June 13, 1961 J. P. FAY 2,988,010

PUMP

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Fig. 1

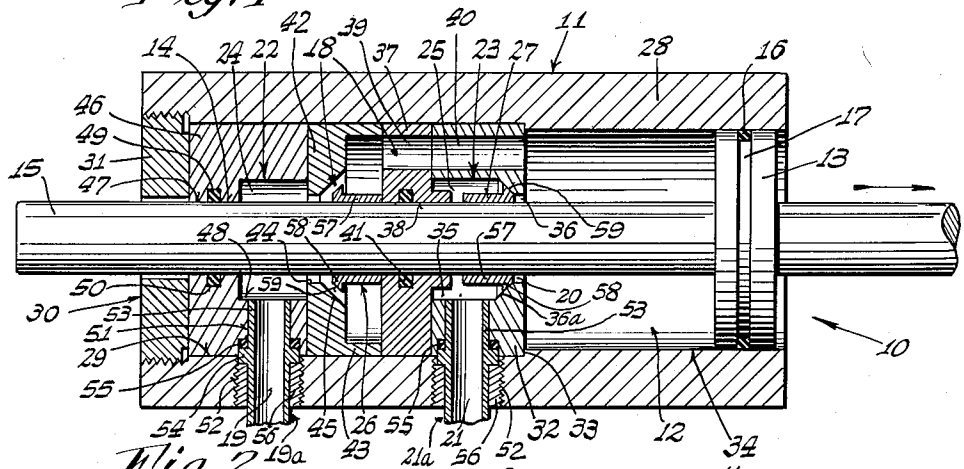


Fig. 2

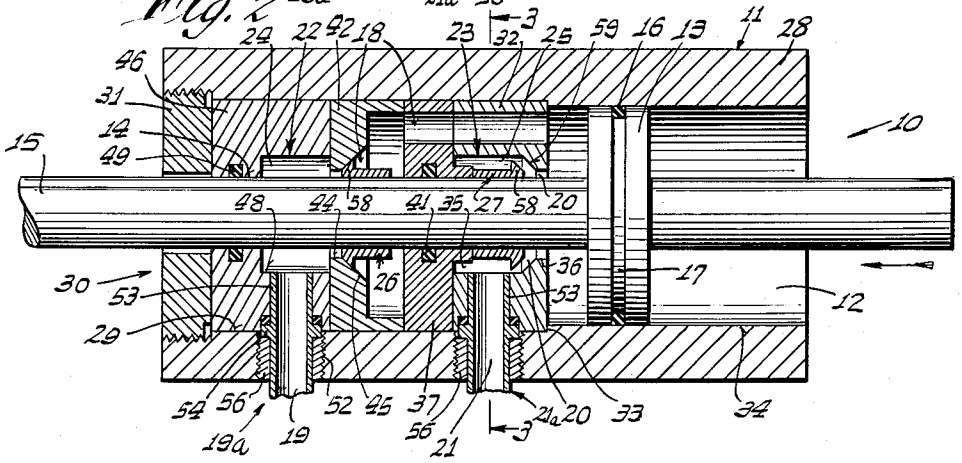
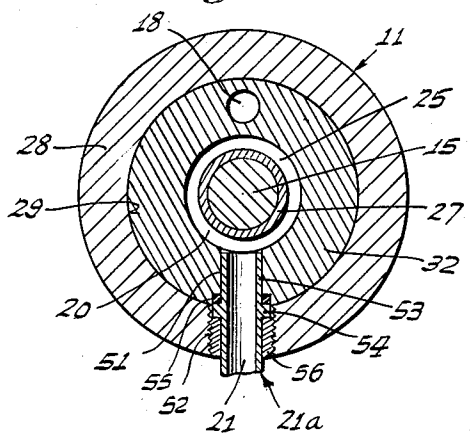


Fig. 3



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10 Claims. (Cl. 103—153)

This invention relates to a pump for pumping or compressing fluids and more particularly, constitutes an improvement on the invention disclosed in my copending application Serial No. 607,157, filed August 30, 1956, now Patent No. 2,919,652.

It is an object of the present invention to provide a pump of relatively simple structure, embodying but a few parts which are easy to form and readily assembled.

It is also an object of the invention to provide a pump wherein the means for valving the inlet and outlet passages from the piston-receiving cylinder comprise relatively rigid members having sleeves frictionally mounted on the piston rod for sliding movement therewith and therealong into and out of valving position.

Another object of the invention is to provide a pump wherein the valve members, while being frictionally mounted by the piston rod for sliding movement therewith into and out of valving position, are relatively rigid, thus resisting distortion and wear and being adapted to withstand extreme pressure.

It is further an object of the invention to provide a pump wherein the piston-receiving cylinder, piston rod-receiving bore, valving chambers and fluid passage means are formed in a housing by cooperating members slidably, sealingly disposed therein, the members being adapted to be fabricated on conventional machinery and readily assembled with the housing.

It is still further an object of the invention to provide a pump of relatively simple construction, having valving members slidably and frictionally carried by the piston rod into and out of valving position for controlling the flow of fluid into and out of the piston-receiving cylinder, which is readily manufactured and assembled at a minimum of expense and is of such rugged character it will function for a long period of time with freedom from all difficulties.

Other objects and advantages will be apparent from the specification and claims when considered in connection with the attached sheet of drawings illustrating one form of the invention wherein like characters represent like parts and in which:

FIGURE 1 is a longitudinal sectional view of a pump embodying the concepts of the invention and showing the piston on the intake stroke and the position of the valving members relative thereto;

FIG. 2 is similar to FIG. 1 but shows the piston and valving members during the compression stroke; and

FIG. 3 is a cross-sectional view of the pump taken in the direction of the arrows 3—3 in FIG. 2.

Referring now to the drawings for a more detailed description of the invention, a pump **10** is shown having a housing **11** provided with a piston-receiving cylinder **12** at one end to receive a piston **13** and a bore **14** extending therethrough to slidably receive a piston rod **15** connected to the piston, said piston and piston rod being reciprocated by any suitable means, (not shown). The piston **13** is provided with a suitable seal, herein illustrated as an O-ring **16** mounted in a groove **17** in the periphery of the piston and adapted to engage the walls of the cylinder. The housing is provided with a passage **18** (see FIG. 1) which communicates an inlet passage **19** of an inlet fitting **19***a* to the cylinder, and with a passage **20** (see FIG. 2) which communicates the cylinder with an outlet passage **21** for an outlet fitting **21***a*. The passages, according to the invention, are controlled by valve

means **22** and **23**, including respectively, valve chambers **24** and **25** and movable valve members **26** and **27**.

While the pump housing **11** may be cast or similarly formed as an integral unit, in the preferred form of the invention, as illustrated, it comprises a cylindrical housing member **28** formed with a bore **29** having cooperating means **30** therein to provide the piston-receiving cylinder **12**, bore **14**, fluid passages **18** and **20** and chambers **24** and **25**. The means, which are slidably, sealingly disposed within the bore **29** and are retained therein by a plug **31** threaded to the end of housing **11**, comprise a plurality of stacked complementary members. As shown, a first annular member **32** abuts a shoulder **33** formed by a reduced portion **34** of bore **29** and defines therewith the piston-receiving cylinder **12**. Annular member **32** is provided with an enlarged axial bore **35** and has a reduced bore portion **36** defining the fluid passage **20**, the bore **35** opening into bore **36** through a flared portion **36***a*. A second annular member **37** abuts member **32** and defines with the enlarged bore **35** the valve chamber **25**. Annular member **37**, which has an axial bore **38** forming part of piston rod-receiving bore **14** and in which the rod is journaled, is provided with a passage **39** extending parallel the bore **38** and aligned with a similarly formed passage **40** in the member **32** for forming part of the fluid passage **18**. An O-ring seal **41** is disposed in an annular groove opening on bore **38** for preventing the flow of fluid around piston rod **15**. Positioned adjacent member **37** is an annular member **42** having an inwardly directed flange **43** engaging the member **37** and spacing it therefrom. The annular member **42** is provided with a bore **44**, forming part of passage **18**, having an inwardly directed flared opening **45** for a purpose to be hereinafter explained. An annular member **46** having a bore **47** forming part of the piston-receiving bore **14** and having an enlarged bore portion **48** defining the valve chamber **24** is disposed between annular member **42** and the threaded retaining plug **31**. An O-ring seal **49** disposed in a groove **50** in bore **47** seals the piston rod-receiving bore against fluid leakage.

The members **46** and **32** are each formed with a radially extending bore **51** adapted to be aligned with a threaded bore **52** formed radially in cylindrical housing member **28**. The bores **51** are adapted to receive the tubular members **53** of fittings **19***a* and **21***a* having integral, outwardly extending annular shoulders **54** intermediate the ends thereof and form the inlet and outlet passages **19** and **21**. The tubular members are positioned in the members **46** and **32** to communicate the chambers **24** and **25** with the inlet and outlet fittings, respectively. An O-ring seal **55** is disposed between the shoulders **54** of each of the tubular members and its respective annular member for sealing the same and the tubular members are locked in position by means of collars **56** threaded into the bores **52**.

The movable valve members **26** and **27** are substantially identical members having sleeves **57** slidably and frictionally carried by piston rod **15** and enlarged head portions **58** bevelled as at **59**.

The sleeve portions **57** of the valve members are of such a length as to permit only limited movement of the members within their respective valve chambers, thus causing the valves to be quick to respond and controlling the amount the fluid passages **18** and **20** are opened. As the valve members are carried to open position by piston rod **15**, they abut annular member **37** which prevents their continued movement. It will be seen that by increasing or decreasing the length of sleeves **57** the amount of fluid permitted to pass through passages **18** and **20** is controlled. The valve members **26** and **27**, which are preferably formed of some substantially rigid material, such as metal, plastic or the like or combination thereof, are as shown, so positioned on the piston rod as to close the

passages 18 and 20, by the engagement of the bevels 59 with the flared passage portions 45 and 36*a*, on the compression stroke or the in-stroke of the piston 13 respectively.

In the operation of pump 10 according to the invention, as the piston 13 and piston rod 15 move to the right in the direction of the arrow, the movable valve members 26 and 27 are frictionally carried by the piston rod to the right to open fluid passage 18 and close fluid passage 20. In this manner fluid is permitted to enter the pump through inlet passage 19 and thereafter travels through fluid passage 18 to the cylinder 12. It at this point should be noted that interference in the continued movement of the piston and piston rod to full in-stroke position is eliminated by the moveable valve members 26 and 27 being slidably mounted thereon. After the valve members have been frictionally carried into valving position, the piston rod is enabled to slide through the sleeve portion of the valve members to continue its travel. After the in-stroke of the pump has been completed, the compression stroke is commenced and the piston rod and the piston move to the left, as shown by the arrow in FIG. 2, frictionally carrying the valve members 26 and 27 to the left to valve-off fluid passage 18 from the inlet passage 19 and open communication through fluid passage 20 from cylinder 12 to the outlet passage 21.

According to the invention, during the in-stroke of the pump, a vacuum is created in piston-receiving cylinder 12 which maintains the valve members 26 and 27 in open and closed position respectively. The piston during the compression stroke, similarly, exerts a pressure on the valve members to maintain them in the position to which they were moved by the piston rod during the compression stroke. Thus it will be seen, that a positive force acts on the valve members to maintain them in open or closed position during the in-stroke and compression stroke of the pump.

By means of the invention a pump has been provided for pumping or compressing fluids which is simple in structure, positive in operation and of such rugged character it will function without interruption for long periods of time.

It will be seen that the simple design of the pump lends itself to various types of construction; it can be made from metal or plastic materials or any combination thereof, and the individual elements of the pump are readily adapted to be fabricated by conventional machine tools.

In assembling the pump illustrated herein, the separate annular members and the movable valve members are positioned in order on the piston rod 15 which is thereafter inserted within the cylindrical housing member 28 so that the piston 13 is disposed within piston-receiving cylinder 12. In order to maintain the proper alignment of the fluid passages during the assembling of the pump, as the elements thereof are stacked on piston rod 15, an aligning pin or the like may be temporarily positioned to extend through bores 39 and 40 of members 37 and 32. After the piston and housing members have been disposed in cylindrical housing member 28, plug 31 is threaded into the end of the housing member to lock the members 32, 37, 42 and 46 in position against shoulder 33.

Thus, among others, the several objects and advantages of the invention as aforenoted are achieved. Obviously numerous changes in the structure may be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in said cylinder and having a piston rod slidable in said bore, said housing having fluid passage means therein connecting with said cylinder and inlet and outlet passages connecting with said fluid passage means; and a valve means including a valve member having a sleeve slidably and frictionally mounted on said piston rod for movement therewith and therealong, said valve member cooperating with said passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages respectively, in response to reciprocation of said rod in said housing.

2. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in said cylinder and having a piston rod slidable in said bore, said housing having fluid passage means therein connecting with said cylinder and inlet and outlet passages connecting with said fluid passage means; and a valve means including a rigid valve member having a sleeve slidably and frictionally mounted on said piston rod for movement therewith and therealong, said rigid valve member cooperating with said passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages respectively, in response to reciprocation of said rod in said housing.

3. A pump comprising a housing having separate means therein forming a piston-receiving cylinder and a piston rod-receiving bore; a piston reciprocatingly mounted in said cylinder and having a piston rod slidable in said bore, said housing having fluid passage means therein connecting with said cylinder and inlet and outlet passages connecting with said fluid passage means; and a valve means including an annular metal valve member having a sleeve slidably, frictionally mounted on said piston rod for movement therewith and therealong, said annular valve member cooperating with said passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages respectively, in response to reciprocation of said rod in said housing.

4. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in the cylinder and having a piston rod slidable in said bore, said housing having means providing spaced chambers opening on said bore; fluid passage means connecting each of said chambers with said cylinder, said housing having inlet and outlet passages connecting with said chambers; and a valve member disposed in each of said chambers and cooperating with said passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing, said valve members each having a sleeve slidably, frictionally mounted on said rod for movement therewith and therealong.

5. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in the cylinder and having a piston rod slidable in said bore, said housing having means providing spaced chambers opening on said bore; fluid passage means connecting each of said chambers with said cylinder, said housing having inlet and outlet passages connecting with said chambers; and a substantially rigid sleeve-like valve member disposed in each of said chambers and cooperating with said passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing, said valve members being slidably, frictionally mounted on said rod for movement therewith and therealong.

6. A pump comprising a housing having removable means forming a piston-receiving cylinder and a piston rod-receiving bore therein and providing spaced chambers opening on said bore; a piston reciprocatingly mounted in the cylinder and having a piston rod slidable in said bore; fluid passage means connecting each of said chambers with said cylinder, said housing having inlet and

outlet passages connecting with said chambers; and valve members having sleeves slidably, frictionally mounted on said piston rod, said valve members being disposed in said chambers and cooperating with said fluid passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing.

7. A pump comprising a housing having means therein forming a piston-receiving cylinder and a piston rod-receiving bore and providing spaced chambers opening on said bore, said means including a plurality of complementary members slidably, sealingly disposed within said housing having aligned passages forming fluid passage means connecting each of said chambers with said cylinder; a piston reciprocatingly mounted in the cylinder and having a piston rod slidable in said bore; said housing having inlet and outlet passages connecting with said chambers; and valve members having sleeves slidably, frictionally mounted on said piston rod, said valve members being disposed in said chambers and cooperating with said fluid passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing.

8. A pump comprising a cylindrical open ended housing having means cooperating therewith forming a piston-receiving cylinder and a piston rod-receiving bore and providing spaced chambers opening on said bore, said means including a plurality of annular complementary members slidably, sealingly disposed within said housing having aligned passages forming fluid passage means connecting each of said chambers with said cylinder and means for locking said members in aligned position in said housing; a piston reciprocatingly mounted in the cylinder and having a piston rod slidable in said bore; said housing having inlet and outlet passages connecting with said chambers; and valve members having sleeves slidably, frictionally mounted on said piston rod for movement therewith and therealong, said valve members being disposed in said chambers and cooperating with said fluid passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing.

9. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in said cylinder and having a piston rod slidable in said bore, said housing having means providing spaced chambers opening on said bore; fluid passage means connecting each of said chambers with said cylinder, said housing having inlet and outlet passages connecting with said chambers; and a valve member disposed in each of said chambers and cooperating wtih said fluid passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing, said valve members each having a sleeve slidably and frictionally mounted on said rod for limited movement therewith and then slidable along said rod, whereby the flow of fluid through said fluid passages is limited.

10. A pump comprising a housing having a piston-receiving cylinder and a piston rod-receiving bore therein; a piston reciprocatingly mounted in said cylinder and having a piston rod slidable in said bore, said housing having means providing spaced chambers opening on said bore; fluid passage means connecting each of said chambers with said cylinder, said housing having inlet and outlet passages connecting with said chambers; and a valve member disposed in each of said chambers and having a sleeve slidably and frictionally mounted on said rod, said valve member cooperating with said fluid passage means for controlling the flow of fluid to and from said cylinder through said inlet and outlet passages in response to reciprocation of said rod in said housing, said valve members being positively maintained in cooperative relation with said fluid passage means in either direction of reciprocation of said piston by the fluid pressures in the cylinder during movement of the piston.

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