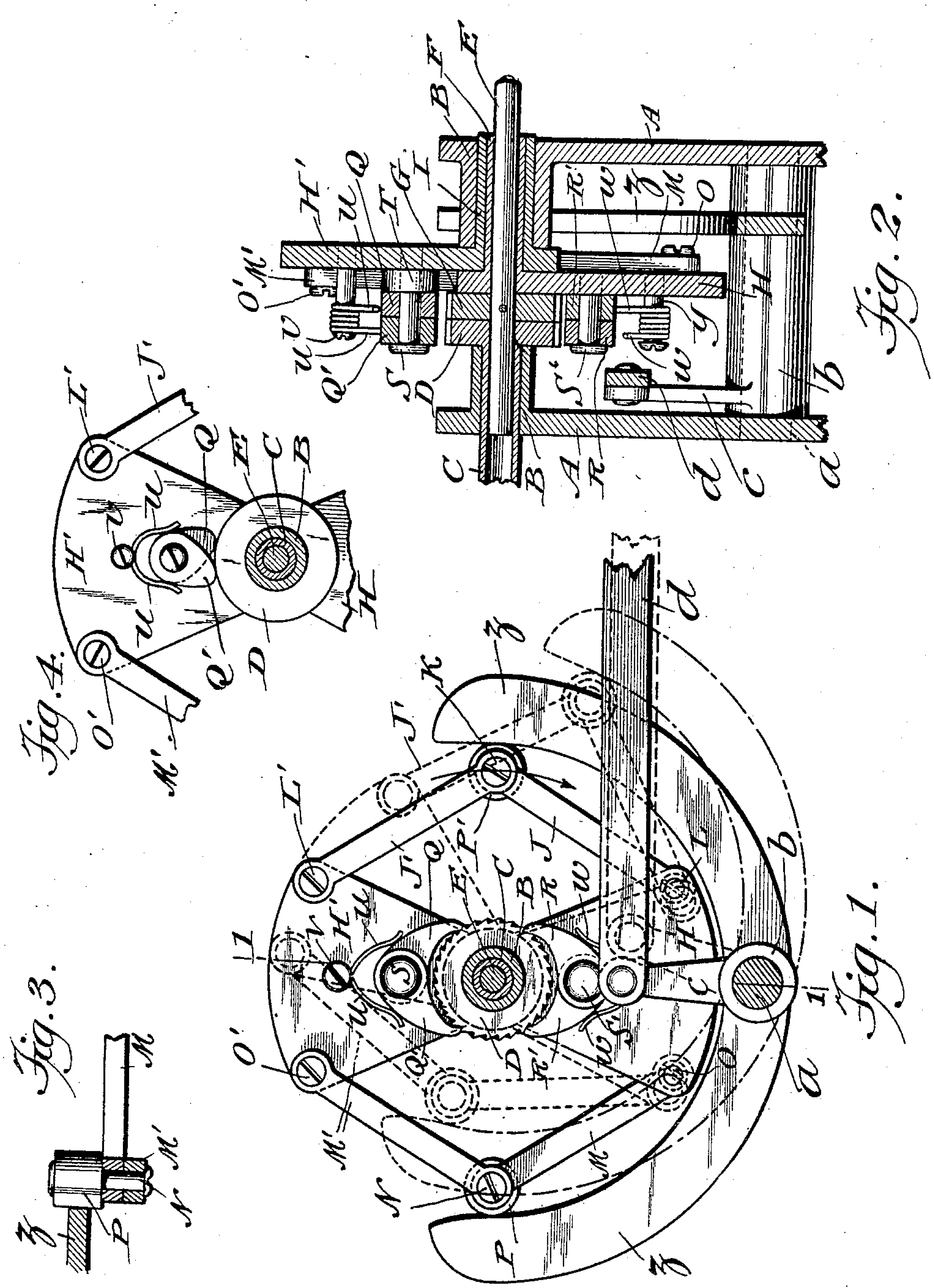
No. 832,210. PATENTED OCT. 2, 1906.

A. W. PUPKE.

VARIABLE SPEED MECHANISM

APPLICATION FILED DEC. 19, 1905.

3 SHEETS—SHEET 1.



Witnesses

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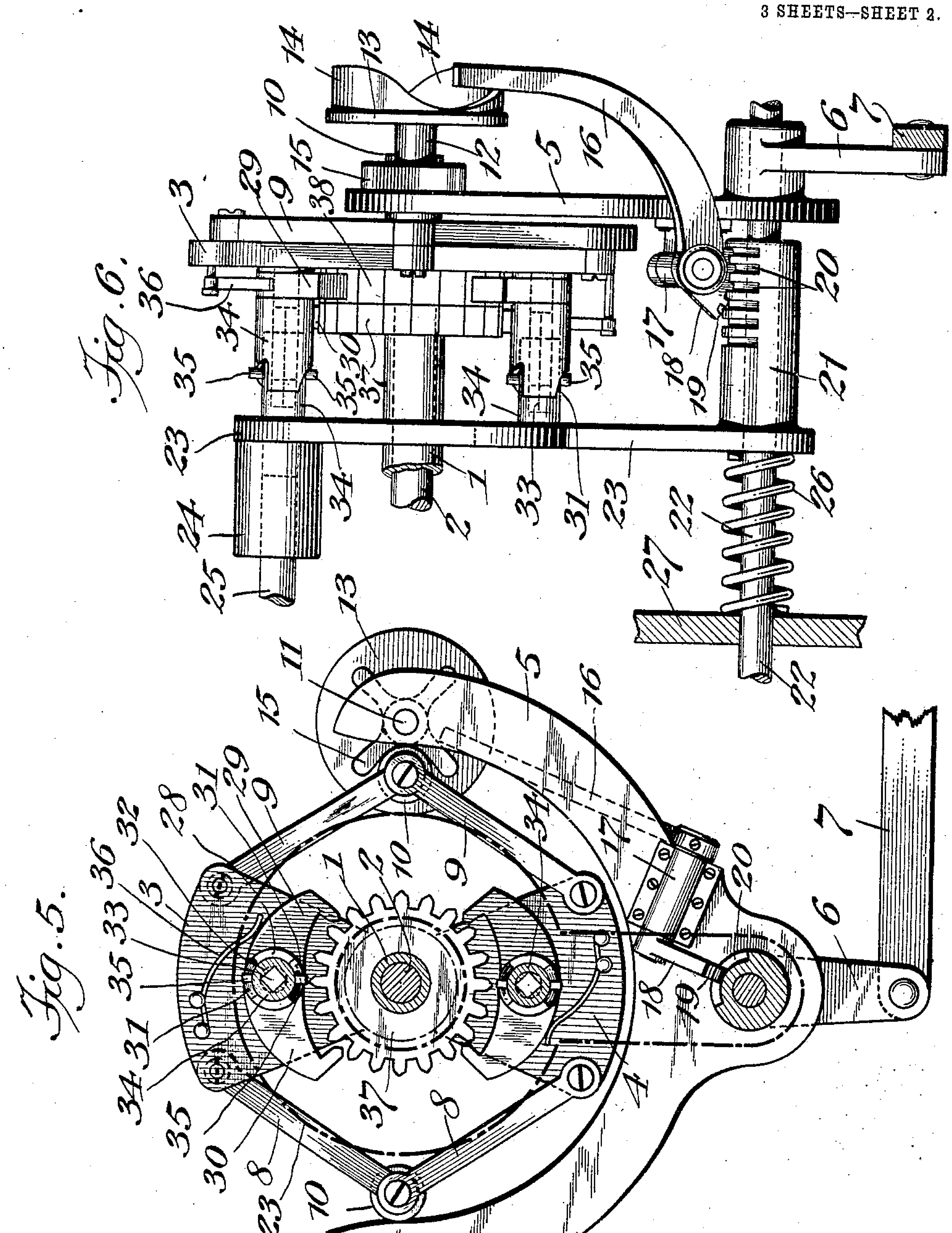

Fig. 6.

Fig. 5.

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3 SHEETS—SHEET 3.

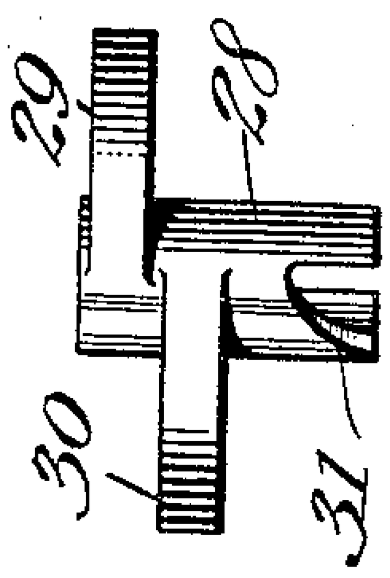

Fig. 8.

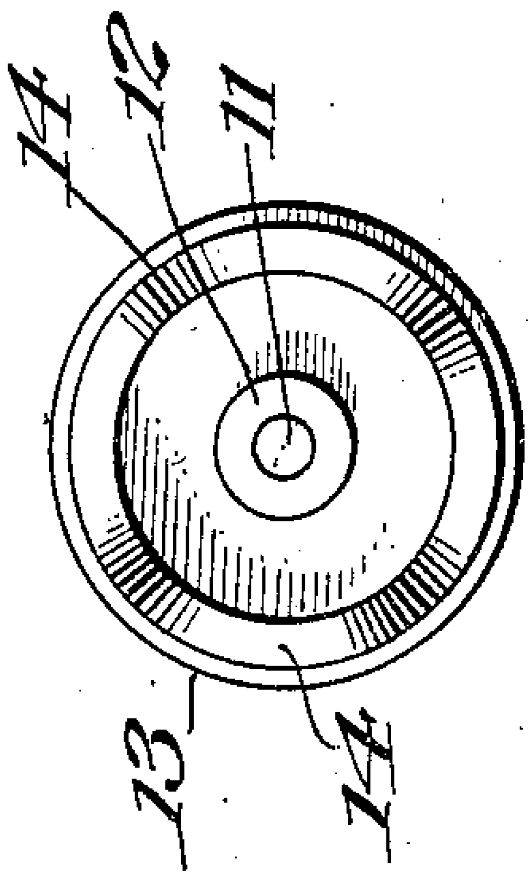

Fig. 9.

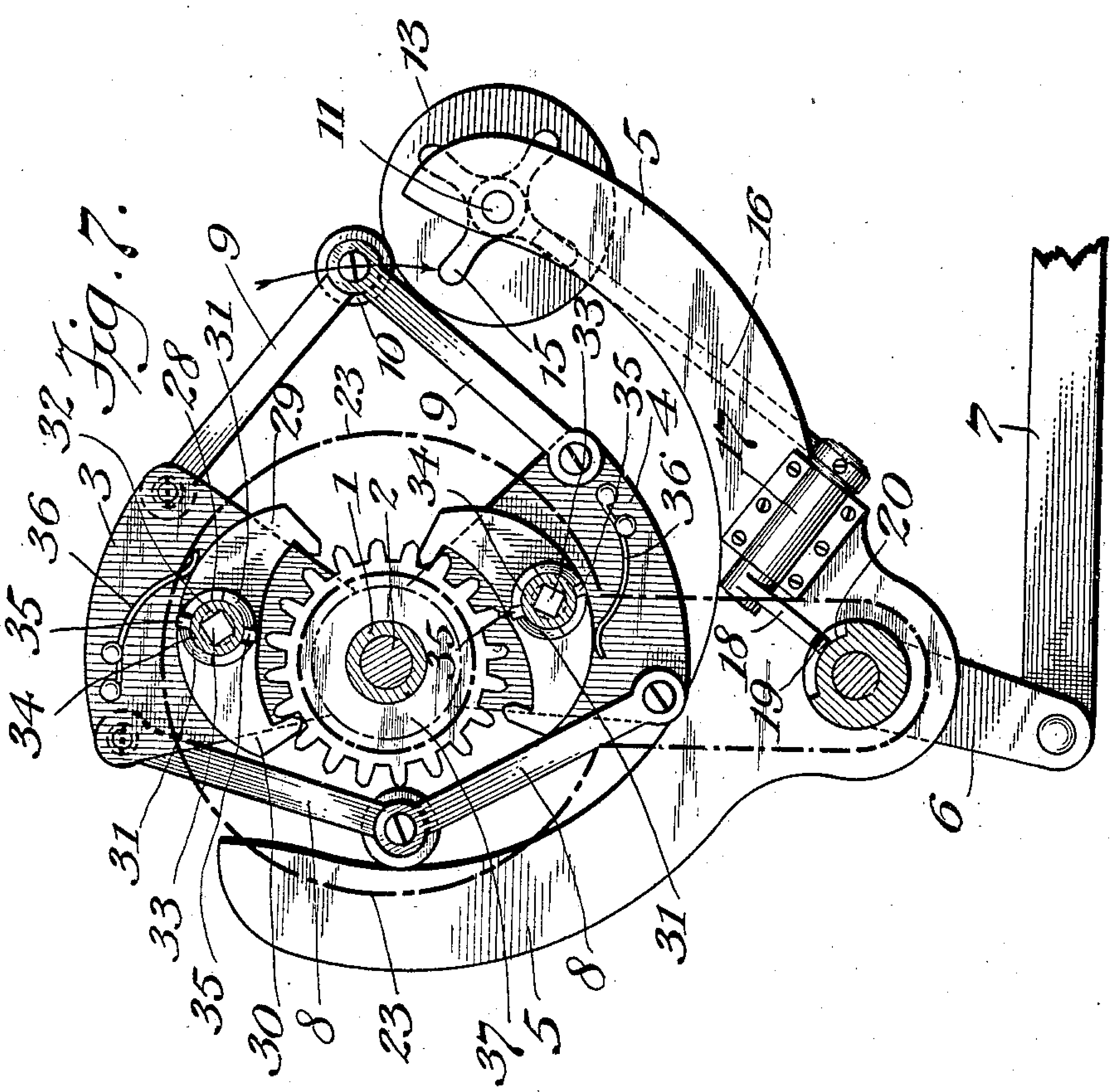

Fig. 7.

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UNITED STATES PATENT OFFICE.

ARNOLD W. PUPKE, OF NEW YORK, N. Y.

VARIABLE-SPEED MECHANISM.

No. 832,210. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed December 19, 1905. Serial No. 292,433.

To all whom it may concern:

Be it known that I, Arnold W. Pupke, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Variable-Speed Mechanism, well adapted to general use, but especially intended for automobiles, autoboats, and the like, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 illustrates a side elevation, partly in section, of the invention. Fig. 2 illustrates a vertical sectional view on the line 1 1 of Fig. 1. Fig. 3 illustrates a plan view, partly in section, of a detail of construction. Fig. 4 illustrates a side elevation of a modification. Fig. 5 illustrates a side elevation of the invention in a modified form, the parts being in their neutral position. Fig. 6 illustrates an endwise elevation of that which is shown in Fig. 5. Fig. 7 illustrates a side elevation of the mechanism shown in Figs. 5 and 6, the parts being in the position they occupy when arranged to increase the motor speed. Fig. 8 illustrates a plan view of one of the double-acting pawls. Fig. 9 illustrates a face view of the circular cam which through mechanism about to be described controls the operation of the double-acting pawls.

Before describing the invention in detail, I will state generally its construction and method of operation. The mechanism embodies a driving-shaft, which may be the motor-shaft or one geared to it, which I will hereinafter call the "motor-shaft." It is also supplied with a driven shaft or that part which applies directly or indirectly the power to the load. These two shafts are connected by interposed mechanism, (three forms of which I illustrate in the drawings hereof,) whereby the speed of the load-carrying shaft may be differentiated from that of the motor-shaft either for its increase or decrease.

This invention, while generically kindred to those for which I have heretofore made applications for Letters Patent, one filed August 3, 1905, Serial No. 272,459, and the other filed October 3, 1905, Serial No. 281,121, relates to mechanical constructions and methods of operation which differ therefrom and which under certain circumstances and for certain uses may be preferred to them.

Referring now to the drawings, in Figs. 1 to 4 thereof, A A represent two suitable standards supporting sleeved journals B B, in one of which revolves a tubular shaft C, to the outer end of which the motor (not shown) is suitably connected. D is a ratchet fast upon the tubular shaft C. E is another shaft, which may be tubular or solid, as preferred. It is supported by and revolves in a sleeve F, and preferably, also, within the tubular shaft C, as shown, so that it may have as complete support as possible. G is a ratchet fast upon the shaft E. It is practically identical with the ratchet D, excepting that its teeth are presented in the reverse direction. The load is carried by the shaft E, suitable gearing or other mechanism being provided. H is a sector-plate which revolves on the shaft E and may advantageously be made integral with the sleeve F, heretofore described. H′ is another similar sector-plate, which is provided with a sleeve-like hub I, which revolves upon the sleeve F. The two sleeves F and I and the shaft E are all supported on the right-hand journal B.

Referring now to Fig. 1, J J′ are a pair of links pivoted together at K and also pivoted at their respective ends to the sector-plates H H′, as shown at L L′. Directly opposite this pair of links is another pair, M M′, which are similarly pivoted together at N and likewise pivoted at their respective ends to the sector-plates H H′, as shown at O O′. The pivots K and N are projected laterally upon the links which they pivotally connect, and upon the projecting parts are arranged anti-friction-rollers P P′. (See Fig. 3.) Q Q′, R R′ constitute four pawls. They are arranged in pairs, as shown, at the opposite sides of the ratchets D and G, respectively. The pawls Q Q′ are connected with the sector H′, being mounted upon a stud S, set into that sector, and the pawls R R′ are in like manner connected with the sector H, being mounted upon a stud S, set in the sector H. The pawls R and Q′ engage with the ratchet D, and the pawls R′ and Q engage with the ratchet G. In order that the pawls Q and Q′ may be offset from the sector H′ the requisite distance to allow for the thickness of the sector H, in the instance shown I employ a spacing-block T, (see Fig. 2,) through which the stud S passes. U U are the two ends of a coil-spring, supported by a stud V or otherwise, as desired, and W W are the two ends of a similar spring supported upon a stud Y or otherwise. These spring ends engage, respectively, with the pawls above described, maintaining them in proper engagement with the ratchets. Z is what I term the "controller." It is a crescent-shaped piece of metal sufficiently rigid and stiff for the purpose and pivotally supported at *a*. It is provided with a hub *b*, which has an arm *c* integral therewith, which engages in any preferred manner with an actuating-lever *d*, which extends to the desired point for convenient manipulation, where it may be connected with the usual operating-lever, provided with a stop-rack, &c. As stated, the controller Z is semicircular in interior contour, and its pivot *a* is so located that the inner circular surface of the controller may by proper manipulation of the lever *d* be made to assume a position concentric with the central shaft E, as shown in full lines in Fig. 1, or eccentric thereto, as shown in dotted lines in that same figure. The controller is also so located that the antifriction-rollers P P′ will engage with its interior circular surface.

The operation of the apparatus as thus far described is as follows: Assuming that the controller and associated parts are in the position shown in full lines in Fig. 1, the motor, as heretofore stated, drives the tubular shaft C and with it the ratchet D from left to right, as shown by the arrow in Fig. 1, and since the pawls R and Q′ are in engagement with the teeth of this ratchet they likewise are carried around with it, and hence also the sectors H and H′, to which these pawls are pivoted, are revolved in the same direction and with the same speed, and since the pawls Q and R′ engage with the ratchet G, which is fast upon the load-carrying shaft E, and are also in engagement with the sectors, that shaft E will likewise be revolved at uniform speed with that of the motor. Consequently when the parts are in the position stated there is neither increase nor decrease of the speed of the load-carrying parts as compared with the speed of the motor. If now the operator wishes to increase the speed, he so manipulates the controller-lever as to cause it to revolve upon its axis to a greater or less extent, depending upon the increase of speed desired. Assume that it is to the degree illustrated by dotted lines in Fig. 1. As soon as this takes place it will be observed that the former relations markedly change—that is to say, whereas formerly the antifriction-rollers P P′ traveled concentrically about the center E, passing without effect over the concentric inner surface of the controller, they and the parts with which they are connected—that is to say, the links J J′ and M M′ and the sectors H H′—are compelled to assume the position shown in dotted lines in Fig. 1, owing to the shift of position of the controller, with the result that whereas formerly the sectors maintained a position squarely opposite to each other, as shown in full lines, during their entire revolution, now, by reason of the inward movement toward the shaft E, which movement the antifriction-roller P is compelled to make, because it is controlled by the inwardly-moved surface of the controller, the sector H′ is by the push of the links M M′ compelled to move forwardly, as shown in dotted lines, projecting the antifriction-roller P′ against the outwardly-moved horn or extremity of the controller, the sector H meantime revolving at the rate of the ratchet D—in other words, the rate of the motor—because of the engagement of the pawl R therewith, thus giving to the sector H′ greater speed than the sector H has and transferring to the load-carrying shaft E, by means of the pawl Q and ratchet G, greater speed than that of the motor. This being the inevitable operation of the parts, it is obvious that the pawls R and Q are those which are at this time in operative engagement with their respective ratchets and that the pawls R′ and Q′ are at this time taking up or slipping. In the next half-revolution there is a repetition of the above-stated operations, excepting that it occurs in connection with the other half, so to speak, of the mechanism—that is to say, as the parts revolve through another half-revolution the antifriction-roller P′, with its coöperating links J J′, attains the same position relative to the controller that the antifriction-roller P of the pair of links M M′ occupies in the drawings. Thereupon there is a repetition of the accelerated movements of the load-carrying shaft E, as compared with the motor, taking place through the sector H, pawls R′ and Q′, instead of through the sector H′ and the pawls Q and R. It will be noted that the resistance of the load cannot interfere with this operation, because were any backward movement attempted on the part of the sectors upon the passage of the antifriction-roller P or P′, as the case may be, from engagement with the inwardly-thrown horn of the controller, it would be at once resisted by the engagement of the temporarily-inactive pawls, whichever pair they may then be, with the appropriate ratchets. The above being the operation of the parts, it will be seen that in each total revolution each of the sectors in turn speeds ahead of the other, the more rapidly running one carrying the load, the other temporarily running at motor speed, and that the increase in speed is because of the simple and positively-acting character of the mechanism effected in a most reliable, smooth, and shockless manner, and, further, that the extent to which the speed may be increased within, of course, reasonable limits may be quickly and effectively regulated by the operator through a mere movement of the controller-lever, whereby it is caused to assume greater or less eccentricity relative to the central shaft E.

In Fig. 4 I show a construction in which friction or, as sometimes called, "jam" pawls, coacting with a toothless ratchet—in other words, a smooth-faced or wheel ratchet—are substituted for the toothed ratchets and coacting pawls above described. In this figure I have lettered the parts the same as before, except those in which the change appears—that is to say, the smooth-faced or wheel ratchet is marked D″ and the jam-pawls Q″ and Q‴, respectively, the operation being substantially identical. The jam-pawls have the advantage of being absolutely noiseless, whereas the other form is more sure and reliable. In some instances one will be preferred, in others, the other. These two forms are illustrated as examples merely. Noiseless pawls of various forms now well known and in general use may also be employed.

The form of the invention illustrated in Figs. 5 to 9, both inclusive, which shows, as above stated, a modified construction, is the same generally as heretofore described, the difference consisting more particularly in the construction and method of operation of the duplex or double-acting pawls, which connect the sectors with the ratchets on the two shafts In these figures 1 represents the motor-shaft, shown in this instance as a tubular shaft; 2, the driven shaft; 3, one of the sectors; 4, the other sector; 5, the controller; 6, the arm on the controller; 7, the lever extending from the arm 6 to suitable mechanism within reach of the operator. 8 8 represent one pair of links; 9 9, the other pair of links; 10 10, the antifriction-rollers connecting the free ends of the links These parts are or may be substantially the same as heretofore described. The modifications are as follows: Near one end of the controller 5 is mounted a shaft 11, upon which is placed a sleeve 12, upon the outer end whereof and integral therewith is a plate 13, having upon its face a double-throw cam 14, and at the opposite end of the sleeve 12 is a four-armed spider 15, the arms of which are so arranged relative to the inner surface of the controller as to project beyond the same in such manner as to engage with the antifriction-rollers 10 as they successively sweep over the face of the controller in making their rotary transit. 16 is an arm pivoted at 17 to the controller and which has an oppositely-projecting segment 18, provided with teeth 19, which register with corresponding circular teeth 20, made in the periphery of a sleeve 21, which is adapted to longitudinal sliding movement on a shaft 22. Integral with the sleeve 21 there is a vertically-arranged plate 23, the shape whereof is best seen in heavy broken lines in Figs. 5 and 7 and in full lines in Fig. 6. At the upper end this plate 23 is provided with a guiding-sleeve 24, which is guided by and slides upon a stud-shaft 25, the purpose of these parts being to properly guide the plate 23 and likewise prevent its rotating about the shaft 22. 26 is a spring which abuts at one end against the plate 23 and at the other against some permanent part of the frame of the machine, such as at 27, which in the instance shown forms part of the main frame, acting as a support for the shaft 22 and also above the point where it is broken off as a support for the motor and driven shafts and for the stud-shaft 25, substantially the same as indicated at A in Fig. 2. The function of the spring 26 is to normally press the plate 23 and its sleeve 21 to the right, that tendency being controlled and adjusted by the arm 16 and its segment 18, coacting with the double-throw cam 14, as will be hereinafter explained. 28 (see Fig. 8) represents the duplex pawls for one of the sectors—as, for instance, the sector 3—the other sector 4 being provided with a similar duplex pawl, the arms of which, however, are presented in an opposite direction. This duplex pawl 28 is provided with a tubular part, as shown, and with oppositely-projecting arms 29 30, which resemble the arms or extremities of an ordinary escapement, except that they are not in the same plane, because they have to engage with cogged teeth resembling ratchets, which are set side by side, hence necessarily in different planes. On one end of the tubular part 28 is cut a cam-shaped opening 31. This duplex pawl is mounted on a circular shaft 32, set rigidly in the sector 3, the outer end of which shaft, as shown best in Fig. 5 at 33, is squared, and upon this squared end is loosely mounted a block 34, which may be circular on its exterior, as shown, and provided with a square opening through it, so that it is adapted to slide lengthwise upon the square projecting shaft or stud 33, but cannot have rotary movement thereon. 35 represents laterally-projecting pins rigidly connected with the part 34. 36 is a spring which engages with one of the escapement-arms and normally tends to depress it into engagement with the teeth of the toothed gear 37 and 38. These two toothed gears are fast, respectively, on the motor-shaft 1 and driven shaft 2, being the same in function as the ratchet-wheels D and G of the other drawings. Indentations upon their peripheries, respectively, are made in the form shown, so as to better coöperate with the teeth of the escapement or duplex-pawl arms. The blocks 34 are preferably made of case-hardened steel and their outer ends polished, so as to present as little frictionaly contact as may be with the polished face of the plate 23, which itself may advantageously be case-hardened, because in the operation of the machine the ends of the block 34 bear against the face of the plate 23, with which they engage. Any suitable antifriction device —as, for instance, a roller or similar device—may be employed.

The operation is as follows: When the parts are in neutral position, as shown in Fig. 5, the driven shaft revolves at the same speed as the motor-shaft for the same reasons as heretofore described relative to the other construction—that is to say, the controller being concentric with the axis of the main—to wit, the driven—shaft 2 no differentiation of the speed results, because although certain of the parts, as will be more fully explained hereinafter, go through the motions which are effective for differentiating the speed when the controller is eccentric to the axis of motion, nevertheless such operation on their part effects no change in speed. When, however, it is desired to change the speed, as in the case indicated to increase it, (the movement of the controller in an opposite direction will similarly decrease it,) then the controller by the appropriate manipulation of the proper parts is thrown into an eccentric position, as shown in Fig. 7, the degree of eccentricity being such as preferred, that shown in the drawings being near its extreme point, in which the speed is markedly increased—in fact, nearly doubled. It will be noted that the friction-rollers 10, owing to their engagement with the inner surface of the controller, compel the links and sectors to assume the position shown, each pair of links and the coacting parts assuming the position shown once in each revolution. As the projected roller, which in Fig. 7 is the right-hand roller, sweeps downwardly, as indicated by the arrow, into engagement with the controller it comes in contact with that one of the projecting arms of the spider 15 which is in its path and during this downward movement carries that member with it, as indicated in Fig. 5, giving the spider, and consequently the sleeve 12 and cam 14, which is integral with it, a quarter-turn, so that the lever 16 (see Fig. 6) rides down the cam, being compelled so to do by the stress of the spring 26 against the plate 23, which through the instrumentality of the sleeve 21 and teeth 20 thereon engaging with the segment 18 causes the above-described movement, and this movement of the lever 16 permits the plate 23, which, as stated, is pressed forwardly by the spring 26, to crowd the non-rotating blocks 34, carrying the pins 35, against the inclined surfaces 31 of the tubular part 28 of the duplex pawl, thereby compressing the springs 36 of both pawls and rocking them upon their axes. The blocks 34 having the pins 35 cannot themselves rotate, because they slide on a square stud 33, as heretofore described. This rocking movement of the duplex pawls causes the escapement member 29 (see Fig. 8) to disengage from the toothed gear 38 with which it was formerly engaged and the escapement member 30 to make en gagement with the toothed gear 37. It will be understood that both of the duplex pawls make this same movement, one escapement-arm of one of them being at all times in engagement with the motor gear or ratchet 37 and one of the arms of the other being similarly at all times in engagement with the driven ratchet or toothed gear 38, and the adjustment is such that if there should not be exact registration between the teeth of the gears or ratchets 37 and 38 at the time of this transfer, the springs 36 coacting with the spring 26 will cause engagement to take place at the most after the passage of one tooth of the gears 37 38—that is to say, the moment these two gears come into registration again. Fig. 5 shows the pawls in mid-position—that is to say, about at the center of their rocking movement, the lever 16 being consequently, as shown in Fig. 6, about at the center of its ascent up the cam 14, with which it is shown as now engaged. In Fig. 7 the rocking of the duplex pawls has been effected, and the lever 16 will of course be at the apex or summit of the cam 14. It will be observed that in the instance shown, inasmuch as there are four arms on the spider 15, the passage of each of the antifriction-rollers 10 by the spider will effect a quarter-turn of it and its associated parts—in other words, that at each such passage the lever 16 will pass from the summit to the valley of each of the cams 14 14, or, vice versa, from the valley to the summit and, that it will take four such operations—in other words, two complete rotations of the segments and associated links and rollers 10—to effect a complete rotation of the cams 14 14. I have heretofore described the movement of the parts when the lever 16 passes from the summit of the cam 14 to its valley occasioned by the passage of one of the rollers 10 past the spider. When the opposite roller 10 in turn engages with the appropriate arm of the spider, the operation will be reversed—that is to say, the lever 16 will by the rotation of the cams 14 be compelled to rise from the valley to the summit of one of them. During this operation the segment 18, under the pressure of the rising lever 16, engaging with the teeth 20 on the sleeve 21, forces the plate 23 rearwardly, compressing the spring 26, and as the plate 23 recedes the blocks 34 34 are caused to follow it, maintaining contact with its face because of the pressure of the springs 36 upon the rocking duplex pawls, because when they rock in the direction now referred to under the stress of the springs 36 the inclined surfaces 31 of the tubular part 28 of the duplex pawls act upon the pins 35 for the projection of the blocks 34 in the same manner as above described, and the pressure of the plate 23 against the ends of the blocks 34 compels rocking of the duplex pawls in the reverse direction. In the manner above described there is continual reciprocation or alternative operation in the parts involved, and the construction and operation of the mechanism is such that the duplex pawls respectively let go of the motor gear or ratchet 37 and take hold of the driven gear or ratchet 38 at such times as to avail of the increased speed of the gear 38 as compared with the gear 37 for the propulsion of the vehicle whatever it may be.

It will be observed that in the three forms of mechanism I have illustrated the same underlying and fundamental invention is present—that is to say, no intermeshing gears of any kind are present—also there is no part of the mechanism which makes a sudden or straining change. On the contrary, everything is smooth and gradual in movement, because even the movement of the spider starts slowly and ends slowly. Moreover, its movement is not transmitted to any of the moving parts of the mechanism except by the introduction of other inclined surfaces—that is to say, those between the blocks 34 and the tubular part 28 of the duplex pawls, where the movement is still further reduced in sharpness and caused to assume a smooth sliding non-jolting form. Also there is what I term the "straight drive" directly across the driving mechanism—that is to say, there is or may be but one line of shafting, and that directly across the mechanism, the motor-shaft and load-carrying shaft being arranged concentrically and on the same axial line with each other. As a result of this construction the invention embodies less mechanism, requires less space, and has less friction-surfaces and less weight than either of my other forms above referred to and also requires no gearing whatever. Incidentally, also, this present mechanism operates with great smoothness, reliability, and under one form shown is practically noiseless. By the employment of my invention it will be noted, further, that the mechanism described is characterized, in addition to the points heretofore referred to, by its simplicity, lightness in weight, compactness, freedom from friction, and reduced number of oiling-points and that if the controller be manipulated with judgment the increase and decrease of speed can be effected in a smooth, uniform, and shockless manner, totally unlike and vastly superior to anything possible with interlocking gears.

The constructions illustrated in the drawings hereof are intended as examples only of desirable forms in which the apparatus may be embodied. It will be clear to those who are familiar with such matters that the details may be modified quite extensively and yet the essentials of the invention be present. In the drawing also I have omitted many parts which coact with those illustrated, because the invention relates to the parts shown and the others would simply complicate the drawings. I have also disregarded proportions in order that the invention may be exhibited more clearly, and for the same reason I have not attempted in some instances to illustrate the best mechanical construction of the parts, and in Fig. 5 I have not shown the detents of the duplex pawls in engagement with the teeth of the ratchets with which they coact, respectively, as would obviously be the cases in the actual running of the machine, because if so the two ratchets would have to be advanced slightly relative to each other, thus markedly complicating and confusing this drawing. It will of course be understood that in the machine as actually constructed and operated the parts will occupy the position above suggested. All these matters will be readily appreciated and the proper construction understood by those skilled in this art.

The forms of mechanism I have illustrated are by no means the only ones in which the invention can be embodied, as stated above. I therefore do not limit myself to that which has been above described and illustrated, because the same may be largely departed from and still the essentials of the invention be embodied. Obviously, also, instead of there being two sectors only there may be more by a simple multiplication of the parts, the principle being identical with that shown, and thereby the differentiations in speed still further accentuated, and any form of mechanism for connecting the sectors with the shafting (many equivalent devices for that shown being now well known) may be substituted for that above described and illustrated. Also by appropriate alteration of the position of the parts the speed may be differentiated downwardly from motor speed, which may be taken as standard, instead of upwardly therefrom, as illustrated, this being effected by similar change in the position of the controller, so that it shall be eccentric to the axis of motion to the left instead of to the right, as also illustrated.

I claim—

1. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-mounted and independently-movable devices connected together, power-transmitting devices carried by the independently-movable devices and adapted to operatively engage alternately with the power-transmitting devices on the respective shafts, a controller coacting with said independently-movable devices, whereby their speed may be varied, the engaging surfaces of the power-transmitting devices upon the shafts and upon the independently-movable devices being such that the speed of the driven shaft will be likewise varied.

2. In mechanism of the class stated, the

combination of a motor-shaft and a driven shaft, the axes of which are coincident, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-mounted and independently-movable devices connected together, power-transmitting devices carried by the independently-movable devices and adapted to operatively engage alternately with the power-transmitting devices on the respective shafts, a controller coacting with said independently-movable devices, whereby their speed may be varied, the engaging surfaces of the power-transmitting devices upon the shafts and upon the independently-movable devices being such that the speed of the driven shaft will be likewise varied.

3. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, the axes of which are coincident, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices connected together and adapted to rotation about an axis coincident with the axis of the said shafts, power-transmitting devices carried by the independently-movable devices and adapted to operatively engage alternately with the power-transmitting devices on the respective shafts, a controller coacting with said independently-movable devices, whereby their speed may be varied, the engaging surfaces of the power-transmitting devices upon the shafts and upon the independently-movable devices being such that the speed of the driven shaft will be likewise varied.

4. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices connected together and adapted to rotation about the axis of the said shafts, power-transmitting devices carried by the independently-movable devices and adapted to engage with the power-transmitting devices on the respective shafts, and a controller coacting with said independently-movable devices, whereby their speed is differentiated.

5. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices adapted to rotation about the same axis as that of the said shafts, devices connecting said independently-movable devices together, power-transmitting devices carried by the independently-movable devices and adapted to operatively engage alternately with the power-transmitting devices upon the respective shafts, a controller adapted to be placed in eccentric position relative to the axis of said shafts and which engages with said connecting devices, compelling them in each rotation to follow a course defined by the controller eccentric to the general axis, whereby the speed of the independently-movable devices and of the driven shaft, with which they are connected, is differentiated.

6. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices adapted to rotation about the same axis as that of said shafts, devices connecting said independently-movable devices together, power-transmitting devices carried by the independently-movable devices and adapted to operatively engage alternately with the power-transmitting devices upon the respective shafts, a controller adapted to be placed in eccentric as well as concentric position relative to the axis of said shafts, and which engages with said connecting devices, compelling them in each rotation to follow a course defined by the controller, whereby the speed of the driven shaft, with which they are connected, may be the same as, or differentiated from the speed of the motor-shaft, as determined by the position of the controller.

7. In mechanism of the class stated, the combination of a motor-shaft, a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices adapted to rotation about the axis of said shafts, means connecting said independently-movable devices together, power-transmitting devices carried by the independently-movable devices and which alternately engage with the power-transmitting devices on the respective shafts, a controller coacting with said connecting devices, whereby the speed of the independently-movable devices may be varied and means whereby said last-named power-transmitting devices are compelled to make and break connection with the power-transmitting devices upon the motor and driven shafts in such manner that the speed of the driven shaft will be likewise varied.

8. In mechanism of the class stated, the combination of a motor-shaft, a driven shaft, a power-transmitting device upon the motor-shaft, a like device upon the driven shaft, independently-movable devices adapted to rotation about the axis of said shafts, means connecting said independently-movable devices together, power-transmitting devices carried by the independently-movable devices and which operatively engage alternately with the power-transmitting devices on the respective shafts, a controller adapted to be placed in eccentric position relative to the axis of said shafts and which, coacting with said connecting devices, compels them in each complete rotation to describe a course eccentric to the axis of said shafts,

whereby the speed of the independently-movable devices is changed and means whereby said last-named power-transmitting devices are compelled to make and break contact with the power-transmitting devices on the motor-shaft and on the driven shaft.

9. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft, a ratchet-like device upon the motor-shaft, a like device upon the driven shaft, a pair of radially-projecting plates suitably supported and adapted to independent rotation about the axis of said shafts, links pivotally connected to said plates and to each other, a double-acting pawl carried by each of said radially-projecting plates and adapted to engage alternately, but not both at the same time, with said ratchet-like devices, a controller adapted to be placed in eccentric position relative to the axis of said shafts, and which engages with the pivoted ends of the several pairs of links whereby they are compelled in each rotation to describe a course eccentric to said shafts, whereby the relative speed of the radially-projecting plates, with which they are connected, is changed, and means whereby said double-acting pawls make and break connection with the ratchet-like devices, so that the speed of the driven shaft is likewise changed.

10. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft located upon the same axial line, a ratchet-like device fast on the motor-shaft, another ratchet-like device fast on the driven shaft, radially-projecting plates supported upon and adapted to rotation about one of said shafts, links pivoted to said radially-projecting plates and likewise pivoted together at their meeting ends, a double-acting pawl-like device upon each of said plates, means whereby they are at predetermined times compelled to make and break connection with the ratchet-like devices on the shafts, a controller adapted to be placed in concentric as well as eccentric position relative to the axis of said shafts and which engages with the pivoted ends of the several pairs of links during each rotation, whereby they are compelled to describe a course determined by the controller, so that the speed of the driven shaft may be the same as that of the motor-shaft or differentiated therefrom.

11. In mechanism of the class stated, the combination of a motor-shaft and a driven shaft located upon the same axial line, a ratchet-like device fast on the motor-shaft, another ratchet-like device fast on the driven shaft, radially-projecting plates supported upon and adapted to rotation about one of said shafts, links pivoted to said radially-projecting plates and likewise pivoted together at their meeting ends, a double-acting spring-actuated pawl-like device upon each of said plates and adapted to alternate engagement with each of said ratchet-like devices, a controller adapted to be placed in concentric as well as eccentric position relative to the axis of the shafts, cam mechanism supported by the controller and actuated by the pivoted ends of the links in each rotation, a pivoted arm engaging said cam, a longitudinally-moving plate actuated in one direction by said pivoted arm and in the reverse direction by a spring device actuated by the movement of said plate, and the spring device itself, whereby the double-acting pawl-like devices are positively caused to make and break connection with said ratchet-like devices respectively.

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

ARNOLD W. PUPKE.

Witnesses:
F. M. DOUSBACH,
IRVING FRANKEL.