

No. 847,914.

PATENTED MAR. 19, 1907.

W. I. CRAWFORD.  
GEARING FOR AUTOMOBILES.  
APPLICATION FILED APR. 30, 1906.

2 SHEETS—SHEET 1.

FIG. 1.

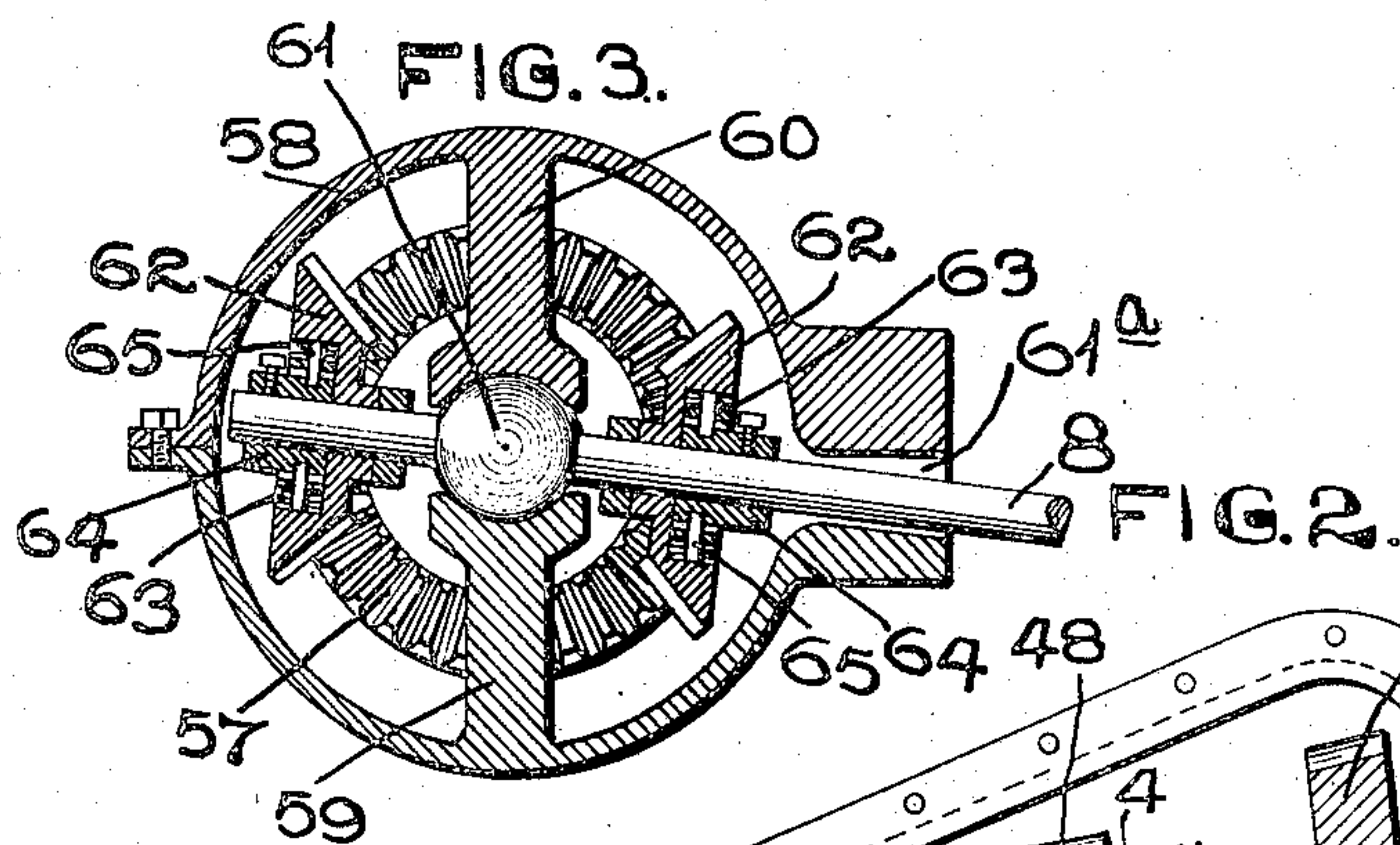
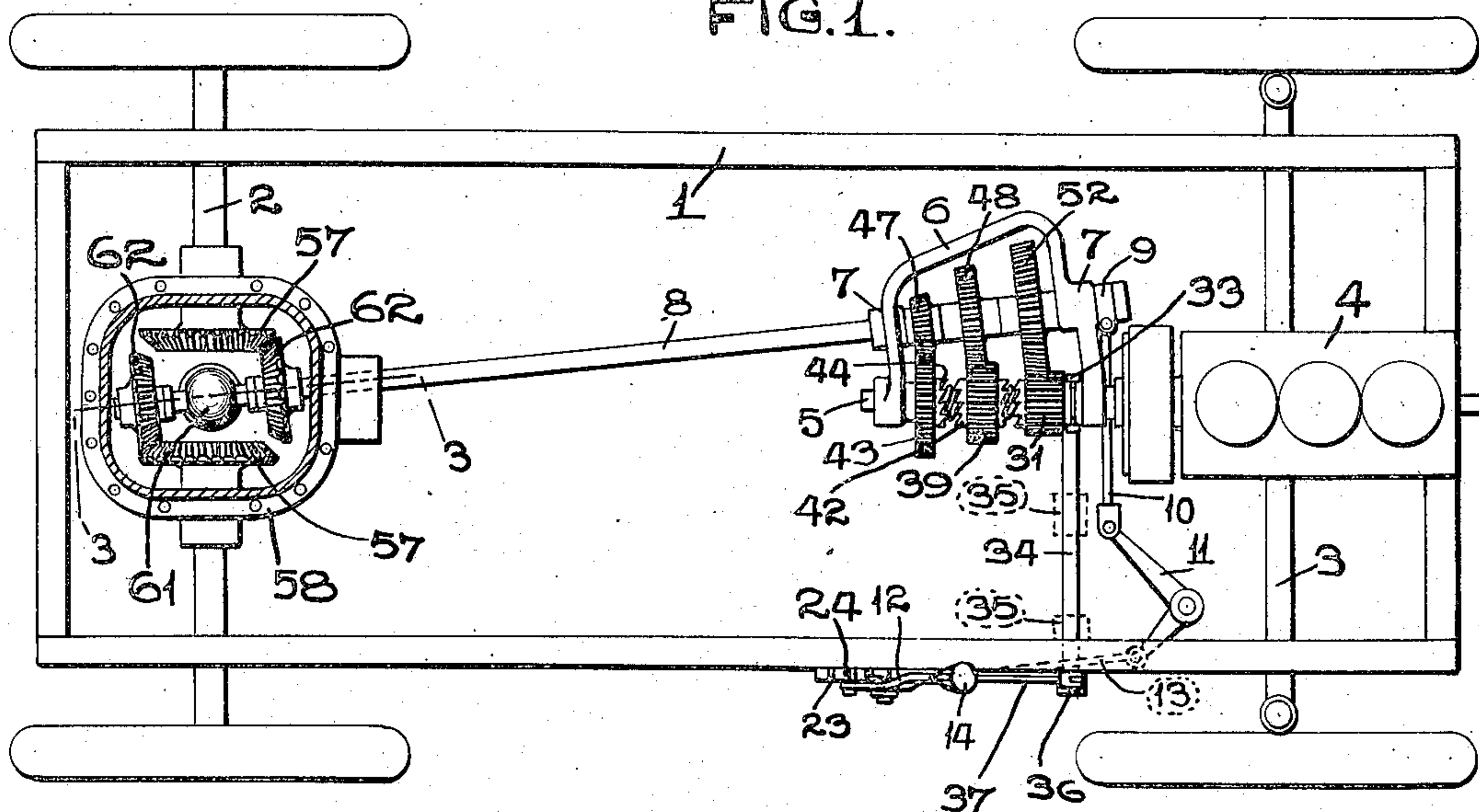
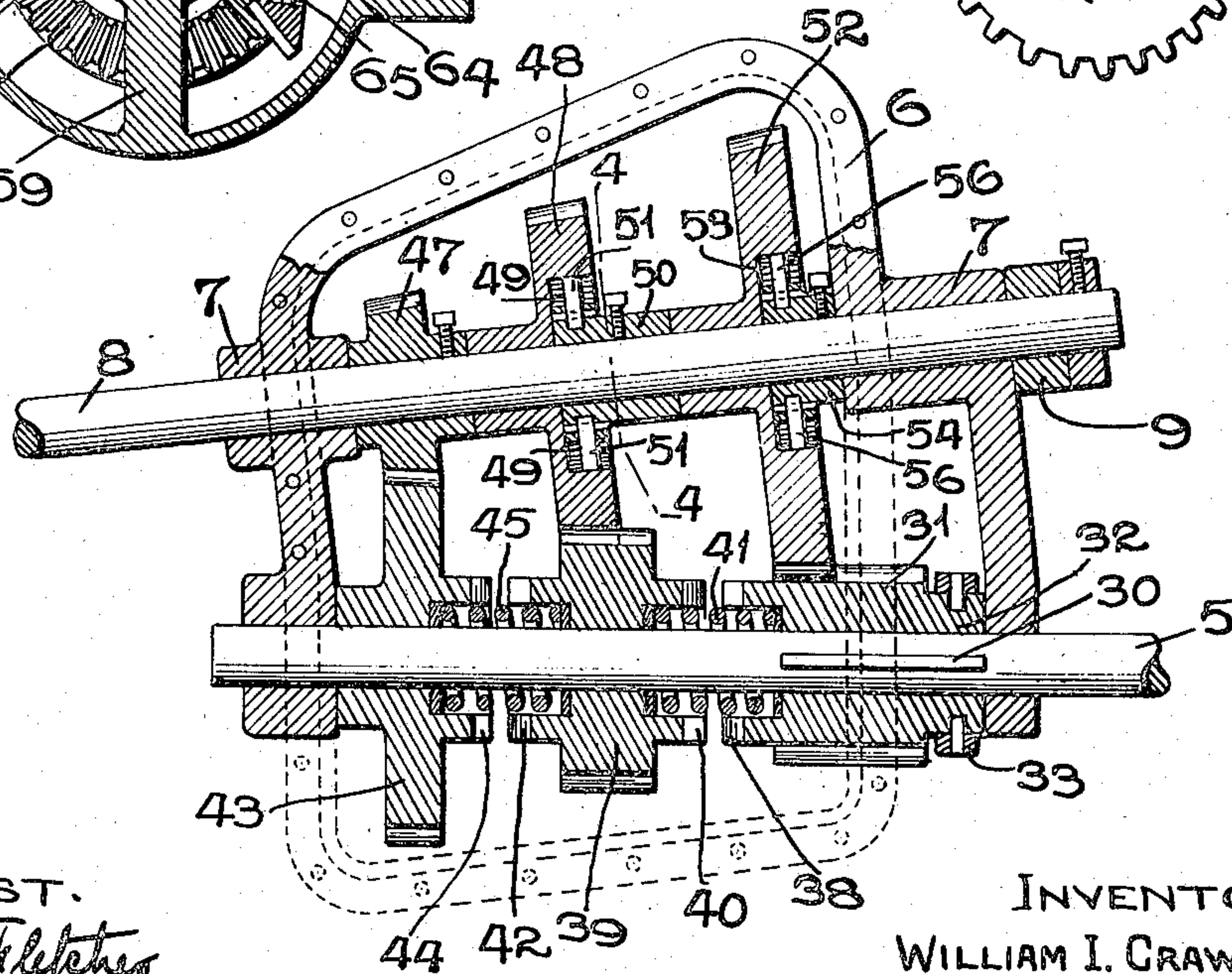
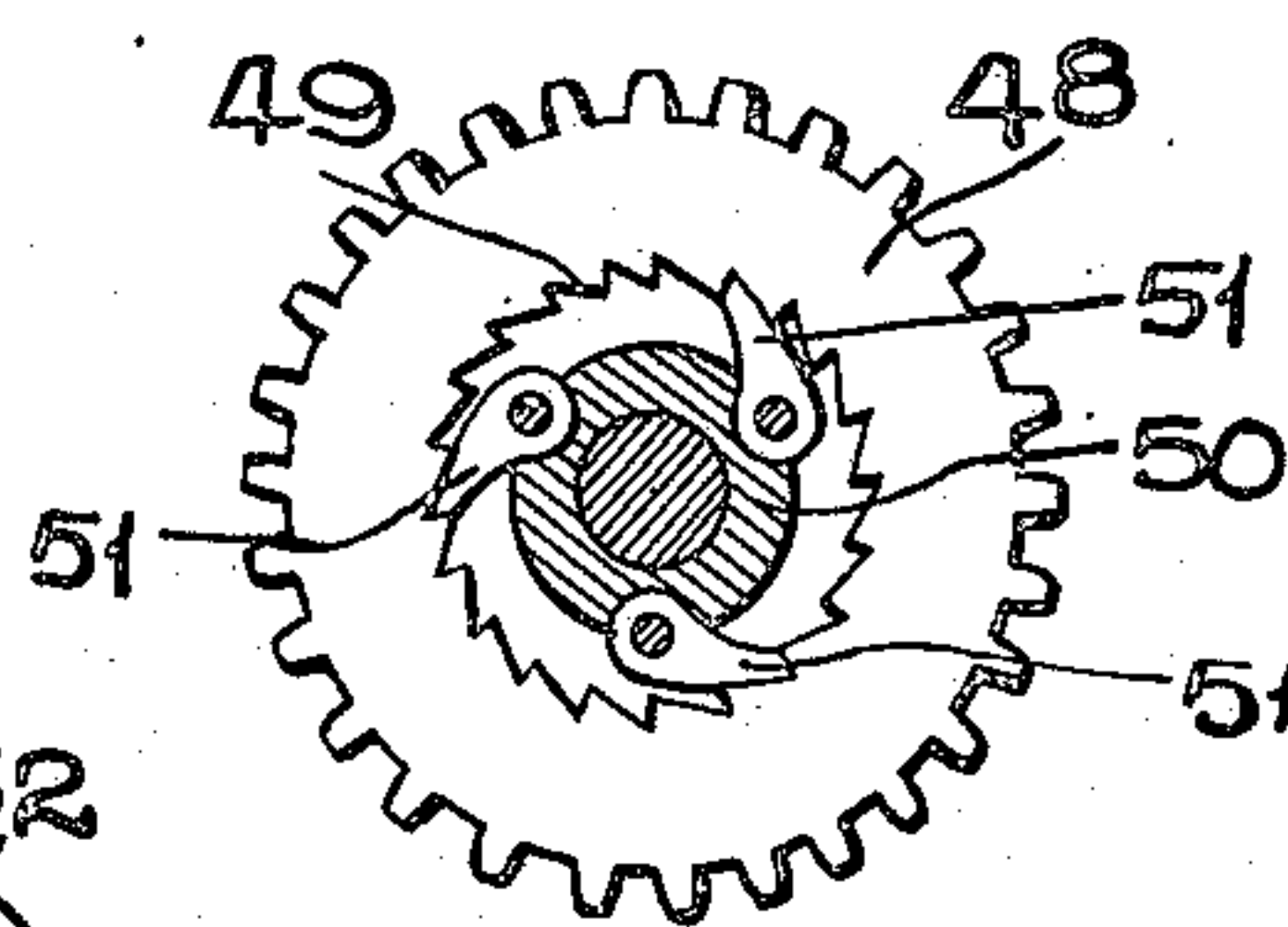


FIG. 4.



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2 SHEETS—SHEET 2.

FIG. 5.

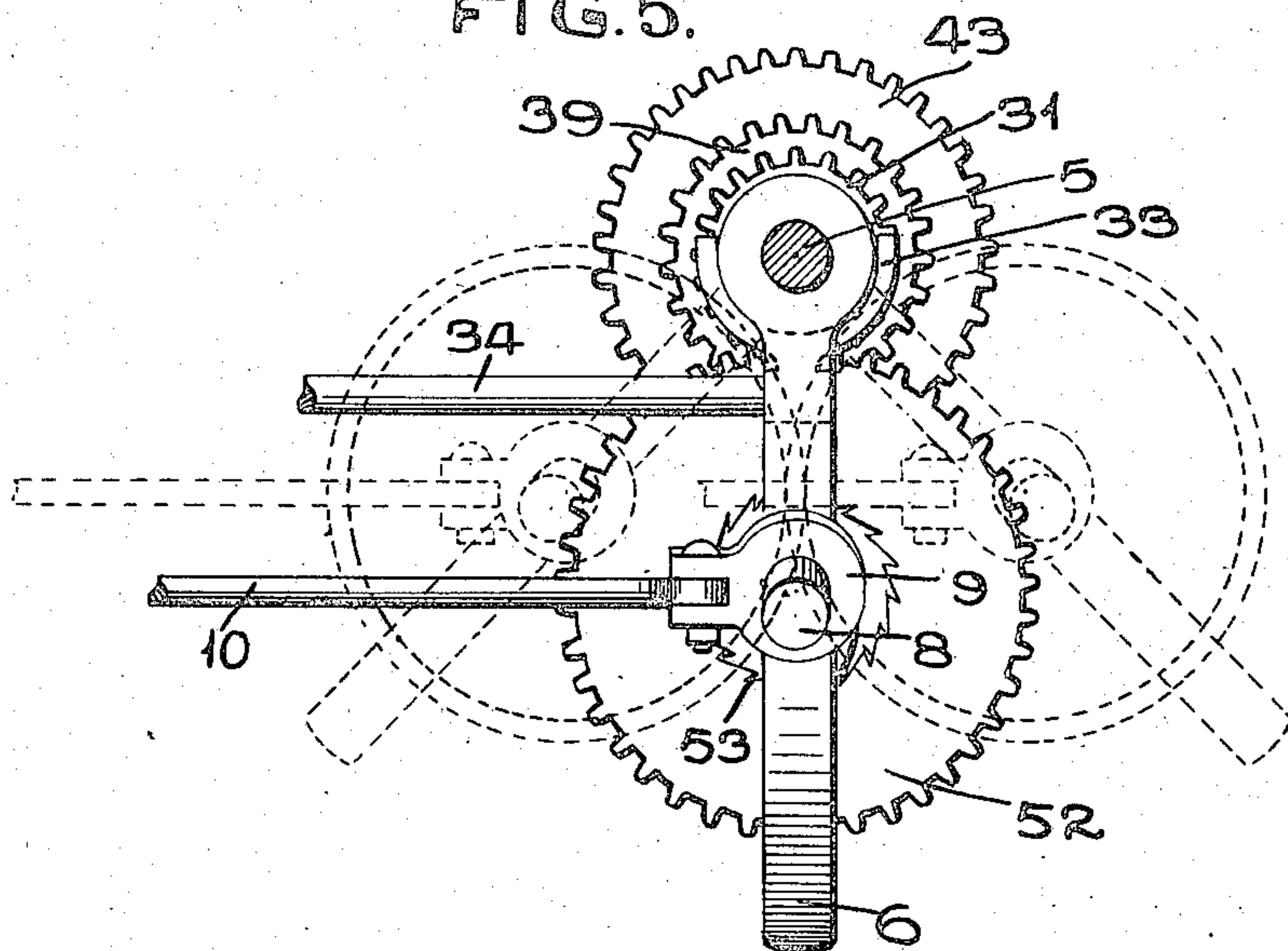


FIG. 6.

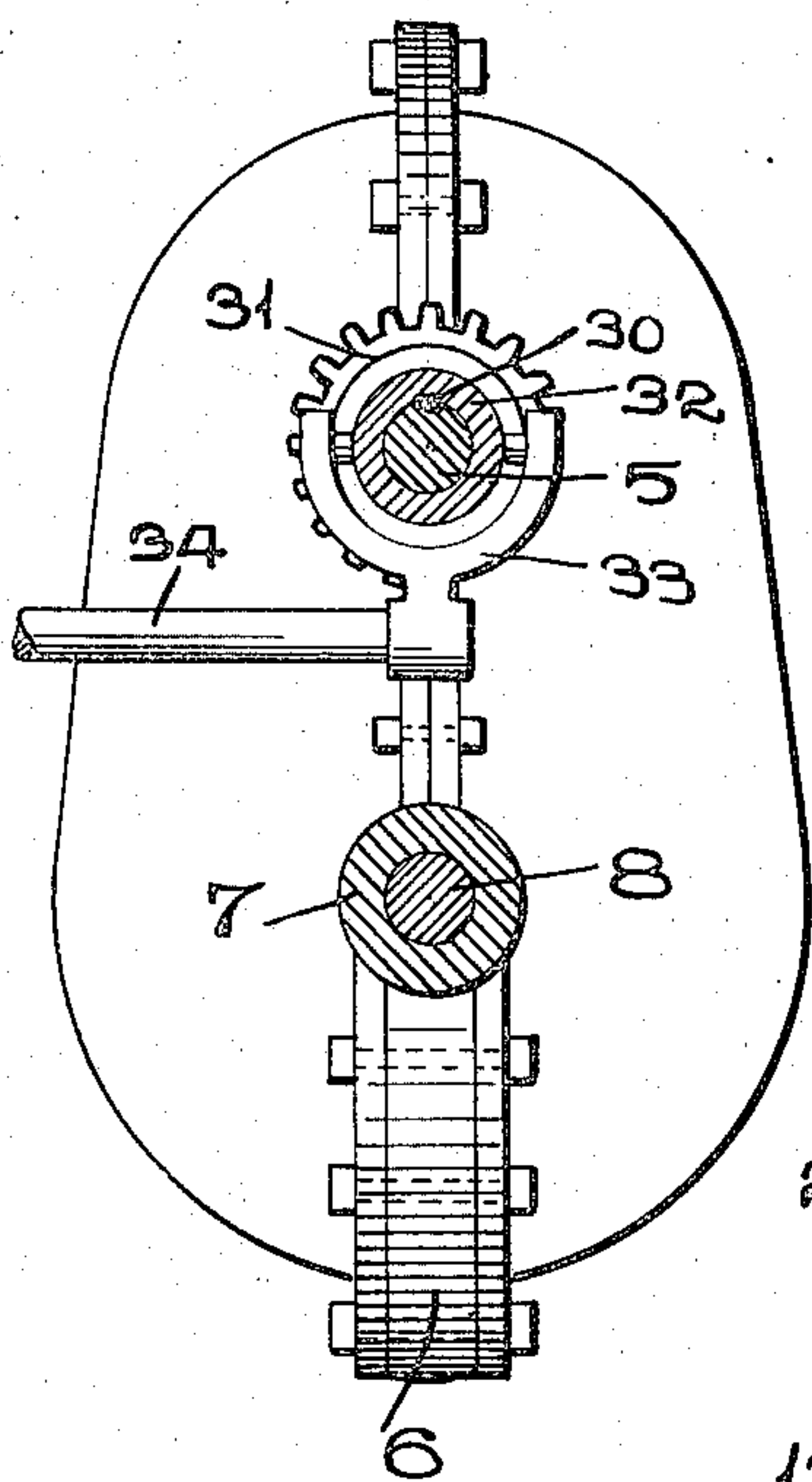


FIG. 7.

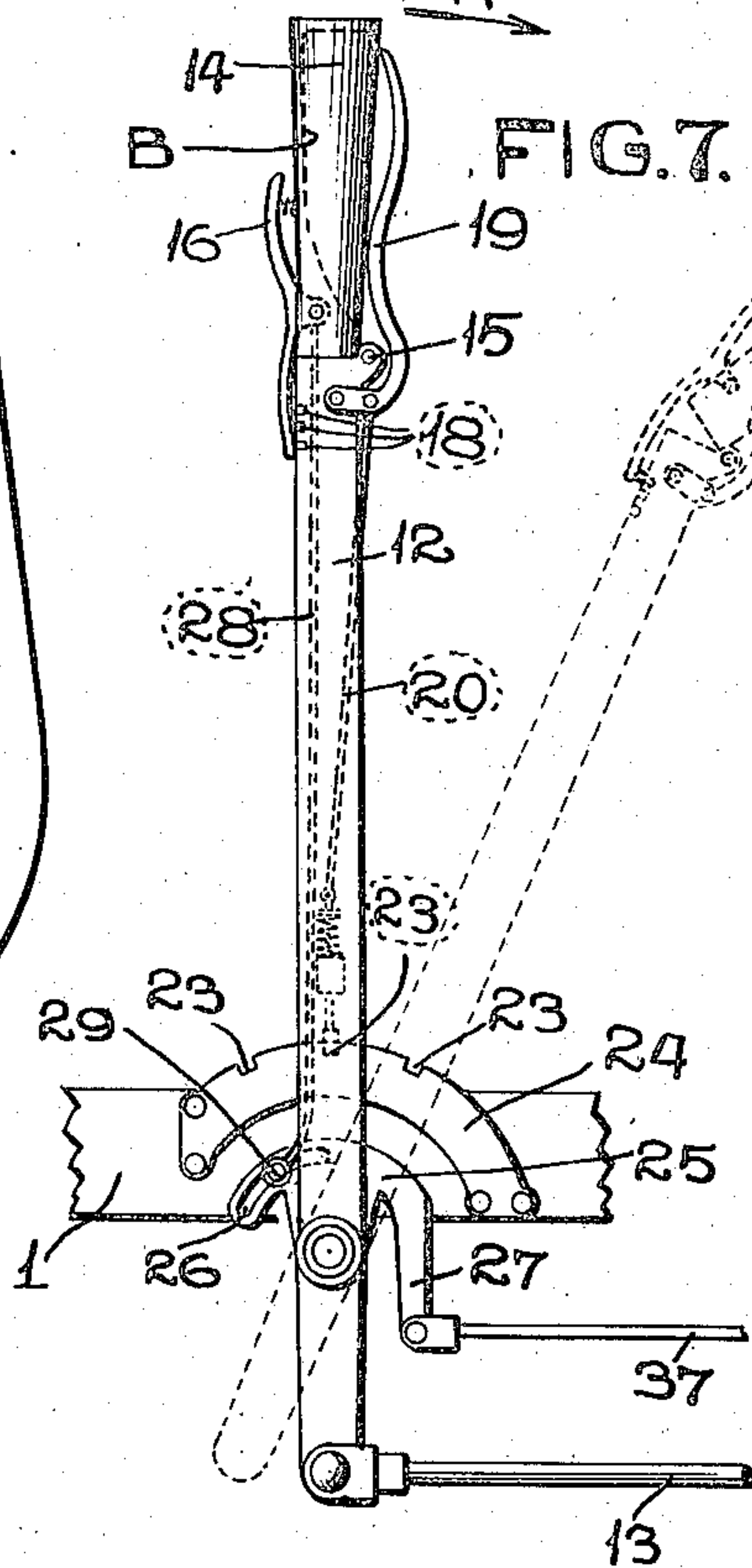
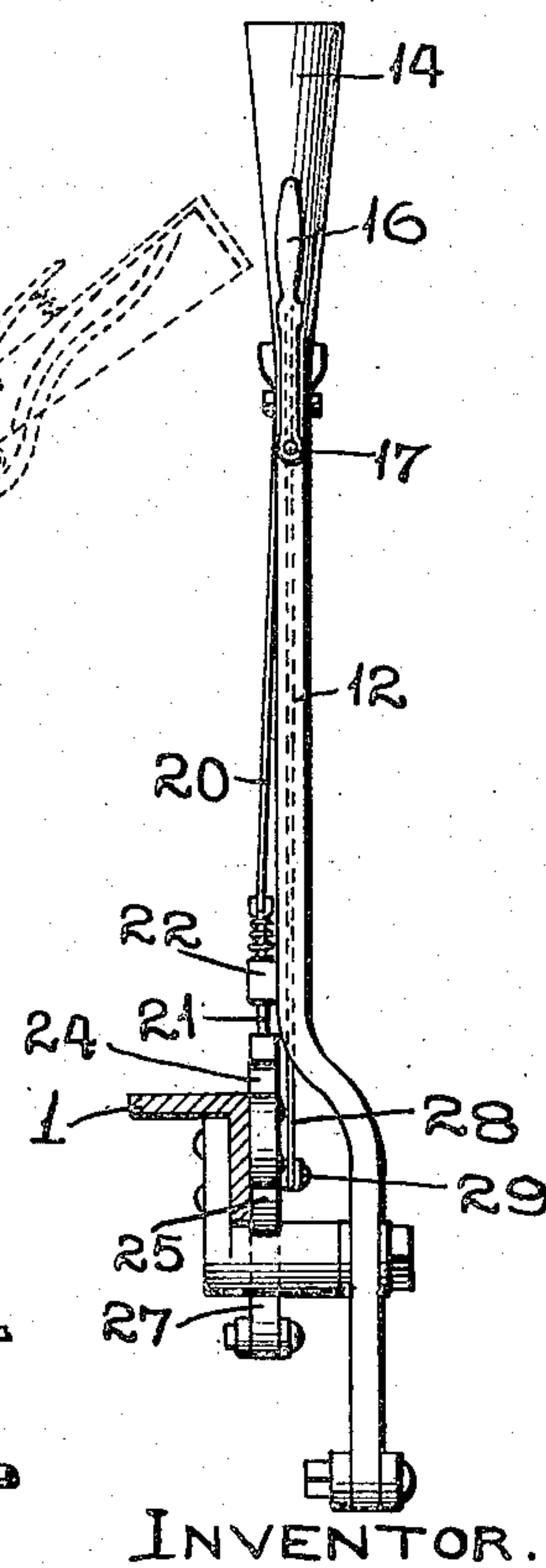


FIG. 8.



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# UNITED STATES PATENT OFFICE.

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## GEARING FOR AUTOMOBILES.

No. 847,914.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed April 30, 1906. Serial No. 314,577.

*To all whom it may concern:*

Be it known that I, WILLIAM I. CRAWFORD, a citizen of the United States, and a resident of St. Louis, Missouri, have invented certain new and useful Improvements in Gearing for Automobiles, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates generally to gearing for automobiles, and more particularly to the driving-gear and controlling mechanism thereof.

The particular object of my invention is to provide a simple and easily-operated mechanism for the manipulation and control of an automobile.

A further object of my invention is to construct a simple differential gear and reverse mechanism and to do away with a number of sliding gears that are ordinarily used in the variable-speed arrangements of automobiles.

My invention further consists in certain novel features of construction and arrangement of parts, which will be hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of an automobile-frame provided with my improved driving mechanism. Fig. 2 is an enlarged horizontal section taken through the center of the variable-speed gearing I make use of in carrying out my invention. Fig. 3 is an enlarged vertical section taken on the line 3 3 of Fig. 1. Fig. 4 is a detail section taken on the line 4 4 of Fig. 2. Fig. 5 is a front elevation of the variable-speed gearing with the movable portion thereof at the half-way point in its travel. Fig. 6 is an elevation of the variable-speed gearing inclosed within a suitable casing. Fig. 7 is a side elevation of the controlling-handle made use of in carrying out my invention. Fig. 8 is a rear elevation of the controlling-handle seen in Fig. 7.

Referring by numerals to the accompanying drawings, 1 designates the automobile-frame; 2, the rear axle of the automobile, which is made in two parts; 3, the front axle, and 4 the engine.

5 designates the engine-shaft, which extends rearwardly from the engine a suitable distance, and loosely mounted thereon are the ends of a swinging bracket or frame 6, of

approximate U shape, and which frame is arranged to swing below the engine-shaft from one side thereof to the other. (See dotted lines in Fig. 5.) Formed in the arms of the bracket 6, a short distance from the ends thereof, is a pair of alined bearings 7, in which is journaled for rotation a driving-shaft 8, which extends rearwardly from the bracket 6 and which is disposed at a slight angle relative the longitudinal portion of the engine-shaft. Loosely mounted on the forward end of the driving-shaft 8 is a collar 9, to one side of which is pivotally secured one end of a connecting-rod 10, the opposite end of which is pivotally connected to the end of the long arm of a bell-crank 11, which is fulcrumed to the right-hand side of the frame 1. Fulcrumed to the right-hand side of the frame 1, to the rear of this bell-crank 11, is an operating-lever 12, the upper portion of which is hollow, and pivotally connected to the lower end of said lever, below the fulcrum-point thereof, is one end of a connecting-rod 13, the opposite end of which is connected to the short arm of the bell-crank 11. The lever 12 thus arranged is utilized for swinging the frame 6 and the forward end of the shaft 8 from one side of the engine-shaft to the other.

A handle 14 is pivotally mounted at 15 to one side of the upper end of the lever 12 in such a manner as that said handle can be swung forwardly, as indicated by the arrow A in Fig. 7. A spring-pressed catch 16 is fulcrumed on the rear side of the handle 14, and the lower end of said catch carries a pin 17, which is adapted to engage in any one of a series of notches 18, formed in the rear side of the upper end of the lever 12. By this construction the handle 14 may be shifted and held in two different positions besides its normal position in alinement with the lever 12.

The front side of the handle 14 is recessed, as indicated by the dotted lines B, Fig. 7, and pivotally mounted on the front side of the lever 12, immediately below the pivot-point 15, is the lower end of a lever 19, and connected thereto, adjacent the pivot-point, is a rod 20, the lower end of which is connected to a spring-pressed locking-bolt 21, which passes through a keeper 22 on the lower portion of the lever 12, and the lower end of said bolt is adapted to engage in any one of a series of three notches 23, which are formed in a segment 24, fixed to the frame 1 above the point



where the lever 12 is fulcrumed. Thus means is provided for holding the frame 6 and parts carried thereby in three different positions.

5 Loosely mounted on the pin on which the lever 12 is fulcrumed is a segment 25, in one side of which is formed a concentric slot 26 and with the opposite side of which is formed integral a downwardly-projecting arm 27.  
10 Secured to the latch 16 is a connecting-rod 28, which extends downwardly through the handle 12 and its lower end being connected to a pin 29, which is arranged to slide in the slot 26.

15 Fixed on the engine-shaft 5, adjacent the front arm of the frame 6, is a key 30, and mounted to slide longitudinally thereon is a pinion 31, having an extra-wide face, and formed integral with the forward end of this  
20 pinion is a grooved hub 32. Engaging this grooved hub 32 is a yoke 33, which is carried by one end of a transversely-disposed rock-shaft 34, which is mounted for rotation in suitable bearings 35. Located on the outer  
25 end of this rock-shaft 34, which projects beyond the left-hand side of the frame 1, is a vertically-arranged arm 36, to which is connected the forward end of a rod 37, the rear end thereof being connected to the lower end  
30 of the arm 27. The end of the pinion 31 opposite from the hub 32 is provided with a series of ratchet-teeth 38.

Loosely mounted on the engine-shaft to the rear of the pinion 31 is a pinion 39, hav-  
35 ing a wide face and which is slightly larger in diameter than is said pinion 31. Formed on the hub of this pinion 39, adjacent the pinion 31, is a series of ratchet-teeth 40, which oppose the ratchet-teeth 38, and located upon  
40 the engine-shaft between the pinions 31 and 39 is an expansive coil-spring 41, which normally holds said pinions apart, so that the ratchet-teeth formed on the hub thereof do not engage. Formed on the hub on the op-  
45 posite side of the pinion 39 is a series of ratchet-teeth 42. Loosely mounted on the engine-shaft to the rear of the pinion 39 and immediately inside the rear arm of the frame 6 is a pinion 43, slightly larger in diameter  
50 than is the pinion 39, and formed on the hub of this pinion 43, adjacent said pinion 39, is a series of ratchet-teeth 44, which oppose the ratchet-teeth 42. Located on the shaft 5 between the pinions 39 and 43 is an expan-  
55 sive coil-spring 45, which normally holds the pinions 39 and 43 apart, so that the adjacent ratchet-teeth 42 and 44 do not engage.

Fixed upon the shaft 8, adjacent the rear arm of the frame 6, is a small pinion 47, which  
60 is in mesh with the pinion 43. Loosely mounted upon the shaft 8, adjacent this pinion 47, is a slightly-larger pinion 48, which meshes with the pinion 39, and formed in one side of this pinion 48 is a circular recess  
65 in which is formed a series of internal

ratchet-teeth 49. Carried by a collar 50, which is fixed on the shaft 8, adjacent the pinion 48, is a series of pawls 51, which are adapted to engage the ratchet-teeth 49. Loosely mounted upon the shaft 8, adjacent  
70 the collar 50, is a large pinion 52, which meshes with the wide-faced pinion 31, and formed in one side of this pinion 52 is a circular recess in which is formed a series of internal ratchet-teeth 53. Fixed upon the  
75 shaft 8, adjacent the pinion 52, is a collar 54, and carried thereby is a series of pawls 56, adapted to engage the ratchet-teeth 53.

Fixed upon the inner ends of the two parts of the rear axle 2 are beveled gear-  
80 wheels 57, which gears are arranged within a housing 58, in the sides of which the two parts of the axle 2 are journaled. Extending upwardly from the bottom of this housing 58 and in the center thereof is a post 59, and  
85 extending downwardly from the top thereof is a corresponding post 60. Loosely mounted in the socket formed between the adjacent ends of the posts 59 and 60 is a ball 61, through which passes the rear portion of the  
90 shaft 8, and there being a slot 61<sup>a</sup> formed in front of the housing 58 for said shaft 8 to operate through. Loosely mounted upon the shaft 8, on each side of the ball 61, are beveled pinions 62, which are adapted to  
95 mesh with the beveled gears 57, and formed in the outer faces of said pinions 62 are circular recesses in which are formed internal ratchet-teeth 63. Fixed upon the shaft 8, adjacent the pinions 62, are collars 64, carry-  
100 ing pawls 65, which are adapted to engage the internal ratchet-teeth 63. When the frame 6 and parts carried thereby is shifted to its extreme swing to either side of the shaft 5, one of the pinions 62, meshes with  
105 one of the gears 57, while the opposite pinion 62 meshes with the opposite gear 57. When the shaft 8 is shifted to a central position, so that its forward end is immediately below the engine-shaft 5, the pinions 62 are both  
110 disengaged by the beveled gears 57, and consequently no motion is imparted to the parts of the rear axle.

The operation of my improved driving-gear is as follows: By means of the lever 12  
115 the bell-crank 11 is shifted so as to swing the frame to its extreme limit of movement toward the left hand or to the position as shown in Fig. 1, and when so positioned and the engine 4 is started the rotary motion of the en-  
120 gine-shaft 5 is imparted, by means of the pinion 31, to the large pinion 52, and by reason of the engagement of the points of the pawls 56 with the teeth 53 the shaft 8 is correspondingly rotated, and this rotary motion  
125 is imparted to the parts of the rear axle 2 by the pairs of meshing beveled gears 57 and 62. During this operation the pawls 65, carried by the collars 64, engage and drive the beveled pinions 62. Owing to the rela-  
130



tive sizes of the pinions 31 and 52 the vehicle will be driven forward at the lowest speed, and when it is desired to increase the speed the operator engages the handle 14 and swings the same forwardly upon its pivot 15 in the direction indicated by the arrow A in Fig. 7, and in so doing disengages the pin 17 from the lowermost recess 18 in which it was seated, and when the handle has been moved said pin will engage in the middle one of said recesses, and thus hold said handle in its tilted position. This actuation necessarily shifts the segment 27 slightly, owing to the engagement of the pin 29 in the upper end of the slot 26, and which pin is in turn moved by the connecting-rod 28, and as a result the pinion 31 is shifted longitudinally on the shaft 5 and key 30, thus compressing the spring 41 and engaging the teeth 38 with the teeth 40. The pinions 31 and 39 now rotate together as one part, and in turn the pinion 48 is driven, for the reason that the ratchet-teeth 49 engage the points of the pawls 51. The shaft 8 and vehicle are now being driven at the middle speed, owing to the comparative sizes of the pinions 39 and 48, and while running at this speed the collar 55 and pawls 56 carried thereby will travel faster than the large pinion 52, and said pawls will in operation slip past the teeth 53 in said large pinion. When it is desired to drive the vehicle at the high speed, the operator manipulates the handle 14 and forces the same to its extreme limit of movement forwardly and engages the pin 17 in the upper one of the recesses 18. This shifts the segment 27 farther forward and in turn rocks the shaft 34 and by means of the yoke 33 moves the pinions 31 and 39, which are locked together longitudinally upon the shaft 5 until the teeth 42 and 44 engage, and in so doing the coil-spring 45 is compressed, and as a result the pinions 31, 39, and 43 all rotate as one piece and at the same speed as the engine-shaft 5. The pinion 43 meshes with the pinion 47 and drives the same, together with the shaft 8, at a high speed, owing to the relative sizes of said pinions, and while traveling at this high speed the pawls 51 and 56 slip past the corresponding ratchet-teeth 49 and 53 of the pinions 48 and 52. The rotary motion thus imparted to the shaft 8 is in turn imparted to the two parts of the rear axle 2 by the beveled pinions 57 and 62, and said pinions 62 are driven by the engagement of the pawls 65 with the ratchet-teeth 63, which pawls are carried by the collars 64, fixed on the shaft 8. To change from the high speed to the low speed, the operator merely disengages the pin 17 of the catch 16 from the upper one of the recesses 18 and brings the handle 14 into alinement with the lever 12 and allows the pin 17 to reengage in the lowermost one of the recesses 18. The expansive coil-springs 41 and 45 will now move the pin-

ions 31, 39, and 43 apart, and following this movement the low speed will be transmitted from the engine-shaft to the shaft 8. When it is desired to throw the driving-gear out of operation and to stop the vehicle, the operator engages the handle 14 and by means of the lever 19 releases the locking-bolt 21 from the forward one of the notches 23 and brings the lever 12 into a vertical position, as shown in Fig. 7. This movement actuates the bell-crank 11 and swings the frame 6 and parts carried thereby into a position immediately beneath the engine-shaft 5. This movement causes the rear portion of the driving-shaft 8, carrying the ball 61, to pivotally swing beneath the posts 59 and 60, and as said shaft 8 now assumes a position at right angles to the parts of the rear axle 2 the pinions 62 are disengaged from the beveled gears 57 and consequently cease to drive the beveled gears 57 and the parts 2 of the rear axle. When it is desired to reverse the motion of the vehicle or to cause the same to move rearwardly, the operator shifts the lever 12 rearwardly, so that the locking-bolt 21 engages in the rear one of the notches 23. This shifts the bell-crank 11 and moves the frame 6 and parts carried thereby, together with the forward end of the driving-shaft 8, to the right hand side of the engine-shaft 5. This movement brings the beveled pinions 62 into engagement with the beveled gears 57, which engagement is reversed in position relative the position assumed by said pinions and gears when driving the vehicle forward, and following this reverse position the driving-shaft 8 will cause the parts of the rear axle 2 to rotate toward the rear and move the vehicle in a like direction.

Owing to the ratchet-and-pawl connection between the pinions 62 and collars 64, fixed on the driving-shaft 8, each part 2 of the rear axle may move differentially when the vehicle turns a corner or is traveling around a curve.

My improved driving-gear is simple in construction and operation, is positive in action, comprises a minimum number of parts, is easily assembled or taken apart, and can be very readily repaired.

I claim—

1. In a gearing for automobiles, the combination with the engine-shaft, of a series of sliding gears arranged upon said shaft, a driving-shaft mounted for rotation in suitable bearings, a driven axle, connections whereby said driving-shaft imparts rotary motion to said axle, a series of gear-wheels mounted upon the driving-shaft and in mesh with the gear-wheels on the engine-shaft, and means whereby the sliding gears on the engine-shaft are locked together; substantially as specified.

2. The combination with the shaft of an engine, of a series of sliding gears arranged



on said shaft, means whereby said gears are locked together, means arranged between said gears for normally holding them apart, a frame arranged to swing upon the engine-shaft, a driving-shaft journaled in said frame, a series of gears mounted on the driving-shaft within the frame and in mesh with the gears on the engine-shaft, an axle and a driving connection between the rear end of the driving-shaft and said axle; substantially as specified.

3. In an automobile, the combination with the rear axle, constructed in two parts, of beveled pinions mounted on the inner ends of the parts of said axle, a driving-shaft fulcrumed between the pinions, pinions loosely mounted upon the driving-shaft in which pinions are formed internal ratchet-teeth, collars fixed upon the driving-shaft, pawls carried by said collars for engaging with the ratchet-teeth, and means whereby the driving-shaft is shifted from one position to another to reverse the position of engagement of the two sets of beveled pinions; substantially as specified.

4. The combination with the shaft of an engine, of a series of different-sized gear-wheels mounted on said shaft certain of which gear-wheels are arranged to slide, means whereby said gear-wheels are locked together so as to rotate with the engine-shaft, an axle, a driving-shaft suitably journaled and arranged to impart rotary motion to said axle, a series of different-sized gear-wheels arranged upon the driving-shaft which mesh with the gear-wheels on the engine-shaft, certain of which gear-wheels are loosely mounted on the driving-shaft, means whereby the loosely-mounted gear-wheels are locked so as to move with the driving-shaft, and means whereby the sliding gears on the engine-shaft are shifted from one position to another; substantially as specified.

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

WILLIAM I. CRAWFORD.

Witnesses:

M. P. SMITH,

EDW. M. HARRINGTON.