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VARIABLE DISPLACEMENT RADIAL VANE ROTARY MOTOR

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Fig. 1.

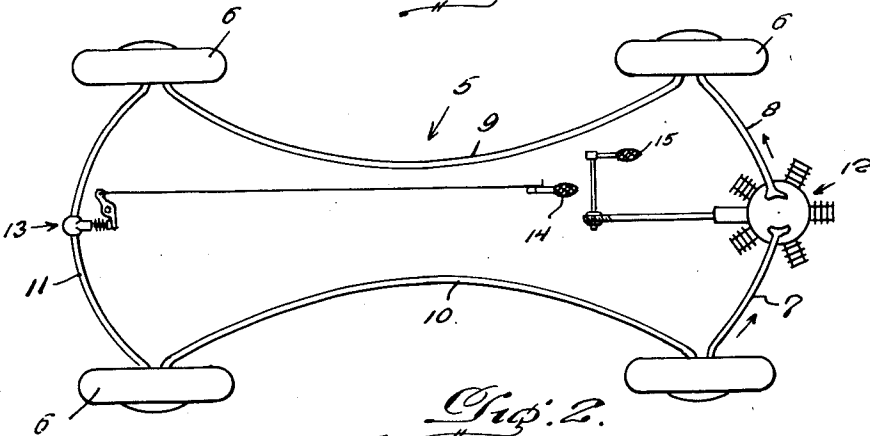
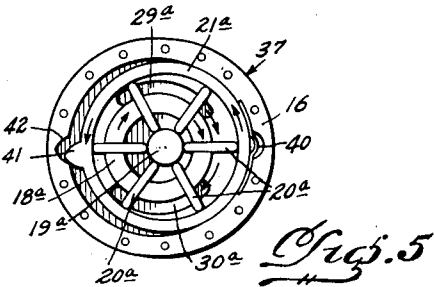
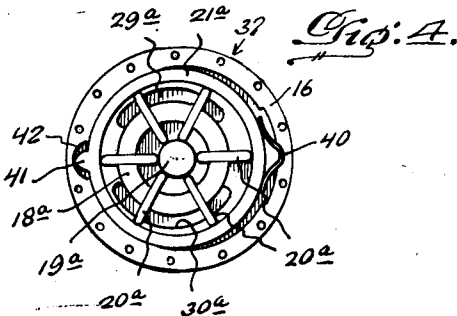
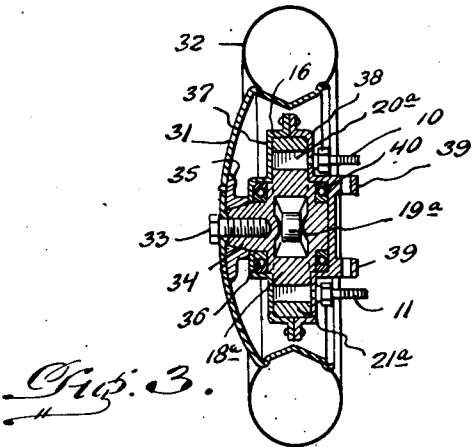
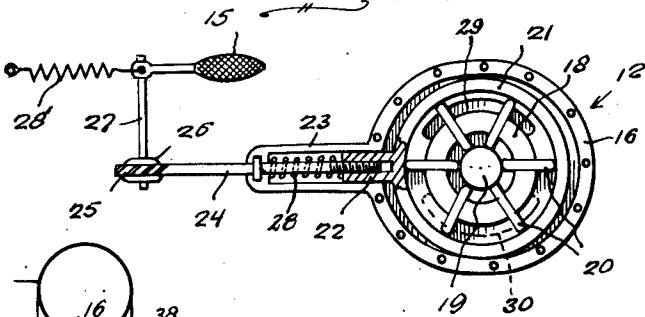


Fig. 2.



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VARIABLE DISPLACEMENT RADIAL VANE ROTARY MOTOR

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2 Claims. (Cl. 121-85)

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The invention relates to an improved hydraulic drive system for wheeled motor vehicles, the principal object of the invention to prove a more simplified, less expensive, and more efficient system of this type, eliminating transmission gear, clutch mechanism, hydraulic drive, overdrive, drive shaft, differential, axles and other presently required mechanism, as well as friction brakes.

These and other important features and advantages of the invention will appear from the following description and the appended drawing, showing for illustration only, a preferred embodiment of the invention.

In the drawing:

Figure 1 shows diagrammatically in plan a system according to this invention;

Figure 2 is an elevation partly in section and with a casing cover removed, of the pump;

Figure 3 is a transverse section through one of the wheels and its motor;

Figure 4 is an elevation with casing cover removed of the motor;

Figure 5 is an elevation similar to Figure 4, showing the vane guide in its extreme shifted position.

Referring to the drawing in detail, the numeral 5, in Figure 1, designates the system as a whole, comprising the four hydraulic motor-driven wheels 6, the series fluid conduits 7 and 8, 9 and 10, and 11 extending between the wheels, the engine-driven compressor or pump 12, to which the conduits 7 and 8 are connected, and the spring opened gate valve 13 which is cable or otherwise connected for operation by a pedal or hand lever 14 mounted in the driving compartment (not shown) of the vehicle. Control of the pump is provided by the handle or pedal lever 15 also mounted in the driving compartment.

The pump 12 shown in Figure 2, comprises the flat obloid casing 16 conveniently composed of flanged connected sections through one of which the shaft (not shown) of the engine passes and is drivingly connected to the annular rotor 18 which spacedly surrounds a floating centerpiece 19. The rotor is radially slotted to slidably receive a suitable number of vanes 20, which have rounded outer ends bearing against the inward side of the circular vane guide 21, and rounded inner ends bearing against the periphery of the floating centerpiece 19. The vanes, the centerpiece, the rotor 18, and the vane guide are confined axially in position by the sides of the casing 16. It will be noted that diametrically opposite sides of the casing are deformed outwardly to provide the obloid shape and permit the vane guide 21 to be

moved in the casing in opposite directions from a centered position in the casing.

For adjustment of the eccentricity of the vane guide the same is provided with a tubular radial lug 22 which projects from the casing 16 through a tubular extension 23 thereon, the lug 22 being internally threaded to accommodate a screw shaft 24 which has a worm 25 at its outer end which is engaged with a wormwheel 26 on the shaft 27 which is operated by the hand lever or pedal 15, already mentioned herein. The casing extension 23 is closed at its outer end and between this closure and the outer end of the lug 22 a tensioning spring 28 is circumposed on the screw shaft 24 to take up looseness or wear in the engaged screw threads. A return spring 28' is provided for the pedal 15. The pedal has a middle position with reference to which it may be operated in either direction.

One side of the pump casing 16 has an arcuate hydraulic fluid inlet port 29 and diametrically opposite it an arcuate output port 30, which ports are connected with the conduits 7 and 8, or 8 and 7, respectively, as may be desired, whereby the hydraulic fluid is circulated under pressure to operate the wheels 6.

Each wheel assembly, shown in Figure 3, comprises the wheel disk 31 carrying the tire 32 and a mounting stud 33 passing through the center of the disk and threading into a hub 34 on which a part 35 on the disk rests. A ball bearing race 36 is mounted on the hub to rotatably mount one section 37 of the obloid rotor casing whose other section 38 has mounts 39 whereby the wheel is mounted to the chassis of the vehicle. The casing section 38 holds a ball bearing race 40 which rotatably supports the opposite side of the rotor 18a from that supported by the ball bearing 36.

The rotor 18a of the wheel assembly is annular, as in the case of the pump described above, and is spaced around the floating centerpiece 19a, against which bear the rounded inner ends of the vanes 20a slotted in the rotor. The rounded outer ends of the vanes bear against the inner periphery of the circular vane guide 21a. One-half of the casing has inlet and output ports 29a and 30a with which the appropriate hydraulic conduits are connected.

The vane guide 21a is normally eccentrically positioned in the wheel motor casing 16 as shown in Figure 4 by the pressure of a spring 40 against one side of the casing, so that a rounded motor guide shifting lobe 41 is positioned to a greater or less depth in a rounded recess 42 in the opposite side of the casing. The recess 42 is circumferen-

tially long enough to permit some turning movement of the vane guide 21a relative to the casing 16. It will be understood that when the rotor and vanes are turned by the incoming fluid, the casing will remain stationary and wheel disk 31 will be turned relative thereto.

Although an air cooled radial engine is illustrated in connection with this drive system, any type of engine may be used. The pump may be located in any part of the vehicle and may be mounted in any position. When more than one motor is driven by the pump, the fluid may be conducted to the motors in series or in parallel or any combination of the two systems. The eccentricity of the motors may be fixed or it may be variable.

The pressure of the fluid has a tendency to rotate the vane guide 21a in the opposite direction through its tendency to rotate the rotor 18a. The fluid pressure causes a reaction against the vane guide 21a, and this reaction has a tendency to rotate the vane guide 21a, but is prevented from doing so by the lobe 41 which is restricted in its movements by the somewhat rounded recess 42 in which it is positioned. When the hydraulic motor has a heavy load, the reaction is strong enough to overcome the tension of the spring 40, which spring 40 has a tendency to keep the lobe 41 in the depressed position of the recess 42.

The eccentricity and therefore the pulling power of the motors are increased whenever the cam action of the lobe 41 overcomes the tension of the spring 40. When the load and the reaction are alike, the spring 40 returns the vane guide 21a to a less eccentric position. In this position, more speed can be obtained without excessive fluid motion. When properly constructed, the lobe 41 and the spring 40 will automatically adjust the eccentricity of the motors to give the correct speed and power ratio between the prime mover and the vehicle wheels.

In the series system shown in the drawing, the eccentricity of the motors is self regulating. This permits differential action as well as increasing the eccentricity of the motors to increase their pulling power when a heavy load is encountered. The eccentricity of the motors is decreased when the load is light. This gives the equivalent of an overdrive and permits higher speeds without increasing the speed of the engine or the flow of the fluid. When pulling very heavy loads or when very slow speed is desired, the eccentricity of the pump can be decreased by the control pedal. Adjusting the pump beyond the centered position reverses the flow of the fluid, also reversing the motors. Braking is accomplished either by decreasing the eccentricity of the pump or by closing the gate valve in the fluid circuit. In either case the backpressure on the fluid increases the eccentricity of the motors, giving them more braking power.

In an automobile or other motor vehicle, the hydraulic drive replaces the standard gearbox, the friction clutch, the overdrive gears, the drive shaft, the differential, the axle shafts and the brakes. It eliminates gear shifting, simplifies the control and gives the vehicle an infinite number of speeds within the range of the drive system. The power can be applied so gradually that heavy loads can be easily started with an engine of low

power. As the vehicle can not roll in either direction when the pump is in the centered position, starting on upgrade presents no difficulty. When descending a hill, the braking action can be regulated to any degree desired and can be continued indefinitely, as there are no brake bands to get hot and burn up. In slow traffic it is possible to keep the speed as low as necessary, by holding the control pedal down slightly. A lever may be substituted for the control pedal if desired.

What is claimed is:

1. A wheel motor for a wheel of a vehicle, said motor comprising a rotor casing, a shiftable circular vane guide in the casing, a floating centerpiece therein, an annular rotor spacedly surrounding the centerpiece within the vane guide, a plurality of radially slidable vanes on the rotor for engaging the vane guide and the centerpiece, a wheel disk fixed to the rotor, inlet and outlet ports in the casing, a hydraulic fluid supply conduit leading to said inlet port, a hydraulic fluid return conduit leading from the outlet, a lobe on one side of the vane guide for engaging the casing, the casing being provided with a cam surface whereby the lobe causes shifting of the vane guide toward greater eccentricity upon increase of pressure at the motor inlet, and an eccentricity-controlling spring expanding in the casing against the opposite side of the vane guide.

2. A wheel motor for the wheel of a vehicle, said motor comprising a rotor casing, a shiftable circular vane guide in the casing, a floating centerpiece therein, an annular rotor spacedly surrounding the centerpiece within said vane guide, a plurality of radially slidable vanes on the rotor for engaging the vane guide and the centerpiece, a wheel disk fixed to said rotor, inlet and outlet ports in the casing, a hydraulic fluid supply conduit leading to said inlet port, a hydraulic fluid return conduit leading from the outlet, the said casing being provided with a cam surface, a vane guide-shifting lobe on one side of the said vane guide for engaging the said cam surface, whereby the vane guide is shifted toward greater eccentricity upon increase of pressure at the motor inlet, an eccentricity-controlling spring expanding in the casing against the opposite side of the vane guide.

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