No. 749,704. PATENTED JAN. 12, 1904.

C. C. & E. A. RIOTTE.

DRIVING MECHANISM.

APPLICATION FILED SEPT. 3, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

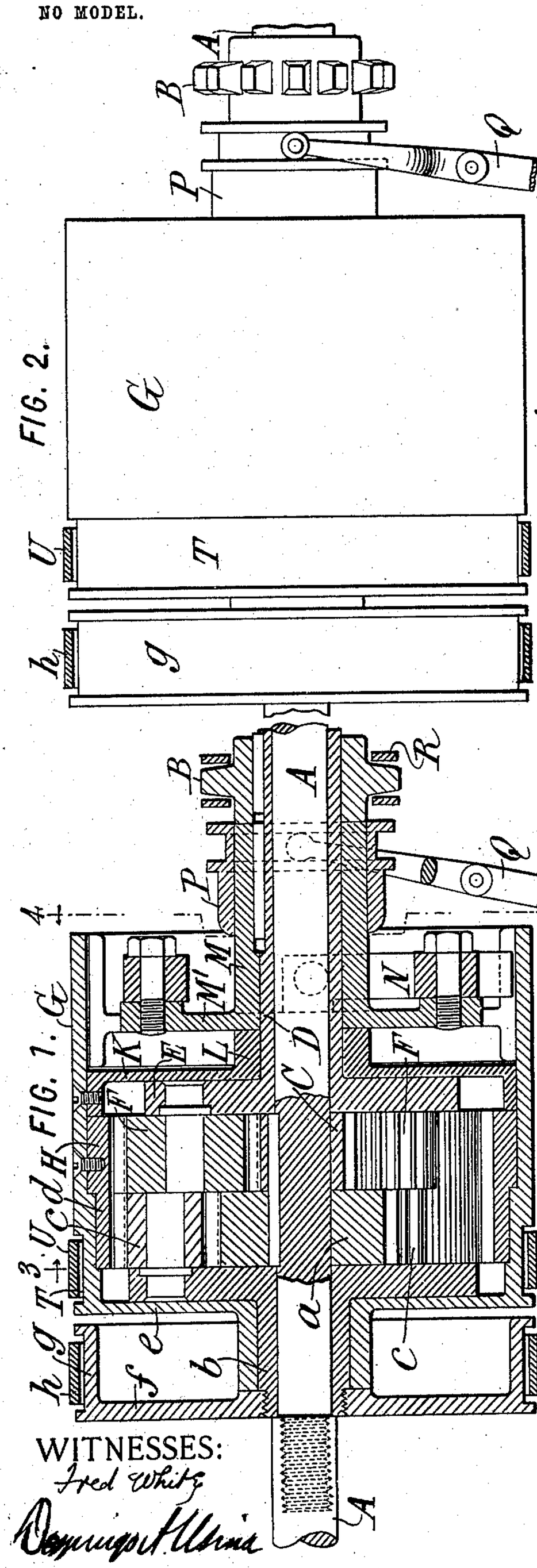

FIG. 2.

FIG. 1.

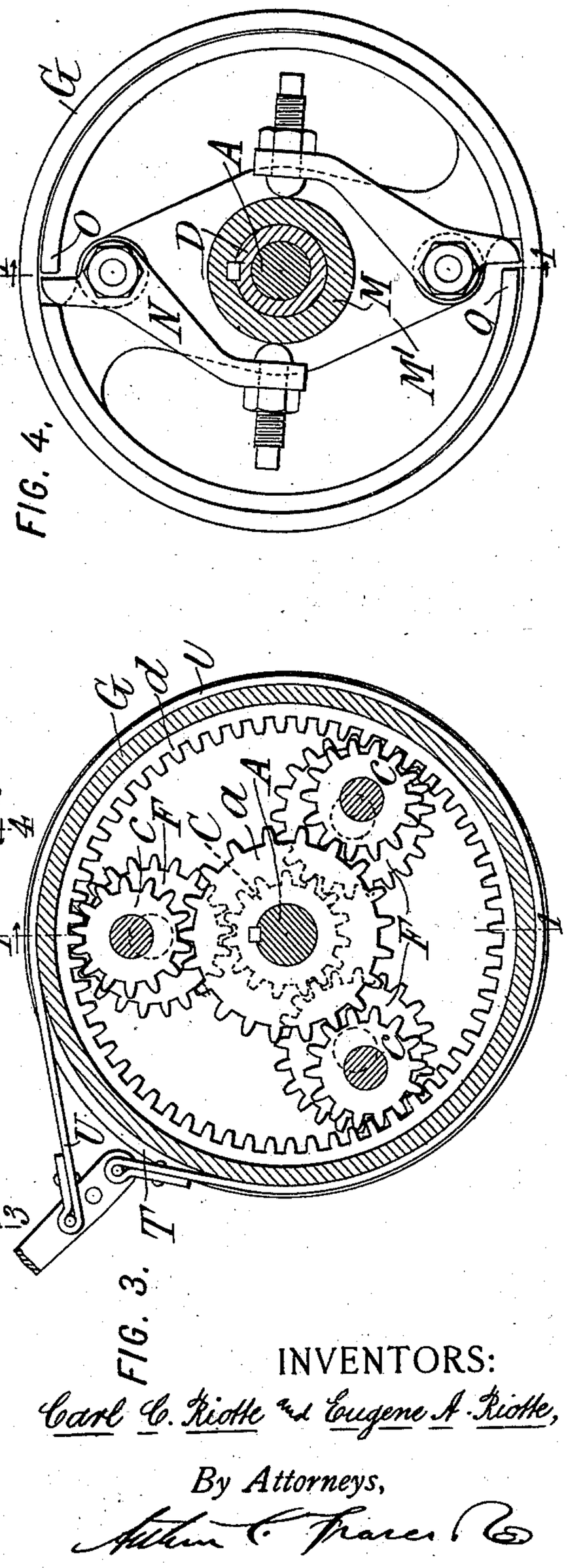

FIG. 4.

FIG. 3.

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NO MODEL. 2 SHEETS—SHEET 2.

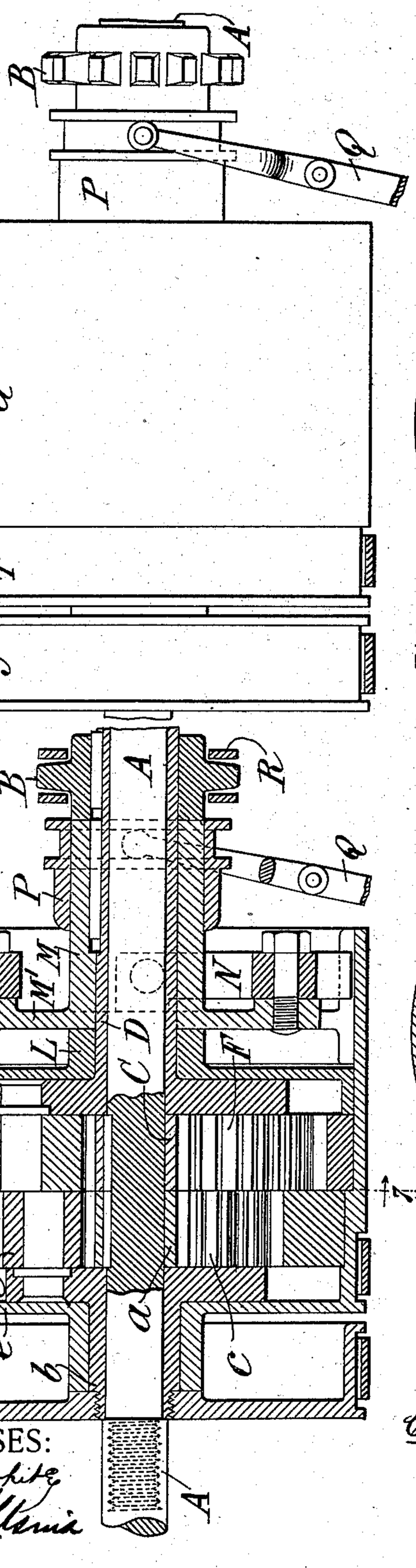

FIG. 6.

FIG. 5.

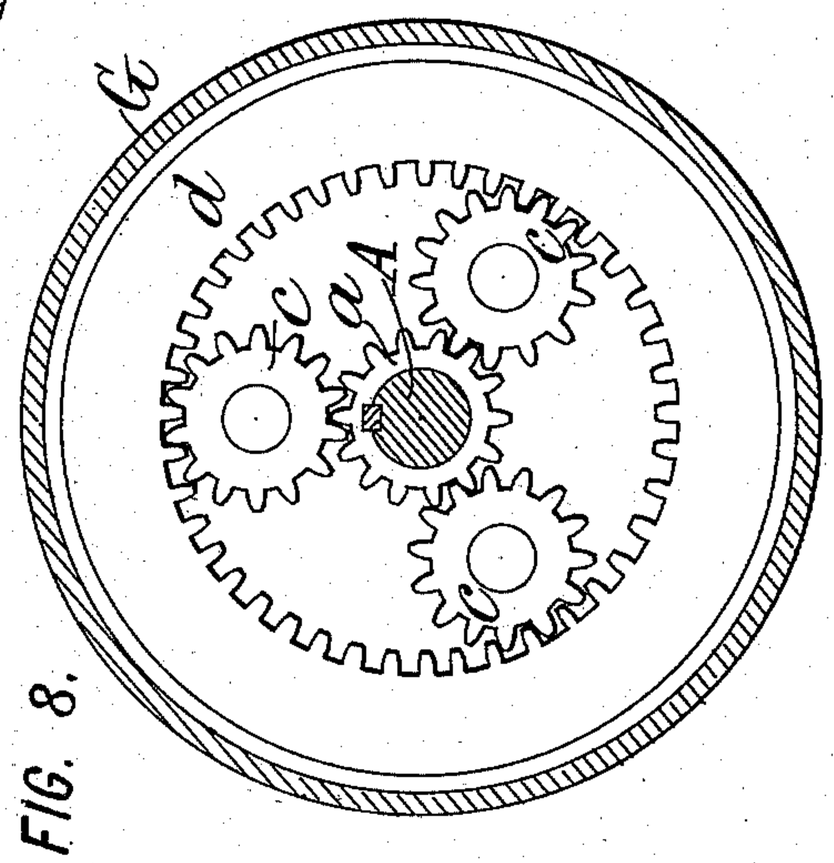

FIG. 8.

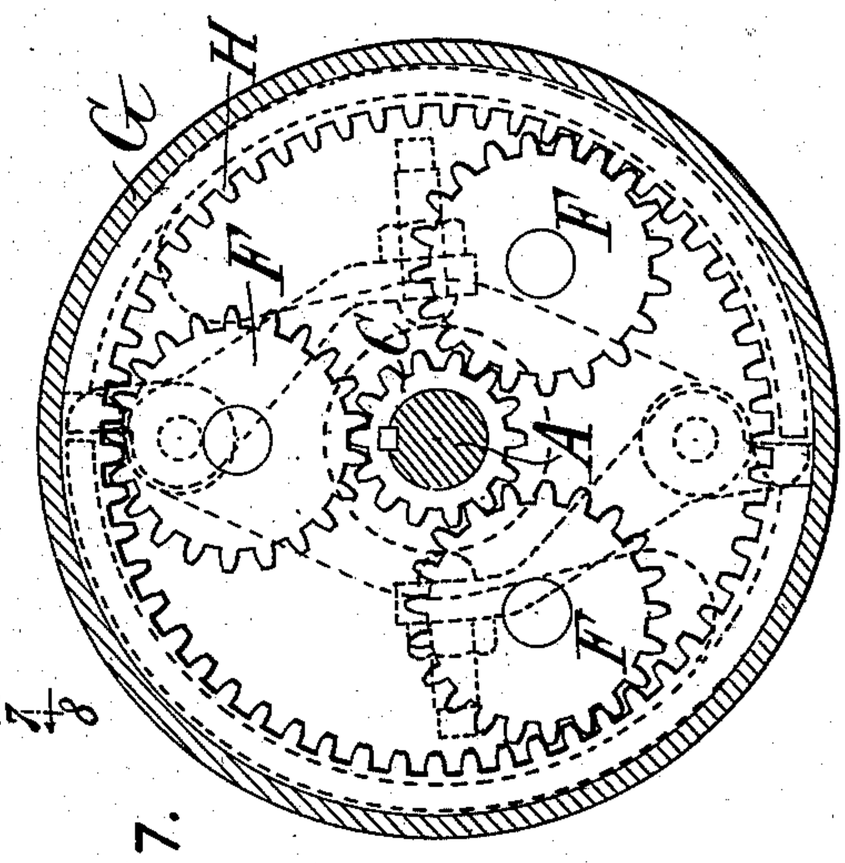

FIG. 7.

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No. 749,704. Patented January 12, 1904.

UNITED STATES PATENT OFFICE.

CARL C. RIOTTE AND EUGENE A. RIOTTE, OF NEW YORK, N. Y.

DRIVING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 749,704, dated January 12, 1904.

Application filed September 3, 1901. Serial No. 74,116. (No model.)

To all whom it may concern:

Be it known that we, CARL C. RIOTTE and EUGENE A. RIOTTE, both citizens of the United States, and residents of the borough of Manhattan, city, county, and State of New York, have jointly invented certain new and useful Improvements in Driving Mechanism, of which the following is a specification.

This invention relates to driving mechanism and devices of the class in which either variable speeds or reverse motions, or both, are obtained from a continuously-operating driving part. Various devices for accomplishing these results have been heretofore employed, which have utilized multiplying or reversing gearing, or both, between the driving and the driven part and means for throwing the different gears into and out of operation for effecting the various results desired.

Our invention aims to provide a simple, strong, and compact driving mechanism which can be easily and accurately constructed without extraordinary expense, which is preferably so arranged as to be well protected from dust or moisture, and which is easily manipulated, so as to obtain a convenient number of different motions from a constantly-running shaft, being especially adapted in these qualities and in others hereinafter recited for use in automobiles and similar mechanism.

Our invention aims to provide also a mechanism having the advantages stated and which, in addition, includes reversing-gearing as well as variable-speed gearing. In this embodiment of our invention we are able to start a forward motion slowly or to go ahead with full speed or to reverse and drive backward with a high leverage and slow speed.

Our invention provides also various other improvements in detail, as hereinafter specified.

Referring to the accompanying drawings, illustrating embodiments of our invention, Figure 1 is a diametral section on the line 1 1 of Fig. 3. Fig. 2 is a side elevation. Fig. 3 is a section on the line 3 3 of Fig. 1. Fig. 4 is a section on the line 4 4 of Fig. 1. Figs. 5 and 6 are views, similar to Figs. 1 and 2, of a modification. Fig. 7 is a section on the line 7 7 of Fig. 5 looking in the right-hand direction. Fig. 8 is a section on the same line looking in the left-hand direction.

The speed varying or controlling elements of our invention include a driving part and a driven part, the driving part being preferably a shaft and being surrounded by a rack mounted to rotate thereabout. The driving part is connected with the rack by means of interposed gearing, which gearing is connected with the driven part, and means are provided for locking the driven part directly to the rack which surrounds the driving part, such means being separate from the driven part and from the rack, so as to be movable independently thereof. By means of this combination of parts we secure the modes of operation hereinafter described. We may also provide additional gearing for transmitting motion from the power-shaft to the rack—as, for example, in the reversing mechanism hereinafter described.

In introducing reversing mechanism as well as speed-varying mechanism we prefer to arrange on the power-shaft a pair of gears each of which meshes with a planetary pinion operating around the shaft and each of which pinions meshes also with a surrounding internal gear or rack, said internal gears or racks being arranged for connection by means of a clutch with a driven part, which driven part may be any suitable transmitting means for transmitting the power to the point at which it is to be used.

Referring now to the drawings, let A indicate a driving part in the form of an ordinary driving-shaft, and B a driven part in the form of a sprocket-wheel for transmitting power to another point, between and connecting which parts are the gears for transmitting the motion from one to the other and the means for controlling the operation of these gears. The gears are shown as spur-gears, pinions, and internal gears or racks and the controlling means as clutches or brakes. It is understood, however, by those familiar with the art that such gearing and controlling means may be varied within a considerable range of equivalents without departing from our invention, the parts shown being taken as convenient examples for illustrating our present

improvements. In the construction shown a spur-gear C is keyed to and revolves with the shaft A. The gear may of course be integral with the shaft instead of being made separately and keyed thereto, as shown. Journaled on the shaft at one side of this gear is a sleeve D, which supports a pinion-carrier E for carrying one or more planetary pinions F, meshing with the gear C. Surrounding the shaft rotatably, preferably by being journaled on the sleeve D, as shown, is a drum G, and on the inner face of said drum is an internal gear or rack H. The drum has a bearing on the sleeve D, as explained, by means of a head K, extended at the point at which it surrounds the bearing to form a hub L. The head K is shown as an imperforate wall coming close against the side of the carrier E and inclosing this carrier and the gears, pinions, and racks against the admission of dirt or moisture at this end of the mechanism. This head K serves also to hold the drum in position in the construction shown. At a point between the driven part and the drum I locate a suitable connecting means—such, for example, as a friction-clutch—which is separate from both the driven part and the drum, so that these parts may be fixed always at the same point on the shaft, and only the clutch needs to move in order to connect or disconnect such parts. In the specific construction shown the sleeve D is continued so as to project outwardly beyond the hub L and beyond the end of the drum, and at a point beyond the hub L it carries a second hub M, which in turn carries a slitted or cut-away disk M′ of the ordinary friction-clutch illustrated in Fig. 4 or of any other suitable form of friction-clutch. As shown, the disk M′ has projecting circumferential flanges fitting within and adjacent to the inner surface of the open projecting end of the drum G. On the disk M′ one or more levers N are mounted, and the outer ends of said levers bear against the free ends O of the circumferential flanges, as shown. The inner ends of the levers N normally bear against the hub M; but when forced away from said hub they cause the outer ends of the levers to bear against the free ends O of the flanges, and thus widen the slit between the flanges at this point, and so spread the flanges to tightly engage the inner face of the drum. The levers are operated by the usual grooved collar P, in the groove of which the pins on the end of a forked lever Q engage. The collar P is beveled on its inner end in the usual way, so that it may be forced between the ends of the levers N to operate them. Preferably outwardly of the collar P, as shown, the driven part B is connected to the sleeve D in any suitable manner. In the construction shown as the driven part is a sprocket-wheel it is simply keyed to the sleeve. A sprocket-chain R is shown for transmitting motion from the sprocket-wheel B.

The internal face of the drum G, which operates in connection with the friction-clutch, is of preferably the same length as the flanges of the disk M′. On its exterior the drum is provided with a clutch or brake surface, (shown as a groove T,) surrounding which is a strap-brake or clutch U, which may be operated in any suitable or usual way.

Each of the planetary pinions F is shown as detachably carried on an axle the shank of which is fixed in the carrier E, the faces of the pinions being flush with the ends of the studs, so that the pinions can be held in place by means of any mechanical element juxtaposed to the outer faces of the pinions—as, for example, by the mechanism shown and hereinafter described or by means of a simple ring fastened to the inside of the drum, as shown in my pending application, Serial No. 53,051, filed March 27, 1901.

The head K is inserted and fastened to the drum after the gears are assembled and holds them firmly in place. The overhanging end of the drum incloses the clutch-disk M′ and its levers N and protects them against injury, while the open end of the drum permits the escape of any oil which may leak into the clutch-chamber, in which these parts are mounted.

In operation with the construction described the clutch U is the starting or slow-speed clutch and the clutch-disk M′ is the full-speed clutch. The shaft A being continuously driven forward, when both clutches are off the resistance of the driven part B is ordinarily sufficient to hold the carrier E stationary, whereupon the drum will be revolved rearwardly at a reduced speed, according to the difference between the diameters of the gear C and the rack H. During this operation the drum is doing no work, but is passively revolving. To start slow driving ahead, the clutch U will be applied to arrest the rotation of the drum, whereupon the forward rotation of the shaft A will cause the planetary pinions F to roll forwardly around the rack H, in which motion the motion of their axes or studs will be transmitted to the carrier E and through the sleeve D to the sprocket B, driving the sprocket-wheel continuously at half the speed of the shaft. To drive forward at full speed, the starting-clutch U will be released and the full-speed clutch applied through the lever Q, locking the drum G and the sleeve D tightly together, thus preventing movement of the axes of the planetary pinions F relatively to the drum, and consequently converting these pinions into a fixed driving connection between the shaft and the sleeve, which in turn drives the driven part B. As soon as this occurs the sleeve D and the sprocket B will revolve forwardly at the same speed as the shaft.

By the use of friction-clutches, as shown, the starting of the mechanism at a slow speed

may be accomplished gradually—that is to say, by pressing more or less on the lever which operates the friction-clutch the speed is gotten up faster or slower. The same is true in changing from a slow speed to a high speed, the friction-clutches shown making it possible to increase the speed without any interruption of the operation and so gradually as to be hardly perceptible. In the class for which our improved mechanism is specially devised—namely, automobile driving mechanism—it is essential that the speed shall be capable of change without stopping the entire machine and that it shall therefore be possible to make the change gradually from one speed to another; also that it shall be possible to maintain for a time speeds intermediate between the highest and lowest, which, of course, is done by applying the friction devices with more or less pressure, so that they form a sort of impositive lock between the parts to be clutched together. This feature of our invention, in connection with the elements previously described, we consider to be of the greatest importance, as adapting to automobile use a mechanism which would otherwise be useless for such apparatus. Furthermore, by the use of both clutches we are enabled simultaneously to lock the driven part directly to the rack and then to limit rotation of the rack, so as to gradually or suddenly, as desired, reduce the speed of rotation of the driven part—a feature which would be impossible with any other than friction-clutches. In similar mechanism there have previously been combined various positive clutches adapted to be operated only when the elements of the mechanism are brought to a particular relative position. By the use and arrangement of our improved friction-clutches with the advantages enumerated we have obviously produced a mechanism of the highest degree of utility.

We have illustrated the embodiment of our invention above described in what seems to us its most practical form; but it is apparent to the skilled mechanic that many changes in the device may be made without departing from the spirit of the invention, or that various additions thereto may be made, so as to obtain greater variation in modes of operation without modifying our mechanism, as above described, and without departing from the invention embodied therein. For example, we have shown our above-described invention in connection with other improvements, whereby, among other advantages, reversibility is secured. This reversibility is arranged so that the machine may be driven backward with a slow speed and at a high leverage. For this purpose we preferably provide a second gear on the shaft, a second planetary pinion, and a second sleeve carrying a rack or internal gear intermeshing with the second planetary pinion, these parts being combined according to any suitable arrangement to secure the results herein specified and preferably according to either one of the two arrangements illustrated.

Referring to Figs. 1 and 5, *a* is a second gear keyed to the shaft A, similarly to the gear C. A sleeve or hub *b* carries the planetary pinions *c*, meshing with the gear *a* and rotating about the same, and meshing also with an internal gear or rack *d*, the pinions *c* and rack *d* being similar to the pinion F and rack H. Preferably the gears and pinions are juxtaposed, as illustrated, so as to form a perfectly compact mechanism and so that each of the planetary pinions holds the other from longitudinal movement on its axle, as previously explained. In order to secure the desired difference of leverage, the ratio of the diameters of the shaft-gear C and the drum-gear H differs from that of the diameters of the second shaft-gear *a* and its drum-gear *d*. This difference may be obtained by making the two shaft-gears of the same size and the two drum-gears or racks of different sizes or in any other desired way; but I prefer to make the two drum-gears of the same diameter and integral with each other, so that the teeth thereof may be cut at one operation, and thus save duplicating the most expensive step in the manufacture of the mechanism. The gears H and *d* are held against longitudinal movement by shoulders on the inner face of the drum G, as shown, and by the head K, as previously described, set-screws being preferably used for additional security and also to prevent relative rotary movement of the gears and drum. The drum G has a head *e*, which serves to inclose the mechanism at this end and which is journaled on the hub *b*, as shown. The driving and reversing mechanism is therefore inclosed in a dust and oil tight chamber. The heads K and *e* serve also to hold the drum in position in the construction shown. The hub *b* projects outwardly beyond the sleeve of the head *e*. Fixed to this projecting end is a brake or clutch mechanism, preferably comprising a disk *f* with a strap brake-face *g*, around which extends a strap-brake *h*. By this means the rotation of the planetary pinions *c* is controlled. This brake *h* may be used either in reverse driving or in braking.

The starting and full-speed clutches having been described, we will now describe the operation in connection with the reversing or braking clutch. For reverse driving, the clutch M′ and the brake U being released, the brake *h* will be applied to hold the pinion-carrier *b* and the planetary pinions *c* stationary. This will cause the pinions *c* to rotate around their stationary studs, and in doing this they will drive the drum rearward at a speed of rotation proportioned to the difference between the number of teeth in the gear *a* and the number of teeth in the rack *d* and a linear speed equal to that of the gear *a*. The reverse motion of the drum will be transmitted to the

rack H and thence to the planetary pinion F, which will be revolved rearwardly at a speed determined by the number of teeth in the rearwardly-revolving rack H and the number of teeth in the forwardly-revolving gear C. As the diameter of the gear *a* is greater than that of the gear C, the linear velocity of rotation of the rack H will be greater than that of the gear C, and the ultimate movement of the studs of the planetary pinions F will be in a backward direction, whose velocity is determined by the difference between the diameters of the gears *a* and C, (supposing the racks *d* and H to be of the same diameter.) The reverse driving is therefore accomplished by a truly differential gearing. The motion of the studs of the planetary pinions F is transmitted directly to the driven member B. The speed and leverage for the different connections may of course be varied at will. The arrangement which we have shown gives a slow reverse speed and a high leverage for the rearward movement as compared with the speed and leverage for the forward movement.

In the construction shown in Figs. 5 and 6 we preserve the same general features; but instead of making the two drum gears or racks the same size we make the two shaft-gears of the same size and obtain a differential effect by varying the relative sizes of the drum-gears. This accomplishes the same mode of operation and enables us to make the shaft-gears either in one piece or in two separate pieces, as shown.

Various other embodiments of our invention may be made without departing from the spirit of the invention.

What we claim is—

1. The combination of a driving part, a driven part mounted to rotate around the driving part, a drum mounted to rotate around the driving part, a rack carried by said drum, means to limit the rotation of said drum, a gear carried by the driving part, a pinion in mesh with said gear and said rack, means for supporting said pinion rigidly connected with said driven part, and connecting means for connecting said driven part with said drum, said connecting means being independent of the gearing and of the means for limiting rotation of the drum and being located between and separate from said driven part and said drum.

2. The combination of a driving part, a driven part mounted to rotate around the driving part, a drum mounted to rotate around the driving part, a rack carried by said drum, a friction-brake arranged to limit the rotation of said drum, a gear carried by the driving part, a pinion in mesh with said gear and said rack, means for supporting said pinion rigidly connected with said driven part, and friction devices independent of said brake for connecting said driven part with said drum independently of the gearing, said friction devices being located between and separate from said driven part and said drum.

3. The combination of a driving part, a sleeve mounted to rotate around the driving part, a driven part carried by said sleeve, a drum mounted to rotate around said driving part and having an end projecting over said sleeve, a rack carried by said drum, means to limit rotation of said drum and rack, a gear, a pinion in mesh with said gear and said rack, said sleeve having an extension for supporting said pinion, and means carried by said sleeve within the projecting end of said drum to lock the sleeve to said drum.

4. The combination of a driving part, a driven part, a rack independent of the driven part mounted to rotate around the driving part, gearing connecting the driving part with the driven part and with said rack, and friction devices for locking the driven part to said rack independent of the gearing, and additional gearing for transmitting motion from said driving part to said rack.

5. The combination of a driving part, a driven part, a rack independent of the driven part mounted to rotate around the driving part, gearing connecting the driving part with the driven part and with said rack, means to limit rotation of said rack, means for locking the driven part directly to said rack, and additional gearing for transmitting motion from said driving part to said rack.

6. The combination of a driving part, a driven part, a member mounted to rotate freely around the driving part, a rack carried by said member, a gear carried by the driving part, a pinion in mesh with said rack and gear, means rigidly connected to the driven part for supporting said pinion, and friction devices independent of the gearing for locking the driven part to said member, and additional gearing for transmitting motion from said driving part to said rack.

7. The combination of a driving part, a driven part, a member mounted to rotate freely around the driving part, a rack carried by said member, a brake to control the rotation of said member, a gear carried by the driving part, a pinion in mesh with said rack and gear, means rigidly connected to the driven part for supporting said pinion, and friction devices for connecting the driven part with said member independent of the gearing, and additional gearing for transmitting motion from said driving part to said rack.

8. In combination, a power-shaft, a pair of gears carried thereby, a pair of sleeves on said shaft, a pinion carried by each of said sleeves, each pinion meshing with one of said gears, a drum, a pair of gears carried thereby each of which meshes with one of said pinions, means for transmitting the motion of said shaft, and a clutch between said transmitting means and said drum.

9. In a driving-gear, a power-shaft, a pair

of gears carried thereby, a pair of sleeves journaled thereon, a pinion carried by each of said sleeves, each pinion meshing with one of said gears, a drum, a pair of gears carried thereby each meshing with one of said pinions, the relative diameter of the first shaft-gear and drum-gear differing from that of the second shaft-gear and drum-gear, power-transmitting means connected to one of said sleeves, and a clutch acting between such sleeves and said drum.

10. In a driving-gear, a power-shaft, a pair of gears carried thereby, a pair of sleeves journaled thereon, a pinion carried by each of said sleeves, each pinion meshing with one of said gears, a drum, a pair of gears each carried thereby meshing with one of said pinions, the relative diameter of the first shaft-gear and drum-gear differing from that of the second shaft-gear and drum-gear, power-transmitting means connected to one of said sleeves, a clutch acting between such sleeve and said drum, and a brake for said drum.

11. In a driving-gear, a power-shaft, a pair of gears carried thereby, a pair of sleeves journaled thereon, a pinion carried by each of said sleeves, each pinion meshing with one of said gears, a drum, a pair of gears carried thereby each meshing with one of said pinions, the relative diameter of the first shaft-gear and drum-gear differing from that of the second shaft-gear and drum-gear, power-transmitting means connected to one of said sleeves, a clutch acting between such sleeve and said drum, a brake for the other of said sleeves, and a brake for said drum.

12. The combination with a driving part, a driven part, a sleeve mounted to rotate around the driving part and to which the driven part is connected, a rack mounted to rotate around the driving part, a gear in mesh with said rack, means for communicating independent rotation from the driving part to said gear, means connected with said sleeve for locking it in connection with the driving part, and means for connecting said gear with said sleeve to actuate the latter and the driven part by the movement of said gear along said rack, of a second sleeve mounted to rotate around the driving part, a second rack independent of the driven part, a second gear in mesh with said second rack, means for communicating independent rotation from the driving part to said second gear, and means for locking said second sleeve against rotation, whereby when said second sleeve is locked the driven part will be operated in reverse direction.

13. The combination with a driving part, a driven part, a rack independent of the driven part mounted to rotate around the driving part, gearing connecting the driving part with the driven part and with said rack, and means for locking the driven part to said rack independent of the gearing, of a second rack independent of the driven part and mounted to rotate around the driving part, a gear driven by the driving part and mounted to rotate around the latter and meshing with said second rack, and means for preventing rotation of the last-mentioned gear around the driving part, whereby the driven part can then be driven in reverse direction.

14. The combination with a driving part, a driven part, a rack independent of the driven part mounted to rotate around the driving part, gearing connecting the driving part with the driven part and with said rack, means to limit rotation of said rack, and means for locking the driven part directly to said rack, of a second rack independent of the driven part and mounted to rotate around the driving part, a gear connecting the driving part with said second rack and mounted to rotate around the driving part, and means to limit the rotation of the last-mentioned gear, and means for locking said second rack directly to the driven part.

15. The combination with a driving part, a driven part, a member mounted to rotate freely around the driving part, a rack carried by said member, a gear carried by the driving part, a pinion in mesh with said rack and gear, means rigidly connected to the driven part for supporting said pinion, and means independent of the gearing for locking the driven part to said member, of a second rack carried by said member, a second gear carried by the driving part, a second pinion in mesh with said second rack and said second gear, and mounted to rotate around the latter, and means to limit rotation of said second pinion, whereby the driven part may be driven in reverse direction.

16. The combination with a driving part, a driven part, a member mounted to rotate freely around the driving part, a rack carried by said member, a brake to control the rotation of said member, a gear carried by the driving part, a pinion in mesh with said rack and gear, means rigidly connected to the driven part for supporting said pinion, and friction devices for connecting the driven part with said member independent of the gearing, of a second rack mounted to rotate around the driving part, a second gear carried by the driving part, a second pinion in mesh with said second rack and said second gear and mounted to rotate around the latter, a second brake controlling such rotation of said second pinion, and means for connecting said second rack with the driven part independent of the gear.

17. The combination with a driving part, a driven part mounted to rotate around the driving part, a drum mounted to rotate around the driving part, a rack carried by said drum, means to limit the rotation of said drum, a gear carried by the driving part, a pinion in mesh with said gear and said rack, means for supporting said pinion rigidly connected with said driven part, and means independent of the gearing for connecting said driven part

with said drum, of a second rack carried by said drum, a second gear carried by the driving part, a second pinion in mesh with said second gear and said second rack and mounted to rotate around the driving part, means for supporting said second pinion, and means for preventing rotation of said second pinion around the driving part, whereby the driven part can be driven in reverse dircction.

18. The combination with a driving part, a sleeve mounted to rotate around the driving part, a driven part carried by said sleeve, a drum mounted to rotate around said driving part, a rack carried by said drum, means to limit rotation of said drum and rack, a gear, a pinion in mesh with said gear and said rack, said sleeve having an extension for supporting said pinion, and means carried by said extension to lock the latter to said drum, of a second sleeve mounted to rotate around the driving part, a second rack carried by said drum, a second gear, a second pinion in mesh with said second gear and said second rack and mounted to rotate around the driving part, and means for preventing rotation of said second pinion, whereby the driven part can be driven in reverse direction.

19. A reversible and variable-speed planetary gearing, comprising a driver, a sun-gear keyed to said driver, a single set of planet-gears engaging said sun-gear, an internal gear engaging and encircling said planet-gears, a driven member, a planet-gear carrier, and a plurality of locking devices whereby the internal gear and the said planet-gear carrier may be locked together, so as to cause the driven member to rotate in unison with the said driver, and whereby relative rotation may be caused between said planet-gear carrier and said internal gear, so as to either reverse or vary the speed of said driven member.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

CARL C. RIOTTE.
EUGENE A. RIOTTE.

Witnesses:
FRED WHITE,
EDWARD A. CULLEN.