(No Model.) 2 Sheets—Sheet 1.

L. DUNCAN.

HYDRAULIC VARIABLE SPEED GEAR.

No. 466,661. Patented Jan. 5, 1892.

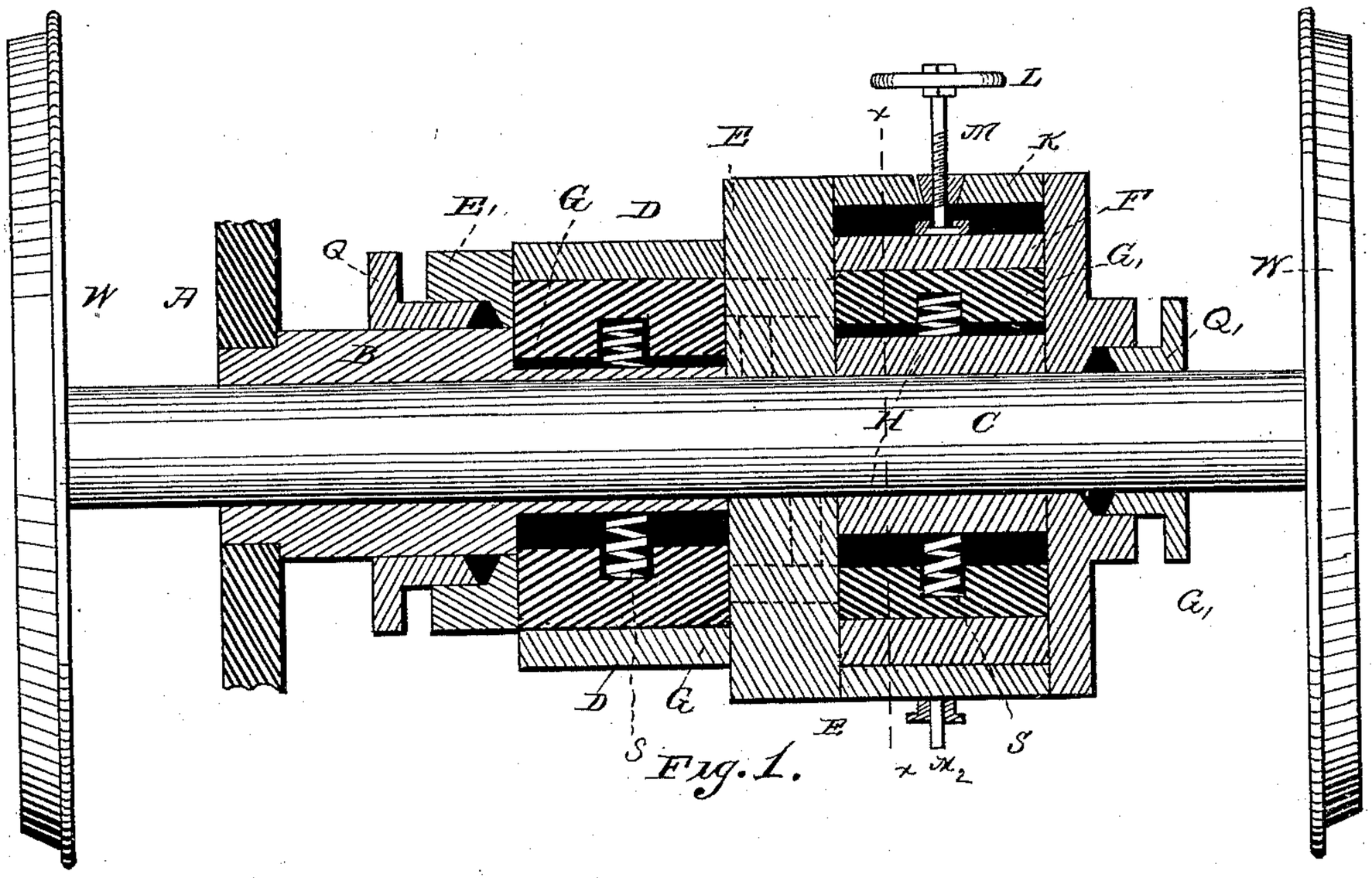

Fig. 1.

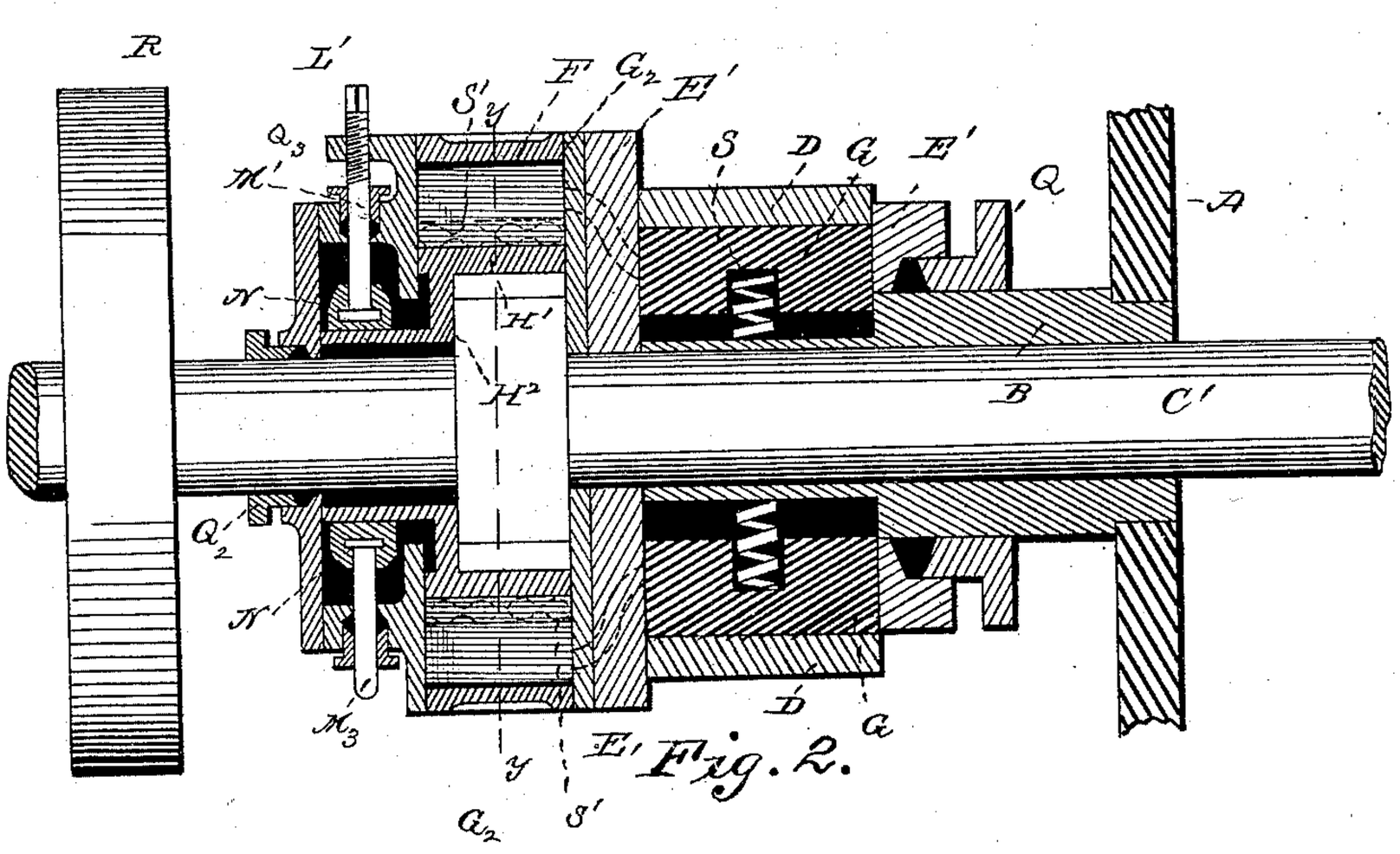

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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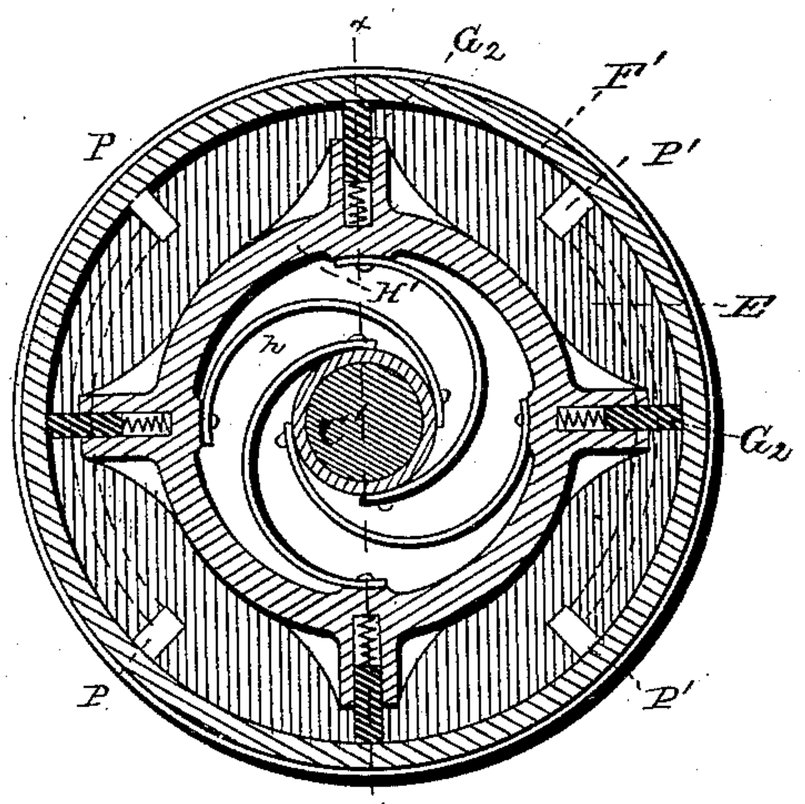

Fig. 3.

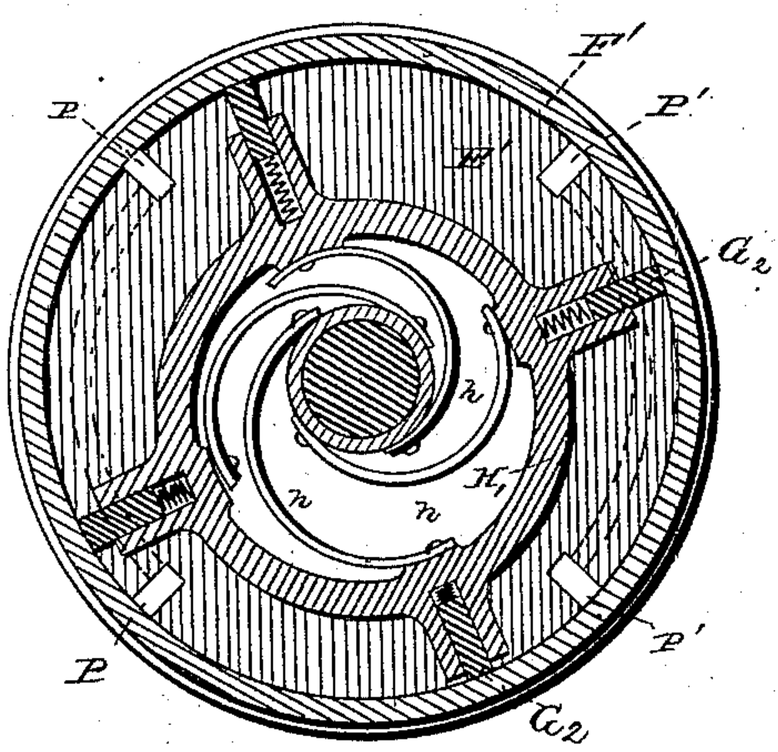

Fig. 4.

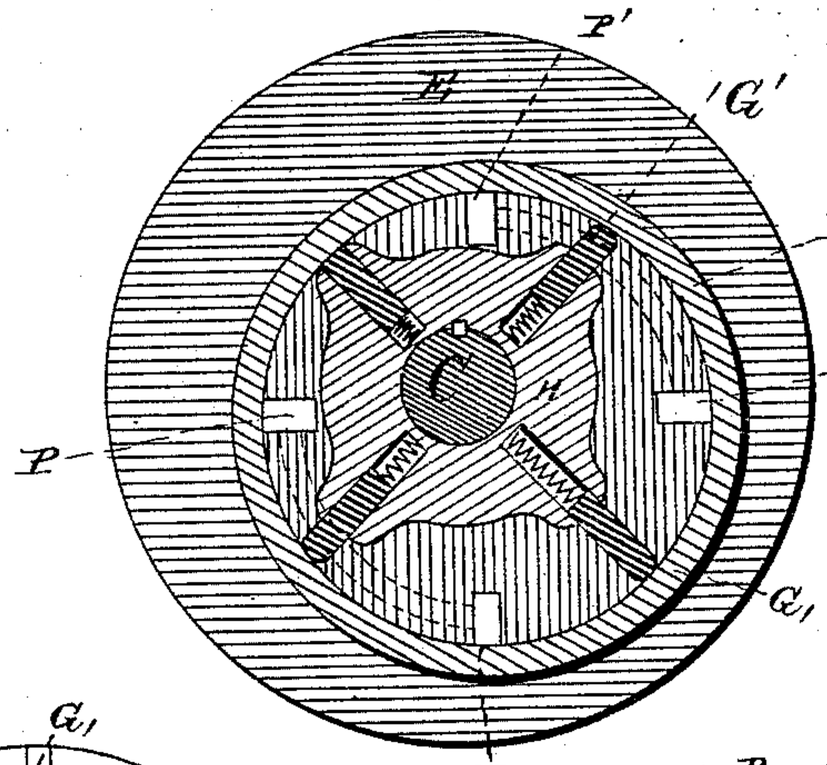

Fig. 5.

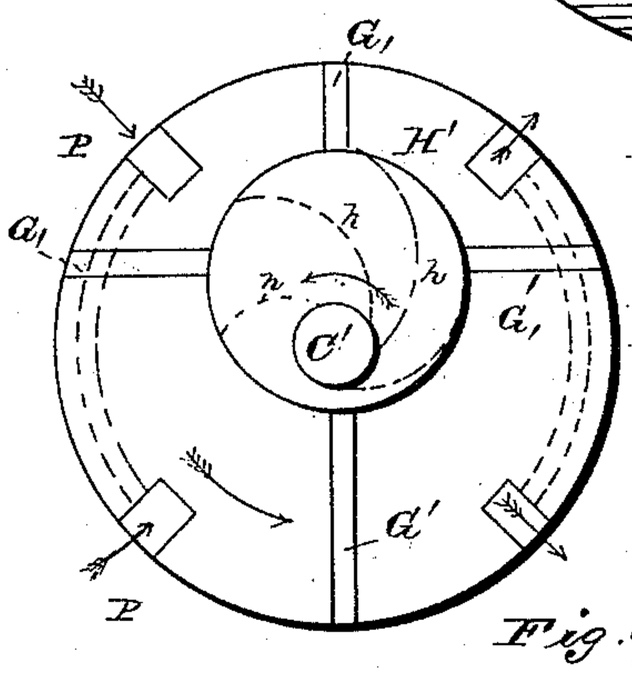

Fig. 6.

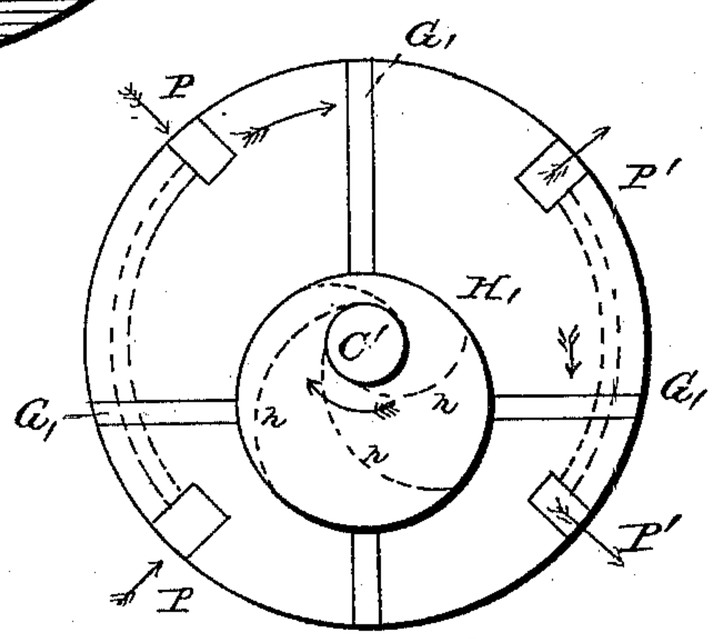

Fig. 7

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UNITED STATES PATENT OFFICE.

LOUIS DUNCAN, OF BALTIMORE, MARYLAND.

HYDRAULIC VARIABLE-SPEED GEAR.

SPECIFICATION forming part of Letters Patent No. 466,661, dated January 5, 1892.

Application filed March 25, 1891. Serial No. 386,356. (No model.)

To all whom it may concern:

Be it known that I, LOUIS DUNCAN, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Hydraulic Variable-Speed Gears; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain attachments to hydraulic motors; and it has for its object the providing of a variable-speed gear for transmission of power.

Reference is had to the accompanying drawings, wherein the same parts are indicated by the same letters.

Figure 1 represents a vertical longitudinal section of a rotary pump driving a motor of variable eccentricity, both mounted on a car-axle. Fig. 2 represents another form of the same device mounted on any suitable driving-shaft. Fig. 3 represents a vertical section of the motor shown in Fig. 2 along the line *y y* and looking to the right. Fig. 4 represents the same section shown in Fig. 2 after the eccentricity of the motor has been altered somewhat. Fig. 5 represents a vertical section of the motor shown in Fig. 1 along the line *x x* and looking to the left. Figs. 6 and 7 represent diagrammatic views showing the effect of changing the eccentricity of the motor.

A represents an electric motor or other source of power for driving the pump. The said electric motor is mounted on a loose sleeve B on the driving-shaft C or C′. This sleeve carries the paddles of the rotary pump driving the hydraulic motor. The said pump is inclosed in a cylinder D, set eccentrically to the shaft C. The disks E and E′ form the heads to this cylinder. The disk E is perforated with a plurality of suitable ports P and P′, preferably four connected together in pairs, as shown in Figs. 6 and 7. These ports connect the pump-chamber with the motor-chamber, the ports P and P being the delivery-ports from the pump, and the ports P′ and P′ being the return-ports from the motor to the pump. Both pump and motor should preferably be kept filled with liquid and so constitute a closed liquid-circuit with the ports for regurgitating-passages.

The motor is inclosed with a ring F or F′, and it consists of a series of rotating paddles eccentrically operating in the said ring. These paddles are set upon a sleeve H in Figs. 1 and 5 and H′ in the other figures. The eccentricity of the motor may be varied in two ways, either from the exterior by moving the inclosing ring F toward the shaft, as in Fig. 1, or from the interior by moving the interior ring H′ toward the shaft, as in Fig. 2. In either case the same result is obtained—that is, the surface of the opposite paddles exposed to pressure is varied and the speed of the motor is increased or diminished.

In Fig. 1 the ring F is raised or lowered by the hand-wheel L turning the screw M, which is revolubly connected to the said ring.

M^2 is a guide-rod attached to the opposite side of the ring F.

The other features of this construction are fully described in my application, Serial No. 374,140, filed December 10, 1890.

In the form of device shown in Figs. 2, 3, 4, 6, and 7 the eccentricity of the motor is varied from the interior of the paddles by screwing up or down on the hand-wheel L′, attached to the screw M′, which is revolubly connected at its lower end to the ring N.

M^3 is the guide-rod attached to the opposite side of the ring N. The said ring furnishes a bearing for the sleeve H^2, rigidly connected to the ring or sleeve H′, which carries the motor-paddles, and when the ring N is raised or lowered the ring H′ is correspondingly moved. The said ring H′ is connected to the shaft C′ by stiff springs *h*. These springs give the strong but yielding connection desired.

S represents a corrugated spring for keeping the paddle extended; but any other form of spring may be adopted.

G^2 represents a motor-paddle.

Q Q′ Q^2, &c., represent followers and other attachments for stuffing-boxes, it being very desirable to keep all the joints tight. Oil is preferably used for the regurgitating-fluid, and its presence on the interior in contact with most of the bearing-surfaces greatly reduces friction. Any loss of liquid due to leakage, &c., may be remedied by a device

(not shown) similar to that generally in use for oiling the cylinders of steam-engines.

In Fig. 1 I have shown my invention as applied to driving the wheels of a car. In Fig. 2 another form of device is shown driving the pulley R on the shaft C′; but it will be evident that my device is applicable to transmit power to a great variety of uses.

My device also acts as a brake in slowing down or stopping. Thus, if the hydraulic motor be driving its shaft and the pump be running at a uniform speed, suppose the eccentricity of the motor to be increased. The pump being driven at a uniform speed would deliver a constant supply of liquid while the motor having its output increased would deliver more than it could get from the pump, if it did not accelerate the latter, and cause a greater flow of liquid in the closed circuit. This acceleration is resisted by the driving-power of the pump and tends to speed up the driving-engine, and, where an electric motor is used to drive the pump, creates a counter electro-motive force in the armature, sending back energy to the line. It will be seen that if the speed of the pump be constant as the eccentricity of the motor be increased the motor will go slower. If the eccentricity of the motor be decreased, the motor must go faster in order to transmit the liquid delivered by the pump. It will also be noted that in going slowly, the motor having a greater eccentricity, the area exposed to unbalanced pressure is greater than when going fast. This renders my device peculiarly suited for the heavy work of starting and stopping, and also for meeting the heavy strains which may cause the moving parts to slow down; also, many modifications may be made which could be used without departing from the spirit of my invention. Thus there is no reason why the pump and motor should necessarily be side by side—they may be even miles apart; nor why a rotary pump should be used; nor, if pump and motor are side by side on the same shaft, why the pump should not be attached to the shaft and driven thereby and the motor be loose on the shaft and gear into its appropriate train of mechanism; nor why the pump may not be inclosed in the motor and separated therefrom by a fixed apertured ring around which the motor-paddles revolve, as shown in my application, Serial No. 386,585, filed March 26, 1891, said motor-paddles being inclosed in a sliding ring, as shown in Fig. 1.

What I claim, broadly, as new is—

1. A variable-speed gear consisting of a pump driven by any source of power, a rotary eccentric hydraulic motor driven by the said pump, and a device or devices for altering the eccentricity of said motor, substantially as described.

2. In a variable-speed gear, the combination, with a pump, of a rotary eccentric hydraulic motor, a closed liquid-circuit connecting said pump and said motor, and a device or devices for altering the eccentricity of said motor, substantially as described.

3. In a variable-speed gear, the combination, with a pump, of a hydraulic motor having extensory paddles and a device for altering the surface of said paddles exposed to the driving-liquid, substantially as described.

4. In a variable-speed gear, the combination, with a pump, of a hydraulic motor driven thereby, extensory paddles in said motor, a fixed ring on one side of said paddles limiting their extension, and a movable ring on the other side altering their eccentricity, with means for moving said ring in the direction of one of its diameters, substantially as described.

5. In a variable-speed gear, the combination, with a pump, of a hydraulic motor driven thereby, extensory paddles in said motor, a fixed ring on the outside of said paddles limiting their extension and a movable ring on the inside of and connected to said paddles and altering their eccentricity, a shaft inclosed in said interior ring, springs connecting the said interior ring with the said shaft, and means for varying the eccentricity of said ring relative to said shaft, substantially as described.

6. In a variable-speed gear, the combination, with a shaft, of a sleeve revolving thereon, a rotary pump having paddles connected to and driven by said sleeve, a hydraulic motor having paddles connected to said shaft and driven by said pump, a ring inclosing said paddles, and means for altering the eccentricity of said paddles, substantially as described.

7. In a variable-speed gear, the combination, with a shaft, of a sleeve revolving thereon, a rotary pump having paddles connected to and driven by said sleeve, a hydraulic motor connected to said pump and having extensory paddles moving within a ring, an interior ring inclosing said shaft and connected to said motor-paddles, springs connecting said interior ring to said shaft, and means for moving said interior ring in the direction of one of its diameters and so altering the eccentricity of the motor, substantially as described.

8. In a rotary hydraulic motor, the combination, with a plurality of extensory paddles, of an exterior ring limiting the extension of said paddles, an interior ring attached to and driving said paddles, and means for altering the eccentricity of either one of said rings, substantially as described.

9. In a rotary hydraulic motor, the combination, with a plurality of extensory paddles, of an exterior ring limiting the extensions of said paddles, an interior ring attached to and driving said paddles, a sleeve attached to said inner ring extending beyond the chamber of said motor, a bearing-ring

inclosing said sleeve, and a screw for moving said bearing-ring and sleeve at right angles to their axes, substantially as described.

10. In a rotary hydraulic motor, the combination, with a plurality of extensory paddles, of an exterior ring limiting the extension of said paddles, an interior ring attached to and driving said paddles, a sleeve attached to said inner ring extending beyond the chamber of said motor, a bearing-ring inclosing said sleeve, guides for said bearing-ring to prevent its turning, and a screw revolubly connected to said ring and capable of moving it at right angles to the axis of said sleeve, substantially as described.

11. In a variable-speed gear, the combination, with the shaft C′, of the sleeve B, driven by any source of power mounted thereon, a rotary pump attached to said sleeve and driven thereby, a rotary hydraulic motor driven by said pump and connected to said shaft, and means for altering the eccentricity of said motor, substantially as described.

12. In a variable-speed gear, the combination, with the shaft C′, of the sleeve B and electro-dynamic motor A mounted thereon, a rotary pump driven by said sleeve, a rotary hydraulic motor having extensory paddles connected to said pump by a closed liquid-circuit, the ring H′ on the interior of said extensory paddles, the sleeve H^2, connected to said ring, the bearing-ring N, inclosing said sleeve H^2, guides for the said bearing-ring, and the screw M′ and hand-wheel L′ for moving said bearing-ring along one of its diameters, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS DUNCAN.

Witnesses:

FELIX R. SULLIVAN,

FRANK H. LONGFELLOW.