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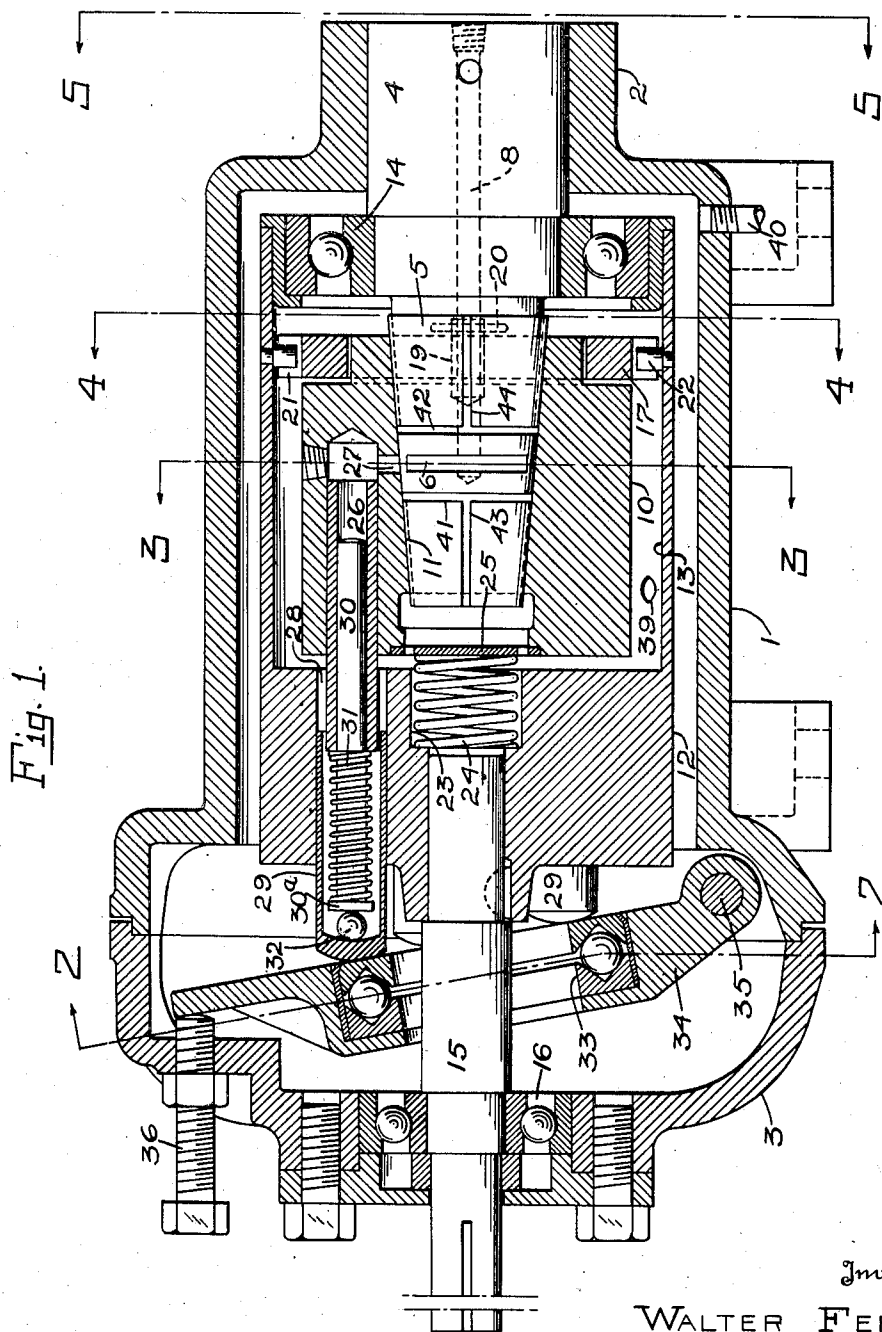
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PUMP

Filed March 18, 1931

3 Sheets-Sheet 1



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Fig. 2.

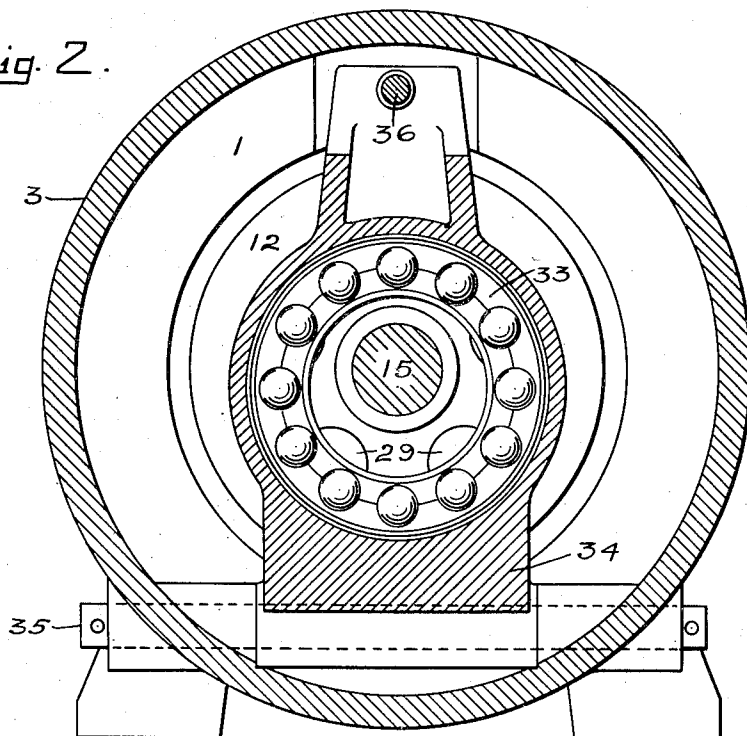
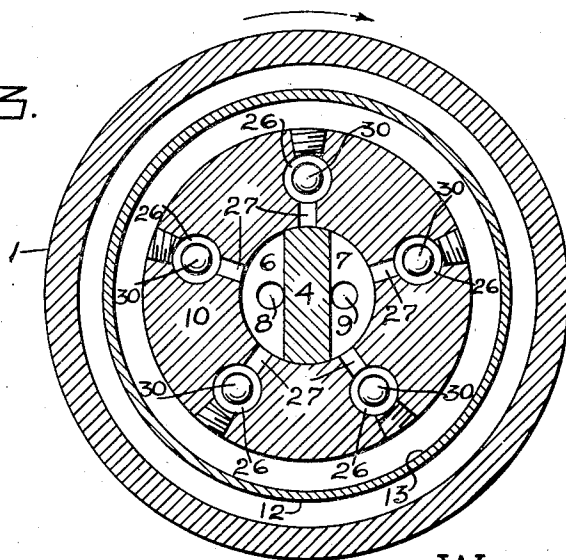


Fig. 3.



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Fig. 4.

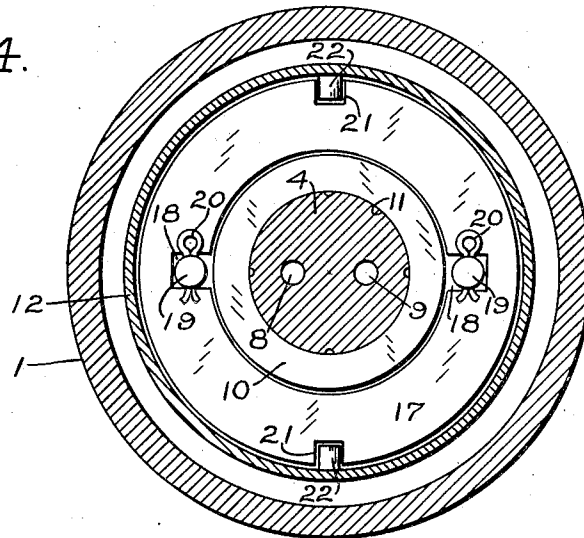
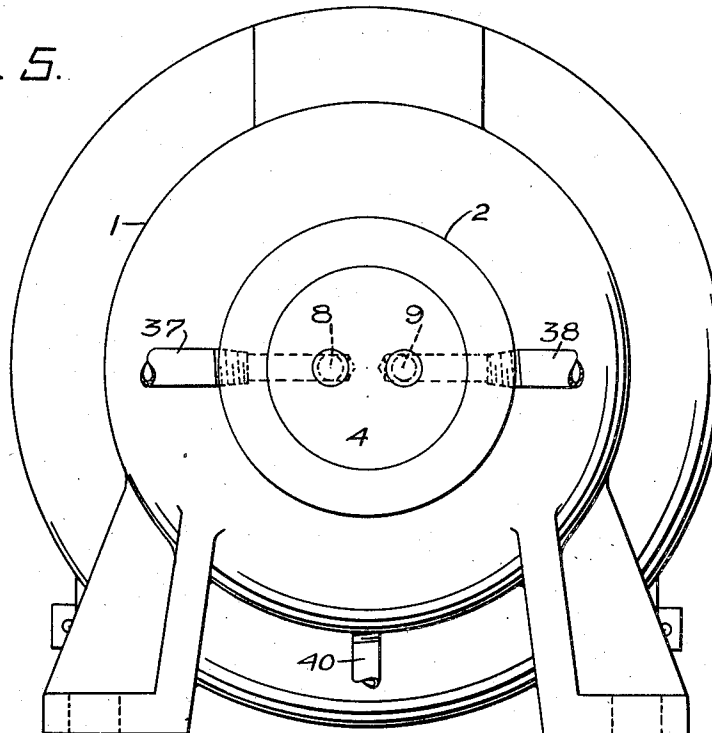


Fig. 5.



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UNITED STATES PATENT OFFICE

1,970,133

PUMP

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Application March 18, 1931, Serial No. 523,436

20 Claims. (Cl. 103—162)

This invention relates to pumps. The pump to which the invention applies in particular has its rotor journaled upon a pintle and provided with cylinders which are parallel to the axis thereof, pistons fitted in the cylinders and reciprocated therein by engagement with a thrust member which is inclined to the axis of rotation, and ports and passageways in the pintle through which liquid is delivered to the cylinders and discharged therefrom.

Liquid escapes from between the complementary surfaces of the pintle and cylinder barrel when the pump is in operation, and this volume of escaping liquid, which is generally designated as the slip of the pump, increases as the pressure created by the pump increases.

The volume of liquid escaping from between the pintle and cylinder barrel at any given pressure varies according to the variation in clearance between the coating surfaces thereof, and variation in this clearance is caused by wear on the coating surfaces and by inaccurate alinement of the parts due to compounding slight manufacturing errors which are difficult to avoid in the manufacture of the pump.

An object of the invention is to provide a pump of this character in which the cylinder barrel is free to adjust itself upon the pintle.

Another object is to reduce the slip of the pump to a negligible volume.

Another object is to maintain the slip of the pump at a substantially constant negligible volume throughout a wide variation in pressure created by the pump.

Another object is to urge the coating surfaces of the cylinder barrel and the pintle toward each other by a force which is proportional to the pressure created by the pump.

Another object is to urge the coating surfaces of the cylinder barrel and the pintle toward each other by a constant force.

Another object is to provide a pump which is compact and sturdy.

Another object is to provide a pump of this character which is efficient in operation.

Another object may be to provide a pump which is easily and readily assembled and disassembled.

According to the invention in one of its aspects, the cylinder barrel is driven through a flexible connection which allows it to adjust itself upon the pintle.

According to the invention in another aspect, the pintle is tapered and the cylinder barrel is urged toward the large end thereof to reduce the

clearance between the coating surfaces of the cylinder barrel and the pintle.

According to the invention in another aspect, the cylinder barrel is arranged substantially within the driver and connected thereto by a flexible connection which allows the pump to be readily assembled and disassembled.

The invention is exemplified by the pump shown in the accompanying drawings in which the views are as follows:

Fig. 1 is a central longitudinal vertical section through the pump.

Fig. 2 is a transverse section on the irregular line 2—2 of Fig. 1.

Fig. 3 is a transverse section on the line 3—3 of Fig. 1.

Fig. 4 is a transverse section on the line 4—4 of Fig. 1.

Fig. 5 is an end view taken on the line 5—5 of Fig. 1.

The pump illustrated in the drawings has its mechanism enclosed within a casing 1 which is closed at its rear end by an integral head 2 and at its front end by a removable head 3.

A pintle 4 is secured in the rear head 2 in a fixed position and has its inner part 5 tapered and provided with two segmental ports 6 and 7 which communicate, respectively, with two passageways 8 and 9 formed in the pintle 4 and in the head 2.

The pintle 4 has a cylinder barrel 10 journaled thereon and provided with a tapered bore 11 which conforms as exactly as possible to the contour of the tapered part 5.

The cylinder barrel 10 is driven by a driver 12 which has a recess 13 extending forward from its rear end and substantially enclosing the cylinder barrel 10.

The peripheral wall of the recess 13 is fitted at its rear end upon the outer periphery of an anti-friction thrust bearing 14 which is arranged upon the pintle 4 between its tapered part 5 and the head 2 and rotatably supports the rear end of the driver 12.

The driver 12 may thus be readily disengaged from the bearing 14 and removed through the front end of the casing 1.

The front end of the driver 12 is rigidly secured to a driving shaft 15 which extends through the front head 3 and is journaled in an anti-friction thrust bearing 16 arranged therein.

The driving shaft 15 is driven from an outside source of power and the thrust bearings 14 and 16 hold the driver 12 and the shaft 15 against axial movement during rotation thereof.

The cylinder barrel 10 has its rear end reduced

in diameter and surrounded by a loosely fitted ring 17 having two diametrically opposed apertures 18 formed therein to receive two loosely fitted pins 19 which are rigidly secured in the cylinder barrel 10 and provided at their outer ends with cotters 20 to hold the ring 17 in position.

The ring 17 has two diametrically opposed notches 21 formed in its outer periphery 90° from the apertures 18, and the driver 12 has two diametrically opposed driving pins 22 secured in the wall of the recess 13 and arranged in the notches 21 to drive the ring 17.

When the shaft 15 is rotated, the driver 12 rotates the ring 17 through the pins 22, and the ring 17 rotates the cylinder barrel 10 through the pins 19.

The ring 17 and the pins 19 and 22 constitute a flexible driving connection or universal joint which positively drives the cylinder barrel 10 and at the same time allows it to adjust itself upon the pintle 4 and to be adjusted axially thereon to compensate for variation in the pressure created by the pump.

This flexible connection thus allows the cylinder barrel to obtain a substantially perfect seat upon the pintle, regardless of errors in alignment of the coating parts or of deflections under load.

The driver 12 is preferably provided with a counterbore 23 concentric to the shaft 15 to receive a compression spring 24 which bears against the inner end of the counterbore 23 and against a plate 25 carried by the cylinder barrel 10 in alignment with its bore 11.

The spring 24 urges the cylinder barrel 10 rearward toward the large end of the tapered part 5 of the pintle 4 and creates an initial pressure between the wall of the bore 11 and the periphery of the tapered part 5.

The cylinder barrel 10 is shown provided with five cylinders 26 arranged parallel to the axis of the pintle 4 and equidistant therefrom and equally spaced from each other.

Each cylinder 26 may be simply a bore formed in the cylinder barrel 10 and communicating with the bore 11 through a port 27 but, preferably, it is a separate cylinder secured in the cylinder barrel 10 and extending forward into a bore 28 formed in the front part of the driver 12, as shown in Fig. 1.

Each of the bores 28 has fitted for reciprocation therein a hollow plunger 29 the inside diameter of which is sufficiently large to allow the plunger to telescope with the cylinder 26 when it is urged rearward.

Each of the cylinders 26 has a piston 30 fitted therein and urged forwardly by a helical compression spring 31 which encircles the piston 30 between the enlarged head 30^a thereof and the end of the cylinder 26.

Preferably, the plunger 29 has a bearing ball 32 arranged between the inner face of its front end and the head 30^a of the piston 30, and the spring 31 urges the piston 30 and the plunger 29 forward and holds the front end of the plunger 29 against an anti-friction thrust bearing 33 carried by a cam plate 34 which is pivoted at its lower edge upon a pin 35 carried by the casing 1.

The cam plate 34 is held in adjusted positions by an adjusting screw 36 which is threaded through the front head 3 and abuts the upper edge of the cam plate 34 at a point diametrically opposite the pin 35.

If the adjusting screw 36 is advanced until the rear face of the bearing 33 is vertical, the pump will be at zero stroke and, if the adjusting screw

36 is retracted until the top of the cam plate 34 is in its forwardmost position, the pump will be at full stroke.

When the cam plate 34 is inclined to the axis of the pump and the shaft 15 is rotated, the plungers 29 will rotate and carry the rear ring of the thrust bearing 33 around with them; the downward moving pistons being forced inward by the cam plate 34 and the upward moving pistons being forced outward by their springs 32.

The shaft 15 may be rotated in either direction but, if it is rotated in the direction of the arrow shown in Fig. 3, the pistons at the left of the vertical center-line will be forced outward by the springs 31 and draw liquid into their cylinders through the ports 27, the port 6 and the passageway 8 which, in this instance, would be connected by an intake pipe 37 to a reservoir or other source of liquid, and the pistons at the right of the vertical centerline would be forced inward by the cam plate 34 and expel liquid from their cylinders through the ports 27, the port 7 and the passageway 9 which, in this instance, would be connected to a discharge pipe 38.

Due to the inclination of the cam plate 34, there is a slight relative radial movement between the pistons 30 and the cam plate 34 during operation of the pump, and the friction produced by this radial movement would cause the pistons 30 to bind in the cylinders 26 and prevent the cylinder barrel 10 from freely adjusting itself upon the pintle 4 if it were not for the plungers 29 which transmit the entire lateral thrust to the driver 12 and thus allow the pistons 30 to reciprocate freely in the cylinders 26.

This lateral movement might cause the coating surfaces of the plungers 29 and the bores 28 to wear and allow the plungers 29 to move laterally in the bores 28 if the bearing balls 32 were not provided to prevent such lateral movement from being transmitted to the pistons 30.

As the cylinder ports pass from one pintle port to the other, liquid is applied to the periphery of the pintle 4 and this liquid is distributed by the rotating cylinder barrel over the entire surface of the tapered part 5 to provide a lubricating film which is subjected to a predetermined initial surface pressure by the thrust of the spring 24.

A part of the liquid composing the lubricating film works along the pintle 4 and escapes from the ends of the tapered part 5, and the amount of liquid which thus escapes is generally designated as the slip of the pump. The volume of escaping liquid would increase as the pressure created by the pump increased if the clearance between the cylinder barrel and the pintle remained constant.

However, the liquid in the pressure cylinders acts against the inner ends thereof and urges the cylinder barrel rearward with a force proportional to the pump pressure and thereby reduces the clearance between the cylinder barrel and the pintle as the pressure rises. The slip of the pump is thus held at a substantially constant minimum.

The liquid escaping from between the cylinder barrel and the pintle flows into the casing 1 through drain holes 39 formed in the wall of the recess 13 and is then delivered to the reservoir or the intake pipe 37 through a drain pipe 40.

The pressure of the discharge liquid is transmitted to the lubricating film on the pressure side of the pintle and tends to move the cylinder barrel laterally. The clearance between the cylinder barrel and the pintle thus tends to increase on the discharge side of the pump and to decrease on the intake side thereof, thereby

tending to throw the cylinder barrel out of balance.

In order to minimize this effect, the pintle bore is provided with two annular grooves 41 and 42 arranged upon opposite sides of the ports 6 and 7 to limit the pressure area, and with axial grooves 43 and 44 leading, respectively, from the grooves 41 and 42 to the ends of the tapered part 5 to allow the escape of liquid collected by the grooves 41 and 42. These grooves also act as lubricating ducts to insure complete lubrication of the tapered portion of the pintle surfaces.

The pump may be disassembled by simply removing the front head 2 and the cam plate 34, then pulling the shaft 15 and the driver 12 through the open front end of the casing 1, and then removing the cylinder barrel 10.

In assembling the pump, the ring 17 is attached to the cylinder barrel 10 which is then placed upon the pintle 4 and then the driver 12 is inserted through the front end of the casing 1 and forced rearward until its rear end is seated upon the outer periphery of the bearing 14, the pins 22 entering the slots 21 in the ring 17 as the driver is moved rearward.

The invention herein set forth is susceptible of various modifications and adaptations without departing from the scope thereof as hereafter claimed.

The invention is hereby claimed as follows:

1. A pump, comprising a pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, and means for reciprocating said pistons.

2. A pump, comprising a pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, plungers arranged in said driver and guided thereby for operating said pistons, and means for reciprocating said plungers.

3. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pis-

tons arranged in said cylinders, and means for reciprocating said pistons.

4. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, plungers arranged in said driver and guided thereby for operating said pistons, and means for reciprocating said plungers.

5. A pump, comprising a pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, and means for reciprocating said pistons.

6. A pump, comprising a pintle fixed at one end thereof in a stationary position and having inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, plungers arranged in said driver and guided thereby for operating said pistons, and means for reciprocating said plungers.

7. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet passageways and inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and provided with ports for communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, means for urging said cylinder barrel toward the large end of said tapered pintle to create a pressure between said cylinder barrel and said pintle, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, and means for reciprocating said pistons.

8. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet passageways and inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable

- cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and provided with ports for communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, means for urging said cylinder barrel toward the large end of said tapered pintle to create a pressure between said cylinder barrel and said pintle, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, and means for reciprocating said pistons.
9. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet passageways and inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and provided with ports for communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, means for urging said cylinder barrel toward the large end of said tapered pintle to create a pressure between said cylinder barrel and said pintle, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, plungers for operating said pistons arranged in said driver and guided thereby to prevent lateral strains upon said pistons, and means for reciprocating said plungers.
10. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet passageways and inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and provided with ports for communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, pistons arranged in said cylinders, hollow plungers arranged in said driver and guided thereby, a piston fitted in each of said cylinders and having a head secured upon its outer end and arranged within the corresponding plunger, a spring urging said piston outward, and means for forcing said plungers successively inward as said driver rotates.
11. A pump, comprising a tapered pintle fixed at one end thereof in a stationary position and having inlet and outlet passageways and inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon and carried by said pintle and having cylinders arranged therein parallel to the axis of said pintle and provided with ports for communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, means for urging said cylinder barrel toward the large end of said tapered pintle to create a pressure between said cylinder barrel and said pintle, a driver for rotating said cylinder barrel, means independent of said cylinder barrel for supporting said driver, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver, hollow plungers arranged in said driver and guided thereby, a piston fitted in each of said cylinders and having a head secured upon its outer end and arranged within the corresponding plunger, a spring urging said piston outward, and means for forcing said plungers successively inward as said driver rotates.
12. A pump, comprising a casing, a stationary pintle carried by said casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver substantially enclosing said cylinder barrel and journaled upon said pintle, means connecting said driver to said cylinder barrel, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, and means for reciprocating said pistons as said cylinder barrel rotates.
13. A pump, comprising a casing, a stationary pintle secured in the rear end of said casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver substantially enclosing said cylinder barrel and journaled upon said pintle at the rear of said cylinder barrel, means connecting said driver to said cylinder barrel, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, and means for reciprocating said pistons as said cylinder barrel rotates.
14. A pump, comprising a casing, a stationary pintle secured in the rear end of said casing and provided with inlet and outlet passageways and having its inner part tapered and provided with inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon the tapered part of said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver substantially enclosing said cylinder barrel and journaled upon said pintle at the rear end of said cylinder barrel, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, and means for reciprocating said pistons to create fluid pressure in said cylinders and thereby urge said cylinder barrel rearward and create pressure between it and said pintle proportional to the pressure created in said cylinders.
15. A pump, comprising a casing, a stationary pintle secured in the rear end of said casing and provided with inlet and outlet passageways and having its inner part tapered and provided with inlet and outlet ports communicating with said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon the tapered part of said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver

substantially enclosing said cylinder barrel and journaled upon said pintle at the rear end of said cylinder barrel, means connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, means for reciprocating said pistons to create fluid pressure in said cylinders and thereby urge said cylinder barrel rearward and create pressure between it and said pintle proportional to the pressure created in said cylinders, and means for maintaining a substantially constant initial pressure between said cylinder barrel and said pintle.

- 15 16. A pump, comprising a casing, a stationary pintle secured in the rear end of said casing and provided with inlet and outlet passageways and having its inner part tapered and provided with inlet and outlet ports communicating with
20 said inlet and outlet passageways respectively, a rotatable cylinder barrel journaled upon the tapered part of said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet
25 ports alternately as said cylinder barrel rotates, a driver substantially enclosing said cylinder barrel and journaled upon said pintle at the rear end of said cylinder barrel, means connecting said cylinder barrel to said driver and allowing it to adjust
30 itself upon said pintle, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, means for reciprocating said pistons to create fluid pressure in said cylinders and thereby urge said cylinder
35 barrel rearward and create pressure between it and said pintle proportional to the pressure created in said cylinders, and a spring for exerting a substantially constant force upon said cylinder barrel to urge it rearward and thereby
40 maintain a substantially constant initial pressure between said cylinder barrel and said pintle.

17. A pump, comprising a casing, a stationary pintle secured in the rear end of said casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled
45 upon said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver substantially enclosing said cylinder barrel and journaled upon said pintle at the rear of said
50 cylinder barrel, a ring pivoted near its inner periphery to the rear end of said cylinder barrel at diametrically opposite points and having two notches formed in its outer periphery and spaced
55 90° from said points, pins arranged in said notches and secured to said driver to enable it to drive said cylinder barrel, means for rotating said driver and thereby rotating said cylinder barrel, pistons arranged in said cylinders, and means for reciprocating said pistons.

18. A pump, comprising a casing, a tapered pintle secured at its rear end in the rear end of said

casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel extending over the same and journaled upon said pintle behind said cylinder barrel, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, a drive shaft journaled in the front end of said casing and connected at its inner end to said driver for rotating the same and supporting the front end thereof, pistons arranged in said cylinders, and means for reciprocating said pistons as said cylinder barrel rotates.

19. A pump, comprising a casing, a tapered pintle secured at its rear end in the rear end of said casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon said pintle and having cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel extending over the same and journaled upon said pintle behind said cylinder barrel, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, a drive shaft journaled in the front end of said casing and connected at its inner end to said driver for rotating the same and supporting the front end thereof, pistons arranged in said cylinders and guided by said driver for reciprocation in said cylinders, and means for reciprocating said pistons as said cylinder barrel rotates.

20. A pump, comprising a casing, a tapered pintle secured at its rear end in the rear end of said casing and provided with inlet and outlet ports and passageways, a rotatable cylinder barrel journaled upon said pintle and having tubular cylinders arranged therein parallel to the axis of said pintle and communicating with said inlet and outlet ports alternately as said cylinder barrel rotates, a driver for rotating said cylinder barrel extending over the same and journaled upon said pintle behind said cylinder barrel, a universal joint connecting said cylinder barrel to said driver and allowing it to adjust itself upon said pintle, a drive shaft journaled in the front end of said casing and connected at its inner end to said driver for rotating the same and supporting the front end thereof, hollow plungers fitted in said driver for reciprocation therein, pistons arranged in said cylinders and extending into said plungers to be reciprocated thereby, and means for reciprocating said plungers as said cylinder barrel rotates.

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