No. 645,902. Patented Mar. 20, 1900.

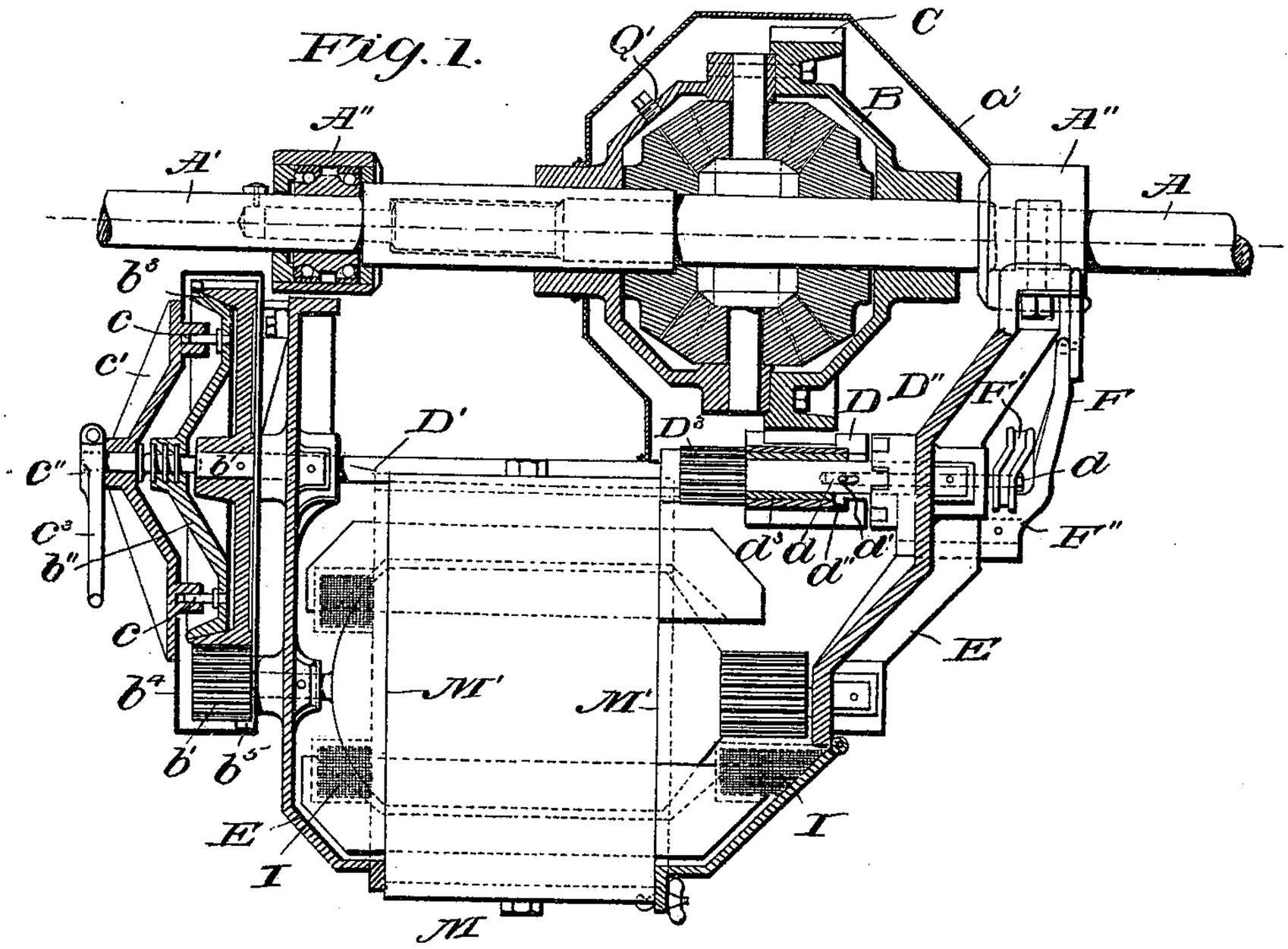
E. A. SPERRY.

MOTOR GEARING.

(Application filed Aug. 25, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



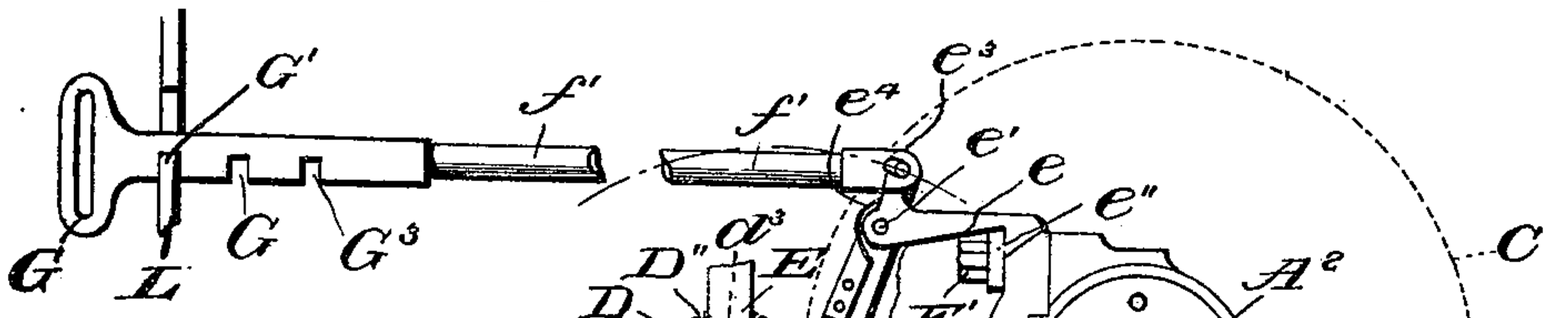


Fig. 2.

Fig. 3.

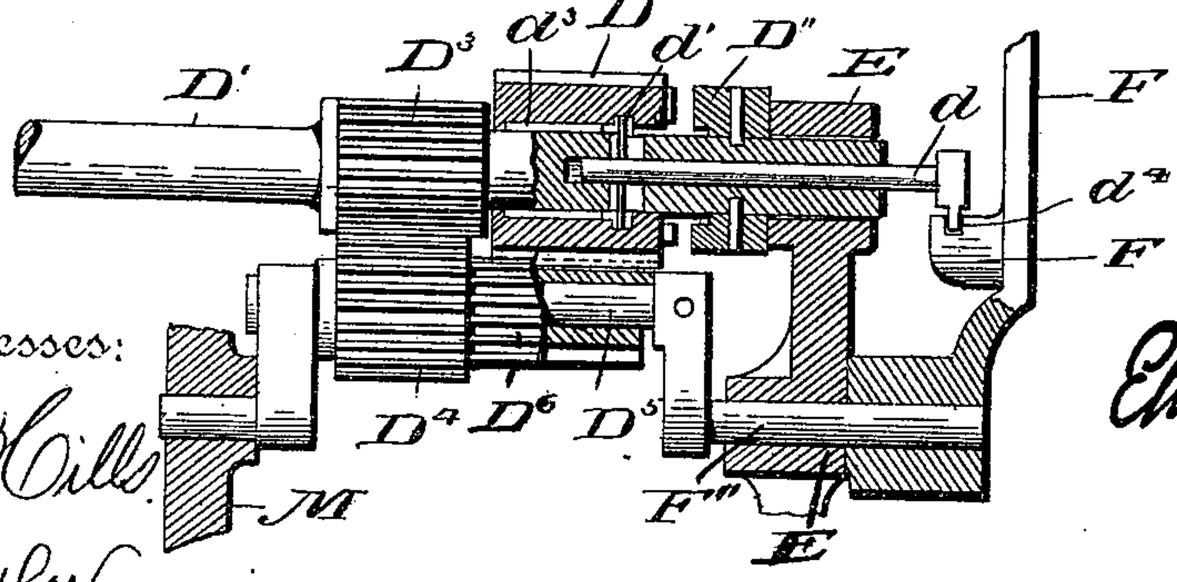


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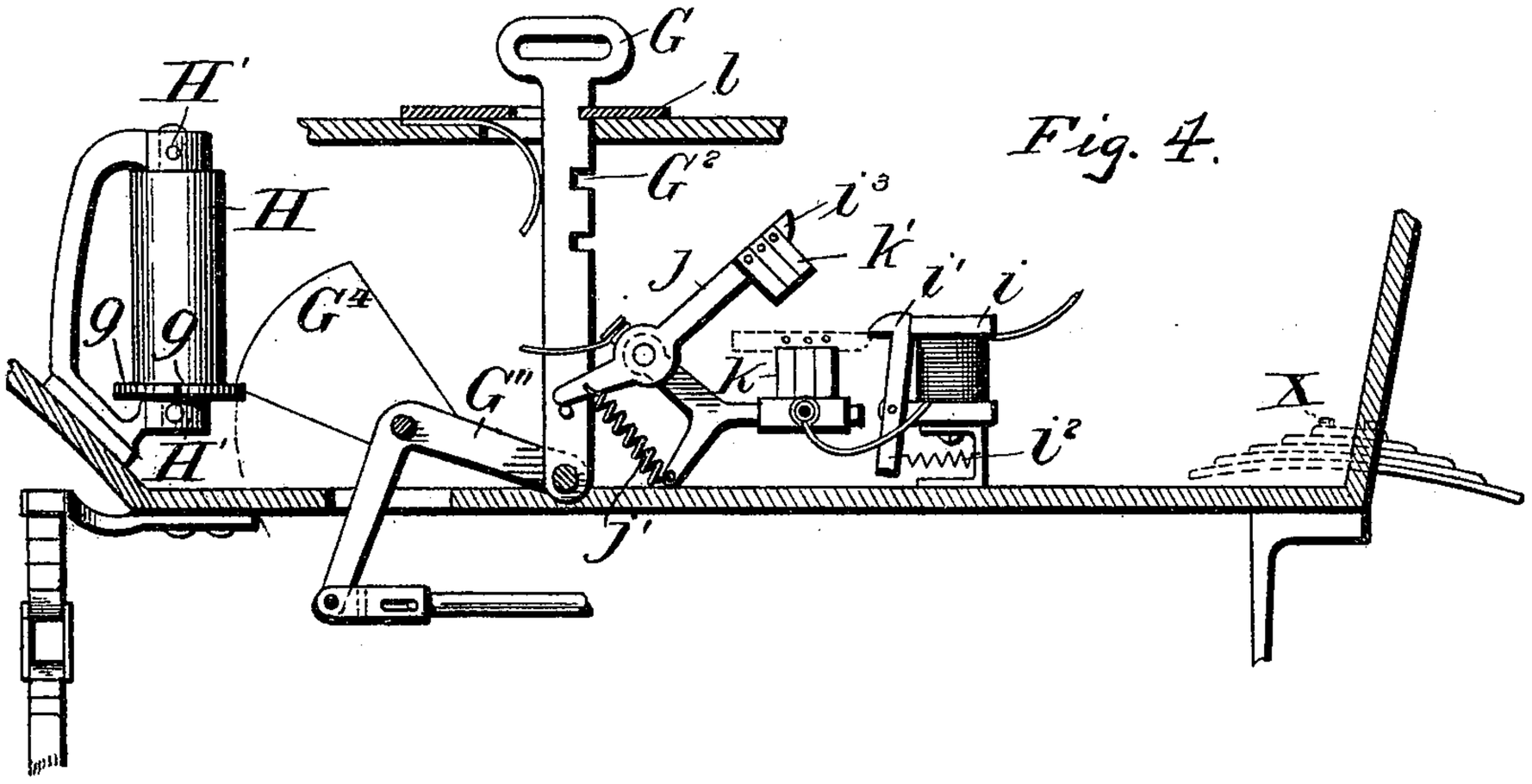
Fig. 4.



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UNITED STATES PATENT OFFICE.

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MOTOR-GEARING.

SPECIFICATION forming part of Letters Patent No. 645,902, dated March 20, 1900.

Application filed August 25, 1898. Serial No. 689,462. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Motor-Gearing, of which the following is a specification.

My invention relates to motor-gearing adapted especially for vehicles, whereby the power connections from the motor to the driving-wheels, axle, or axles may be compounded at will and the motor may be given an increased leverage over the load.

It also relates to manipulating connections for the gearing and interlocking device with the control of the vehicle, whereby the compound gearing and power connections are interrelated as to their operations, all of which is described and fully set forth in the present specification and illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of the motor housings and gearing; Fig. 2, a diagram showing arrangement of the control and lock for the change-gear devices. Fig. 3 is supplemental to Figs. 1 and 2, being a section through the intermediate shaft, showing change-gear. Fig. 4 is a diagrammatic view showing the manipulating devices mounted upon the body connected with the operating parts of the motor-gearing.

Similar letters of reference indicate like parts throughout.

Referring now to Fig. 1, let A and A′ represent the members, respectively, of a compound axle, a planetary-gear arrangement being clearly illustrated. To these shafts are connected, respectively, gears meshing with revolving pinions, all within the oil-housing B, furnished with oil-plug *a*. The housing will be seen to consist of the extended web of the gear C, which meshes with the pinion D, all within the inclosing housing *a′*. The "jack-in-the-box" structure being familiar it will not be explained in detail. The pinion D is mounted upon a shaft D′, which in turn is mounted and journaled within the motor-housings, which receive support from the journals A″ A‴, mounted upon the compound axle. The motor-housings E are secured to the circular journal-case A″ by two surfaced angular recesses, preferably parallel with the axis, for holding the parts accurately in line, being clamped by suitable bolts, (shown at E′ E′.) The shaft D′ is preferably supplied with a driving-gear *b*, which meshes with the motor-pinion *b′*. One form of a mechanical clutch or brake is shown, consisting of the disk *b″*, cooperating with the bevel-face within the gear at b^3 and supported by pins *c c*, which slide in the yoke *c′*, suitably attached to the motor frame or housing E and serving at its center to hold a rotating screw-threaded shaft *c″*, rotated by the arm c^3, the screw-threads operating to insert and withdraw the conical friction-disk *b*. All is preferably surrounded by the housing b^4, separable at b^5. The other end of the shaft D′ is socketed for the reception of the rod *d*, fitted to slide within the socket. The pin *d′*, carried by the rod *d*, extends laterally through an elongated slot (clearly seen) and having its ends securely fastened within the internal circular groove, (clearly seen at *d″*.) The rod *d* in moving backward and forward thus serves to move the pinion D, which is loose upon the shaft D′, out of and into engagement with the clutch D″, rigidly attached to shaft D′. This clutch may be of any suitable construction—such, for instance, as a friction-clutch—but I prefer to use the positive jaw-clutch shown, so that when the pinion D is slipped to the left, as shown, it is free from the clutch and to the right it is in engagement therewith. The pinion is moved by a swinging cam F′, mounted upon the cam-lever F, swinging about a pivot F″, reference to which will be made later.

Attention is called to the fact that the pinion D is in a position difficult of lubrication, which is required when the same is free upon the shaft. This of necessity is done away with by supplying it with a roller-bearing consisting of a circular roll of needles, (indicated at d^3,) this style of bearing being also adapted for longitudinal motion upon the shaft, necessary in this instance.

The shaft D′ is supplied with the rigidly-attached gear D^3. (Clearly seen in the figures.)

This gear is organized to mesh with gear D^4 on a swinging shaft D^5, (clearly seen in Fig. 3,) being pivoted at F'' in the housing E and being manipulated by lever F, which attaches to pivot F'' outside the housing. Integral with the gear D^4 and rigidly attached thereto is gear D^6, which, together with D^4, is organized to turn loosely upon the shaft D^5 and which is organized to mesh with master-pinion D, mounted loosely upon shaft D'. It will be seen that by the use of lever F the shaft D^5 is swung into and out of mesh or operative engagement with its coöperating gears, and at the same time the master-pinion D may be made to engage and disengage with its coöperating clutch D'' by means of the cam F', (clearly seen in the figures,) which is mounted upon lever F' and moves therewith. This cam engages rod *d*, provided with an engaging pin d^4, manipulating the rod *d* longitudinally within the socketed shaft D', and thus manipulating one member of the coöperating clutches. The arrangement shown in the drawings contemplates the movement of the loose pinion D longitudinally upon the shaft, so that the engaging teeth B'' may be engaged, and this action will be seen to occur at the same time that the throwing in and out of engagement of the gears upon the shaft D^5 takes place, the cam-slot being of such contour that the action is not simultaneous with the actual engagement of the gears, but rather occurs dissimultaneously or successively, the clutch being disengaged before the gears are engaged, and vice versa.

In Fig. 3 is seen the lateral pin d^4, which serves to connect the rod *d* with the cam F'. The contour of this cam is plainly seen in the figures and operates to engage the pinion D with its clutch D'' and with its coöperating gear alternately, there being a position where both are disengaged and there being a region in the center part of the cam where one is disengaged before the other is engaged and where the pinion is entirely free from either.

Owing to the mechanical strains brought to bear upon the lever F and its connected parts, a mechanical lock is used, shown by the latch *e* and its coöperating stationary part *e''*, having an undercut pawl pivoted upon the lever F at *e'* engaging the finger e^3. The finger e^3 is pressed upon at one side by a spring e^4 and upon the other side engages a pin *f*, connected rigidly with the rod *f'*. The pin *f* slides in a slot, (shown in dotted lines at F^3,) constituting a lost-motion device, in the head of the lever F, so that the pin *f* after traveling a short distance comes into rigid engagement with the lever in either one or the other direction. The rod *f* is manipulated by any suitable device—located, for instance, in a carriage. From the different diameters of the gears D^3, D^4, D^5, and D increased leverage from their use will readily be understood. It will also be seen that the pinion D serves two other gears—viz., being in constant engagement with the main driving-gear C and also at times with the gear D^6.

Suitably mounted, for instance, within a vehicle-body X (see Fig. 4) is the controller for the motor M, (indicated at H,) pivoted so as to revolve in journals H' H' and supplied at some point in its moving system—for instance, at the base of the cylinder—with a disk *g*, having notches, one of which is shown at *g'*, and which serve to allow the segment G^4 to pass freely. The segment G^4 forms a part of the manipulating system or connection for the compound gear, as described above. It will be seen that when the controller is so turned that a notch *g'* is presented in the path of the segment G^4 the handle G may be manipulated freely; but if the controller is not so turned that a notch is present the handle G is locked, and this locking action may take place in either of its extreme positions. This position I will denominate as that in which the controller is out of action—viz., when the segment G^4 is allowed to pass freely—and it will be seen that when the segment is only partially turned the controller will be locked in this position or locked out of action and prevented from turning into any one of its active positions. Moreover, it will be noticed that should the operation of the handle G be stopped in the middle of its excursion—say at notch indicated at G^3—the segment G^4 will then be found only part way through the notch, thereby effectually locking the controller H from rotation in either direction, as above referred to. Of course the notch *g'* may be a wide one, so that the lock is effectual only in one direction, without departing from the spirit of the invention.

In or about the vehicle and within operating distance of the manipulating-handle G or its connected parts is the limit-switch or automatically-operating self-releasing cut-off or cut-out. The operation of this device is well known and may be briefly referred to as follows: The magnet *i* when energized retracts its hooked armature *i'*, pivoted, as shown, against the spring *i''*, which has a predetermined tension. The hook coöperates with the nose i^3 of the lever *j*, which also is furnished with the retractile spring *j'*. The stationary contact, which may be in circuit with the magnet *i*, is shown at *k* and coöperates with the contact *k'*, mounted upon the lever *j*. When these contacts are closed, the circuit is complete and the hook *i'* engages the nose i^3 and holds the contacts in closed-circuit relation against the tension of the spring *j'*. Whenever the current increases beyond a certain strength, the hooked armature *i'* is retracted, releasing the lever *j* and allowing the spring *j'* to open the contacts *k* and *k'*. I prefer to reëngage the cut-off contacts or close

the circuit by a movement of the handle G for the following reasons, among others: first, the double use of the same handle simplifying construction and operation, and, second, when the limit-switch or cut-off operates it indicates that an extraordinary demand is being made upon the motor and may be made to indicate that the compound gear, which greatly increases the leverage of the motor over the load, should be called into operation, and it is natural that the same handle be made in this way to accomplish both purposes—viz., that of increasing the power for the motor over the load, and thereby correcting the cause, and reëstablishing the circuit, so that its operation may again go forward.

The use and operation of the various structures have been faithfully pointed out as they have been described and will readily be understood by those versed in the art to which it pertains.

It will be readily seen that some of the rotating members—for instance, shaft D′—are exposed and not housed. Such exposed rotating parts are useful in bringing the teeth of the clutch or gear opposite, so as to properly mesh when throwing the lever F. This lever, it will be noticed, may always be thrown out of gear or into its middle position from either extreme position. The rotating parts being thus freed, their rotation, as above, may be accomplished by any means, preferably without rotating the axle A, and it is found convenient for properly throwing the change-gear mechanism. The lever F or connected parts are provided with retaining means, preferably for both operative positions, as well as the central or inoperative position, one form of such locking device being shown in Figs. 2 and 4 by the notches G′ G^2 G^3, cooperating with the stationary member H, all of which may be operated by the handle G.

It will be readily understood that while it is designed to use the above parts in the relation shown, yet some may be used without the others, and the invention extends to such use.

It will be furthermore readily understood that the construction and arrangement may be varied without departing from the spirit of the invention.

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

1. In a motor-gearing, a shaft and first gear upon the shaft, a fourth gear mounted loosely upon the said shaft and a clutch upon the shaft coöperating therewith, a device for engaging and disengaging the clutch, a movable shaft, a second and third gear on said shaft, meshing in order numbered with the first and fourth gears on the first-mentioned shaft, means for swinging the movable shaft and an operating connection between the said means and the said device.

2. In a motor-gearing, a socketed shaft, a clutch upon the shaft, a gear mounted loosely upon the shaft, provided with a coöperating clutch, a device for engaging and disengaging the clutch, protruding beyond the end of the shaft from the socket, and a swinging lever, bearing a cam and operating connection between the cam and the device.

3. In a motor-gearing, a first gear suitably mounted, a fourth gear mounted loosely, a coöperating clutch for said fourth gear, a device for engaging and disengaging the clutch, a movable shaft, a second and third gear on the movable shaft, meshing with the first and fourth gears, means for swinging the movable shaft, an operating connection between the means and said device, and a socketed shaft for the said first and fourth gears and the clutch.

4. In a vehicle-motor gearing, a change-gear mechanism, an operating means extending to the mechanism, a controller for the motive power and an interlock between the means and the controller.

5. In a vehicle-motor gearing, a change-gear mechanism, an operating means, extending to the mechanism, a controller for the motive power and a device operated by the means for locking the controller out of action when the change-gear mechanism is in its disengaged position.

6. In a vehicle-motor gearing, a change-gear mechanism, an operating means extending to the mechanism, a power cut-off and an actuating device for the cut-off, operated by the means.

7. In a motor-gearing, a drive-wheel gear, a revolving source of power, an intermediate shaft between the source and the gear, having a pinion meshing with such gear and a gear which sustains the connection to the said source, the last-named gear being hollow and having an internal face, in combination with a brake organized for coöperation with the internal face of the gear.

8. In a motor-gearing, a revolving source of power, connected to the drive-wheel gear through an intermediate shaft, a large and small gear upon such shaft, the large gear being bored from one edge, offering an internal friction-surface, a non-rotatable friction member, coöperating with such surface and an operating means for such member.

9. In a motor-gearing, a shaft and first gear upon the shaft, a fourth gear mounted loosely upon said shaft, and a clutch upon the shaft coöperating therewith, a device for engaging and disengaging the clutch, a movable shaft, a second and third gear on said shaft meshing in the order numbered with the first and fourth gears on the first-mentioned shaft, means for swinging the movable shaft, an operating connection between the means and the device, and a locking device for the means.

10. In a motor-gearing, a shaft and first

gear upon the shaft, a fourth gear mounted loosely upon said shaft, and a clutch upon the shaft coöperating therewith, a device for engaging and disengaging the clutch, a movable shaft, a second and third gear on said shaft meshing in the order numbered with the first and fourth gears on the first-mentioned shaft, means for swinging the movable shaft, an operating connection between the means and the device, and a three-position locking device for the means, whereby the same may be retained in its two operative and also in its inoperative positions.

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