

June 3, 1930.

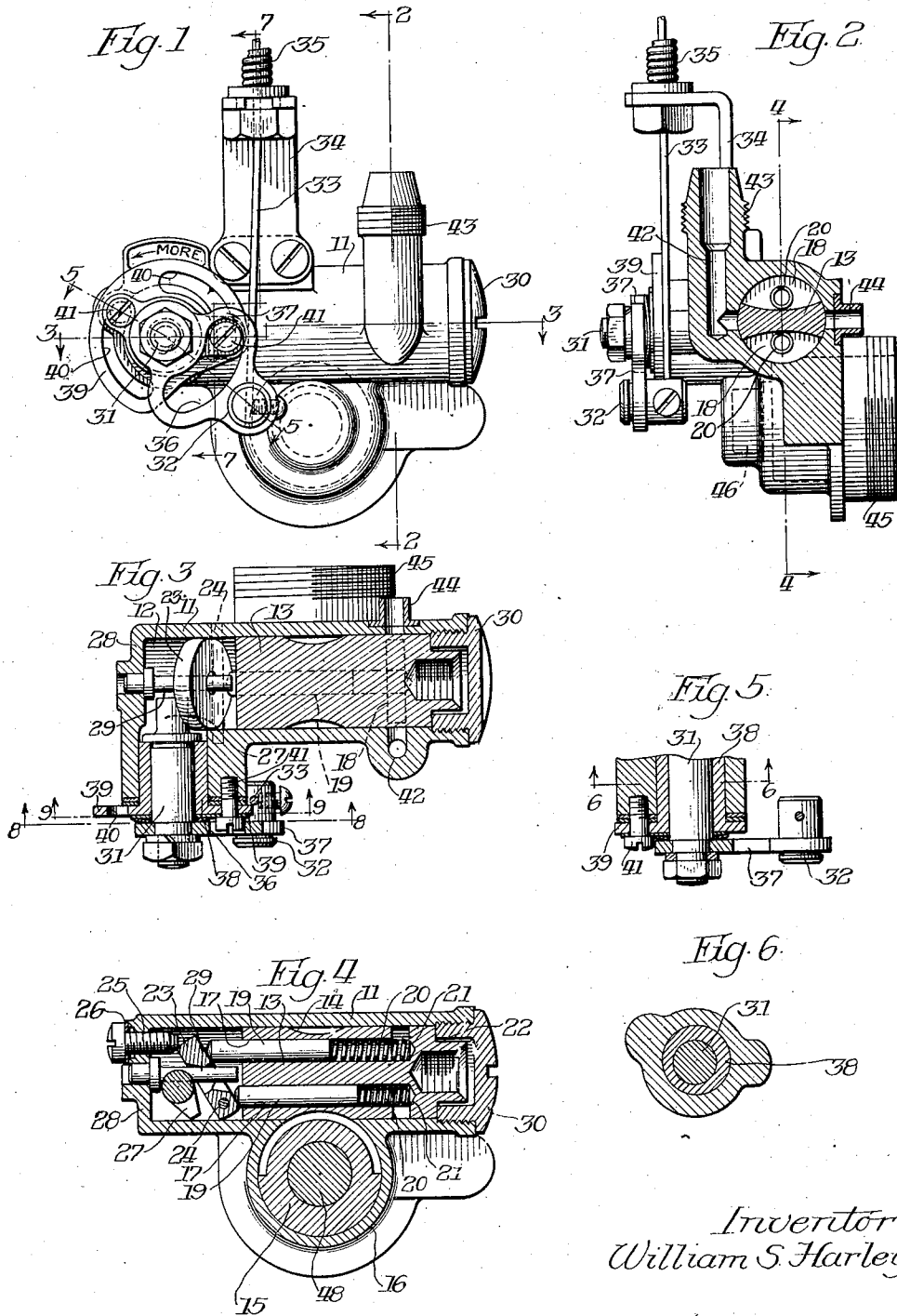
W. S. HARLEY

1,761,038

PUMP

Filed Oct. 31, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 7

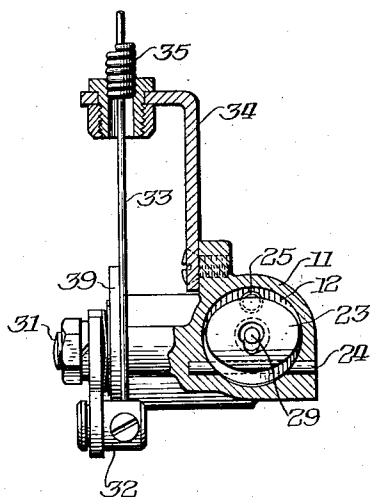


Fig. 8

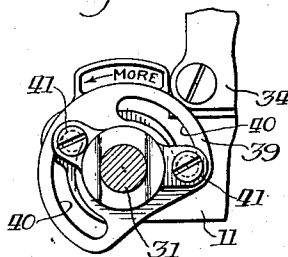


Fig. 9

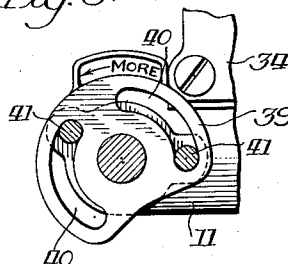
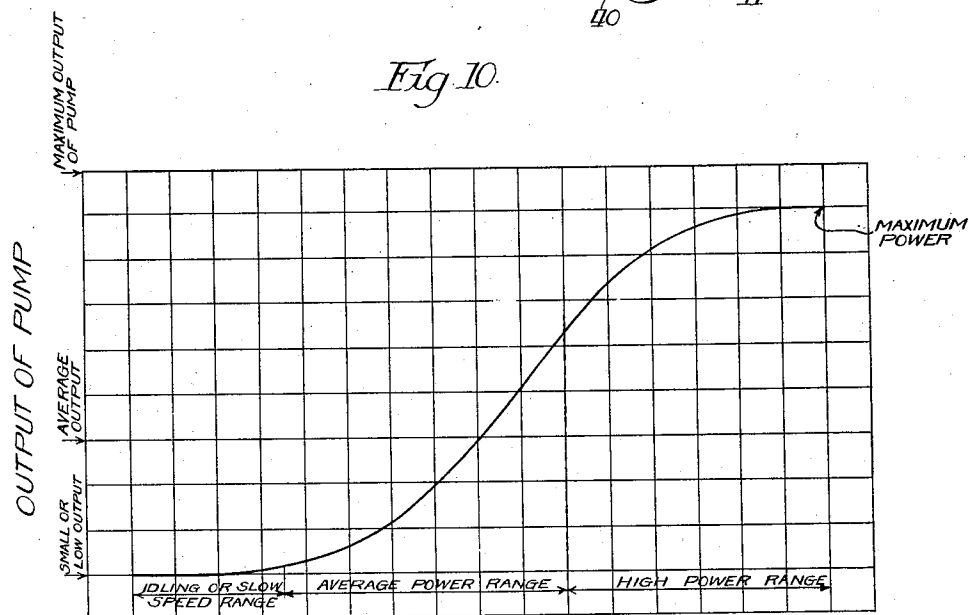


Fig. 10



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UNITED STATES PATENT OFFICE

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PUMP

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The present invention relates to pumps.

More particularly the present invention relates to oil pumps suitable for use upon self-propelled vehicles. The present invention has been illustrated and will be described with particular reference to pumps for use on motorcycles, though as the description proceeds it will be clear that the invention has a much broader application.

Pumps are commonly used on self-propelled vehicles, which pumps are mechanically driven by means operating in synchronism with the engine which drives said vehicle. The oil delivered by said pump varies ordinarily in proportion to engine speed, the amount of oil being delivered per engine revolution being the same at all speeds. This arrangement leaves much to be desired, inasmuch as the self-propelled vehicle ordinarily requires more oil per engine revolution when performing heavy duty (as for example when going through sand or going uphill) than when performing lighter duty. An expedient which has been used is to set the pump for overoiling at low speeds or under idling conditions, in order that the pump may partially respond to high speed requirements.

An object of the present invention is to provide a pump for use upon a self-propelled vehicle such as a motorcycle, which will vary the amount of fluid pumped per revolution of the driving engine of said vehicle in response to the power developed by said engine.

A further object is to provide an oil pump for an engine driven vehicle which automatically varies its output in response to the power requirements of the engine of said vehicle.

A further object is to provide an oil pump for a self-propelled vehicle which will automatically vary its output in response to movement of the fuel feeding throttle of said vehicle.

Further objects will appear as the description proceeds.

Referring to the drawings—

Figure 1 is a view in side elevation of an oil pump embodying the principles of the present invention;

Figure 2 is a sectional view taken along the plane indicated by the arrows 2—2 of Figure 1;

Figure 3 is a sectional view taken along the plane indicated by the arrows 3—3 of Figure 1;

Figure 4 is a sectional view taken along the plane indicated by the arrows 4—4 of Figure 2;

Figure 5 is a fragmentary sectional view taken along the plane indicated by the arrows 5—5 of Figure 1;

Figure 6 is a sectional view taken along the plane indicated by the arrows 6—6 of Figure 5;

Figure 7 is a sectional view taken along the plane indicated by the arrows 7—7 of Figure 1;

Figure 8 is a view taken along the plane indicated by the arrows 8—8 of Figure 3;

Figure 9 is a view taken along the plane indicated by the arrows 9—9 of Figure 3; and

Figure 10 is a diagram showing an illustrative curve of output of pump throughout the power range of the engine with which said pump is associated.

The numeral 11 indicates a housing having a cylindrical bore 12, which cylindrical bore contains the rotor 13. Said rotor 13 has a toothed periphery, as indicated by the numeral 14, for engagement with the worm 15, which worm 15 is housed within a portion 16 of the housing 11. The axis of the worm 15 is disposed in a plane at right angles to the axis of the rotor 13, and as said worm 15 is turned, a movement of rotation is communicated to said rotor 13. Said worm 15 may be connected to be driven by the engine (not shown) of the self-propelled vehicle with

which the present invention is adapted to be used.

According to the illustrated embodiment of the present invention, the rotor 13 is provided with two bores 17—17 having their axes parallel with the axis of rotation of the rotor 13. Said bores 17—17 are open at one end of the rotor 13, and at their other ends communicate with the apertures 18—18, which provide openings extending to the periphery of the rotor 13. Disposed within each of the bores 17—17 is a plunger 19, said plungers 19—19 being urged toward the extremity of the rotor 13, spaced from the apertures 18—18 by means of springs 20—20, each of which springs 20—20 has one end exerting force against the corresponding plunger 19 and its other end disposed in a seat 21 in the end portion 22 of the rotor 13. The outer extremities of the plungers 19—19 are adapted to ride against the swash plate 23, which is angularly disposed relative to the axis of rotation of the rotor 13. Said swash plate 23 is swingingly mounted relative to the housing 11, being mounted upon the pin 24 extending across the bore 12 of said housing 11 in a chord of said bore, said pin 24 having its extremities riveted or otherwise secured in the opposite walls of said housing 11. The cap screw 25 is provided for limiting swinging movement of the swash plate 23. By means of shims 26, the inner extremity of the cap screw 25 may be accurately and positively set whereby the maximum angularity of the position of the swash plate 23 may be accurately and positively set. The numeral 27 indicates a cam adapted to abut against the swash plate 23 to move said swash plate angularly away from the cap screw 25 in opposition to the force of the springs 20—20. Said cam 27 is connected to the throttle or other part associated with an internal combustion engine which is responsive to or which controls the power developed by said engine. The connections of the cam 27 will be described presently. As the parts are viewed in Figure 3, the left-hand end of the housing 11 has an end wall 28, which end wall is screw-threaded for the reception of the cap screw 25. Said end wall 28 also serves to support the guide pin 29, which guide pin extends through a central aperture in the swash plate 23 and which forms an abutment for the rotor 13. The other extremity of the housing 11 is closed by the cap 30, which limits the position of the rotor 13 in the opposite direction. From an inspection of Figure 3, it will be noted that the cam 27 is disposed at the inner extremity of the pin 31. The outer extremity of said pin 31 is provided with the lever 32, which lever is connected at its outer swinging extremity with the cable 33, which may be connected to the throttle of the internal combustion engine with which the present invention is adapted to be asso-

ciated. In the case of a motorcycle, said cable 33 may be conveniently connected to the handlebar throttle, which controls the feeding of the fuel to the cylinders of the internal combustion engine. The numeral 34 indicates a bracket, which may be secured to the housing 11, which bracket serves to guide the cable 33 and also serves as an abutment for one extremity of the armor 35, which may be provided for protecting the cable 33. The lever 32 is provided with an arcuate slot 36 having its axis coincident with the axis of the pin 31. Said arcuate slot 36 has closed extremities and is adapted to receive loosely a stud 37 carried by the housing 11, which stud 37 limits the angular movement of the lever 32 in response to operation of the cable 33. It will be clear that operation of the cable 33 will communicate a turning movement to the pin 31, which in turn will turn the cam 27 to change the angular position of the swash plate 23. Adjustment of the pin 31 and consequently of the cam 27 in a direction longitudinally of the rotor 13 is provided by means of the eccentric bushing 38, the eccentricity of which is shown exaggerated in Figure 6. Said eccentric bushing 38 is provided with the flange 39, which in the illustrated embodiment of the present invention is provided with a pair of arcuate slots 40—40 for receiving cap screws 41—41 adapted to be mounted in the housing 11. By loosening said cap screws 41—41 and turning the flange 39, the position of the eccentric bushing 38 may be changed, whereby the axis of the pin 31, and therefore the axis of the cam 27, may be adjusted longitudinally of the bore 12. The slot 36 in the lever 33 is sufficiently wide to permit the adjustment referred to.

It will be understood, of course, that the cam 27 may be shaped to give the range of oil output suitable for any specified requirements. Figure 10 gives an idea of the relative amounts of oil output at certain predetermined ranges of power in a self-propelled vehicle, such as a motorcycle.

Communicating with the bore 12 of the housing 11 at a region adjacent to the apertures 18—18 of the rotor 13 is the passageway 42, provided by the tube 43. Said tube 43 may be connected to an oil reservoir. Said passageway 43 is positioned to communicate with the apertures 18—18 of the rotor 13 as said rotor turns. Oppositely disposed relative to the passageway 42 is the outlet passageway 44, also adapted to communicate with the apertures 18—18 as the rotor 13 turns. Said passageway 44 may communicate with the parts of the vehicle which are to be oiled. The rotor will, of course, fit its bore sufficiently closely to prevent the passage of oil therealong under the pressures involved. The worm 15 is disposed within the cavity 45, which communicates with the bore 12 of the housing 11. The inner extremity

of the cavity 45 is provided with a seat 46 for receiving the extremity of the shaft 48, which carries the worm 15.

The mode of operation of the above described embodiment of the present invention will be clear from the description appearing above. It may be stated briefly, however, that oil will be admitted through the passageway 42, and as the rotor 13 turns, due to operation of the engine with which the device is associated the oil entering through passageway 42 will communicate successively with the apertures 18—18 of the rotor 13. Each aperture 18 will receive a charge of oil from said passageway 42, which charge of oil will be received at the time when the corresponding plunger 19 is disposed outwardly of its corresponding bore; that is to say, oil will be admitted from the passageway 42 to each aperture 18 when the corresponding plunger 19 is in contact with that portion of the swash plate 23 spaced from the pin 24. As the rotor 13 turns, the plunger 19 corresponding to the aperture 18 which has received a charge of oil will be inwardly moved in opposition to the corresponding spring 20, being caused to move inwardly by reason of the wedging action of the swash plate 23. Communication between each aperture 18 and the outlet 44 will be had at a time when said aperture is out of communication with the inlet passageway 42, whereby the corresponding plunger 19 will force the oil from said aperture 18 through said outlet 44. For any setting of the swash plate 23, the amount of oil pumped will be substantially constant per engine revolution. As indicated above, however, it is desirable to increase the amount of oil pumped per engine revolution as the power demands upon the engine increase. Accordingly, according to the present invention, the angularity of the swash plate 23 is controlled by means of the cable 33, which may be connected to the throttle of the engine with which the present invention is adapted to be used, or with any other member which is responsive to the power control or to the power output of said engine. Movement of the cable 33 in response to changes of power will result in movement of the lever 32, which in turn communicates movement to the pin 31 and to the cam 27. Turning of the cam 27 swings the swash plate 23 about the axis of the pin 24, thereby modifying the length of stroke of the plungers 19—19 and modifying the output of the pump in response to changes in position of said cable 33. Settings may be made of the cam 27 by means of the eccentric bushing 38. By turning said eccentric bushing, the position of the axis of the pin 31 and therefore the axis of movement of said cam 27 may be adjusted longitudinally of the bore 12. While the effect of this adjustment is felt at all speeds, the percentage

change is much greater at low output, and consequently this adjustment may be considered a low speed adjustment. By means of the screw 25, the total output of the pump is determined and is maintained. In other words, when the engine is operating at full throttle either at high speed or up hills, or through heavy sand, a certain amount of oil is pumped, in accordance with the setting of the screw 25.

Though a preferred embodiment of the present invention has been described in detail, many modifications will occur to those skilled in the art. It is intended to cover all such modifications that fall within the scope of the appended claims.

What is claimed is—

1. In combination with an engine, means driven synchronously with said engine, a plunger movable in response to operation of said synchronously driven means, a plate disposed angularly with reference to the line of movement of said plunger for determining the length of stroke of said plunger, a cam for changing the angularity of said plate, and means operating in synchronism with the power control of said engine for controlling said cam, said cam being provided with adjustment means for shifting the axis of said cam.

2. In combination with an engine, means driven synchronously with said engine, a plunger movable in response to operation of said synchronously driven means, a plate disposed angularly with reference to the line of movement of said plunger for determining the length of stroke of said plunger, a cam for changing the angularity of said plate, and means for operating in synchronism with the power control of said engine for controlling said cam, eccentric mounting means for said cam and means for moving said eccentric mounting means to shift the axis of said cam.

3. In combination with an engine, a member driven synchronously with said engine, a pump driven by said synchronously driven member, said pump including a rotor, a plunger disposed longitudinally of said rotor, a spring for moving said plunger to a predetermined position, a plate disposed angularly with reference to the axis of said rotor adapted to engage an extremity of said plunger and to cause movement of said plunger in opposition to said spring longitudinally of said rotor, a stop for limiting the angularity of said plate, an adjusting member for adjusting the angularity of said plate, means responsive to the power control of said engine for controlling said adjusting member, and eccentric means for shifting the axis of said adjusting member.

4. In a pump, in combination, a rotor, bores in said rotor having their axes disposed parallel to the axis of rotation of said rotor, plunger

ers in said bores, said rotor having outlets communicating with said bores, springs in said bores cooperating with said plungers and tending to hold said plungers away from said outlets, a swinging plate adapted to engage the ends of said plungers distant from said springs, said swinging plate being hinged eccentrically with reference to the axis of said rotor, a cam member for adjusting the position of said swinging plate, eccentric mounting means for said cam member, and means for adjusting the axis of said cam member.

Signed at Milwaukee, Wisconsin, this 28th day of October, 1927.

WILLIAM S. HARLEY.

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