P. N. RAMSEY.

VARIABLE SPEED MECHANISM.

APPLICATION FILED JAN. 13, 1904.

912,487.

Patented Feb. 16, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

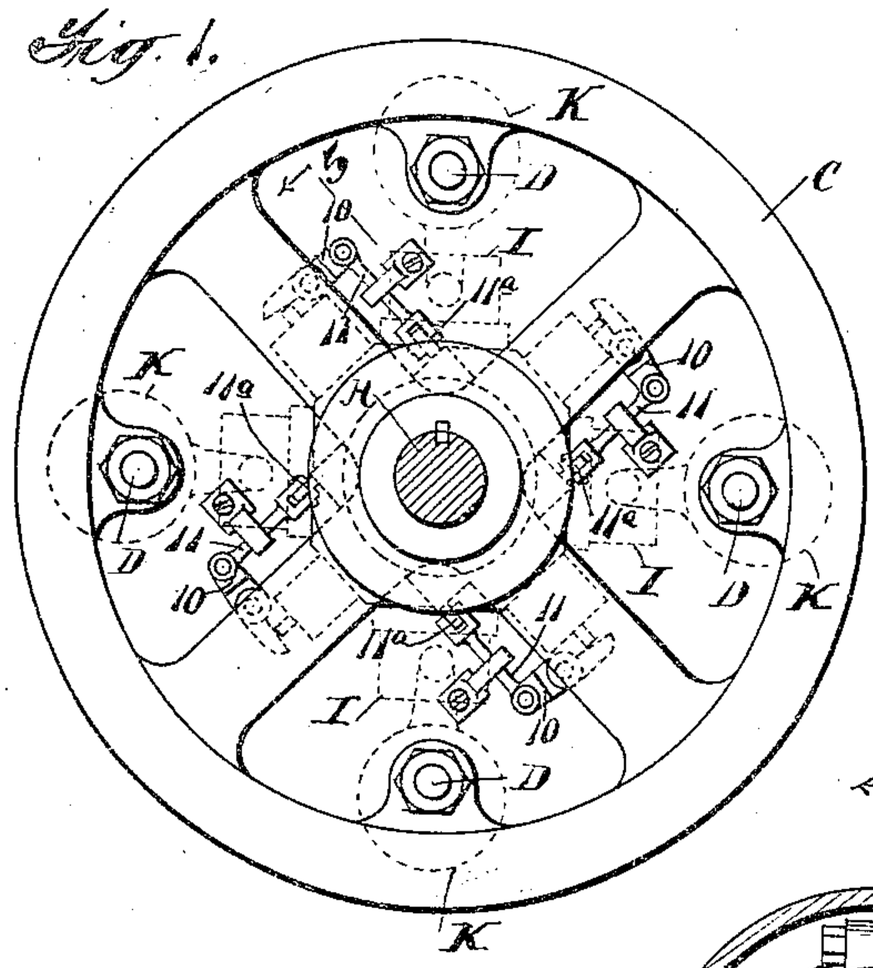


Fig. 2.

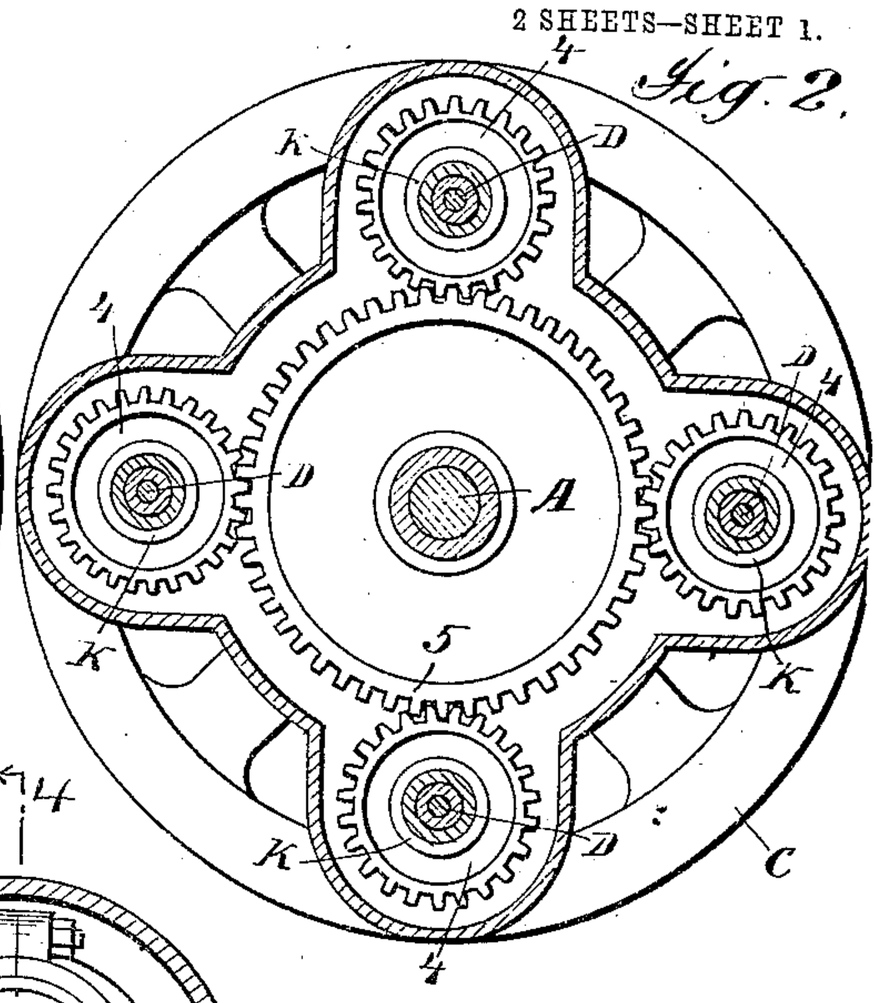
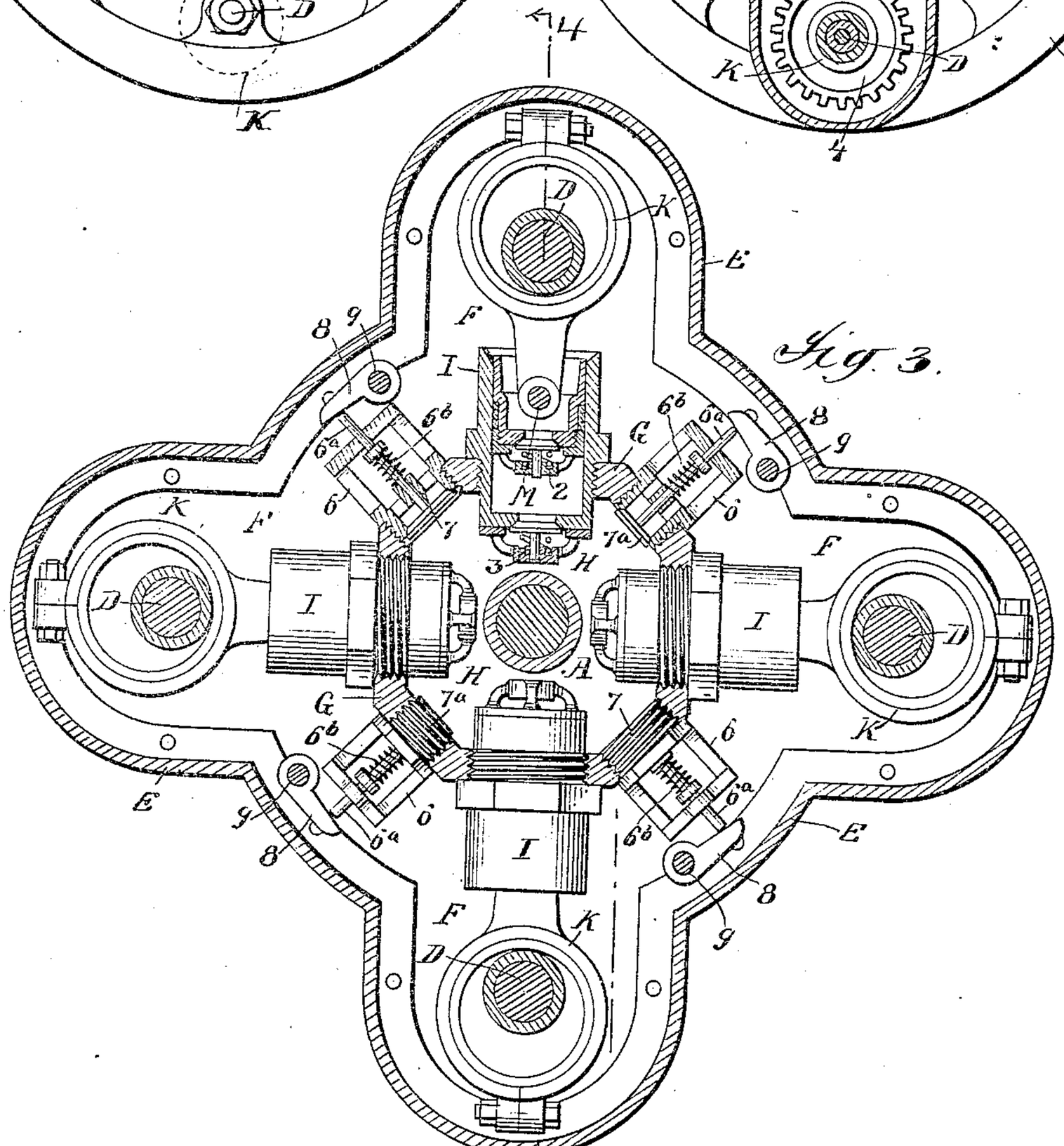


Fig. 3.



Witnesses

P. A. Shoe

E. Winthrop

Inventor

Peter N. Ramsey

By his Attorneys

Philip Lawyer Rice & Kennedy

P. N. RAMSEY.

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2 SHEETS—SHEET 2.

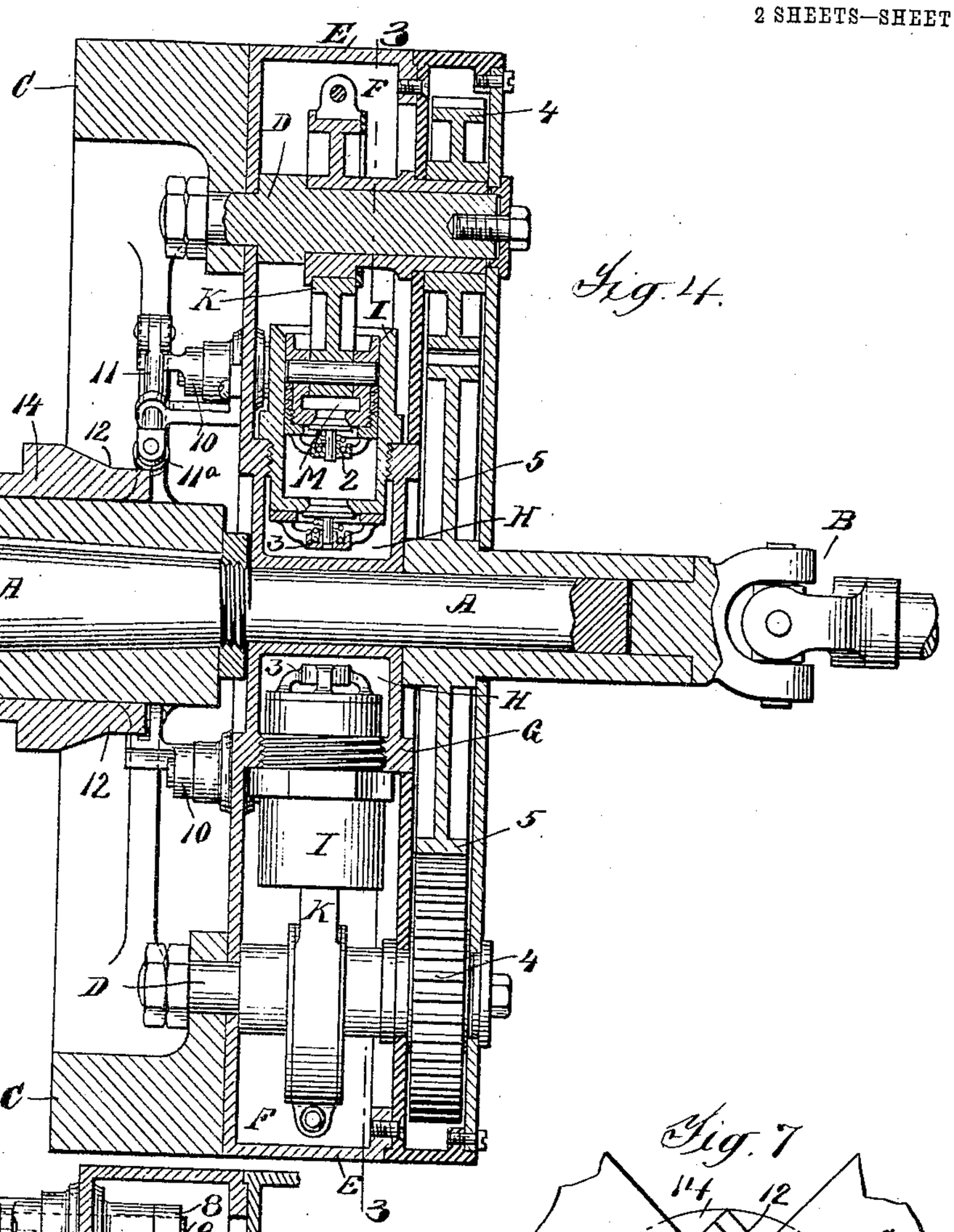

Fig. 4.

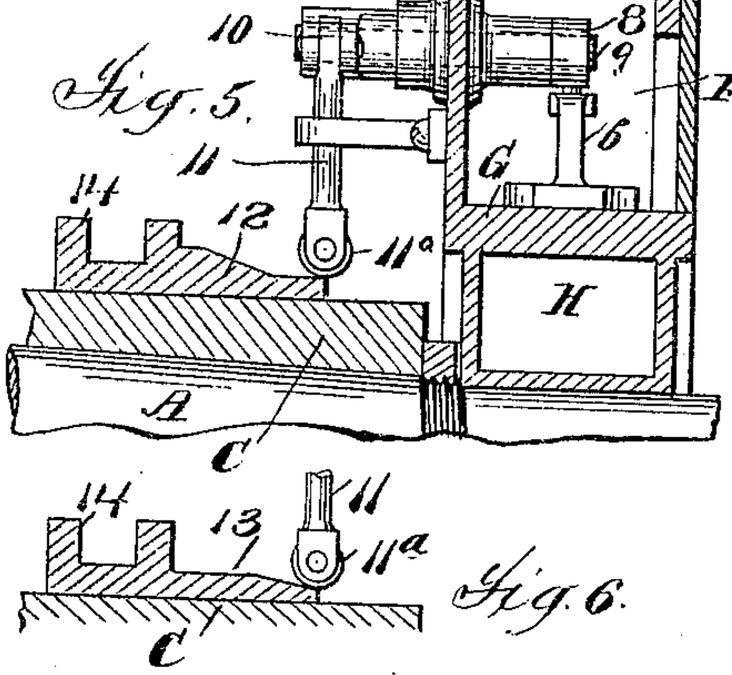

Fig. 5.

Fig. 6.

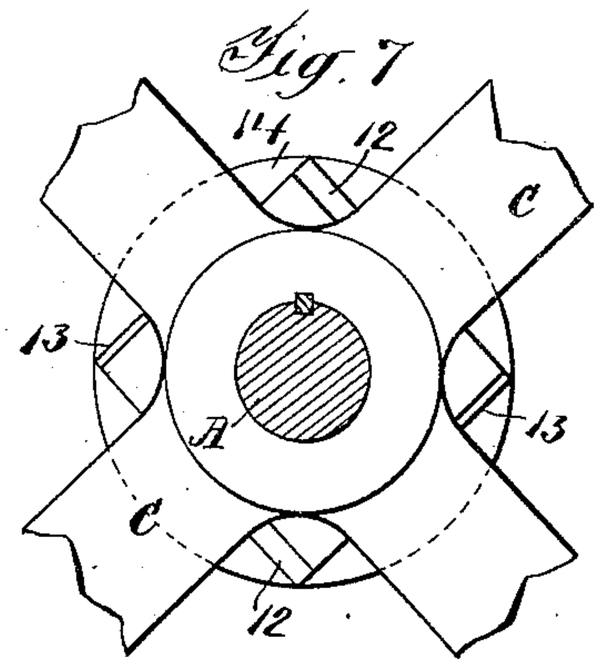

Fig. 7.

Witnesses
J. F. Kehoe
S. Winthrop

Inventor
Peter N. Ramsey
By his Attorneys
Philipp Sawyer Rice & Kennedy

UNITED STATES PATENT OFFICE.

PETER N. RAMSEY, OF NEW YORK, N. Y.

VARIABLE-SPEED MECHANISM.

No. 912,487. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed January 13, 1904. Serial No. 188,822.

To all whom it may concern:

Be it known that I, PETER N. RAMSEY, a citizen of the United States, residing at New York city, county of New York, and State of New York, have invented certain new and useful Improvements in Variable-Speed Mechanism, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to fluid controlled driving mechanisms for driving one shaft or other part from another, so that the speed of the driven part may be varied or the driven member stopped while the speed of the driving member remains constant, the object of the invention being to provide a simple, efficient and durable mechanism of this class.

For a full understanding of the invention, a detailed description of a construction embodying all the features of the invention in their preferred form will now be given in connection with the accompanying drawings forming a part of this specification, and the features of the invention will then be particularly pointed out in the claims.

In the drawings—Figure 1 is an end view looking to the right in Fig. 4, on a smaller scale. Fig. 2 is a section taken just inside the pinions and gear in Fig. 4, looking to the right, on the same scale as Fig. 1. Fig. 3 is a cross section on line 3 of Fig. 4. Fig. 4 is a section on the line 4 of Fig. 3. Figs. 5, 6 and 7 are detail views, Fig. 5 being a view partially in section on line 5 of Fig. 1.

Referring now to the drawings and especially Figs. 2, 3 and 4, A is a driving shaft driven by any suitable outside power, B a part of the shaft being driven, the part shown being one member of a universal joint. Any suitable means whereby the operating mechanism is carried may be employed. In the preferred form of construction and as shown, however, a fly wheel C is provided mounted on the driving shaft A. This fly wheel has secured to it in any suitable manner, preferably by bolts or studs D, a casing E which forms a chamber F adapted for the reception of the controlling fluid, which is preferably a liquid, although a compressible fluid may be used. Secured to or formed integral with the casing E is a second inner casing G mounted preferably concentrically with the outer casing. This second or inner casing G may be of any suitable form, but for convenience and strength it is preferably made octagonal as shown. This casing forms a second chamber H into which the liquid or other fluid is pumped from chamber F.

Secured in the casing G are any suitable fluid pumping means. These means are preferably cylinders I, these cylinders being provided with plungers M suitably secured to eccentrics K mounted on the studs D which are, as before stated, secured to the fly wheel C. These plungers (see Fig. 3), are provided at their bottoms with inlet valves 2 and the cylinders in which the plungers are carried are provided at their bottoms with suitable outlet valves 3. By this means the liquid or other fluid in chamber F is pumped into the inner chamber H.

On the hubs of the eccentrics K mounted on the studs D are pinions 4 with which rotate the eccentrics, both revolving with the fly wheel C to which they are secured. These pinions 4 are arranged to mesh with the gear wheel 5 loosely mounted on the shaft A, the gear wheel 5 having a hub to which is secured the member B of the shaft to be driven. As the fly wheel C rotates with the studs D and the eccentrics K and pinions 4, these pinions 4 rotate about the studs D when the eccentrics on the hub of which they are secured are free to turn, but when the eccentrics are held from turning the pinions can not turn on the studs D, and thus are locked to the gear 5 and rotate the latter to drive the shaft B.

The eccentrics and pinions are held against rotation on studs D by holding the plungers M against movement, for which there are provided valve supports 6 secured to the casing G in any suitable manner, these valve supports carrying valves 7 and 7^a opening into the chamber H which valves, when closed, prevent the passage of any of the liquid in the chamber H into the chamber F and when open allow the liquid or fluid in the chamber H to pass into the chamber F. These valves are normally closed by springs and the pressure in chamber H.

Any suitable number of plungers and valves may be employed. Preferably and as shown in the drawings, however, there are four cylinders I carrying four plungers M, and four valves 7 and 7^a. These valves 7 and 7^a are preferably of different sizes, the two valves 7^a being comparatively small and the two valves 7 being considerably larger, the area of all the valves 7 and 7^a

being, however, greater than the combined area of the valves 3 of the cylinders I. By this arrangement of valves of different sizes, the area of all being greater than the area of the valves of the cylinders, a widely varying degree of pressure in the liquid container in the inner chamber H can be obtained. These valves 7 and 7ª are opened by the following mechanism, with which each of the valves is provided: An arm 8 is carried inside the casing E on rock shaft 9. This arm rests on the upper end of a valve stem 6ª. The rock shaft 9 also carries at its outer end arm 10 (see Fig. 1) which has secured to it in any suitable manner a rod 11 which carries at its lower end a cam roller 11ª which engages one of two cam surfaces 12 and 13 (Figs. 1 and 7). These cam surfaces are formed on a sleeve 14 mounted on driving shaft A. This sleeve 14 is splined on the shaft to revolve with the shaft and at the same time to permit its sliding freely back and forth thereon and is held on the shaft in any suitable manner, as by sleeve 14ª. This sleeve 14 is moved back and forth on the driving shaft A by any suitable shifting lever or other shifting means to bring the cam surfaces 12 and 13 into engagement with the cam rollers 11ª. When these rollers are thus in engagement with the cam surfaces, the rollers riding up on the cam surfaces force the rods 11 outward, which in turn lift the arms 10 and press down the arms 8 on the rock shafts 9. The arms 8 force down the valve stems 6ª and open the valves 7 and 7ª against the pressure of the springs 6ᵇ, thereby allowing the fluid in chamber H to pass into the chamber F. When the sleeve 14 is moved backward on the shaft A and the cams out of engagement with the cam rollers 11ª, the pressure on the valve stems 6ª is removed and the valves are closed by the action of the springs 6ᵇ.

The cam rollers 11ª of the smaller valves 7ª are operated by the cam surfaces 13 and the cam rollers 11ª of the larger valves 7 by the cam surfaces 12. These cam surfaces have different degrees of incline and are so positioned that the cam surfaces 13 are moved into engagement with the cam rollers which operate the smaller set of valves 7ª before the cam surfaces 12 come into engagement with the cam rollers operating the larger set of valves 7. By this means a small amount of liquid or fluid is first allowed to escape from the inner chamber H through the valves 7ª, which amount depends on the distance the valves 7ª are opened by the movement of the cams 13, and then, if desired, after the valves 7ª are fully opened, the valves 7 may be opened by the further movement of sleeve 14.

The operation of the mechanism is as follows: When the driven member B is to be driven at the same rate of speed as the driving member, the cams 12 and 13 are retracted, as shown in Figs. 1, 5 and 6. The fly wheel C rotated by the driving shaft A from any suitable outside power carries around with it the studs D and the eccentrics K mounted thereon and the pinions 4 secured to the hubs of the eccentrics. In this position, the valves 7 and 7ª being closed and the chamber H filled with fluid, the plungers M in the cylinders I cannot operate against the pressure of the fluid in the chamber H, as no fluid can be forced from that chamber into the chamber F, so that the plungers can have no up and down movement, and the eccentrics, therefore, cannot turn around the studs D, and consequently the pinions 4 geared on the hubs of the eccentric cannot turn and are locked in engagement with the gear wheel 5 and turn this gear wheel and the driven member B connected thereto at the same speed at which the driving member A which carries the pinions 4 is driven. When it is desired to operate the shaft B at a less speed from that of the shaft A, the sleeve 14 is shifted on the shaft A so that the cam surfaces 13 come into engagement with the cam rollers which are connected with the small set of valves 7ª, thereby opening these valves as previously described and allowing a small amount of fluid to escape from the chamber H into the chamber F, this fluid being forced out by the pressure of the plungers M in the cylinders I. The plungers M then may move under a resistance depending on the amount the valves 7ª are opened, and the pinions will operate to rotate the gear 5 with an amount of relative movement or rotation between the pinions 4 and gear 5 depending on the relation of the resistance to the movement of the plungers to the load on the driven member B. The speed of member B will be varied from the speed of shaft A, according to the relative movement of rotation of the pinions 4 permitted, which is controlled by the extent to which the valves 7ª are opened. The cam surfaces 13 as shown in the drawings are so formed as to permit of any desired amount of fluid being forced through the small set of valves 7ª, thereby varying the speed produced in the shaft B to any desired extent, the speed of the driving shaft remaining the same. When it is desired to stop the shaft B altogether the sleeve 14 is forced in farther and cam surfaces 12 are brought into engagement with the cam rollers 11ª connected to the large set of valves 7 which are thereby opened as previously described. The valves 7ª having already been opened and the total area of valves 7 and 7ª being greater than the area of the valves 3 of the pumping cylinders I, all the fluid which is forced into the chamber H by the plungers M can escape through the valves 7 and 7ª, and the fluid will be freely pumped around through the cham-

bers, substantially all resistance to the movement of plungers M thus being removed, and the pinions 4 being permitted to rotate freely as they are carried about gear 5. The pinions will then simply revolve around the gear wheel 5 and no rotation of the driven member B result.

It will be understood that I am not to be limited to the specific construction shown, but that many modifications may be made in the structure and arrangement of the parts without departing from the invention defined by the claims. The invention is illustrated as applied to a mechanism suitable for automobiles, for which it is admirably adapted, but it will be understood that the invention is of general application in driving mechanisms, and that the form and arrangement of the parts in which the invention is embodied will vary with the use made of the invention.

What I claim is:—

1. The combination with a driving and a driven member, of a gear carried by and rotating with one member, a second gear carried by the other member and mounted on said other member to revolve around or with the first mentioned gear and to rotate on its own axis, a pumping plunger operated by the rotation of said second gear, and means for opening and closing the outlet of the pumping plunger to control the rotation of said second gear during its revolution.

2. The combination with a driving and a driven member, of a gear carried by and rotating with one of the members, a second gear carried by the other member and mounted on said other member to revolve around or with the first mentioned gear and to rotate on its own axis, a pumping plunger operated by the rotation of said second gear, and valve devices adjustable to control the delivery of the pumping plunger to vary the resistance to rotation of said second gear during its revolution.

3. The combination with a driving and a driven member, of intermeshing gears carried by said members, one of said gears being carried by and rotating with one of the members and the other gear being carried by the other member and mounted on said other member to revolve around the first mentioned gear and to rotate on its axis, a pumping plunger connected to one of said gears to reciprocate when the gear rotates, and means for enlarging and contracting the outlet of the pumping plunger to vary the speed of rotation of said gear connected to the pumping plunger during its revolution.

4. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted on said other member to revolve around the first mentioned gear and to rotate on their axes, a pumping plunger connected to each of said series of gears to reciprocate when the gears rotate, and means for opening and closing the outlet of the pumping plungers to control the rotation of the series of gears during their revolution.

5. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted on said other member to revolve about the first mentioned gear and to rotate on their axes, a casing moving with said series of gears and having two fluid chambers, a series of pumping plungers connected to said series of gears to reciprocate when the gears rotate and acting to pump fluid from one of said chambers into the other, valves controlling the delivery of fluid by the pumping plungers, and means for opening and closing said valves for controlling the rotation of the series of gears during their revolution.

6. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted on said other member to revolve about the first mentioned gear and to rotate on their axes, a casing moving with said series of gears and having two fluid chambers, a series of pumping plungers connected to said series of gears to reciprocate when the gears rotate and acting to pump fluid from one of said chambers into the other, a plurality of valves of different dimensions for controlling the delivery of fluid by the pumping plungers, and means for opening and closing said valves to control the rotation of the series of gears during their revolution.

7. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted to revolve about the first mentioned gear and to rotate on their axes, a casing moving with said series of gears and having two fluid chambers, a series of pumping plungers connected to said series of gears to reciprocate when the gears rotate and acting to pump fluid from one of said chambers into the other, valves controlling the delivery of fluid by the pumping plungers, and a cam and connections for actuating said valves to control the rotation of the series of gears during their revolution.

8. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted to revolve about the first mentioned gear and to rotate on their axes, a casing moving with said series of gears and

having two fluid chambers, a series of pumping plungers connected to said series of gears to reciprocate when the gears rotate and acting to pump fluid from one of said chambers into the other, a plurality of valves for controlling the delivery of fluid by the pumping plungers, and a plurality of cams and connections for opening some or all of said valves to control the rotation of the series of gears during their revolution.

9. The combination with a driving and a driven member, of a gear carried by and rotating with one of said members, a series of gears carried by the other member and mounted to revolve about the first mentioned gear and to rotate on their axes, a casing moving with said series of gears and having two fluid chambers, a series of pumping plungers connected to said series of gears to reciprocate when the gears rotate and acting to pump fluid from one of said chambers into the other, a plurality of valves of different dimensions controlling the delivery of the pumping plungers, and a cam carrier and connections for opening some or all of the valves to control the rotation of the series of gears during their revolution, said cam carrier being provided with cams adapted to open the larger valves only on a further movement after opening the smaller valves.

10. The combination of driving and driven members, casing E having fluid chambers F, H, and carried by one of said members, pumping plungers M, eccentrics K for operating said plungers, pinions 4 carried by casing E and rotating with the eccentrics, gear 5 on the other member with which pinions 4 mesh, and adjustable valve devices for controlling the delivery of fluid by said pumping plungers from one chamber to the other, substantially as described.

11. The combination with a driving member and a driven member, of fluid containing devices carried on one of said members, mechanism operated by one of said members to cause the fluid to flow in said fluid containing devices, means for controlling the flow of the fluid in said fluid containing devices, and connections between said driving member and said driven member adapted to be thrown into and maintained in different degrees of operative connection by controlling the flow of the fluid in said fluid-containing devices, substantially as described.

12. The combination with a shaft, a rotatable member journaled thereon, and fluid containing devices carried on said rotatable member, of mechanism operated by said rotatable member to cause the fluid to flow in said fluid containing devices, means for controlling the flow of the fluid in said fluid containing devices, and connections between said shaft and said rotatable member adapted to be thrown into and maintained in different degrees of operative connection by controlling the flow of the fluid in said fluid containing devices, substantially as described.

13. The combination with a shaft, a gear secured to said shaft, a rotatable member journaled on said shaft, and driving mechanism, of gears rotatably mounted on said rotatable member and meshing with the gear on said shaft, fluid containing devices connected with said gears on said rotatable member, and means for braking said gears and throwing said shaft and said rotatable member into and maintaining them in different degrees of operative connection by checking the free passage of said fluid through said fluid containing devices, substantially as described.

14. The combination with a shaft, a gear secured to said shaft, a rotatable member journaled on said shaft, and means for driving said rotatable member, of gears rotatably mounted on said rotatable member and meshing with the gear on said shaft, fluid containing devices connected with said gears on said rotatable member, and means for braking said gears and throwing said shaft and said rotatable member into and maintaining them in different degrees of operative connection by checking the free passage of said fluid through said fluid containing devices, substantially as described.

15. The combination with a shaft, a gear secured to said shaft, a rotatable member journaled on said shaft, and means for driving said rotatable member, of gears rotatably mounted on said rotatable member and meshing with the gear on said shaft, fluid containing devices connected with said gears on said rotatable member, means operated by said gears to force the fluid back and forth in said fluid containing devices as said gears rotate, and means for throwing said shaft and said rotatable member into and maintaining them in different degrees of operative connection by checking the free passage of said fluid through said fluid containing devices, substantially as described.

16. In a speed changing device, the combination with the driving and driven elements, of a planetary transmission element forming a connection therebetween, a fluid brake adapted to act upon said planetary transmission element, means for controlling the fluid therein to vary the action of the brake upon said planetary element and means for holding said controlling means in desired positions of adjustment.

17. In a speed changing device, the combination with the driving and driven elements, of a planetary transmission element

forming a connection therebetween, a revoluble cylinder and piston, a connection between one of said elements and the planetary transmission element, whereby rotation of the planetary transmission element will cause relative movement between the piston and cylinder, a fluid container communicating with said cylinder, means for controlling the flow of fluid between the container and cylinder, and means for holding said controlling means in desired positions of adjustment.

In testimony whereof, I have hereunto set my hand, in the presence of two subscribing witnesses.

PETER N. RAMSEY.

Witnesses:
C. J. SAWYER,
T. F. KEHOE.