April 18, 1967 G. H. DRUTCHAS ETAL 3,314,368

ROTARY PISTON PUMP WITH RETRACTABLE CAM SEALING ELEMENTS

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Fig-1

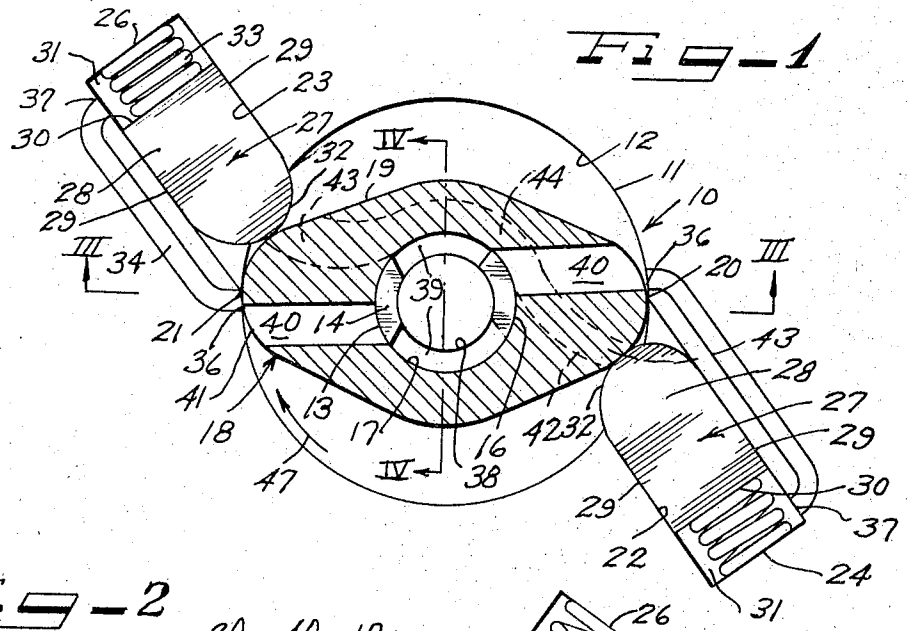

Fig-2

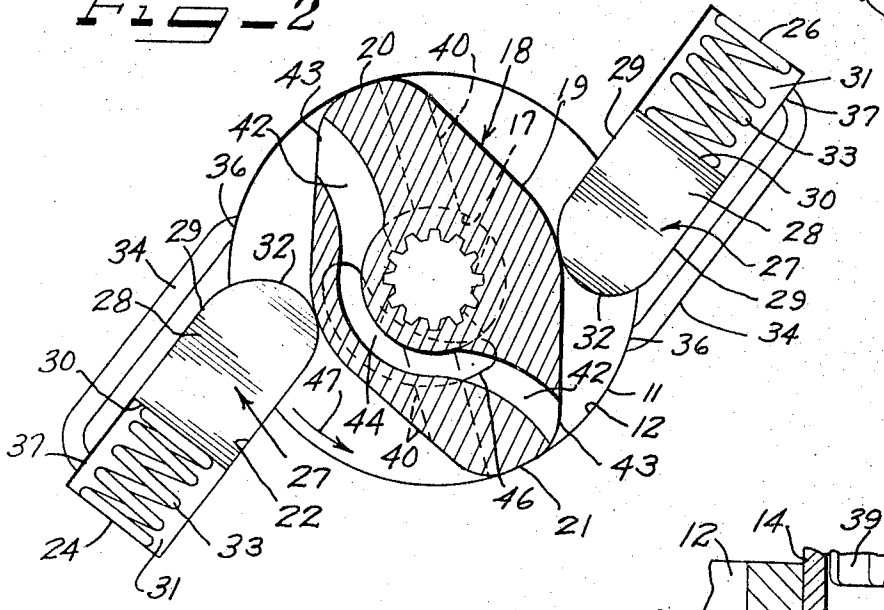

Fig-3

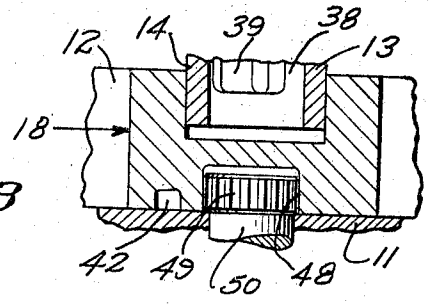

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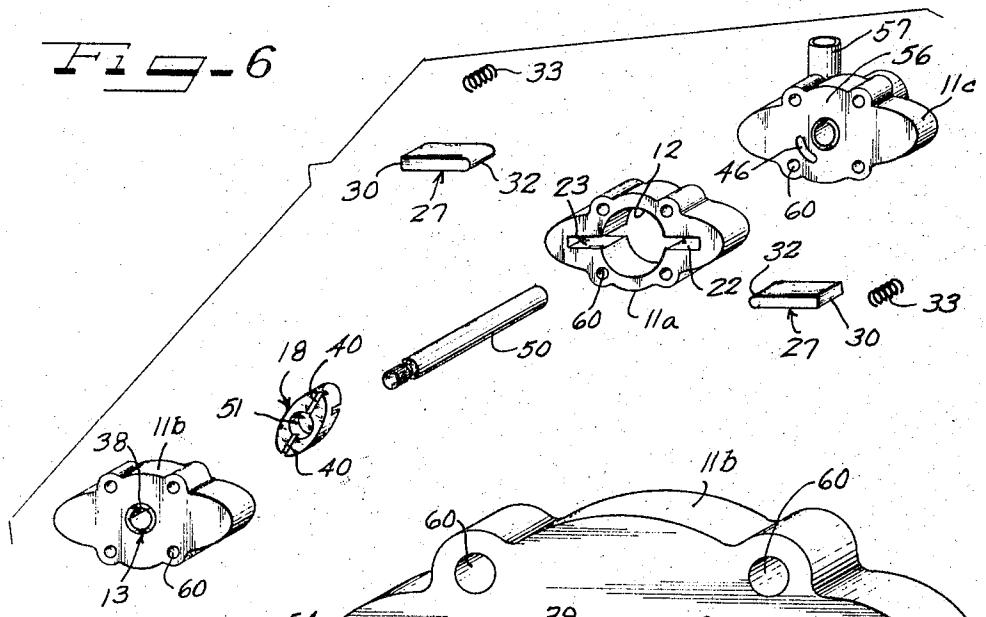
Fig. 6



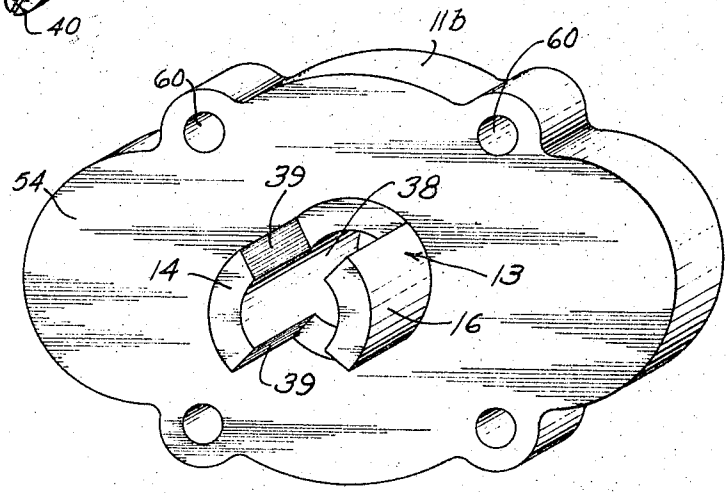


Fig. 5

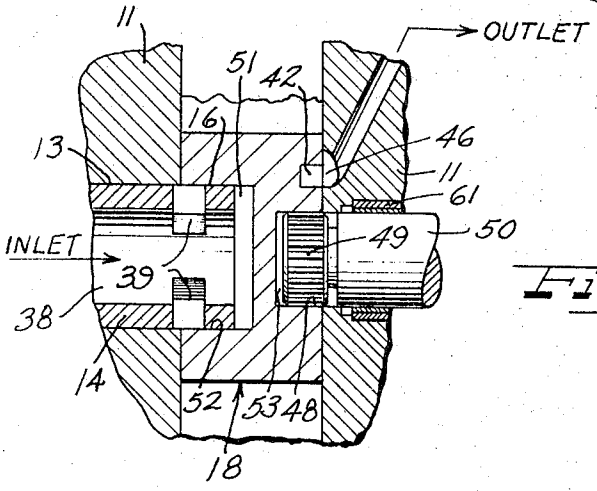


Fig. 4

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ROTARY PISTON PUMP WITH RETRACTABLE CAM SEALING ELEMENTS

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4 Claims. (Cl. 103—123)

This invention relates generally to methods and apparatus of pumping or motoring fluids of any type and more particularly relates to a rotary piston pump with retractable cam sealing elements wherein a rotary piston having two movable sealing points slidably engaging the walls of a circular pumping chamber is, in turn, sealed by two slidably retractable cams which may be pressure loaded into sealing engagement with the rotary piston, thereby to successively expand and contract the volume of pumping spaces formed between the respective cams, which pumping spaces are ported through the rotary piston.

It is an object of the present invention to provide an improved rotary piston pump.

Another object of the present is to provide a rotary piston pump with retractable cam sealing elements which are pressure-biased by fluid at pump-generated pressures.

Still another object of the present invention is to provide a rotary piston pump wherein a fixed commutation pintle forms a portion of the inlet passage and inlet fluid is conducted from the pintle to the pumping chamber via the rotary piston.

A still further object of the present invention is to provide a rotary piston pump wherein fluid is discharged through a side porting arrangement and at least a portion of the discharge passages are formed in the rotary piston of the pump.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a structural embodiment of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a somewhat schematic view of a rotary piston pump with retractable cam sealing elements as provided in accordance with the principles of the present invention;

FIGURE 2 is a view of the pump of FIGURE 1 showing the opposite side of the pumping construction;

FIGURE 3 is a fragmentary cross-sectional view taken generally on line III—III of FIGURE 1;

FIGURE 4 is a fragmentary cross-sectional view taken generally on line IV—IV of FIGURE 1;

FIGURE 5 is an elevational view of the rear header incorporated in the pump of the present invention and showing additional details of construction of the pintle arrangement included in the pump; and

FIGURE 6 is an exploded view showing additional details of construction of the pump and showing the header of FIGURE 5 from the opposite side.

As shown on the drawings:

The pump of the present invention is shown generally at **10** and comprises a casing **11** in which is formed a pumping bore of circular configuration **12**.

A pintle shown generally at **13** has a bearing portion **14** projecting into the pumping bore **12** and a bearing surface **16** on the periphery of the bearing portion **14** rotatably supports a bearing surface **17** formed in the hub portion of a rotor shown generally at **18**. The rotor **18** has an irregular peripheral surface **19** which is

characterized by a pair of circumferentially spaced sealing areas located in diametrically opposed relation to one another and shown at **20** and **21**, respectively. Thus, when the rotor **18** is rotated within the pumping bore **12**, the sealing areas **20** and **21** will slidably engage the adjoining wall of the pumping bore **12** in sealing relation therewith.

The casing **11** is further characterized by a pair of slots **22** and **23** which extend outwardly of the pumping bore **12** in generally parallel relation to one another and in a chordal relation relative to the circular pumping bore **12**. Each of the slots **22** and **23** includes spaced apart side walls which terminate in a bottom wall shown at **24** and **26**, respectively.

A retractable cam member **27** is located in each respective cam slot **22** and **23** and since the cam members are of identical construction, like reference numerals will be used to identify like parts.

Each cam member **27** is generally of rectangular configuration including longitudinally spaced end walls **28**, side walls **29**, **29** and a bottom wall which forms a motive surface **30**. The motive surface **30** is spaced from the bottom wall **26** at the bottom of the slot **22** or **23**, thus to form a pressure control chamber **31**.

The portion of the cam **27** projecting into the pumping chamber **12** constitutes a curved cam action surface **32**, thereby to slidably engage the peripheral surface **19** of the rotary piston **18** in sealing relationship therewith.

A continuous biasing means which may conveniently take the form of a coil spring **33** is located in each respective slot **22** and **23** and has one end bottomed against the motive surface **30** and the other end bottomed against the corresponding bottom wall **24** or **26** of each corresponding slot **22** and **23**, thereby to preload the cams **27** into sealed relation with the rotary piston **18**.

In order to afford pressure loading of the cam members **27**, the casing **11** is formed with a passage **34** communicating with the pumping chamber **12** as at **36** and opening into the bottom portion of the slot at **37**. Thus, fluid at pump-generated pressure will be conducted into the pressure control chambers **31** and the pressure will thus be exerted against the motive surface **30** to pressure-load the cams **27** into sealing relation with the rotary piston **18**.

The pintle **13** is hollow thereby forming an axial inlet passage **38** and the bearing portion **14** is characterized by radially outwardly extending inlet ports **39**, **39**. The inlet ports **39**, **39** in the pintle **13** communicate with inlet passages formed in the rotary piston **18** and which are shown at **40**. Each of the passages **40** extends generally radially outwardly and it will be noted that each passage **40** opens out of the peripheral surface **19** of the rotary piston **18** as at **41** on one circumferential side of the corresponding sealing areas **20** and **21**, respectively.

The rotary piston **18** is also formed with discharge passages more clearly shown in FIGURE 2 and the discharge passages are shown at **42** and extend inwardly from a location **43** on the opposite circumferential side of the respective sealing areas **20** and **21** inwardly towards a common area **44** in register with a kidney-shaped side outlet port **46** formed in an adjoining wall of the casing **11**.

By virtue of such provision, when the rotary piston **18** is rotated in the direction of the arrow **47**, it will act to successively expand and contract the volume of the pumping spaces between the respective cams **27** and the respective sealing areas **20** and **21**. Accordingly, fluid will be drawn in through the inlet passages **40**, the ports **39**, **39**, and the axial inlet passage **38** and the pintle **13**. When compressed through rotative action of the rotary piston **18**, the pressurized fluid will be discharged

through the passage **42** and the port area **44** into the outlet port **46** for direction to a point of utilization.

In order to provide a rotatable driving connection for the rotary piston **18**, the hub portion of the rotary piston **18** is formed with a spline coupling **48** which cooperates with a corresponding spline **49** in a shaft **50**.

As shown in FIGURES 3 and 4, the hub portion of the rotary piston **18** has two separate recesses formed therein, one recess being shown at **51**, thereby to form a bearing surface **52** for journaling relationship on the bearing surface **16** of the bearing portion on the pintle **13** and the other recess being shown at **53** for the purpose of forming the splined coupling **48**.

The structural characteristics of an actual commercial embodiment of the pump thus far described is shown in FIGURES 5 and 6 and it will be noted that the casing **11** is shown therein as constituting three separate parts including a center section **11***a*, a rear header **11***b* and a so-called housing bushing assembly **11***c*.

In FIGURE 5, the structural configuration of the pintle **13** is particularly clear and there it will be noticed that the inlet ports **39** communicate with the axial inlet passage **38** to direct the inlet fluid through the bearing surface **16** directly into the inlet passages **40** formed in the rotary piston **18**. The rear header **11***b* has a radial face **54** which closes one side of the pumping chamber **12** and the bearing portion **14** of the pintle **13** projects from the face **54** into the pumping chamber **12**.

The housing bushing assembly also provides a radial face **56** which closes the other side of the pumping chamber **12** and it is in the face **56** that the outlet port **46** is formed. A passage extending through the housing bushing assembly **11***c* directs the fluid to a discharge outlet **57** and such passage is shown in FIGURE 4 at **58**. All of the casing components **11***a*, **11***b* and **11***c* are suitably apertured as at **60** so they may be fastened together in integral relationship with one another. The housing bushing assembly **11***c* is also provided with a sleeve bearing **61** in order to provide a bearing support for the shaft **50**.

In the view of FIGURE 1, the pump is at dead center and full-fill, "no pressure condition." The pumping fluid has flowed from the stationary commutation pintle **13** through the axial eye passage **38**, through the radial ports **39**, **39** in the pintle **13** intersecting the bearing surface **16** and thence through the inlet passages **40**, **40** of the rotary piston **18** into the displacement cavities of the pumping chamber **12**. Since the pasages **40**, **40** are on the bottom face of the rotor or rotary piston **18** relative to the sealing surfaces **20** and **21**, intake fluid will flow upon rotation of the rotor into the pumping cavities since the pumping cavities are expanding relative to the retractable cams **27**, **27**.

In the view of FIGURE 2, the rotor or rotary piston **18** has passed to a midway position in its stroke and the pumping cavities in communication with the inlet passages **40** are again increasing while the pumping cavities in communication with the outlet passages **42** are under compression. The under side of the cams **27**, **27** are pressure-energized through the passages **34**, thereby holding the sealing engagement between the cam action surfaces **32** and the peripheral surface **19** of the rotor or rotary piston. Thus, fluid at increased pressure will flow from the compression cavities through the passages **42**, **44** and into the outlet port **46**. From the port **46**, the fluid is discharged through the passage **58** and the discharge outlet **57**.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. A pump comprising:

a casing including:

a center section,

a rear header, and

a housing bushing assembly,

said center section having a generally circular pumping chamber formed therein,

said center section further including at least a pair of diametrically opposed slots extending outwardly of said pumping chamber in parallel chordal relation thereto,

a rotary piston in said pumping chamber having an irregular peripheral surface characterized by two circumferentially spaced sealing areas slidably sealing against the adjoining wall of said pumping chamber upon rotation therein,

a retractable cam in each of said slots having a motive surface spaced from the adjoining bottom wall of the corresponding slot to form a pressure control chamber and having a curved cam action surface projecting out of said corresponding slot to slidably seal against said peripheral surface of said rotary piston,

a coil spring bottomed in each slot and engaging said motive surface of the corresponding cam to preload the cam into engagement with said rotary piston,

passage means in said casing between said pumping chamber and the bottom of each said slot to conduct fluid at pump-generated pressure into said pressure control chambers to pressure-load said cams into sealing relation with said rotary piston,

said rear header having a side face for closing one side of said pumping chamber,

a pintle in said rear header having a bearing portion projecting into said pumping chamber,

said pintle having a hollow interior forming an inlet passage and including radial inlet ports in said bearing portion,

said rotary piston having a bearing recess formed therein for journaling said rotor on said bearing portion of said pintle and a pair of radially outwardly extending inlet passages opening into said pumping chamber on one circumferential side of each corresponding one of said sealing areas,

thereby to conduct pumping fluid into the pumping chamber,

said housing bushing assembly having a side face for closing the other side of said pumping chamber and being characterized by an outlet port formed therein,

said rotary piston having outlet passages extending inwardly from the other circumferential side of said sealing areas and opening out of the side of said rotary piston for discharging through said outlet port,

a discharge outlet on said housing bushing assembly receiving the fluid from said outlet port,

and a shaft journaled in said housing bushing assembly and having a driven connection with said rotary piston to rotatably drive said rotary piston.

2. A pump comprising a casing having

a generally circular pumping bore formed therein,

a hollow pintle in said casing having a bearing portion projecting into said pumping bore,

a rotor journalled on said bearing portion having a peripheral surface of irregular configuration and including a sealing area for slidably engaging and sealing against the adjoining wall of said bore,

said bearing portion having an inlet port extending radially outwardly and

said rotor having inlet passage means formed therein to conduct inlet fluid from the hollow interior of said pintle into said pumping bore,

and a continuously biased retractable cam sealing means in said casing having an action surface projecting into said bore for slidable sealing contact with said peripheral surface of said rotor,

said casing having a side discharge port adjacent said rotor and said rotor having a discharge passage means therein for conducting fluid at increased pressure to said discharge port,

means forming a pressure control chamber behind said cam means, and

said cam means having a motive surface in said pressure control chamber,

and passage means to conduct fluid at pump-generated pressure into said pressure control chamber behind said cam sealing means to pressure-load said motive surface and thereby urge said cam sealing means into sealing relationship with said rotor.

3. In a rotary piston pump,

the improvement of a casing

having an inlet and an outlet and a generally circular pumping chamber formed therein,

said pumping chamber being intersected by a pair of circumferentially spaced slots extending outwardly of said pumping chamber and formed in said casing,

a rotary piston in said pumping chamber having an irregular peripheral surface including a pair of circumferentially spaced sealing areas slidably engaging the adjoining wall of said pumping chamber in sealing relation for pumping fluid from the inlet to the outlet,

and a retractable cam in each said slot and each having a curved cam action surface to slidably engage said peripheral surface of said rotary piston,

and a spring preloading each cam outwardly of the slot,

thereby to develop a pumping action upon rotation of the rotary piston,

means forming a pressure control chamber in said casing behind each said cam,

and passage means formed in said casing for conducting fluid at pump generated pressure from said pumping chamber to said control chambers to pressure load said cams into sealing relation with the rotary piston.

4. In a rotary piston pump,

the improvement of a casing

having an inlet and an outlet and a generally circular pumping chamber formed therein,

said pumping chamber being intersected by a pair of circumferentially spaced slots extending outwardly of said pumping chamber and formed in said casing,

a rotary piston in said pumping chamber having an

irregular peripheral surface including a pair of circumferentially spaced sealing areas slidably engaging the adjoining wall of said pumping chamber in sealing relation for pumping fluid from the inlet to the outlet,

and a retractable cam in each said slot and each having a curved cam action surface to slidably engage said peripheral surface of said rotary piston,

and a spring preloading each cam outwardly of the slot,

thereby to develop a pumping action upon rotation of the rotary piston,

a pintle having a bearing portion,

said piston having a hub forming a bearing surface for journalling said rotary piston on said bearing portion of said pintle,

said pintle being ported to form an inlet passage opening at said bearing portion,

said piston having inlet passages opening out of said periphery and out of said bearing surface,

said casing having an outlet including a port adjacent said rotary piston,

said piston having outlet passages formed therein opening out of said periphery in spaced relation to said inlet passages and opening out of the side of said rotary piston to direct pressurized fluid into said outlet port,

means forming a pressure control chamber in said casing behind each said cam,

and passage means for conducting fluid at pump generated pressure from said pumping chamber to said control chambers to pressure load said cams into sealing relation with the rotary piston.

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