F. J. ZIEGLER.

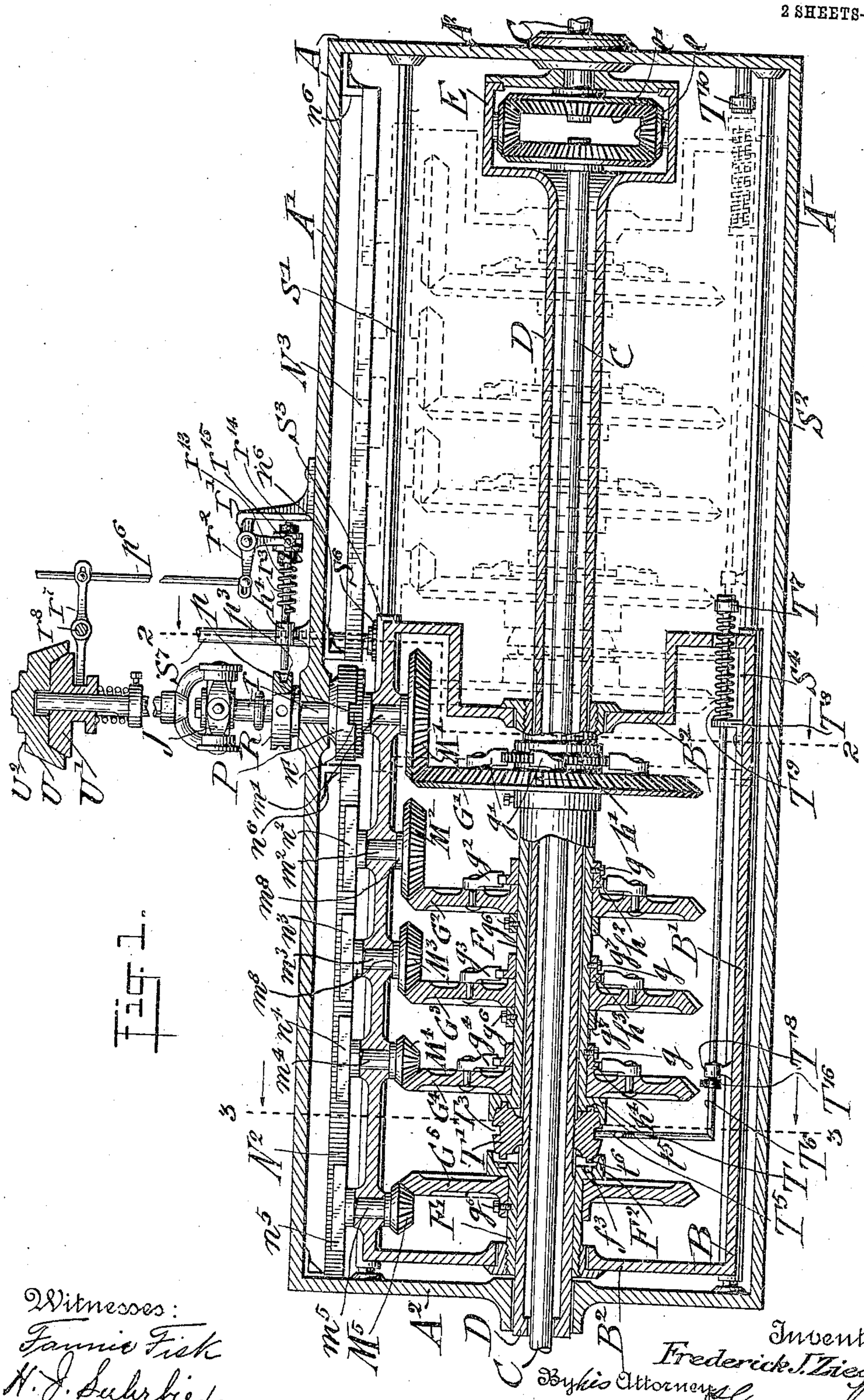
SPEED CHANGING MECHANISM.

APPLICATION FILED MAY 20, 1908.

952,171.

Patented Mar. 15, 1910.

2 SHEETS—SHEET 1.



Witnesses:
Fannie Fisk
H. J. Sulzbach.

Inventor
Frederick J. Ziegler
By his Attorneys
Goepel & Goepel.

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2 SHEETS—SHEET 2.

Fig. 2.

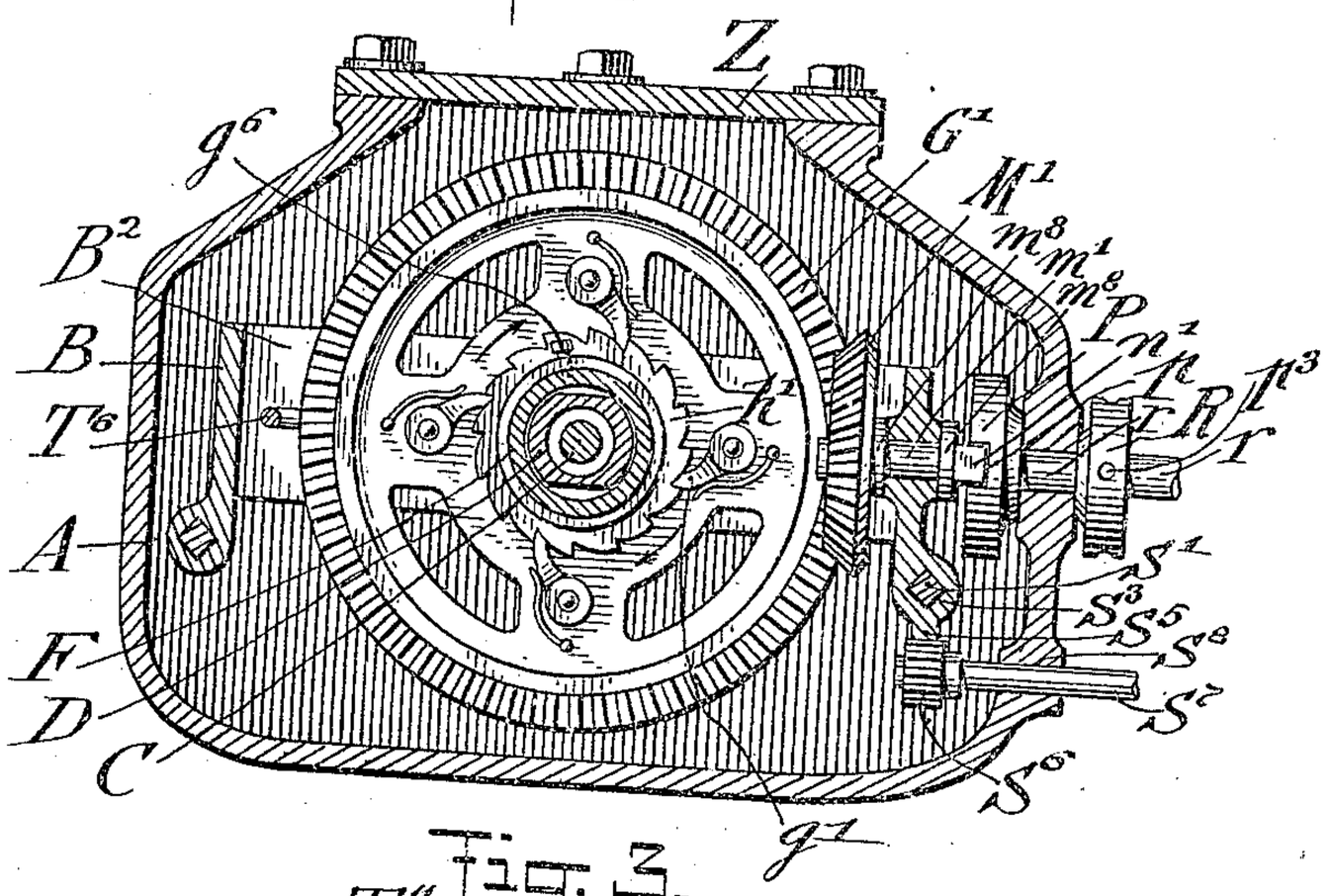


Fig. 3.

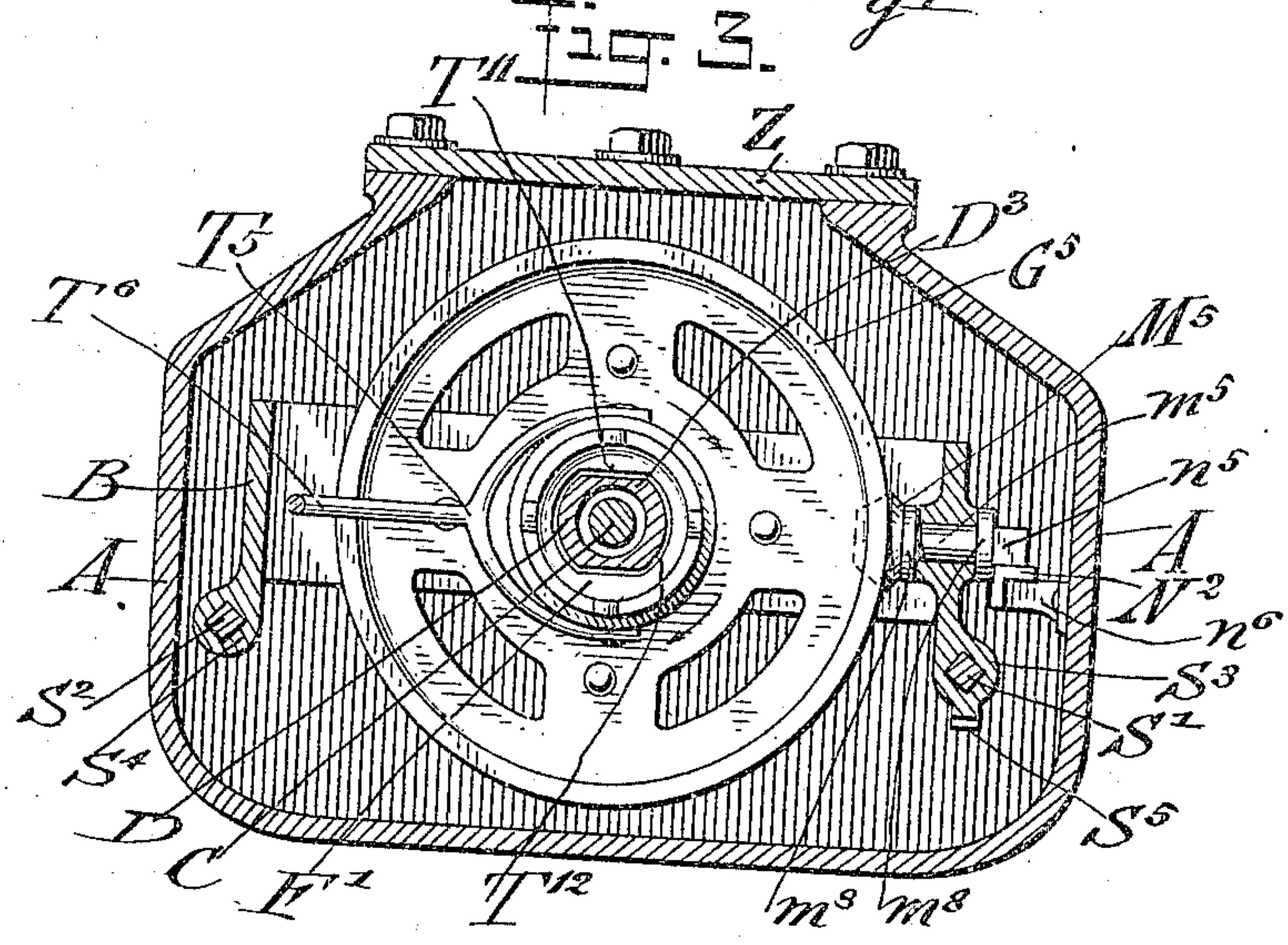
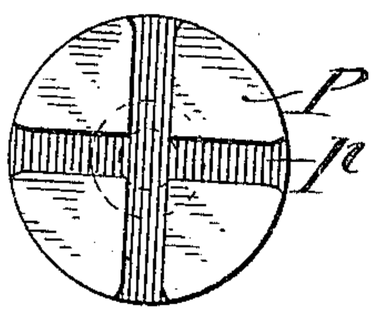


Fig. 4.



Witnesses:
Fannie Fick
H. L. Buchbiel.

Inventor
Frederick J. Ziegler
By his Attorneys
Howell & Howell

UNITED STATES PATENT OFFICE.

FREDERICK J. ZIEGLER, OF NEW YORK, N. Y.

SPEED-CHANGING MECHANISM.

952,171. Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed May 20, 1908. Serial No. 433,829.

To all whom it may concern:

Be it known that I, FREDERICK J. ZIEGLER, a citizen of the United States, and resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Speed-Changing Mechanism for Automobiles, of which the following is a specification.

This invention relates to speed changing mechanism for automobiles, and has for its object to provide a mechanism which is not subject to the disadvantages of those hitherto in use and in which considerable lost power prevails and which are usually accompanied by noise and jarring, attendant with considerable wear and tear.

It is the object of this invention to provide a mechanism in which the transmission is direct for each of the individual speeds, and in which a change of speed from one velocity to another can be immediately accomplished without noise or shock.

For this purpose my invention consists of a speed changing device for automobiles, comprising a plurality of gears each of a different size, and corresponding to the various speeds, means for causing the engagement of any one of these gears with the power shaft, a plurality of gears, each meshing with one of the first-named gears, and means for transmitting to the driving shaft the motion of that gear in mesh with the gear in engagement with the power shaft.

The invention consists of certain further novel features which will be more fully described hereinafter, and finally pointed out in the claims.

In the accompanying drawings, Figure 1 is a horizontal longitudinal section, partly in elevation, of my improved speed changing mechanism, Fig. 2 is a vertical transverse section taken on line 2—2 of Fig. 1, Fig. 3 is a vertical transverse section taken on line 3—3 of Fig. 1; and Fig. 4 is a detail view of one of the parts.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, in which Fig. 1 shows a general view of the mechanism embodying my invention as applied to the rear shaft of an automobile and in coöperation with the transmission-shaft and crank-shaft of the motor, a gear-box A supports a frame B movable therein from one side of the same to the other. The gear-box A is formed by longitudinal side-walls A^1 and two transverse end-walls A^2 and the frame B consists of longitudinal bars B^1 and end-bars B^2. The end-walls A^2 of the gear-box A and the end-bars B^2 of the frame B are provided with openings for the passage of the jack or rear-shaft C of the automobile, and of sleeves surrounding the same. Of these sleeves, one, D, is formed as a continuation of a casing E of a differential, such as is well known, and other sleeves, F, and F^1, surround sleeve D. Loosely mounted on the sleeve F are a plurality of bevel gear-wheels G^1, G^2, G^3 and G^4, each provided with a pawl, g^1, g^2, g^3 and g^4 respectively, and each engaging a ratchet h^1, h^2, h^3 and h^4 respectively, which are suitably secured to the sleeve F by means of screws g. Collars g^7 secured to the sleeve F by set-screws g^6, keep the gear-wheels G^1, G^2, G^3 and G^4, in position. Meshing with the gears G^1, G^2, G^3 and G^4 are bevel gears M^1, M^2, M^3 and M^4, of different sizes, corresponding to the different speeds, and having shafts m^1, m^2, m^3 and m^4 moving in bearings supported in one side of the frame B. To these shafts are respectively secured key-rods n^1, n^2, n^3 and n^4, slidable on horizontal guide-ways N^2 and N^3 secured to the inner part of the gear-box A by means of brackets n^6, and which have their inner adjacent ends spaced apart a distance larger than the length of one of the key-rods. Collars m^8 are secured to the shafts m^1, m^2, etc., to keep them in position. A disk P having slots p at right angles to each other, and of a width slightly greater than the thickness of the key-rods n^1, n^2, n^3 and n^4, as shown in Fig. 4, with the ends of the slots somewhat larger as there shown to permit the ready entrance into the slots of the key-rods, rotates in the space formed between the inner adjacent ends of the bars N^2 and N^3, and is secured to a shaft r journaled in the side-wall A^1 of the gear-box A. The shaft r extends outwardly from the exterior of the gear-box and is provided with a disk R having recesses p^3 on its periphery, spaced 90° apart, corresponding to the slots of the disk P, and is further provided with a universal joint J to take up the disalinement caused during the movement of the machine. A suitable clutch-mechanism U

operates to transmit motion from the crank shaft of the motor, to the transmission shaft r.

The gear-box A is provided on its exterior with brackets h^4 and r^1, the latter pivotally supporting an elbow lever r^2 having one of its free ends co-acting with a spring-actuated rod r^3, supported by the bracket h^4. Rod r^3 has one end of a spring r^{13} secured thereto, the other end of which abuts against a collar r^{15} secured to the free end of the lever r^2, and through which the rod r^3 freely passes. When it is desired to insert the rod r^3 into one of the recesses p^3 of the disk R the movement of the collar r^{15} against the spring will cause the movement of the rod r^3 against the periphery of the disk R, and simultaneously compress the spring r^{13} before the rod enters one of the recesses p^3. After the rotation of the disk R sufficient to bring the end of the rod r^3 immediately above one of the recesses p^3, the expansion of the spring r^{13} will cause a quick entrance of the end of the rod r^3 into one of the recesses p^3. In order to withdraw the rod r^3 quickly and positively, a stop-collar r^{14} is secured to the end of the rod r^3 so that when the lever arm r^2 is actuated so as to withdraw the rod r^3, the collar r^{15} will be moved against the collar r^{14} and thereby cause the rod r^3 to be positively and quickly withdrawn from the recess p^3. The other end of the elbow lever co-acts with rod p^6, which is in turn connected with one end of a lever arm r^7 pivoted to the frame of the automobile in some suitable manner, not shown, as at r^8, the other end of which is connected with the shiftable member U^1 of the clutch-mechanism U movable on the transmission shaft r. The forward movement of the rod p^6 disengages the shiftable member U^1 from the power-member U^2, whereby the speed of the transmission-shaft r will gradually decrease until almost standstill is attained. Simultaneously with the forward movement of the rod p^6, the rod r^3, will be caused to be pressed against the disk R, until its end engages one of the recesses p^3, bringing thereby the disk to a standstill at a fixed and determined position. This will bring one of the slots p of the disk P in a horizontal position so as to permit the entrance of one of the key-rods n^1, n^2, n^3 and n^4.

The gear-box A is provided with guide-bars S^1 and S^2 surrounded by guideway-tubes S^3 and S^4 secured to the exterior of the frame B so as to permit the to and fro movement of the frame from one side of the gear-box to the other. One of these tubular guideway-tubes S^3 is provided with a rack S^5 engaged by a pinion S^6 secured to a shaft S^7 movable in a bearing S^8 located in the gear-box. The shaft S^7 extends forwardly to the front part of the automobile and is suitably connected with the hand lever on the proper manipulation of which, the frame B may be moved from one side of the gear-box to the other. The gear-box A is provided with the usual oil-tight gear-box cover, as shown by Z.

The end of the sleeve F is provided with a flange T which forms one member of a clutch, having suitable recesses t^5, adapted to be engaged by dogs t^6 of the shiftable member T^1 of the clutch. This member T^1 has a central opening T^{12}, the walls forming which being mainly circular in shape but with two straight sides T^{11}, and adapted to be moved to and fro on the sleeve D. The cross-section of the sleeve D is also mainly circular but also has two straight sides D^3 corresponding to the straight sides of the shiftable member T^1. The consonance of the opening of shiftable member T^1 with the periphery of the sleeve D, forms a key action. It follows, that by the rotation of the shiftable member the sleeve D is also rotated.

Beyond the forward movement gears G^1, G^2, G^3 and G^4, a reversing gear G^5 is provided which is similar in operation to those described, excepting that this has no pawl nor ratchet engaging therewith. The reversing gear is secured directly to a sleeve F^1 which, similar to the sleeve F, is rotatable on the sleeve D. The sleeve F^1 is also provided with a flange portion F^2 having recesses f^3 and forming one member of a clutch when co-acting with the dogs t^6 of the shiftable member T^1. The gear M^5, shaft m^5, and key-rod n^5 slidable on the guide-rod N^2, all correspond to those described in connection with the forward movement of the machine.

The shiftable member T^1 of the positive clutch is provided with a groove T^3 which is engaged by a fork T^5, the rod T^6 of which is provided at its end with a buffer T^7 which is guided by brackets T^8, between which buffer and the nearest bracket a spring T^9 is interposed. When it is desired to reverse, the shiftable member T^1 must be thrown out of engagement with the forward-movement sleeve F, and into connection with the reverse-movement sleeve F^1. The object of the buffer is to cause this movement. When the frame B is moved toward the end of the gear-box so as to cause the key-rod n^5 of the reversing gear M^5 to engage with the disk P, a stop T^{10} secured to the end of the gear-box, is encountered by the buffer T^7 whereby the fork T^5 moves the shiftable member T^1 so as to engage the flange F^2 of the sleeve F^1. The shiftable member T^1 is held in engagement with the flange T of the sleeve F by the action of the spring T^8, with the exception of that case when the buffer T^7 is acted upon by the stop T^{10}, to bring about the reverse action. To prevent

undue frictional action between the fork T^5 and groove T^3 of the shiftable member, a stop T^{10} is fixed to the rod T^6 so as to limit the movement of the same. The position of frame B when ready for the reverse movement is shown in dotted lines in Fig. 1.

The differential E, as is well known, consists of the miters *e* engaged by the bevel-gears e^1, one of which is secured to one part of the shaft C and the other bevel to the other part of the shaft C.

The operation of my improved device is as follows: When a certain speed is desired, as for instance, the highest speed, the frame B is moved in the position shown in full lines in Fig. 1, so as to insert the key-rod n^1 into one of the slots *p* of the disk P, whereby, on the rotation of the disk P, the bevel-gear M^1, hence the bevel-gear G^1, ratchet h^1, sleeve F, shiftable-member T^1, sleeve D, and, finally the shaft C is rotated. It will be noted that during this particular speed no other gear-wheel rotates but that just described which is in the line of direct transmission. Hence, there is no lost motion of the other gears, and these parts are not subjected to wear or tear or breakage. If a different speed should be desired, the transmission shaft *r* is thrown out of engagement with the power-shaft by means of the clutch U whereby the speed of the disk P will be reduced, and the rod r^3 inserted into one of the recesses p^3 of the disk R, so as to bring the disk R, and hence the disk P, to standstill. This permits the withdrawal of the key-rod n^1 from the slot *p* of the disk P and the insertion of another key-rod connected with a gear, corresponding to a different speed, and to the speed desired. For this purpose, the frame B is moved by means of the pinion S^6 and rack S^5, the rod S^7 being properly manipulated at the front of the machine. When the key-rod corresponding to the speed desired is inserted into the slot of the disk P, the rod r^3 is withdrawn, simultaneously with the engagement of the clutch-members, and thereby a direct line of transmission had, all the other gears not being in action. If, however, the machine is desired to be reversed, the frame B, is moved by means of the pinion S^6 and rack S^5, after the disk P is brought to standstill as before described, until the key-rod n^5 engages one of the slots *p* of the disk P. This movement of the frame B will bring the buffer T^7 against the stop T^{10}, and cause thereby the fork T^5, to move the shiftable member T^1 against the flange F^2 of the reverse-movement sleeve F^1, and bring about an engagement therewith. The rod r^3 is then withdrawn, and simultaneously the transmission shaft *r* rotated by the engagement of the clutch-members U^1 and U^2. The line of transmission will then be through the disk P, key-rod n^5, shaft m^5, bevel-gear M^5, gear-wheel G^5, sleeve F^1, shiftable member T^1, sleeve D, through differential E to the shaft C. The other gears, out of this line of transmission, do not rotate.

My invention has the advantage of the least possible amount of power lost in transmission, absolute silence in rotation in contrast to the noisy spur-gears and noiseless change will be accomplished at all times; further, absolute selection of speeds with the advantage and convenience of the progressive system. Further change from higher to the lower speed can be immediately accomplished without noise or shock owing to the sleeve overrunning the bevel-gears due to the action of the ratchets for the reason that there will not be any backlash on account of the ratchets.

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

1. A speed changing mechanism for automobiles comprising a driving-shaft, a driven shaft arranged at right angles to the driving-shaft, a plurality of transmission members severally capable of operative connection with the driving-shaft and of different sizes corresponding to various speeds, and motion transmitting means severally capable of operative connection with the named transmission members and the driven shaft, the connection depending on which one of the members is in operative connection with the driving-shaft.

2. In a speed changing mechanism for automobiles the combination of a driving shaft, a driven part, a movable frame, a plurality of motion transmitting members carried by the frame and movable therewith and severally capable of operative connection with the driving shaft and means between said driven part and said members for communicating motion to said driven part from whichever member is in operative connection with the driving shaft.

3. In a speed changing mechanism for automobiles, a driving-shaft, a driven shaft, a frame, a plurality of motion transmitting members movable therewith, severally capable of being operatively connected with the driving shaft, a sleeve movable with the frame, a plurality of motion transmitting means on the sleeve, coöperating with the transmitting members, and means operatively connecting the driven shaft and sleeve.

4. In a speed changing mechanism for automobiles, a driving-shaft, a driven part, a frame, a plurality of motion transmitting members movable therewith, severally capable of operative connection with the driving-shaft, a plurality of motion transmitting means loosely mounted, ratchets on the driven part, and means on the motion transmitting means for engaging the ratchets.

5. A speed changing mechanism for auto-

mobiles, comprising a driving shaft, a plurality of gears, capable of operative connection therewith, a frame supporting the gears movable in respect to the driving shaft, a second plurality of gears, each meshing with one of the first named gears, and also supported by the frame, a driven shaft, and means for transmitting the motion of the last named gears to the driven shaft.

6. A speed changing mechanism for automobiles, comprising a driving shaft, a plurality of gears, capable of operative connection therewith, a sleeve, a second plurality of gears, each meshing with one of the first named gears and loosely mounted on said sleeve, a plurality of ratchets secured to the sleeve, pawls on the second named gears for engaging the ratchets, a driven shaft, and means for transmitting motion from the sleeve to the driven shaft.

7. In a speed changing mechanism for automobiles, a driving shaft, a collar on the driving shaft having slots, elongated key-rods adapted to severally engage the slots so as to be rotatable therewith, a driven shaft and means connecting the key rods with the driven shaft.

8. In a speed changing mechanism for automobiles, a driving part having a collar with elongated slots therein, a plurality of transmitting members having key-rods adapted to engage said slots and to be placed into longitudinal alinement with each other, and a driven part connected to the transmitting members.

9. In a speed changing mechanism for automobiles, a driving part, carrying a collar, having a slot therein, transmitting members carrying key-rods adapted to be engaged by said slot and adapted to be placed in longitudinal alinement, a driven part and means between said driven part and said members for operatively connecting said driven part with whichever member is in operative connection with the driving part.

10. A speed changing mechanism for automobiles, comprising a driving shaft, a plurality of gears of various sizes, capable of operative connection with the driving shaft, a second plurality of gears meshing with the first named gears, a sleeve for the same, means for transmitting motion from the second plurality of gears to the sleeve therefor, a reversing gear also meshing with one of the first named gears, a sleeve for supporting the reversing-gear, a frame for supporting all of said gears, a driven shaft, and means for transmitting motion to the driven shaft from either of the sleeves, said means being adapted by a movement of the frame to be thrown out of engagement with one of the sleeves and into engagement with the other of the sleeves.

11. In a speed changing mechanism for automobiles, a driving shaft, a driven part, a plurality of motion transmitting members severally capable of operative connection with the driving shaft, reverse motion transmitting means, also capable of operative connection with the driving shaft, means connected with the driven shaft and normally in operative connection with the motion transmitting member then in operative connection with the driving shaft, and means for actuating said last named means for operatively connecting the reverse motion transmitting means with the driving part.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FREDERICK J. ZIEGLER.

Witnesses:

HENRY J. SUHRBIER,

M. D. AVIDON.