No. 735,456. PATENTED AUG. 4, 1903.

H. B. BRAZIER.

VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 13, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

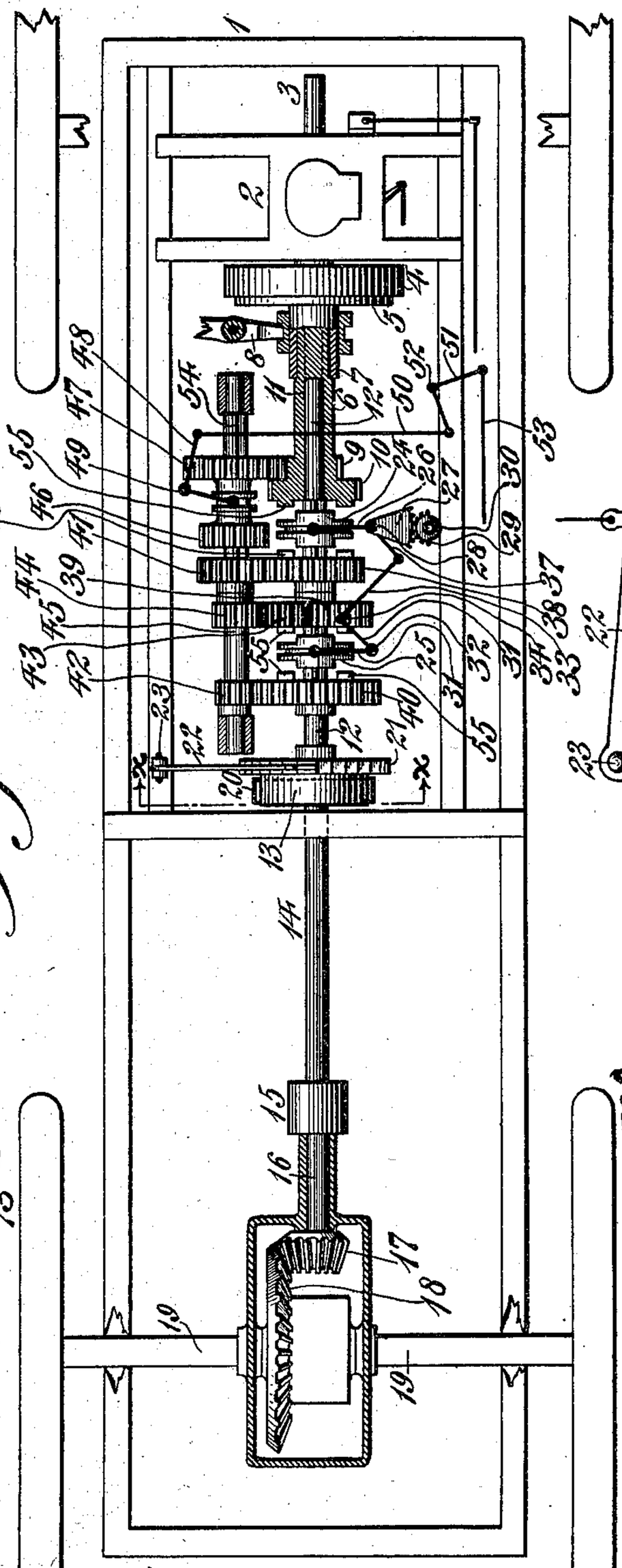

Fig. 1.

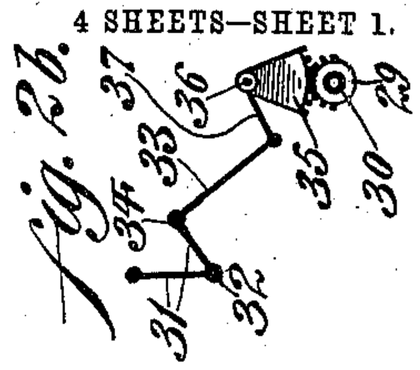

Fig. 2b.

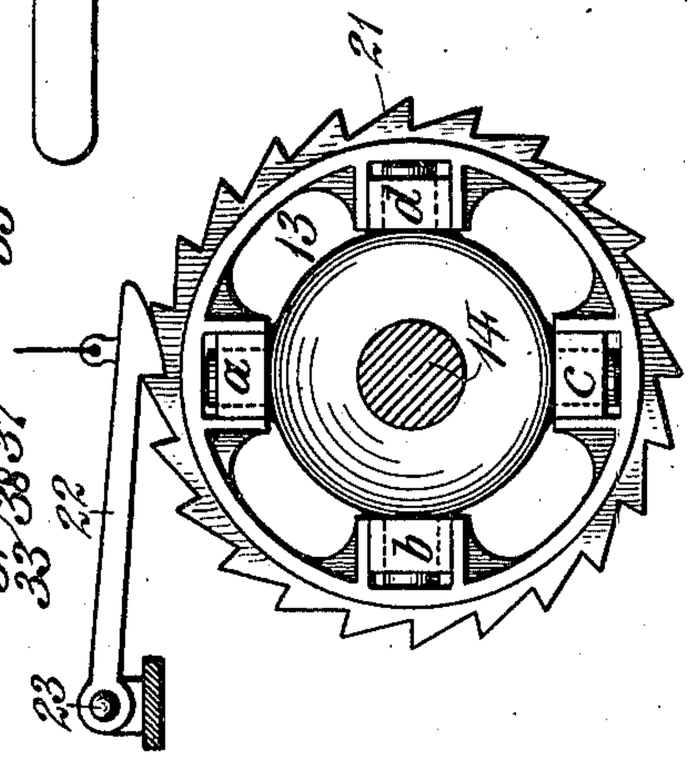

Fig. 2.

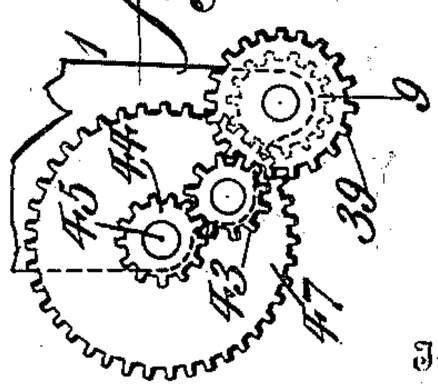

Fig. 2a.

Witnesses
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VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 13, 1902.

NO MODEL. 4 SHEETS—SHEET 2.

fig. 3.

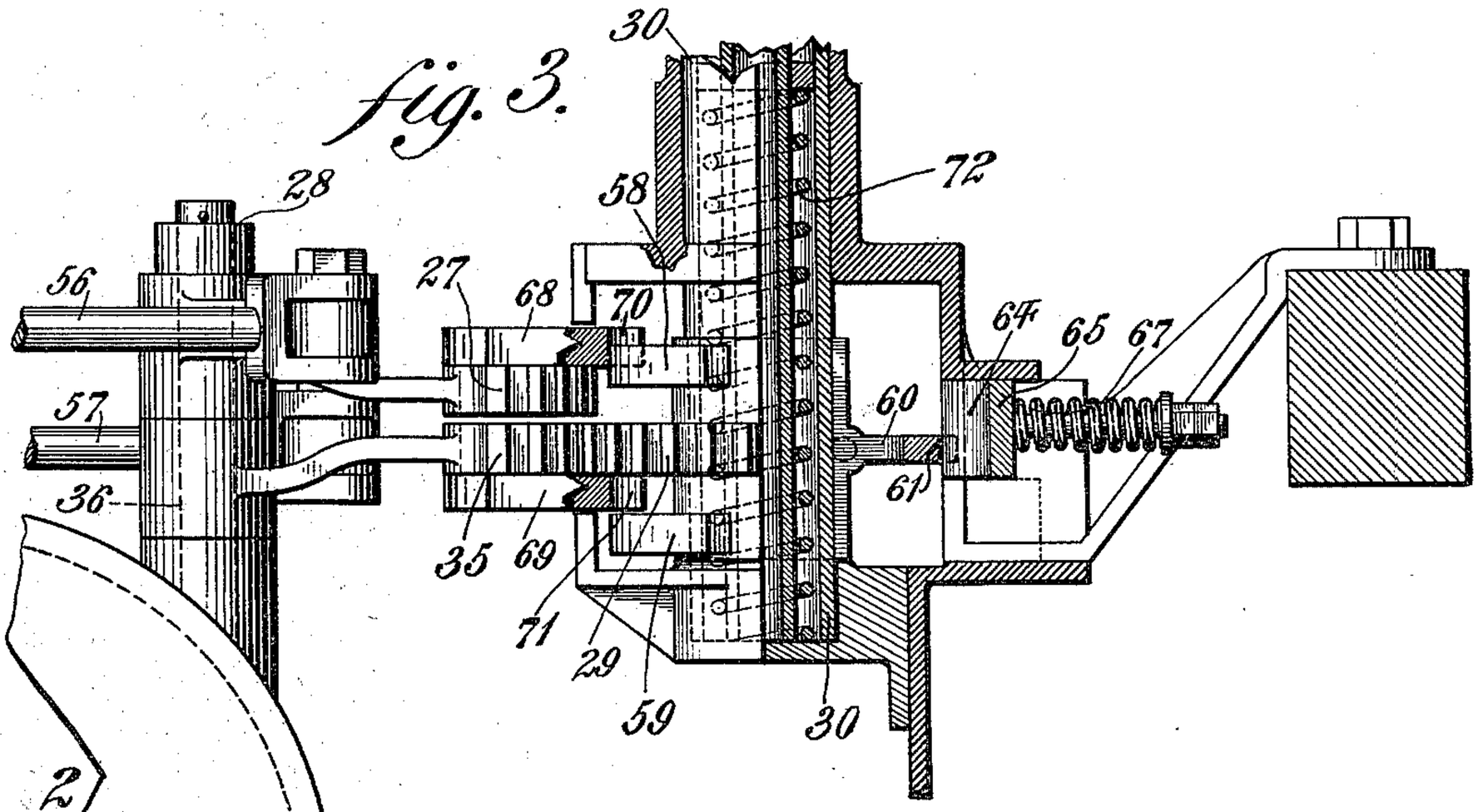
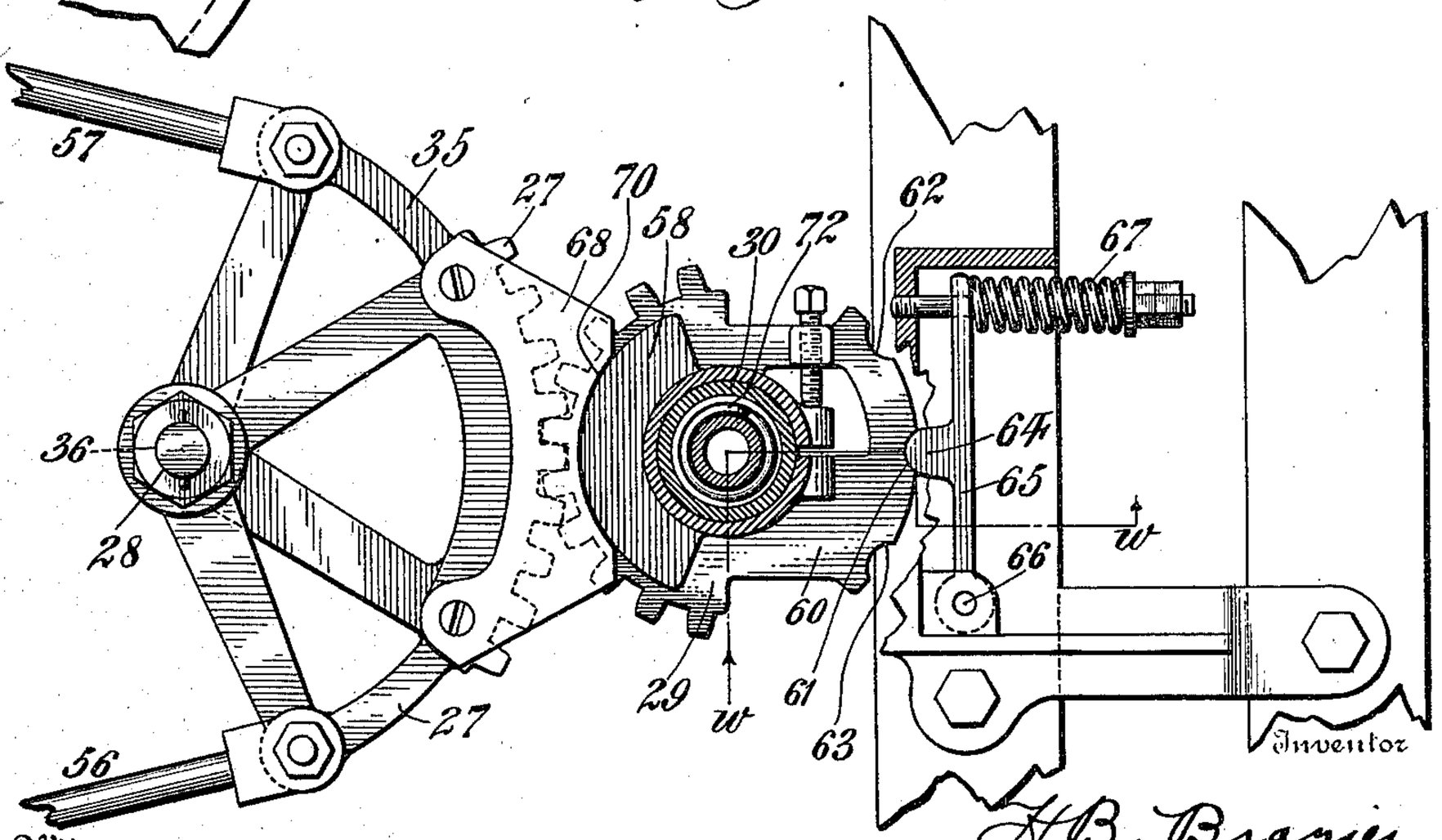


fig. 4.



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VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 13, 1902.

NO MODEL. 4 SHEETS—SHEET 3.

fig. 5.

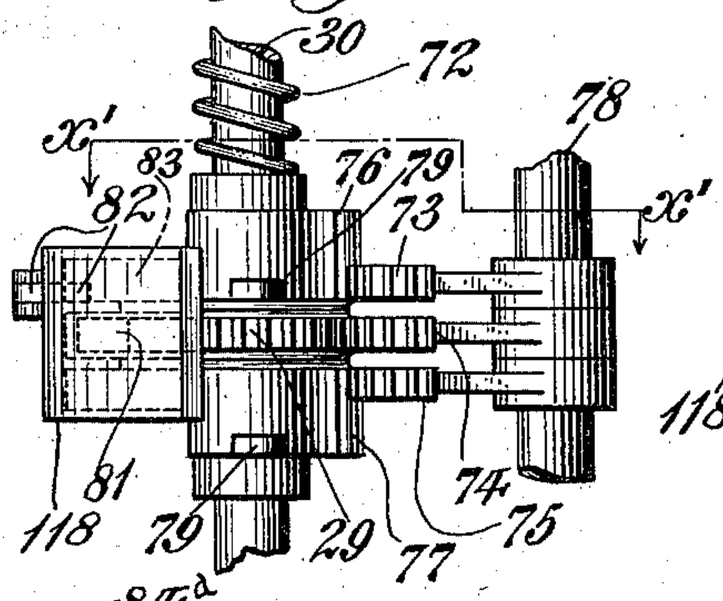


fig. 7

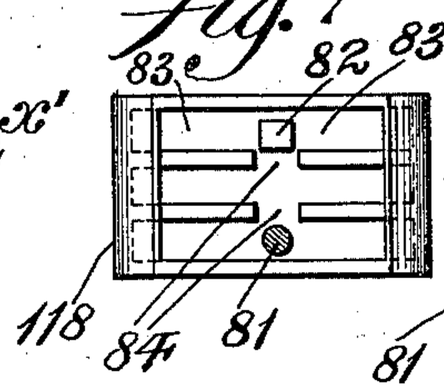


fig. 8.

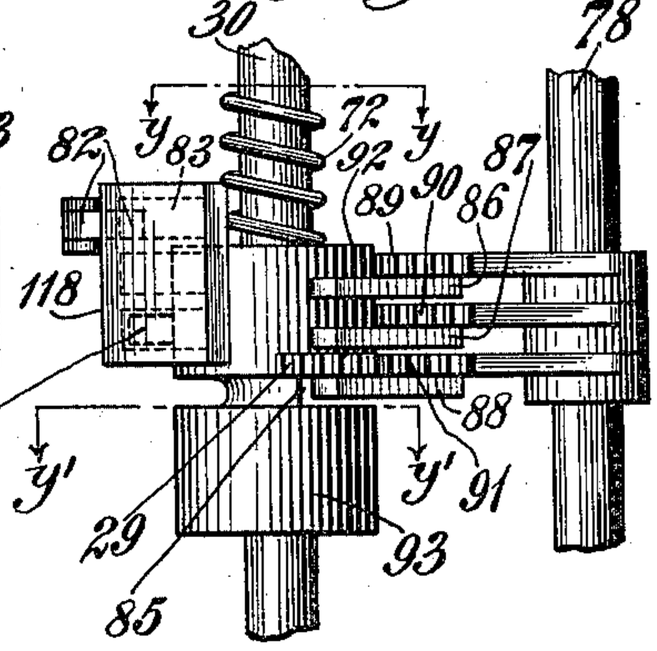


fig. 6.

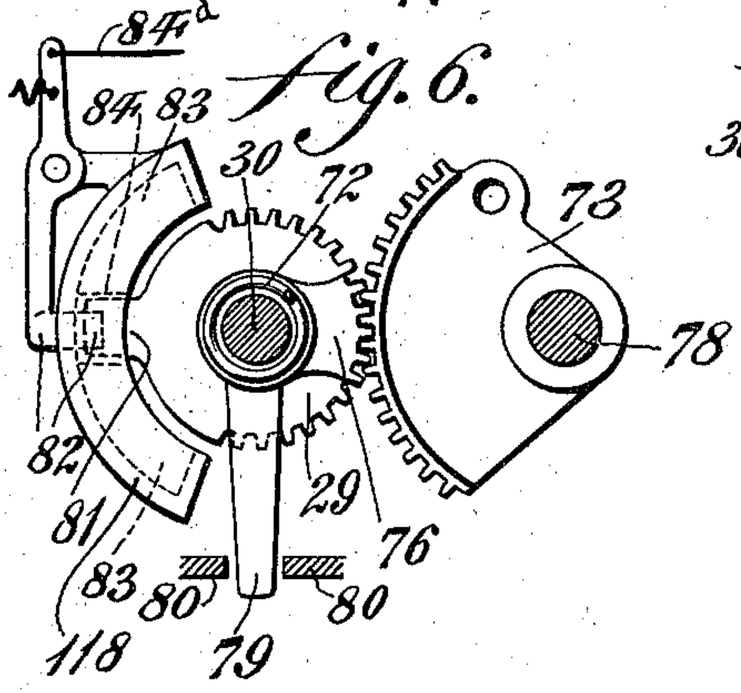


fig. 10.

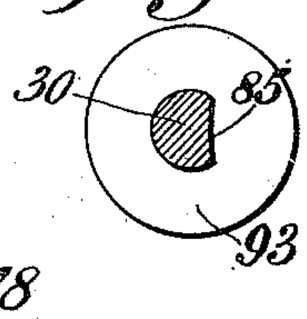


fig. 9.

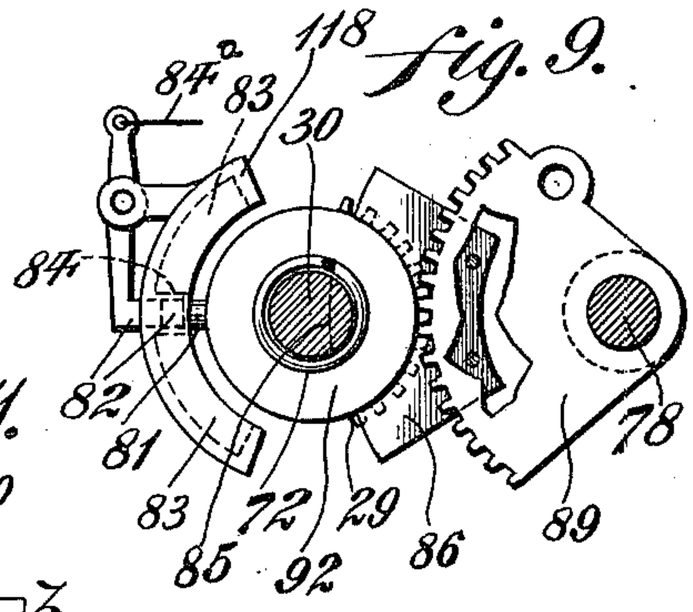


fig. 11.

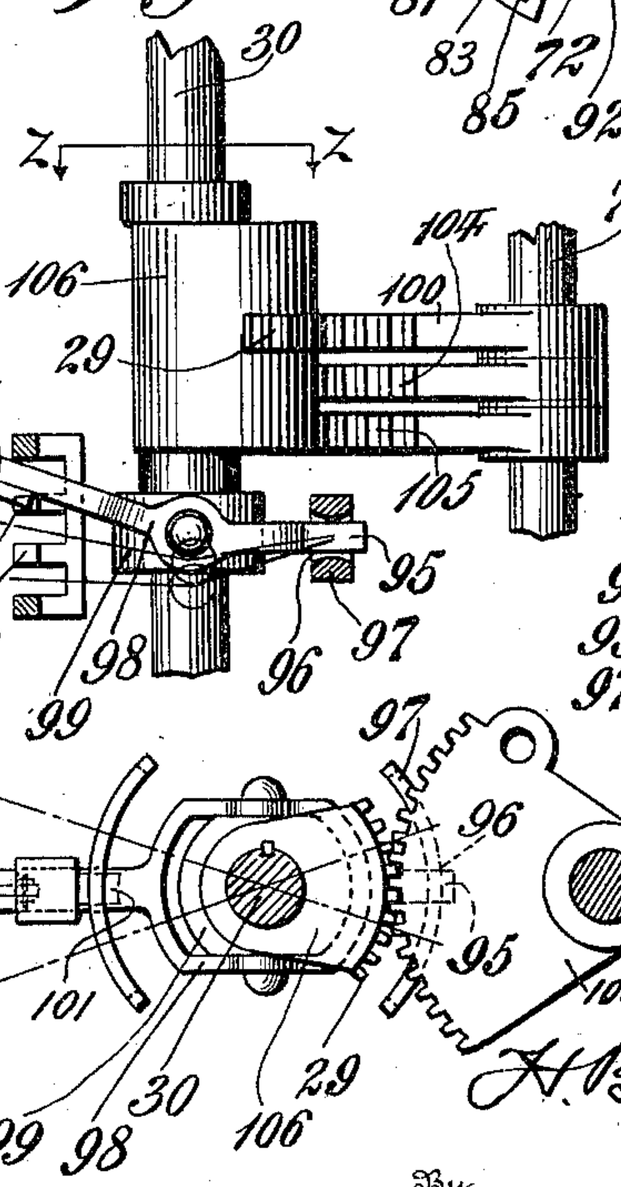


fig. 11a.

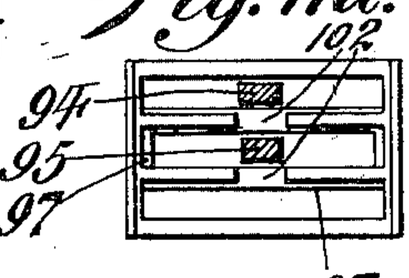


fig. 11b.

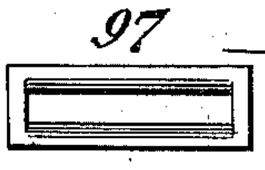
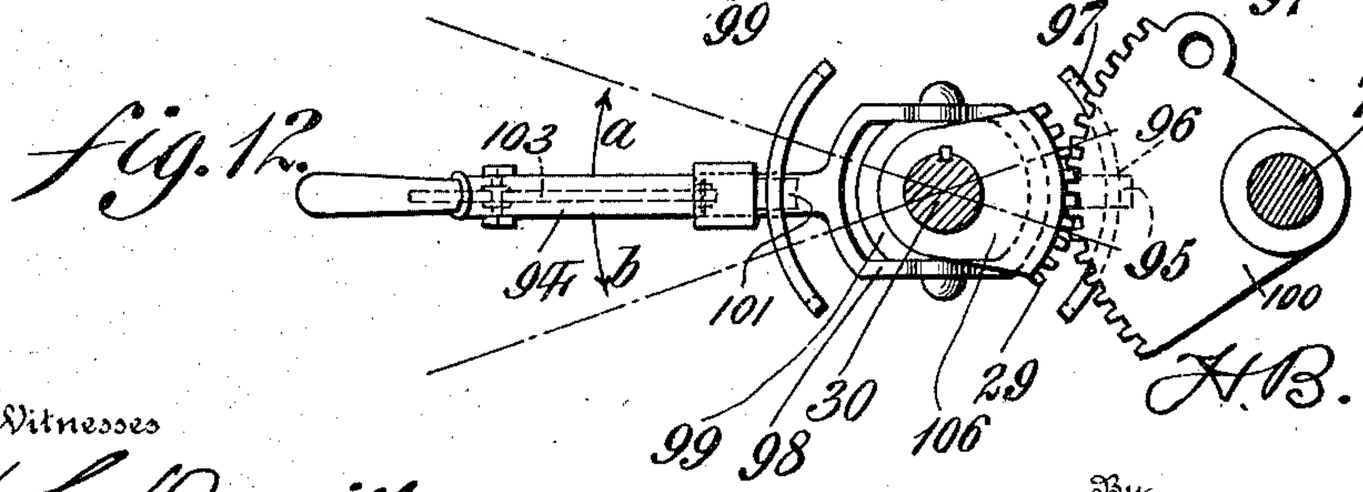


fig. 12.



Witnesses

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No. 735,456. PATENTED AUG. 4, 1903.

H. B. BRAZIER.

VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 13, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 13.

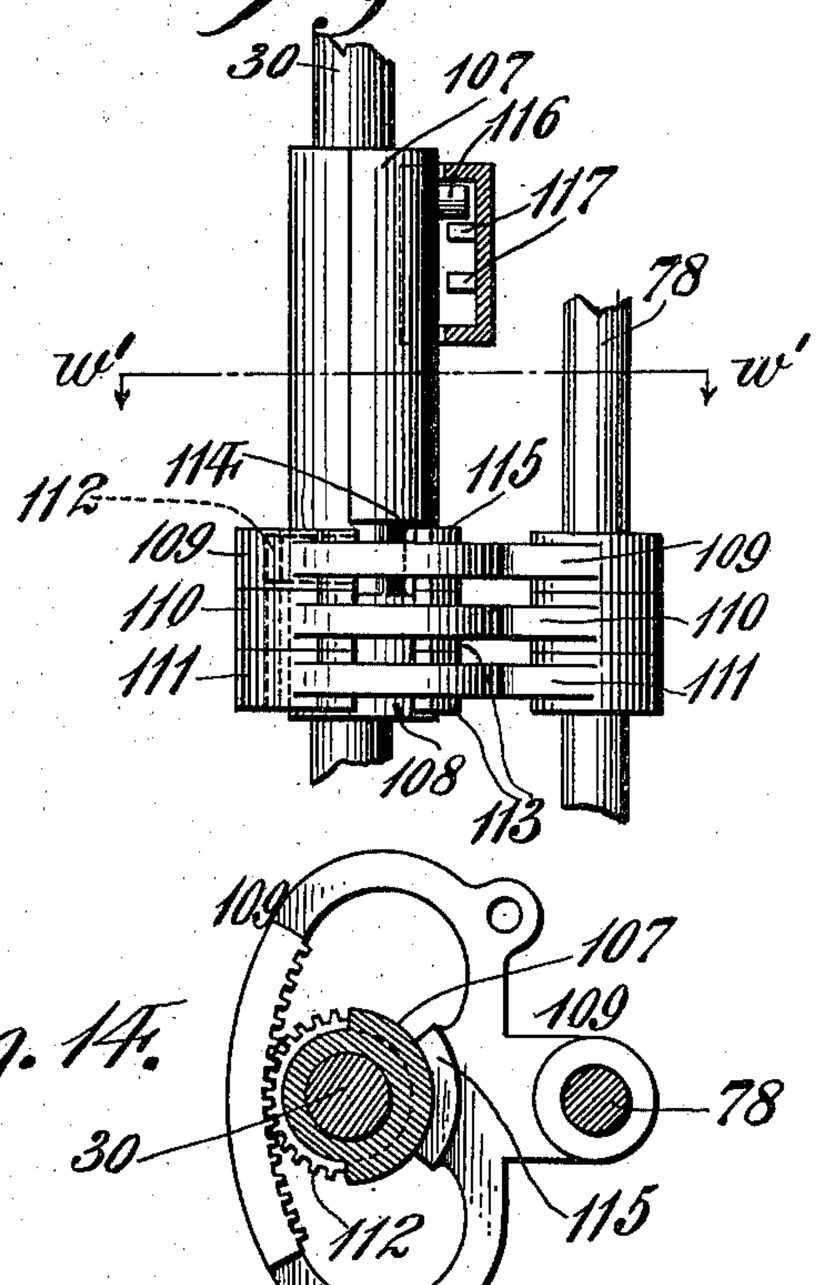

Fig. 14.

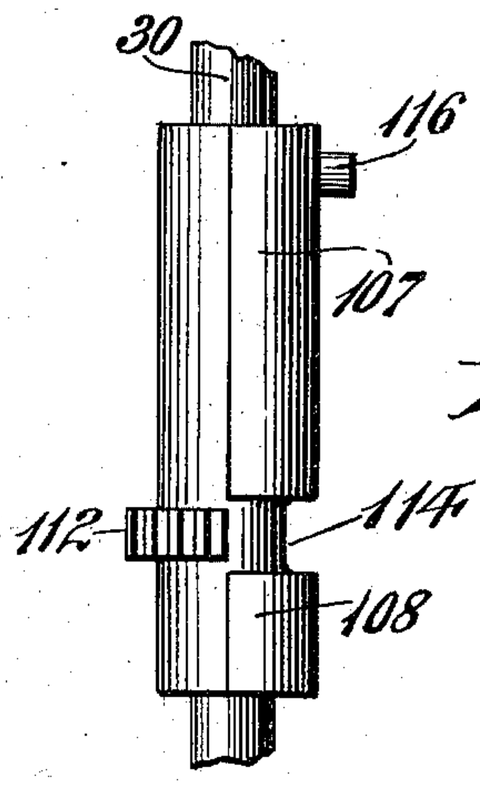

Fig. 15.

Witnesses

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No. 735,456. Patented August 4, 1903.

UNITED STATES PATENT OFFICE.

HENRY BARTOL BRAZIER, OF PHILADELPHIA, PENNSYLVANIA.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 735,456, dated August 4, 1903.

Application filed August 13, 1902. Serial No. 119,491. (No model.)

To all whom it may concern:

Be it known that I, HENRY BARTOL BRAZIER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Variable-Speed Mechanism, of which the following is a specification.

My invention relates to improvements in variable-speed mechanism; and it consists of means whereby the gear-wheels or their equivalents may be acted upon in such a manner as to produce different combinations in the train of gearing, so as to readily change the speed of the machine to be driven, which machine may, as is evident, be any one of the numerous kinds in which a change either in the speed or in the power of the device is required.

It further consists of means for reversing the direction of the rotation of a shaft which carries either a propeller, a drill, a crank-wheel, or its equivalent, or, as in the case of an automobile, said shaft may carry a bevel gear-wheel, as seen in the accompanying drawings, so as to transmit motion to a shaft or axle lying at a right angle to the main driving-shaft.

It further consists of means whereby when the reversing of the motion of a machine is to be effected the same can be accomplished only after the clutch that causes the machine to move in one direction is brought in its inoperative position, thereby preventing any possibility of injury to the gear-teeth, which would in all probability result from an abrupt change in the direction of revolution of the gear-wheels.

It also consists of means whereby when one predetermined combination of gearing is in operation all the remaining combination of gearing are retained in a locked condition.

It further consists of means whereby no two combinations of gearing can be effected at the same time.

It further consists of novel details of construction, all as will be hereinafter fully pointed out in the claims.

Similar numerals of reference indicate corresponding parts in the figures.

Figure 1 represents a partial plan view and partial horizontal section of certain portions of the device as applied to an automobile. Fig. 2 represents a partial end elevation and partial vertical section of certain of the parts seen in Fig. 1. The same is on an enlarged scale, and the section is taken on line $x\ x$ in Fig. 1. Fig. 2^a is an end elevation of certain of the gear-wheels seen in Fig. 1. Fig. 2^b represents a plan view of certain detached portions of the device. Fig. 3 represents a partial side elevation and partial vertical section of certain detached portions of the device. The section is taken on line $w\ w$ in Fig. 4 on an enlarged scale. Fig. 4 represents a partial plan view and partial horizontal section of the parts seen in Fig. 3. Fig. 5 represents a side elevation of a modification of certain of the parts seen in Fig. 3. Fig. 6 represents a horizontal section on line $x'\ x'$ in Fig. 5. Fig. 7 represents an end elevation of a detached portion of the device seen in Fig. 8. Fig. 8 represents a side elevation of a modification of certain of the parts seen in Fig. 3. Fig. 9 represents a partial plan view and partial horizontal section of the parts seen in Fig. 8. The section is on line $y\ y$ in Fig. 8. Fig. 10 represents a horizontal section on line $y'\ y'$ in Fig. 8. Fig. 11 represents a partial side elevation and partial vertical section of a modification of certain of the parts seen in Fig. 3. Fig. 11^a represents a partial end elevation and partial vertical section of certain of the parts seen in Fig. 11. Fig. 11^b represents an end elevation of a detached portion of Fig. 11. Fig. 12 represents a horizontal section on line $z\ z$ in Fig. 11. Fig. 13 represents a partial side elevation and partial vertical section of a modification of certain of the parts seen in Fig. 3. Fig. 14 represents a horizontal section on line $w'\ w'$ in Fig. 13. Fig. 15 represents a side elevation of certain of the parts seen in Fig. 13.

Referring to the drawings, 1 designates a portion of the frame of an automobile, to which is secured a motor 2, which may be any one of the well-known types adapted for the purpose. Secured to the driving-shaft 3 of the motor 2 is a clutch member 4, which works in connection with a clutch member 5, which latter may be moved either toward or away from the member 4, so as to cause said members 4 and 5 to interlock or to be separated from each other when so desired, it being understood that when the members 4 and 5 are

engaged with each other and the motor 2 is in operation motion is transmitted to the sleeve 6 by reason of the sleeve 7, which is adapted to be moved longitudinally on the sleeve 6 by a lever 8 in the usual manner, it being understood that the sleeve 7 is feathered on the sleeve 6, so as to cause the two latter to revolve in unison for a purpose hereinafter described.

The sleeve 6 is provided with the gear-wheels 9 and 10, as seen in Fig. 1.

The sleeve 6 is provided with an opening or socket 11, in which is loosely fitted one end of the shaft 12, which latter is journaled in a convenient manner in the frame 1. The end of the shaft 12 opposite the end that is fitted into the socket 11 has secured thereto a universal coupling 13, which is coupled to the shaft 14, so that the latter may be caused to rotate in unison with the shaft 12. The shaft 14 is also coupled to a universal coupling 15, which is secured to the shaft 16, which latter is provided with a bevel-pinion 17, that meshes with a bevel gear-wheel 18, so as to rotate the rear axle 19 of the automobile, and consequently impart motion to the latter.

The universal coupling 13 is encircled by a band 20, which acts as a brake and is operated in the usual manner.

The universal coupling 13 is provided with a ratchet 21, with which engages a check-pawl 22, pivoted at 23 and for a purpose hereinafter described. The pawl 22 is permitted to engage the ratchet 21 and is also removed from engagement therewith by any of the well-known means for accomplishing this end.

The shaft 12 has fitted thereon the clutches 24 and 25, which may be moved longitudinally on said shaft, it being understood that said clutches and the shaft 12 revolve in unison, as will be apparent from an inspection of Fig. 1. The clutch 24 is operated by an arm 26, which projects from a toothed sector 27, pivoted at 28 to some convenient fixed point. The teeth of the sector 27 engage with the teeth of a segment 29, which is operated by a tube or rod 30, journaled in the frame 1.

The clutch 25 is operated by a bell-crank lever 31, pivoted at 32, (see Figs. 1 and 2^b,) which has connected therewith, as at 34, one end of a link 33, whose opposite end is pivoted to an arm 37, which projects from the toothed sector 35. (See Fig. 2^b.) The sector 35 is similar to the sector 27 and is located beneath the latter and is pivoted at 36, it being understood that this pivotal point is in vertical alinement with the pivot 28. (See also Figs. 3 and 4.)

The teeth of the sector 35 mesh at certain times with the teeth of the segment 29 for a purpose hereinafter described.

The shaft 12 has loosely mounted thereon the gear-wheels 38, 39, and 40, it being noted that the gear-wheel 38 meshes with a gear-wheel 41 and that the gear-wheel 40 meshes with a gear-wheel 42, and, furthermore, that the gear-wheel 39 meshes with an idler 43, which in turn meshes with a gear-wheel 44 for a purpose hereinafter described.

It is to be noted that the gear-wheels 41, 42, and 44 are keyed or otherwise secured on the shaft 45 and that the latter has mounted thereon the gear-wheels 46 and 47, which may be moved longitudinally on said shaft by reason of the bell-crank lever 48, pivoted at 49, the link 50, the bell-crank lever 51, pivoted at 52, and the rod 53, which latter may be operated in any suitable manner and the object of all of which will be hereinafter described. The gear-wheels 46 and 47 cause the shaft 45 to rotate therewith by reason of the spline or feather 54.

The gear-wheels 10, 38, 39, and 40 have lugs 55 thereon, which serve as clutch members in connection with the clutches 24 and 25.

It will be noted on referring to Fig. 2 that the universal coupling 13 drives the shaft 14 from four points of bearing, as at *a b c d*, instead of only two points of bearing, as heretofore.

In Figs. 3 and 4 the sectors have coupled thereto the rods 56 and 57, respectively. The rod 56, when employed, is coupled to the bell-crank lever 31, (seen in Fig. 1,) and the rod 57, when employed, is coupled to the arm 26, so that said rods 56 and 57 may transmit motion to the clutches 24 and 25, respectively, for a purpose hereinafter described. It is to be understood that when the rods 56 and 57 are employed the sectors 27 and 35 do not occupy the same position relatively to the clutches 24 and 25 as that seen in Fig. 1.

The tube or rod 30 is provided with locking-plates 58 and 59 and also with a plate 60, which latter is provided with recesses 61, 62, and 63, into either of which may enter the tooth 64, which projects from a lever 65, fulcrumed at 66 and held against the plate 60 by a spring 67 for a purpose hereinafter described.

The sectors 27 and 35 are provided with plates 68 and 69, respectively, it being noted that the plate 68 is provided with a depression 70 and that the plate 69 is provided with a depression 71 for a purpose hereinafter described.

The rod or tube 30 is retained in its uppermost or normal position by the spring 72, which yields when the rod or tube 30 is depressed.

The operation is as follows: When the motor 2 (seen in Fig. 1) is in operation, it imparts a rotary motion to the clutch member 4, which engages with the member 5, it being evident that a rotary motion is imparted to to the sleeve 6, and consequently to the gear-wheels 9 and 10. Assuming the parts seen in Fig. 1 to be in the position seen in said figure, it is apparent that the gear-wheel 9 transmits motion to the gear-wheel 47, which in turn revolves the shaft 45, and consequently the several gear-wheels thereon, which in their turn transmit motion to the gear-wheels

with which they mesh. When, for instance, it is desired to run a shaft 12 at the same speed as that of the motor, the rod or tube 30 is turned, and with it the segment 29, which is then in mesh with the sector 27, thereby causing the arm 26 to slide the clutch 24 along the shaft 12 and engage the lugs 55 on the gear-wheel 10, whereupon the rotary motion of said wheel 10 is transmitted to the shaft 12, the universal coupling 13, the shaft 14, and universal coupling 15, the shaft 16, the bevel gear-wheels 17 and 18, and finally to the wheels 73ª of the vehicle. When the rod or tube 30 was turned, the spring 67 (seen in Fig. 4) yielded and permitted the tooth 64 to be forced out of the recess 61 by the turning of the plate 60, and when the recess 63 was brought in alinement with the tooth 64 the latter, owing to the spring 67, immediately sprang into the recess 63 and retained the sector 27 in its proper position when the gear-wheel 10 and clutch 24 were working conjointly. It will be apparent that the vehicle is stopped by disengaging the members 4 and 5, which are held normally together by a spring (not shown) and will disengage from their assembled position by the lever 8. When the rod or tube 30 is turned so as to cause the recess 62 to receive the tooth 64, the clutch 24 is brought in a position to become locked with the gear-wheel 38, to which motion is imparted by the gear-wheel 41, secured to the shaft 45 and to which latter motion is imparted by the gear-wheel 47, which is driven by the gear-wheel 9 on the sleeve 6, which is driven by the motor 2. It is apparent that the present combination of gearing produces a speed different from the first one. Should it be desired to obtain a still further change in the speed of the vehicle, the rod or tube 30 is depressed and brought into the position seen in Fig. 3, whereupon the segment 29 is withdrawn from its engagement with the sector 27 and is caused to mesh with the sector 35. When the rod or tube 30 is turned so as to cause the clutch 25 to become locked with the gear-wheel 40, the latter carries the clutch 25 around with it, and consequently imparts motion to the shaft 12 and finally to the wheels 73ª. Motion is imparted to the wheel 40 by the gear-wheel 42 on the shaft 45, which latter is driven as hereinbefore described. The engagement of the wheels 10 and 46 will cause the shaft 45 to rotate faster than it did when the gear-wheels 9 and 47 were in mesh with each other. It is evident that this change of speed in the revolution of the shaft 45 permits of additional changes in the speed of the shaft 12 by bringing into action the clutches 24 and 25 in a manner similar to that hereinbefore described. When it is desired to cause the vehicle to travel backward, the clutch 25 is operated by the rod or tube 30, the segment 29, the sector 35, and levers connected therewith in such a manner as to cause said clutch 25 to interlock with the gear-wheel 39, whereupon the gear-wheel 44, which transmits motion to the idler 43, and consequently to gear-wheel 39, will cause the latter to rotate in a direction opposite to that of the other gear-wheels on the shaft 12 and cause the wheels 73ª to turn backward, as is evident. It will be noted on referring to Fig. 3 that when the segment 29 is in mesh with the sector 35 the locking-plate 58 is engaged with the plate 68 and prevents the sector 27 from turning on its axis 28, it being further noted that the locking-plate 59 is not in contact with the plate 69, whereby the sector 35 may be turned on its axis 36 at pleasure. When it is desired to turn the sector 27, the rod or tube 30 is raised partly by hand and partly by the expansion of the spring 72, whereupon the segment 29 will likewise move upward, so as to be brought in mesh with the sector 27, it being understood that when this is done the locking-plate 58 is also moved upward a sufficient distance to clear the plate 68, whereupon the sector 27 may be turned on its axis 28 at pleasure. It is to be noted that when the segment 29 is in mesh with the sector 27 the locking-plate 59 is engaged with the plate 69 and locks the same, so as to prevent the sector 35 from turning on its axis 36. It is also apparent that it is impossible to turn the two sectors at the same time.

In Figs. 5, 8, 11, and 13 the sectors are three in number and bear the numerals of reference 73, 74, and 75 and are loosely mounted on the rod 78, so as to turn independently of each other, said figures being modifications of Fig. 3. When the several parts are in the positions seen in Figs. 5 and 6, the rod 30 when turned will cause the sector 74 to turn and operate a clutch similar to either the clutch 24 or the clutch 25, it being noted that the sector 74 is in engagement with the segment 29 and that the sectors 73 and 75 are locked by the toothed segments 76 and 77, respectively. The segments 76 and 77 are prevented from turning on the rod 30 by reason of the arms 79, which project from said segments, and are held rigid by the walls 80. (See Fig. 6.) When it is desired to operate the sector 73, the rod 30 is raised sufficiently to bring the segment 29 in alinement therewith, so that said sector 73 and the segment 29 mesh with each other. When this is done, the segment 76 is removed from engagement with the sector 73 and the latter is then free to be turned on the rod 78.

It is to be noted that the segments 29 (seen in Figs. 5, 6, 8, and 9) are provided with a projecting member 81, adapted to abut against a bolt 82, which normally lies in the path thereof to prevent said member 81 from entering the passage 83 in the box 118 except when the bolt is withdrawn from said passage, which is done by exerting a pull on the cord 84ª. The object in providing the bolt 82 is to prevent reversing abruptly the direction of rotation of the bevel gear-wheels 17 and 18, it being understood that in order to cause the vehicle to go backward the segment 29

must mesh with the sector 73, and if the vehicle were moving forward at a high speed and then immediately reversed damage to the machine would result therefrom, and in order to remove all possibility of injury to the machine from this cause the bolt 82 is employed, so that in the event of the one in charge of the vehicle attempting to reverse too abruptly this bolt 82 will act as a reminder that he must first permit the vehicle to come to a standstill or to such a reduced speed that the reversing of the vehicle can be accomplished without injury thereto. When the segment 29 is in mesh with the sector 73, the segment 76 is withdrawn from engagement therewith, and said sector 73 is then free to turn on the rod 78, and it is to be noted that the segment 77, which moves upward in unison with the rod 30, is then in engagement with the sector 74 and 75, so that neither of these can turn on the rod 78.

The passages 84 (best seen in Fig. 7) are to prevent the segment 29 from being either raised or lowered except when the teeth in the sector which it is on the point of leaving have been brought into the proper position to be again engaged, when desired, by the segment 29, it being noted that the extension 81 on the segment 29 must register with the passages 84 before said segment can be moved up or down.

In Fig. 8 the rod 30 is recessed, as at 85, (see also Fig. 10,) to permit the locking-plates 86, 87, and 88 to pass the rod 30 when so desired, it being noted that said locking-plates are secured to the sectors 89, 90, and 91, respectively, which turn freely on the rod 78.

When the several parts are in the positions seen in Fig. 8, it will be apparent that the recess 85 permits the locking-plate 88 to pass the rod 30 when the segment 29 is turning the sector 91 and that the sectors 89 and 90 are locked by reason of the locking-plates 86 and 87 and the cylindrical portion 92 of the rod 30. When the rod 30 is raised to such extent that the segment 29 meshes with the sector 90, the recess 85 is then brought in alinement with the locking-plate 87, and the latter can then pass the rod 30 when the segment 29 is turning the sector 90, it being understood that the cylindrical portion 92 of the rod 30 is withdrawn from the path of the locking-plate 87 and that the cylindrical portion 93 of the rod 30 is in engagement with the locking-plate 88, which prevents the sector 91 from turning. By still further lifting the rod 30 the segment is caused to leave the sector 90, and when in alinement with the sector 89 it meshes therewith, and the recess 85 is in alinement with the locking-plate 86 and permits the latter to pass the rod 30 when said rod is turning the sector 89, it being apparent that the cylindrical portion 93 is now in engagement with the locking-plates 87 and 88 and that the sectors 90 and 91 are prevented from turning on the rod 78.

In Fig. 11 the rod 30 may be raised and lowered by the lever 94, whose extremity 95 is fulcrumed at 96 in a slotted plate 97, which latter is rigid relatively to the other parts of the device. The lever 94 is provided with a yoke 98, which has pivoted thereto the collar 99, which is keyed or otherwise secured to the rod 30, which latter may, if desired, be moved in a horizontal direction instead of a vertical one.

When the several parts are in the positions seen in Fig. 11, the segment 29 is in mesh with the sector 100, and in order to permit the lever 94 to turn said sector on the rod 78 it is necessary to first withdraw the bolt 101 from the passage 102, which is accomplished by operating the rod 103, after which the lever 94 may be turned either in the direction indicated by the arrow *a* or in that indicated by the arrow *b* in Fig. 12, so as to turn the sector 100, it being noted that the sectors 104 and 105 are locked by the lower portion of the member 106 of the rod 30.

The passages 102 permit the lever 94 to be raised and lowered only when said lever is in alinement therewith, so that it is impossible for the segment 29 when passing from one sector to another to leave the sector in any but the proper position, so that its teeth are in the proper position to be again engaged by the segment 29 when so desired.

It is apparent that when the lever 94 is turned on its fulcrum 96 in the direction indicated by the arrows *c* and *d* in Fig. 11 the segment 29 may be made to engage with either the sector 104 or the sector 105.

In Figs. 13, 14, and 15 the rod 30 is provided with the members 107 and 108, which are adapted to lock the sectors 109, 110, and 111 (seen in Fig. 13) when these are not engaged by the segment 112, it being noted that when the parts are in the positions seen in Fig. 13 the member 108 engages with the members 113 on the sectors 110 and 111, and thereby prevents said sectors from turning on the rod 78, and it is to be further noted that the rod 30 is provided with a recess 114, (see Figs. 13 and 15,) which is in alinement with the segment 112, and permits the sector, which is in engagement with said segment, to be turned by the same, as will be apparent from Fig. 13, in which the sector 109 is represented in a position to be turned by the segment 112, it being noted that the recess 114 is in alinement with the member 115 of said sector 109, whereby said member 115 may pass through the recess 114, and thus permit the sector 109 to be turned on the rod 78. It is apparent that when the rod 30 is lowered the segment 112 may be made to engage with the sectors 110 and 111 and that the member 107 will then lock the sectors not in alinement with the segment 112.

The stud 116 and passages 117 are for a purpose similar to that described in connection with the member 81 and passages 84. (Seen in Figs. 7, 8, and 9.)

The object of the pawl 22 and ratchet-wheel

21 is to prevent the machine from moving backward when said pawl and ratchet-wheel are in engagement, and it is apparent that the pawl 22 must first be removed from engagement with the ratchet-wheel 21 before the forward movement of the machine can be reversed.

It will be evident that various changes may be made by those skilled in the art which will come within the scope of my invention, and I do not, therefore, desire to be limited in every instance to the exact construction herein shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, means for directly connecting and disconnecting said shaft and said motor, and an independent set of gears movably supported with respect to said gears on the shaft to mesh with certain of said gears at the proper time, operative connections between said movable gears and certain others of said loosely-mounted gears, and means for connecting said loosely-mounted gears with their shaft.

2. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, means for directly connecting and disconnecting said shaft with respect to said motor, an independent set of gears movably supported with respect to said gears on the shaft and adapted to mesh therewith at the proper time, means for locking to said shaft the gear to which motion is to be applied and means for locking said shaft against improper revolution.

3. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, means for causing said gears to revolve with said shaft, a plurality of gears adapted to mesh with the gears on the shaft and movably supported with respect thereto whereby said movable gears may be operated to mesh with various of the shaft-gears.

4. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, means for causing any of said gears to rotate with said shaft, a plurality of gears adapted to mesh with the gears on the shaft and movably supported with respect thereto whereby said movable gears may be operated to mesh with various of the shaft-gears and means for locking the shaft against improper movement.

5. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, means for directly connecting and disconnecting said shaft and said motor, an independent set of gears movably supported with respect to said gears on the shaft and adapted to mesh with certain of said gears at the proper time, operative connections between said movable gears and certain others of said loosely-mounted gears, means for locking to said shaft the gear to which motion is to be applied, means for locking said shaft against improper revolution and a gear and coöperating devices adapted to be engaged to reverse the vehicle.

6. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, gears loosely mounted on said shaft, clutches on said shaft for engagement with the gears, a second shaft, an independent set of gears movably supported with respect to the first-mentioned gears, fixed gears on the second-mentioned shaft and adapted to mesh with those of the first-mentioned shaft and to receive motion from the motor, means for operating the clutches to cause certain of said first-mentioned gears to be locked to the shaft, means whereby but one clutch can be operated at a time whereby no two combinations of gearing can be effected at the same time, and means for locking the first-mentioned shaft against improper revolution.

7. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, means for connecting said shaft directly with the motor, and for disconnecting the same, gears loosely mounted on said shaft, means for imparting motion to any one combination of said gears at separate times, and means for locking, to the shaft, the gear to which motion is to be applied.

8. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, means for connecting said shaft directly with the motor, and for disconnecting the same, gears loosely mounted on said shaft, means for imparting motion to any one combination of said gears at separate times, means for locking, to the shaft, the gear to which motion is to be applied, and means for preventing improper rotation of the shaft.

9. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, means for connecting said shaft directly with the motor and for disconnecting the same, gears on said shaft for imparting a forward movement to the vehicle when said gears are operated, means for actuating said gears one at a time to operate the same, and a gear adapted to be engaged to reverse the vehicle.

10. In a variable-speed mechanism for vehicles, a motor, a shaft suitably connected with the running-gear of the vehicle, means for connecting said shaft directly with the motor and for disconnecting the same, gears on said shaft for imparting a forward movement to the vehicle when said gears are operated, means for

actuating said gears one at a time to operate the same, a gear adapted to be engaged to reverse the vehicle, and means adapted to normally prevent improper rotation of the shaft and means to release it when it is desired to reverse the movement of the vehicle.

11. In a variable-speed mechanism for vehicles, the combination of a segment suitably supported and provided with a projecting member, a box having a passage therein, a bolt normally in the path of said projecting member, and means for actuating said bolt.

12. In a variable-speed mechanism for vehicles, the combination of a segment, a member projecting therefrom, a box having a plurality of passages therein, a bolt located within one of said passages against which said member is adapted to abut, whereby said member is prevented from entering said passage only when said bolt is withdrawn therefrom, a segment meshing with the first-mentioned segment and means for actuating said bolt.

13. In a variable-speed mechanism for vehicles, the combination of a shaft, clutch members longitudinally movable on said shaft and mounted to revolve in unison therewith, members coöperating with said clutch members, a toothed sector, means for actuating said sector and pivoted connections between said sector and said clutch members.

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Witnesses:
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