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HYDRAULIC DIFFERENTIAL DRIVING MECHANISM.

APPLICATION FILED SEPT. 4, 1908.

997,069. Patented July 4, 1911.

2 SHEETS—SHEET 1.

Fig. 1

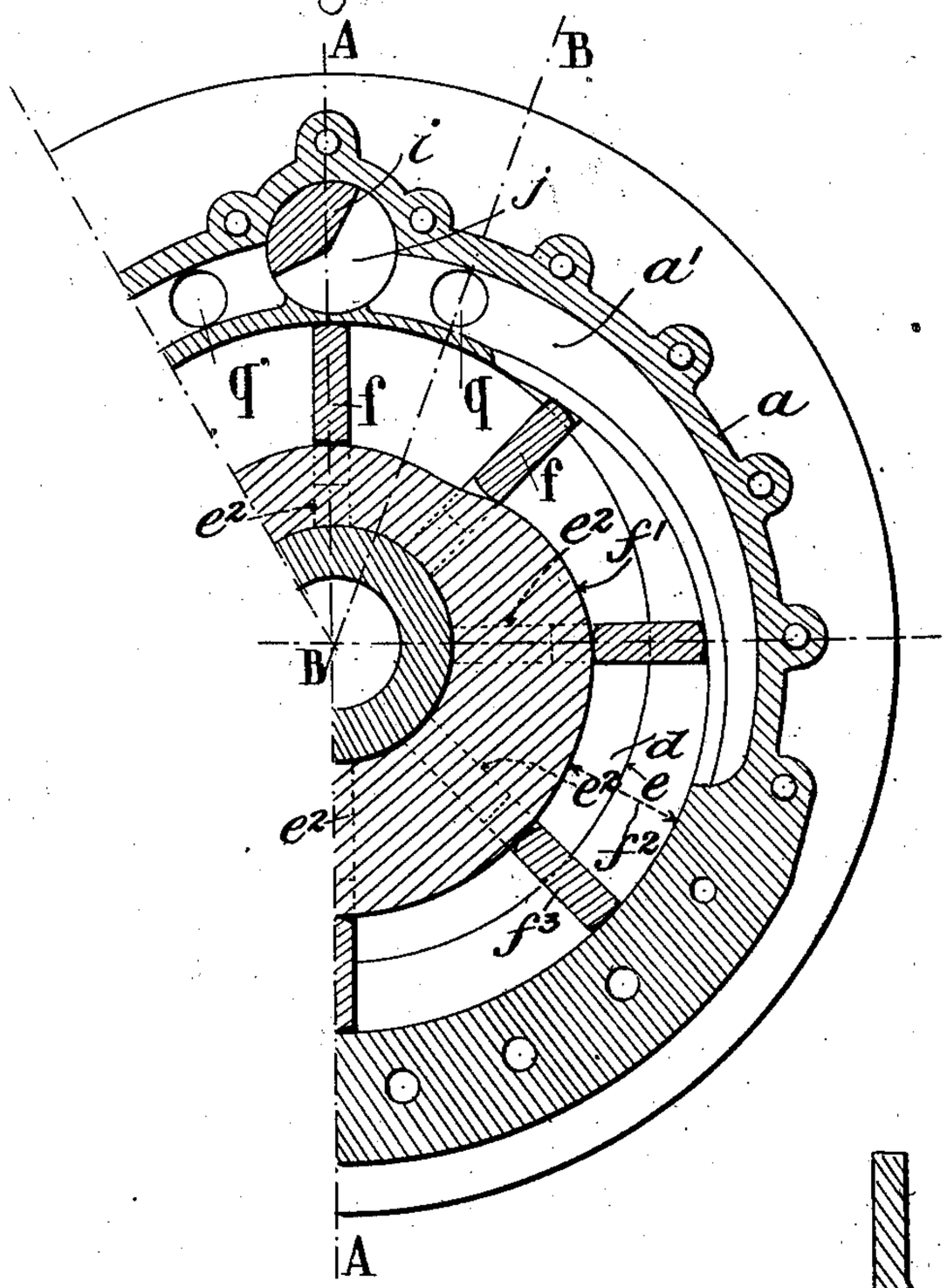
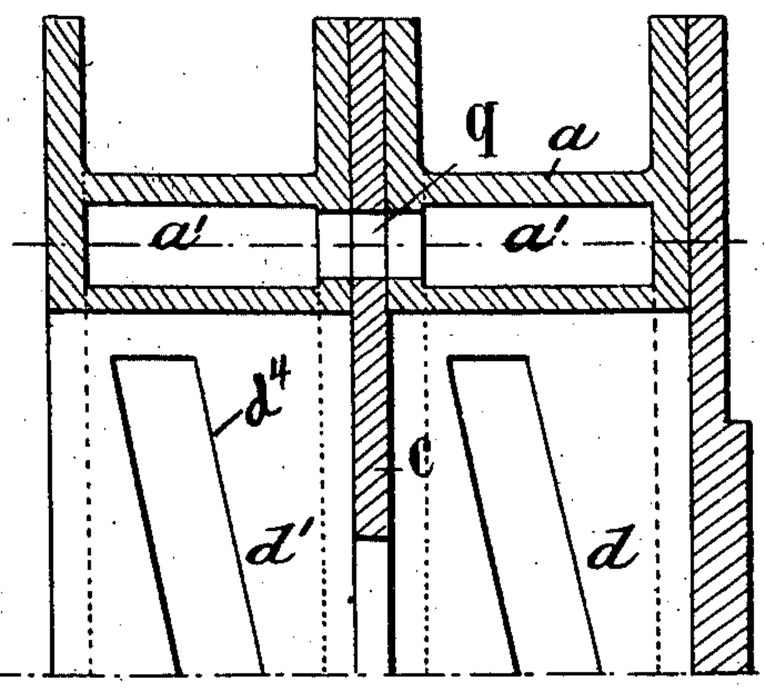


Fig. 3.



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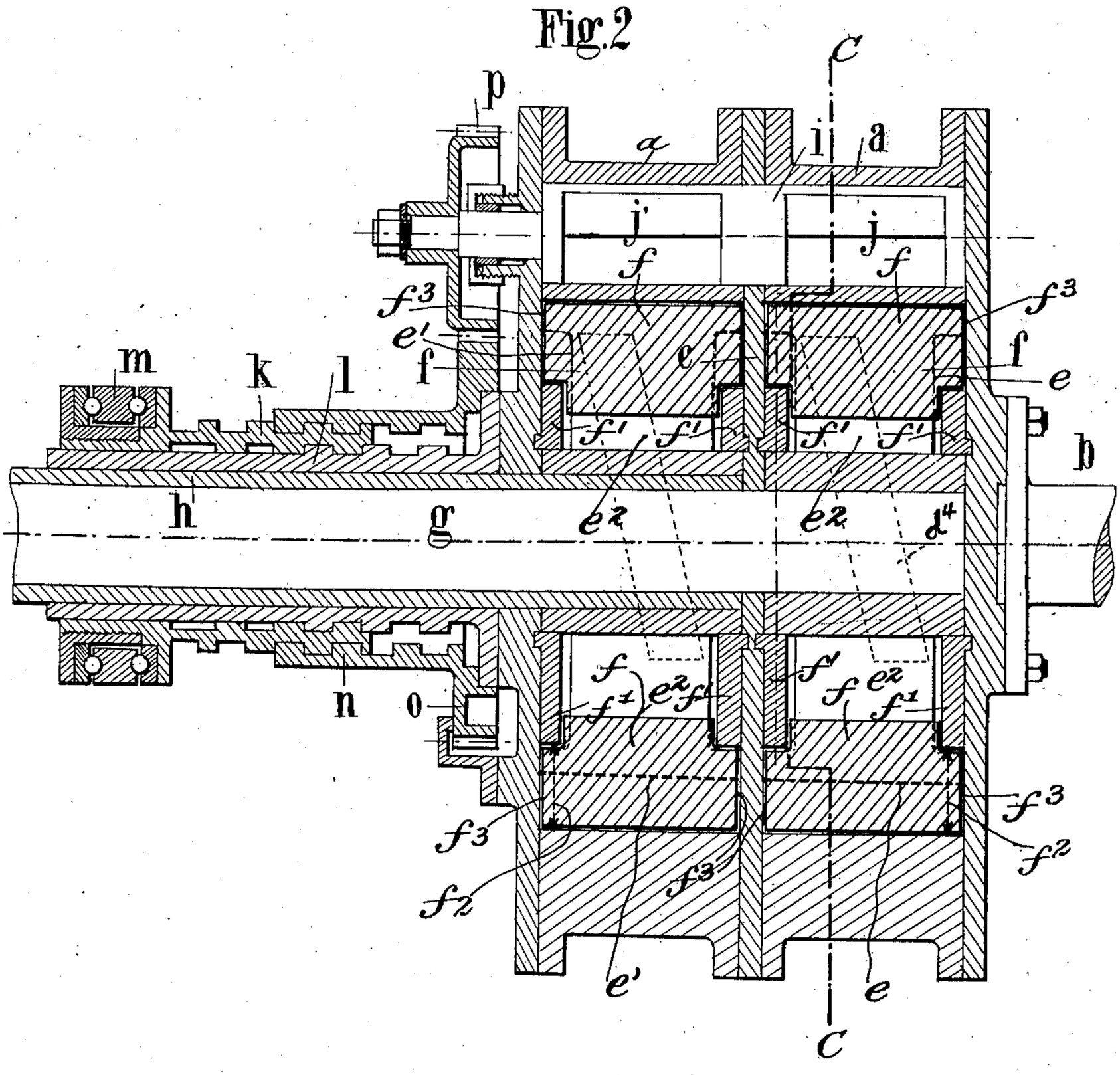
2 SHEETS—SHEET 2.

Fig. 2



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HYDRAULIC DIFFERENTIAL DRIVING MECHANISM.

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Application filed September 4, 1908. Serial No. 451,742.

To all whom it may concern:

Be it known that I, LÉON MARIE JOSEPH CLÉMENT LEVAVASSEUR, a citizen of the Republic of France, and resident of Puteaux, near Paris, France, have invented a new and useful Improvement in or Relating to Hydraulic Differential Driving Mechanisms, which improvement is fully set forth in the following specification.

This invention relates to hydraulic mechanism applicable where both a clutching action and a differential action are required as, for example, in connecting the two driving wheels of a motor vehicle with the source of power.

It has been previously proposed to substitute for ordinary differential gearing a hydraulic gearing or mechanism comprising two rotary pumps each of which has two members of which one is connected to one of the driven members or shafts while the other is connected to a common driving wheel or shaft which is actuated by the source of power. The inlets and outlets of the two pumps are connected together so that each pump may either deliver liquid to or receive it from the other pump, and thus the action of the two pumps compensates for different speed of rotation in the members driven thereby in the same degree as occurs in the use of toothed gearing. In such a device it has also been proposed to provide each pump with a valve-controlled by-pass with the object of utilizing the pumps as clutches. When the by-pass valves are closed the pumps act in the manner above described, transmitting the full power from the driving member to the driven members, but when the by-pass valves are open the fluid in the pumps passes idly through the by-passages and no power is transmitted from the driving member to the driven members, the effect being the same as if the connections between the motor and the driven members were interrupted in the usual manner by means of a mechanical clutch.

The present invention relates to a device of the character above set forth and the object of the invention is to produce a mechanism of this kind in which the valve mechanism controlling the by-passages is so constructed and arranged that it may be manually controlled during the operation of the differential mechanism and regardless of the rotation of the pump members on which the valve mechanism is carried.

The above described invention consists in the improved hydraulic differential driving mechanism hereinafter described and defined in the succeeding claims.

A preferred embodiment of my invention is illustrated in the accompanying drawings in which—

Figure 1 is a partial vertical section on the line C—C, in Fig. 2, Fig. 2 is a vertical longitudinal section on line A—A, in Fig. 1, and Fig. 3 is a vertical longitudinal section of a portion of the casing on the line B—B in Fig. 1.

In the illustrated embodiment of my invention the driving member is a shaft *b* which may be connected with a motor or any suitable source of power and the driven members are respectively a shaft *g* arranged in line with the shaft *b* and a hollow shaft or tube *h* journaled upon the shaft *g*. The two rotary pumps by which the driving member and the driven members are connected together have, in common, a casing *a* which is centrally divided by a partition *c* into two chambers in which the pistons or abutments of the pumps operate. The pistons comprise sleeves *e*, *e'* which are fixed respectively to the shaft *g* and the shaft *h*. These sleeves are provided with radial slots e^2, as shown in Fig. 1, for the reception of transverse vanes *f* which act as the pistons of the pumps. The vanes *f* engage the inner surfaces of the pump chambers and are maintained in contact therewith by means of cams *f'* which are fixed to the casing *a* and the partition and which engage the inner ends of the vanes. The portion of the casing which is uppermost in the figures is contracted radially so that when the vanes *f* are moved by the slots e^2 relative to the

casing and the cams f' at this part of the casing the vanes are moved inward in the driving member and the spaces afforded at the lower part of the pumps between the successive vanes and between the inner surfaces of the chambers and the corresponding surfaces of the driven members of the compartments d d' are gradually contracted so that as the vanes revolve toward the upper part of the casing the fluid between them is expelled. The fluid expelled by the vanes in the manner above described enters by-passages a' in the upper part of the casing a and, after passing a valve i, is returned to the pump chambers at the point where the casing widens again and the vanes move outwardly. When the valve i is opened, therefore, the pumps act idly to force the liquid contained therein through the openings d^4 and the by-passages. It is to be understood that the by-passage a' and the spaces between the vanes f are at all times entirely filled with oil or some other incompressible fluid. Under these conditions if the casing a be rotated by the shaft b, to which it is fixed, the shafts g and h will not be rotated since there will be no substantial pressure against the vanes f tending to rotate the pistons of the pumps. If on the other hand, the valve i be closed, thereby closing the by-passages, the casing a and the piston members of the two pumps are practically locked together so that both of the shafts g and h will be rotated at the same speed as the driving shaft b.

The differential action of the mechanism is secured by providing the pumps with inlets and outlets connected together by passages q, q' in the casing. The effect of this arrangement is to permit the interchange of the fluid between the two pumps so that although the sum of the rotations of the two piston members is always equal, one piston may be rotated faster than the other.

If for any reason either one of the shafts g or h and its corresponding vanes f be retarded, the continuing movement of the casing a will cause a backward motion of the said vanes relative to the casing. This will cause the oil to be forced out through the opening d^4, by-passage a' and passage q or q' and into the space between the other set of vanes f, thus causing them to be accelerated and to accelerate the shaft which they drive.

The present invention resides particularly in the combination, with the pump mechanism, of the valve-mechanism which will now be described.

The valve i, as illustrated, is a rotary valve, arranged to turn in a recess in the casing a and formed with two passages j j' corresponding respectively with the by-passages of the two pumps. This rotary valve has a stem at one end to which is fixed a pinion p meshing with a second pinion o journaled upon the casing concentric with the shafts g and h. The pinion o carries a sleeve n which has a screw thread engagement with a second sleeve k. The sleeve k has also a screw thread engagement with an inner sleeve l mounted upon and fixed to the casing. The inner and outer threads of the sleeve k are differentially formed so that if the sleeve k while rotating freely with the sleeve l be moved longitudinally it acts to rotate the sleeve n and the pinion o, thereby rotating the pinion p and the valve i. The longitudinal motion is imparted to the sleeve k by means of a ring m which is mounted between ball bearings in an annular slotted portion at the end of the sleeve k. The ring m does not, therefore, rotate with the other parts of the mechanism and it may be connected in any ordinary or suitable manner with suitable manually controlled devices. When the ring m is moved longitudinally as above described, by the manually controlled devices, it acts therefore through the mechanism described to rotate the valve i, and this action occurs whether the motor casing be rotating or stationary and thus the pump mechanism may be operated either to clutch and to unclutch the driven shafts from the driving shaft or to move the valve to a partly open position in which a certain degree of power, less than the full power of the motor, may be transmitted through the mechanism.

The invention is not limited to the details of construction and operation of the illustrated embodiment thereof but may be embodied in various other forms within the nature of the invention and the scope of the following claims.

I claim:

1. A hydraulic differential driving mechanism having, in combination, a rotary driving member, two rotary driven members, connections between each driven member and the driving member comprising a rotary pump provided with a by-passage, a valve mechanism controlling both of said by-passages simultaneously, passages between the by-passages of the pumps and manually controllable means, independent of the rotation of the pumps, for actuating the valve mechanism during the operation of the differential mechanism.

2. A hydraulic differential driving mechanism having, in combination, a rotary driving member, two driven members rotating coaxially with the driving member, connections between each driven member and the driving member comprising a rotary pump provided with a by-passage, cross connections between the inlets and outlets of the two pumps to permit the interchange

of fluid between the pumps, a valve mechanism controlling both of said by-passages simultaneously, and manually controllable means, independent of the rotation of the pumps, for actuating the valve mechanism during the operation of the differential mechanism.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LÉON MARIE JOSEPH
CLÉMENT LEVAVASSEUR.

Witnesses:
EMILE LEOBRET,
H. C. COXE.